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# DESIGNING SUSTAINABILITY FOR ALL

Edited by Marcelo Ambrosio and Carlo Vezzoli

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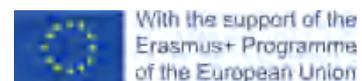
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# Designing sustainability for all

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## FOREWORD

*Designing sustainability for All was a call for contributions and actions to the whole world design community, which is not limited to design researchers, design educators, and design practitioners but also unites other disciplines such as architecture, engineering, economy, policy-making, and sociology.*

*The Conference has been a unique event hosted simultaneously in Mexico City (Mexico), Curitiba (Brazil), Cape Town (South Africa), Bangalore (India), Beijing (China) and Milan (Italy), on 3rd-5th April 2019. In fact, in each of the 6 venues, it has been possible to listen to any of the presentations happening in the other ones.*

## LENSIN PROJECT

LeNSin, the International Learning Network of networks on Sustainability (2015-2018), is an EU-supported (ERASMUS+) project involving 36 universities from Europe, Asia, Africa, South America and Central America, aiming at the promotion of a new generation of designers (and design educators) capable to effectively contribute to the transition towards a sustainable society for all.

LeNSin ambitions to improve the internationalisation, intercultural cross-fertilisation and accessibility of higher education on Design for Sustainability (DfS). The project focuses on Sustainable Product-Service Systems (S.PSS) and Distributed Economies (DE) – considering both as promising models to couple environmental protection with social equity, cohesion and economic prosperity – applied in different contexts around the world. LeNSin connects a multi-polar network of Higher Education Institutions adopting and promoting a learning-by-sharing knowledge generation and dissemination, with an open and copyleft ethos.

During the three years of operation, LeNSin project activities involve five seminars, ten pilot courses, the setting up of ten regional LeNS Labs, and of a (decentralised) open web platform, any students/designers and any teachers can access to download, modify/remix and reuse an articulated set of open and copyleft learning resources, i.e. courses/lectures, tools, cases, criteria, projects.

LeNSin will also promote a series of diffusion activities targeting the design community worldwide. The final event will be a decentralised conference in 2018, based simultaneously in six partner universities, organised together by the 36 project partners from four continents.

## THE LENS CONFERENCE

The Conference is the 3rd edition of one of the largest design international conferences for lecturers, researchers, professionals, and relevant institutions and organizations. It has become a reference event where experts from all over the world get together to present and share their knowledge, projects, tools, and visions to diffuse sustainability for all.

The Conference is organized as a part of the LeNSin, the International Learning Network of networks on Sustainability project (2015-2019, EU funded Erasmus+ program) that aims to be both visionary and pragmatic, and to stimulate new ways of thinking.

The scope is to share the latest knowledge and experiences around the concept of sustainability for all.

This will be achieved through cross-fertilizing a wide range of disciplines: predominantly design, but also engineering, economy, policy-making, and sociology.

## LENS MANIFESTO

A new ethos for a design community: towards an open source and copy left learning-by-sharing attitude/action.

We, the undersigned, aware of both the urgent changes required by sustainable development, the potential role of design (and design thinking) in promoting system innovation in the way we produce, consume and interact, as well as the opportunities offered by the ever more interconnected society, propose the adoption and diffusion of a new ethos within a worldwide design community:

To view design as a unique multi-polar learning community promoting, enabling and activating any possible learning-by-sharing process aiming at effective knowledge osmosis and cross-fertilisation in design for sustainability in an open and copy left ethos.

We, the undersigned, commit our selves in such an ethos, trying our best to apply this in our daily life as individuals or representatives of institutions in the design community.

In relation to our competencies and possibilities we will make our acquired knowledge to be, as far as possible, freely and easily accessible in a copy left and open source modality (while safeguarding our authorship and scientific recognised publication activity), that enable others in the design community to acquire them free of charge, with the possibility to replicate, modify, remix and reuse, through e.g. adopting creative commons licences.

As researchers, this knowledge includes our acquired research knowledge base (e.g. papers, books, etc.) and knowhow (e.g. methods and tools).

As educators, this knowledge includes our educational resources (slideshows, texts, video of lecture, educational support tools, etc.)

As designers and design thinkers, this knowledge includes the design for sustainability concept proposal of products, services, systems and scenarios, as well as a knowhow they used to design them.

We commit our selves to seek the commitment of other individuals or institutions in such an ethos within the design community. In relation to our competencies and possibilities we will:

do our best to commit individuals such as researchers, educators, professional designers and design thinkers as well as institutions such as research institutions, design schools, and designer's associations to adopt the same ethos

do our best to generate and/or enable open learning networking of sustainability of design researchers, design educators, professional designers and design thinkers.

## **4. SYSTEM AND CIRCULAR DESIGN FOR SUSTAINABILITY**



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## SYSTEM DESIGN FOR TERRITORIAL CYCLE TOURISM

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### ABSTRACT

Many territories suffer from the lack of strategies and tools for the promotion, fruition and enhancement of their heritage. They require new forms of organisation, ICT interaction platforms, stakeholder participation, infrastructures and services to avoid inadequate fruition and loss of the potential value of their resources. This could generate significant negative effects on the environmental, social and economic aspects of the territory. Nonetheless, the growing interest in ecotourism and the global proliferation of bike sharing systems foreshadow an increasing demand of cycle tourism related services and products. Furthermore, the improved performance features achieved by the technological E-bikes development, could help traveling safely through longer distance and tourist itineraries with steep slopes, especially for users with different abilities and of diverse ages. The paper describes the intermediate results of the current PhD research, based on the definition of an advanced system model applied to cycling tourism for the enhancement and sustainable fruition of territorial resources.

Key Words: Ecotourism, Cycle tourism, E.bike sharing, System Design, Design for Sustainability

## 1. INTRODUCTION

The most strategically issue in sociological and economic terms of sustainable tourism is represented by the phenomenon of ecotourism bike sharing as a tool for accessing the numerous natural, cultural and historic-artistic resources offered by a territory. This specific form of bicycle tourism makes it possible to observe, learn about and appreciate particular natural areas and landscapes, natural attractions, local craftsmanship, food and wine. In this scenario, the responses offered by standard urban bike sharing models are inadequate to the complexity of issues raised by ecotourism and sustainable tourism. They require new focused design scenarios, stakeholder participation, the promotion of new forms of organization and the definition of actions and ICT system interaction. Furthermore, long-distance and tourist itineraries with steep slopes require bikes with improved performance features (comfort and efficiency), above all for users with different abilities and of diverse ages.

This paper presents the intermediate results of the ongoing PhD research called “System Design for territorial cycle tourism”, aimed to demonstrate the possibility to obtain the enhancement of fruition and valorization of a territory heritage, through the definition of an advanced system model (service / product / communication) applied to cycling tourism. Specifically, the paper describes the progressive steps that will result in the definition of new possible solutions offered by extra-urban e.bike sharing system, starting from the description of ecotourism and bicycle tourism phenomenon and the analysis of the problematics within the territorial areas (2. Ecotourism by territorial E.bike Sharing). This is followed by the presentation of the criteria, tools and methods of System Design and System Innovation employed by the research (3. Methodology). Consequently the text describes the definition of the state of the art of cycling tourism through its main characteristics, dynamics and potentialities, but also its problems and necessities (4. State of the art of Cycle Tourism), then the definition of the cycle tourist's main characteristics, starting from the identification of the types and subsequently to the definition of the cyclist's needs (5. Definition of cycle tourism needs). Finally, the text foreshadows what could be a possible scenario for the ongoing development of an integrated and coherent combination of cycle tourism service and product design for the enhancement of territorial heritage (6. System Design for territorial cycle tourism scenario).

## 2. ECOTOURISM BY TERRITORIAL E.BIKE SHARING

### 2.1. Ecotourism and Ecotourism Cycling

The phenomenon of Ecotourism developing in the early years of the new millennium is driven by the need to reconcile access to natural, cultural and social resources with their conservation. In 2002 the Québec Declaration on Ecotourism proclaimed by the United Nations defined the principles and clarified the meaning of this term, moving beyond the concept of ecological tourism to incorporate aspects tied to the respect for local communities and economic development.

According to the most commonly accepted definition provided by the International Ecotourism Society, “ecotourism is now defined as responsible travel to natural areas that conserves the environment, sustains the well-being of the local people, and involves interpretation and education”. It is characterised by a number of fundamental aspects: a focus on the promotion of sustainable development in tourism; avoiding the deterioration or depletion of resources; promoting and protecting respect for the environment; valorising natural resources by responding to a philosophy that is more biocentric than anthropocentric; it is founded on a direct encounter with the environment and inspired by a dimension of direct cognition. According to the 10° Rapporto Ecotour, released in 2014 by Enit and Istat in collaboration with the University of L'Aquila, ecotourism is a growing phenomenon worth 12 billion Euro per year, with the bicycle being the preferred activity for the second consecutive year: bicycle tourism has leapt to the top of the list of activities preferred by tourists, at 30%, surpassing backpacking (21%) and trekking (18%).

Given this socio-cultural perspective of sustainable tourism and ecotourism, bicycle tourism represents a strategic opportunity for testing new forms of tourism and technologically appropriate service-product concepts. In 2012 bicycle tourism in Europe registered more than 2 million trips and 20 million room reservations, for a total value of 44 billion Euro; the same year, in France, the principal destination of bicycle tourists, bicycle tourism generated more than 2 billion Euro in revenues, and 9 billion in Germany. In Italy, the potential value of bicycle tourism is estimated at 3.2 billion Euro per year (source: Italian Ministry of Infrastructure and Transportation). Given the projected growth of bicycle tourism, there is a need to improve a number of aspects: intermodal connections with other transport systems, such as rail, river and maritime networks; favouring the realisation of interconnections between different bicycle tourism itineraries; developing bike hotels; realising services and products for bicycle tourism that favour inclusion, accessibility and safety.

### 2.2. From Bike Sharing to Extra-Urban E.bike Sharing

Current solutions to bike sharing, progressively more common in many cities and centres of tourism, present a number of critical elements, above all for users with low to medium physical preparation. On the one hand, they do not favour this form of mobility in hilly and mountainous areas with challenging topographies. On the other hand, they are unsuitable to favouring extra-urban mobility and long-distance travel, both for the characteristics of the bike themselves and the quality and specialization of the services offered. Strategies for the valorization of territorial

resources require new forms of sustainable tourism and ecotourism based on solutions for bicycle tourism that are highly inclusive, accessible and safe. This means rethinking integrated services and products using a System Design and Design for All (DfA) approach.

Furthermore, the feasibility of new extra-urban e.bike sharing solutions can now be guaranteed by technological innovations in the field of propulsion systems. In general, Light Electric Vehicles and, in particular, e.bikes (Electric Bicycles) that can travel without the need to pedal and reach sustained speeds; Pedelec (Pedal Electric Cycle) or EPAC (Electric Pedal Assisted Cycle) that, thanks to assisted pedalling, can reach a maximum allowable speed of 25 km/h, using a motor that must not exceed 250W of continuous power (European Directive 2002/24/EC).

By exploiting the potentials of e.bike sharing it is possible to expand the target market to include those whose abilities vary in relation to age, culture and physical preparation (Design for All). Moreover, recent evolutions in photovoltaic technologies make it possible to charge batteries using renewable energies such as solar and/or wind power (Solar Design).

### 3. METHODOLOGY

The research started with the definition of the intervention context, the problematic area and the thematic area. Specifically, the intervention context has been identified in the territorial areas (extra-urban, hilly, coastal and mountain areas, etc.), the thematic area has been identified with cycle tourism and the research field with the Strategic Design for Sustainability and in particular with Systems Design (service / product / communication mix).

Later on the research has been focused on exploring the state of the art of cycle tourism and analyzing Case Studies and Best Practices. The collected data have been organized through Database records in four bike related areas (economy, infrastructures, intermodality, bike services), as well as the analysis of Best Practices and Case Studies.

Currently the research is heading towards the definition of the Product Brief, concept design (generation of ideas, synthesis and verification of one or more solutions) and concept development (evaluations and development of the general project outline).

The methodological process used in this last phase is the Method for System Design for Sustainability (MSDS), developed and adopted during the LeNS research (2007-10) by the System Design and Innovation for Sustainability Research Unit (DIS) of the Indaco Department at the Milan Polytechnic (Vezzoli, 2007).

The MSDS method is based on phases of strategic analysis (analysis of context and Case Studies), the exploration of opportunities for innovation (system ideas and design orienting scenario) and a set of tools (system orienting scenario, stakeholder motivation matrix, system map and interaction table) that will help the ongoing definition of the system concept and the sustainability assessment.

### 4. STATE OF THE ART OF CYCLE TOURISM

In order to define the current state of the art of cycle tourism the research has been addressed towards the analysis of four main bike related topics: economy, infrastructures, intermodality and bike related services.

- **Economy:** the collected data give an estimate of the size and the direct economic impact of current cycling activities in Europe and in Italy (excursions, cyclical journeys, annual revenues, etc.), but also the economic value of the production of bicycles in Italy (traditional bikes and e-bikes), exports and related industries. The value of cycle tourism in Europe is about 44 billion Euros of annual revenues, deriving from 20 millions annual cycling holidays and 2.300 daily cycling excursions (AA.VV. The European Cycle Route Network Eurovelo Study, 2012). In Italy, the potential value of bicycle tourism is estimated at 3.2 billion Euro per year (source: Italian Ministry of Infrastructure and Transportation), while the economic value of the production of bicycles in Italy is about 1.2 millions of Euros, with +48% of E.bikes production, a +19% E.bike market growth and 148.000 E.bikes sold in 2017, making Italy the European leader in bike manufacturing (Confcommercio ANCM, 2018).
- **Infrastructures:** the data gathered have provided the dimensions and the capillarity of the infrastructural network linked to cycle tourism in Italy and in Europe, with particular attention to the high traffic propensity cycling networks (landscape, monumental, food and wine, etc.). Some of the most important infrastructural networks worth mentioning are Eurovelo, a network of 15 long-distance cycling routes crossing 42 countries, reaching a total of 70.000 kilometers in length once it will be completed and Bicalia, a project of a tourist cycle network planned by FIAB for Italy, included in the Eurovelo network with the expected overall length of approximately 16,500 km.
- **Intermodality:** the search for information has been addressed considering it in two main aspects: transporting the bike on other vehicles and exchanging the bike with other vehicles. The collected data gave an overview of the possible interactions between Italian and European transport between bikes and other vehicles (bike / train, bike / bus, bike / ferry, bike / plane etc.). In Europe this service is guaranteed by local and regional trains. Instead for long-distance trains that cross national borders, the situation appears more critical: the bicycle slots, where present, are reduced to a few numbers. In Italy, intermodality still presents numerous deficits, although at regional level some administrations have proved more sensitive to the needs of cyclists. In Italy there were 350 thousand bicycles (excluding

folding bicycles) transported on board the regional trains in the first ten months of 2016.

- Services: the information was collected with the aim of defining the current status of the services linked to cycle tourism and their presence on Italian and European territory. The data obtained allowed us to identify the types (receptivity, refreshment, bike sharing services, assistance / rescue, information) and possible interactions between them. The main European bike sharing services have around 150,000 shared bikes available in 31 countries and operating in 472 cities while in Italy, around 200 Bike sharing services were in operation in 2016 with around 13,700 shared bicycles

## 5. DEFINITION OF CYCLE TOURISM NEEDS

After the data interpretation phase, the research focused on delineating the specific characteristics of the cycle tourism, starting from the identification of the types and subsequently to the definition of the cyclist's needs. The types of cycle touring have been identified through the definition of the following parameters:

- Journey time: The number of holiday days changes several factors such as quantity of luggage, need for hotel, food, distance that can be traveled, use of different means (intermodality), staying in one country or going abroad, etc. Three types of activities can be identified:
  - Excursion: one day
  - Short stay: two days
  - Holiday: more than three days
- Type of journey: You can distinguish two types of travel or itinerary based on the place of overnight stay.
  - Petal or star: It is characterized by the presence of only one basic structure to which the cyclist will return at the end of each day to spend the night there. The advantage is that the cyclist can book, with greater convenience and for several days, a single structure where he can leave most of the bags with the advantage of being able to travel very light bringing with him only the bare essentials
    - Ring or open: It includes movements along a previously planned itinerary, during which there are some stages and various overnight accommodation facilities. It is more complex than the previous one, but allows you to ride a lot and visit new places every day.
- Types of cycle tourism.
  - Guided: practiced by people who do not have enough experience and prefer to opt for a guided journey.
  - Self-guided: more free and flexible, going alone or in a group without time or company constraints.
  - Self-supported: practiced by those who know how to manage themselves independently
- Types of cycling tourist:
  - Proximity cyclist
  - Daily cyclist
  - Vacation cyclist
  - Explorer cyclist
  - Sport cyclist
- The cyclist's needs: the common basic needs are essentially those of restoring, resting and sleeping, taking every opportunity to increase one's culture, to relax and enjoy oneself and above all to obtain the necessary information to undertake and lead the journey to the end. The cyclist's needs have been identified through the definition of the following parameters:
  - Obtaining information: before the journey, during the journey
  - Refreshment: meal, refreshment
  - Rest: (bike hotels, hotels, hostels, camping sites etc.
  - Infrastructures: cycle routes, cycle tracks, charging stations, etc.
  - Assistance: bicycle workshops, first aid
  - Culture / Leisure / Relax

## 5. SYSTEM DESIGN FOR TERRITORIAL CYCLE TOURISM SCENARIO

The research is currently on its way to reach the definition of an advanced system model concept applied to cycling tourism for the enhancement and sustainable fruition of territorial resources. At this stage the process is based on the succession of phases for defining the Product Brief, concept design (generation of ideas, synthesis and verification of one or more solutions) and concept development (evaluations and development of the general project outline).

The previous collected data are currently being elaborated through the Method for System Design for Sustainability (MSDS) in order to to guide and orientate the solution within this fragmented and complex context, to coordinate all the stages and obtaining the necessary results. Specifically the Stakeholder Motivation Matrix is being used to define the role and contributions that each actor can bring to the partnership in general, and to each single actor in particular. The Offering Diagram is being used to define the functions provided by the system to users. Finally, the Interaction Table (Story Board) will visualises and describes the sequence of the principal actions carried out by the user while the services are being provided.

Although the research has still not reach the final definition of an advanced system model applied to cycling tourism, this paper tries to foreshadow what could be a possible future cycle tourism system scenario: an improved E.bike sharing systems in accordance with Design for All criteria; connected and implemented bicycle routes by exploiting rivers valleys and decommissioned roads and railway lines; cycle routes provided with more sustainable supporting services and structures (bike hotels, bike restaurants, bike parking, proper signage), implemented intermodal connections with rail, bus and ferries, communicating the vision towards the territory and promoting the product to the general public. Specifically the research is evaluating the feasibility as well as the potential effectiveness of a system that incorporates specific features described in the following lines.

An E.bike sharing system comprised of rental stations, interactive information totems, solar battery charging stations and variable geometry frame e.bikes. The different configurations of the bike make it possible to adapt the e.bikes to different uses (tourism, sport) and different users body conformations. A safer cycle route infrastructure network provided with intelligent lighting and monitoring system for bicycle-pedestrian paths along the cycle routes consisting in linked network of intelligent “poles” equipped with technological devices such as motion sensors, optical smoke detectors, WI-FI antennas, video cameras and weather stations.

A diffuse hospitality through a smart modular platform for outdoor cyclist accommodation using modular and energy self-sufficient platform modules, provided with bedroom, bicycle storage and mini-repair shop, toilet, bicycle washing station, washer/dryer, photovoltaic system, relax area.

A smart-green-market system that offers local food and wine products in different dining areas: fast food for take-away by bicycle, areas for longer and more comfortable pauses.

A smart information system offering assistance to bicycle tourist consists in a mobile device, a smartphone application, a signage system and a energy self-sufficient information device located along the bicycle path, offering a tool that fosters interaction between users and the territory.

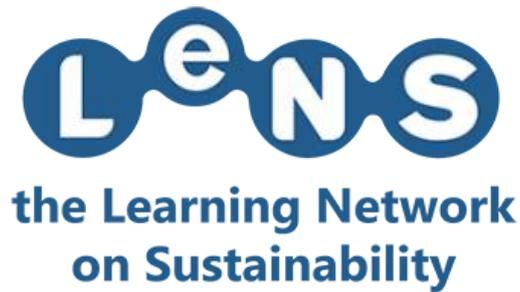
## 6. CONCLUSION

All the successful experiences demonstrate that cycle tourism needs safe spaces and infrastructures, a dedicated product and a consequent communication that knows how to enhance the territory and pierce the imaginary of potential customers. Designing for cycle tourism means planning a system that bring out the qualities and the specificities of the territories. Bicycle routes should enhance the hidden territory's qualities that only with a slow pace can really emerge and be enjoyed. Planning a cycle tourism system should take into consideration how to read the territory, the historical signs, the landscape and present them in such a way that they are attractive to the contemporary tourist. The infrastructures as well as the E.bike Sharing Systems should be designed for different users with different abilities and of diverse ages, from those who want to discover the wonders of the territory, for those who travel with the family, for short and long vacations, to those who are dedicated to large journeys but also for the sporty ones. The design and execution of the infrastructure should go hand in hand with the creation of a product that knows how to put together all the stakeholders who will have to sell it and make it competitive on the market.

The communication of the vision towards the territory and the promotion of the product to the general public are two important aspects that need to be implemented in a strategic way in order to attract tourists in a specific territory. Lastly, particular attention should be given to all those aspects that can decree the attractiveness of a cycle tour, such as signage, connection to public transport and intermodality, support services and reception to the cyclist.

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## DESIGN TOOLKIT FOR SUSTAINABLE IDEATION

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### ABSTRACT

The work proposes a card-based design toolkit for sustainable ideation in product development. The solution consists of two decks - the 'Problems' deck for identification of sustainable design issues and the 'Prompts' deck that provides prompts for tackling these issues. The toolkit abstracts data through user studies (interviews, peer-to-peer observations, market research, etc.) to understand the product design cycle and breakpoints in sustainable product design. To validate the design intervention, during the ideation stage, the user(s) picked up cards from the Problems deck that denote sustainable design issues posed by the product to the environment throughout its lifecycle. Thereafter, user would pick multiple cards from the Prompts deck denoting tools for sustainable innovation and ideated upon them. The prompts helped the teams to laterally and collectively target multiple sustainable design issues rather than focusing on individual problems. The toolkit promotes Design for Sustainability (DfS) by presenting sustainability as an opportunity.

Key Words: Design for Sustainability, Lateral thinking, Card game

## 1. INTRODUCTION

Introduction of sustainable solutions in product design cycle can be classified into three common discreet but erroneous approaches. One, sustainability is enforced for passable design, which creates only surface level solutions; two, sustainability is discussed in later stages, which makes the process expensive and three, sustainability is thought of after product disposal, which is extremely late for remedy. Apart from this, a study by BCG/MIT in 2015 finds that whereas 90% of executives find sustainability to be important, only 60% of companies incorporate sustainability in their strategy, and merely 25% have sustainability incorporated in their business model proving that there exists a knowing-doing gap in the sustainability sector.<sup>1</sup> The study further describes that there is unequal distribution of sustainable responsibility in businesses. The aim of this research is to develop a design intervention for overcoming this knowing-doing gap and promoting sustainable innovation and creation among businesses.

### 1.1. Problem Identification and Research Gap

The comparison between the various existing sustainability toolkit is as shown in Table 1:

[Table 1.1] Comparison of existing Sustainability toolkits

Toolkits	Learning	Understanding	Execution	Pros	Cons
The Cambridge Sustainable Design Strategy Cards	Awareness of terminologies	Complicated to learn	Multiple factors make it difficult to execute	Diverse and detailed	Possible that the user may become over dependant
Sustainable Design Tool Kit by Shift	Detailed description and examples	Simple	Usage is only described not initiated	Interesting to understand sustainable ideas	Very generic and vague details
Designing our Tomorrow business toolkit	Disjointed and very specific to business	Complicated and very specific to fields	Specific directions for tackling specific problems	Easy to use in particular cases	Over specialized

The existing solutions offer either business strategies for management or toolkits that are adopted by the management. The various issues being:

- The solutions are deployed very late into the product creation stage, therefore, they become non-iterative and non-lateral in problem solving.
- The solutions are very detailed or complicated, using the toolkit as an intensive process, which takes away the creative problem-solving capability, handicapping the user.
- The tools are extremely specialised, thus, being difficult in learning and not applicable universally.

### 1.2. Objectives and Scope of Work

The aim of the work is to introduce sustainability at the grass-root level, here, at the ideation stage, through tools that are adaptable, simple and non-coercive. The tools can act as benchmarks for sustainability as well as provide the designers with new prompts and openings to approach Design for Sustainability (DfS) by

- Creation of a tangible strategy or toolkit from business and alignment towards sustainability.
- The ability to customize the toolkit may include company's own brand values and sustainability outlook.
- Deployment of simple, affordable, portable, and easy to use toolkit, that does not overshadow lateral creative thinking and helps the designers to understand various modes to incorporate sustainability in the design solutions proposed by them.

## 2. METHODOLOGY

This segment discusses various methodologies and design tools to gather qualitative as well as quantitative data for creating the framework for the toolkit.

### 2.1. Research Methodology

The study was conducted for two objectives. The primary objective being to understand the working of a product design cycle and secondary to identify various breakpoints in sustainable products along with identification of multiple ways or directions for product refinement. The methods deployed for the primary objective are:

- Telephonic interviews, to understand various checkpoints in a product design cycle and the methods in which sustainable design was approached.
- Peer to peer observation and brainstorming, where the subjects were asked about the approaches and checkpoints in their previous employment as depicted in Figure 1.

1.MIT Sloan Management Review



[Figure 1] Peer to peer review in action

The second objective was fulfilled by carrying out market research, to realise various sustainability hiccups (pain points) and ways in which these lacunas are filled (prompts).

### 2.2. Observations and Design direction

The methods underlined the requirement of team thought while generating sustainable ideas. Lateral thinking is crucial for sustainability and a toolkit can introduce interaction, simulate creativity and maintain ideation in the spectrum of sustainability.

## 3. DESIGN

The research generated a pipeline to fulfil the demands in ideation for sustainability. The need for an intervention that promotes sustainability while guiding lateral thinking led to the creation of a toolkit that provides a creative intervention.

### 3.1. Concept Framework

After understanding various lacunae of sustainable product design and its approach to solution, a toolkit for sustainable product design was developed. The toolkit was divided into two categories - the 'Problems' and the 'Prompts'. The intervention targets the designers in a firm, who directly take part in product creation at the ideation stage of product development. Targeting the designers in the company is another way to garner sustainable creation, as sustainability is not just the responsibility of management.

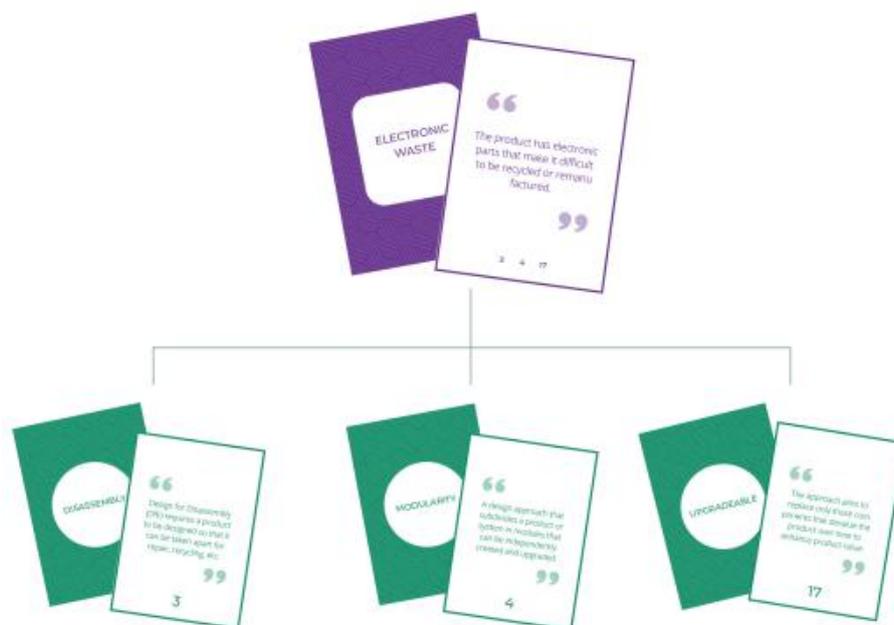


[Figure 2] Cards from toolkit, purple deck for problems and green for prompts

The toolkit includes 40 cards, 15 problems (in purple) and 25 prompts (in green). All these cards include the option of customisation, so that the toolkit is closer to the company's values. Each card has two sides, one includes the title phrase and other its explanation to aid in understanding. For the purple cards, numbers at the bottom correspond to the three most viable design directions from the prompts deck as shown in Figure 2.

### 3.2. Proposed Ecosystem

In a conventional product design process, designers research, brainstorm and define the problem statements. Post design problem selection, the environmentalist team alongside the design team selects various problems that arise in the product from the purple deck and hands them over to the designers for ideation. The designers then choose random prompts from the green deck and ideate while keeping the prompts at the root of the concept. The designers can subsequently ideate on multiple prompts, adding on their own, as and when required. The system is not rigid and therefore the company may define their own interventions. An example of multiple prompts corresponding to a problem is shown in Figure 3.



[Figure 3] Multiple prompts corresponding to a single problem to generate variety in ideation

## 4. TESTING

The following segment elaborates on the procedure of testing and validation of the proposed toolkit. Physical prototypes were created for conducting the experiments. The collection of feedback and insights from the participants have been further discussed in detail within this segment.

### 4.1. Exercise

A short exercise was designed to validate and test the impact of the proposed concept in the actual design process. The exercise consisted of two rounds of ideation – first, without the use of the toolkit and the next round with the toolkit. Twelve participants (including 2 facilitators) were selected from within the Design Discipline of PDPM IITDM Jabalpur and were grouped into two teams of six members each for the exercise. These participants included students from the third and fourth year of the Bachelors of Design programme, who have worked in well-known design firms and institutions while working for their capstone projects or internships and have experienced the design process adopted by the industry. Further, keeping in mind the use scenario of the toolkit, the exercise was conducted during the ideation phase of an ongoing Product Design course, wherein students were to redesign existing or develop innovative product-based solutions.

For the first round of ideation, each of the teams was allotted 30 minutes to ideate on multiple concepts to incorporate sustainability in their products. At the end of this round, participants were asked to describe their struggles and limitations during the process. The second round of ideation for 30 minutes involved the use of the designed toolkit. The teams were asked to first identify the sustainable design issues pertaining to their products from the Problems deck. After identifying the problems, the teams were once again asked to ideate on sustainable design concepts but with the help of cards from the Prompts deck. Each team member had to pick out random cards with prompts and ideate on concepts with the prompt acting as the design direction. At the end of the round, the participants were asked about their struggles during ideation and also how the toolkit had affected the process as compared to the previous round.

### 4.2. Observations

The insights from participants at the end of each round of ideation alongside the observations made by the facilitators of each team creates the groundwork for the validation of the concept. At the end of round one of ideation (without the cards), participants stated that it was difficult for them to generate a variety of concepts that diverge from the obvious interventions for sustainability such as the use of renewable materials or the 6R concept. Moreover, they also pointed out that it was difficult to ideate while keeping sustainability at the root of ideation. The facilitators observed that the concept generation process was being governed by the concern towards the feasibility than the variety.

At the end of round two of ideation (with the cards), participants pointed out that the Problems deck helped them in identifying precise directions for the problem solving. Also, the Prompts deck helped the teams to think laterally and come up with almost twice the number of concepts generated previously with much less effort, without focusing on the end results. Facilitators stated that the toolkit provided the participants with a broader view for ideation and also helped kickstart conceptualization, making the activity not only more enjoyable but also which would work well with the design process in the industry. However, the facilitators observed that the cards within the toolkit were exhaustive and the participants might also become dependent on the toolkit for ideation. Process is showcased with the help of Figure 4.



[Figure 4] Designers selecting out problems(left) and discussing prompts(right)

## 5. RESULTS AND DISCUSSIONS

The following segment discusses the results and discussions in regards to the observations from the exercise performed for validation and also addresses the feedback from the blind peer review.

The following results can be obtained based on the observations made from the exercise:

- There is a distinct variation in the quality and quantity of concepts generated while using the toolkit as opposed to the conventional procedure.
- The toolkit helps users to ideate laterally creating diversity among concepts thus paving way for sustainable innovation.
- The toolkit also acts as a concise database for DfS concepts and sustainable design education.

The context the cards were tested in and the outcomes have been discussed previously. However, the cards could not be tested in other contexts such as one in which the participants have no knowledge of DfS, or one where the participants have experience using other tools for sustainable design. The proposed toolkit focuses on aiding in sustainable ideation and lateral thinking and can be used by novice users as opposed to other card/prompt based DfS strategies that contribute to the development of a sustainable solution unique to the problems that a product poses and are elaborate, time consuming as well as require some experience with the toolkit itself.

## 6. CONCLUSIONS

The toolkit essentially targets at bringing sustainable product creation down to the root level of design ideation following the “Attitude to Action” concept. The toolkit also aims at complimenting two of United Nations Environment Programme’s sustainable development Goals, i.e., number 9 (Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation) and number 12 (Ensure sustainable consumption and production patterns) for the year 2030 by creating a pathway to sustainable product innovation.<sup>2</sup>

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## THE SUSTAINABILITY OF PACKAGING FOR E-COMMERCE: FROM SYSTEM TO PRODUCT.

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### ABSTRACT

The e-commerce is a fast-growing sector, which has substantial impacts due to delocalisation, cost-effectiveness, rapidity and availability anywhere at any time. It implies not only a different logistic organisation but requires a radically different interaction between sellers and customers. This research aims at applying the concepts of local and sustainable development to the world of e-commerce, with particular attention to the role of packaging. The topic has been explored at two design levels: first, the methodology of Systemic Design was used to define innovative future scenarios for the logistic management of the e-commerce system; secondly, different eco-design methodologies have been used to focus on the development of packaging for different scenarios. The analysis allowed to establish the main guidelines for the definition of futuristic sustainable scenarios of logistics. Starting from these, six main trends for designing sustainable packaging have been identified and tested through real concepts.

Key Words: packaging design, systemic design, sustainable development, e-commerce

## 1. THE ENVIRONMENTAL CHALLENGES OF THE BOOMING E-COMMERCE INDUSTRY

The e-commerce represents a rapidly growing phenomenon, which interests almost all production sectors, and has substantial impacts at the global level. On-demand economy is booming and continues to expand into new businesses: although the future of this sector is still clouded, it will definitely change consumption patterns, supply chains, competitiveness, as well as local and global regulations (Kerrigan, 2018; Netcomm, 2018). Online marketplaces are able to offer product ranges broader than any store could offer, by providing real-time information and added value services to sellers and buyers (Kestenbaum, 2017): if businesses are getting closer to their consumers, e-commerce is also allowing people to come together through the use of information technology (Leonard & Jones, 2015). Both in Business-To-Consumer (B2C) and Consumer-To-Consumer (C2C) e-commerce, the relationship between sellers and buyers is mediated by digital infrastructures and aimed at buying and selling goods and services. However, the interaction with web 2.0 tools often brought to a more social and collaborative approach used in online marketplace (Parise & Guinan, 2008) to enhance users adding value by generating and sharing content (Huang & Benyoucef, 2013). This creative and, often, unpredictable way of communication represents a fresh social challenge. However, the way people interact with each other involves also environmental factors: in other words, the sustainability of the e-commerce system is deeply affected by how users behave by creating new relations and new information concerning each other and the products and services they buy. The Digital Age is reshaping our way of living towards a new “augmented reality” in which digital reality is inseparably linked with the physical one (Jurgenson, 2012); this leads to many consequences that we do not intend to address here. What we are concerned with is the importance of analysing the complex digital-physical system of e-commerce to understand the potentialities of sustainability.

The world of e-commerce marked a paradigm shift both in the logistic organisation and in the stakeholders' interactions. On the one hand, we are moving to a global scale that strengthens the trend towards delocalisation and cost-effectiveness but, on the other hand, e-commerce retailers need to be a regular presence at the local level to ensure rapidity and availability anywhere at any time, addressing different cultural and purchasing needs. Therefore, the design of products, packaging and services for e-commerce has to face pressing challenges: designers are required to deal with many different factors, from packaging materials and technologies to techniques for storage and delivery to data management and visualisation. At the same time, the widespread interest in sustainable development is bringing new requirements of sustainability to e-commerce, especially concerning consumption patterns.

This research contributes to the body of knowledge about this emerging sector, aiming at applying the concepts of local and sustainable development to the world of e-commerce, with particular attention to the role of packaging. Because of the complex and interconnected nature of an e-commerce system, the research has started from the analysis of the logistics systems, focusing on their criticalities and potentials towards sustainability. In the second phase, the study addressed the design of packaging for e-commerce, by analysing the current scenarios and identifying the main trends to follow to design sustainable packaging able to effectively dialogue with the e-commerce systems. The research project was carried out in collaboration with the National Consortium for the Recovery and Recycling of Cellulose-based Packaging (COMIECO) and has involved the students from the Design degrees at Politecnico di Torino. The joint work of academic researchers and students allowed to innovatively address the matter, leading to a combined perspective on the topic that was then discussed with local and international stakeholders working in the e-commerce sector.

## 2. RESEARCH METHODOLOGY: FROM SYSTEM TO PRODUCT

The current investigation has been driven by two primary research questions: firstly, which is the role of Design concerning e-commerce, and how can designers cope with the material and immaterial complexity of this sector? Secondly, how can Design support the sustainable development of e-commerce, and how can designers deal with the environmental issues that new purchasing models are leading?

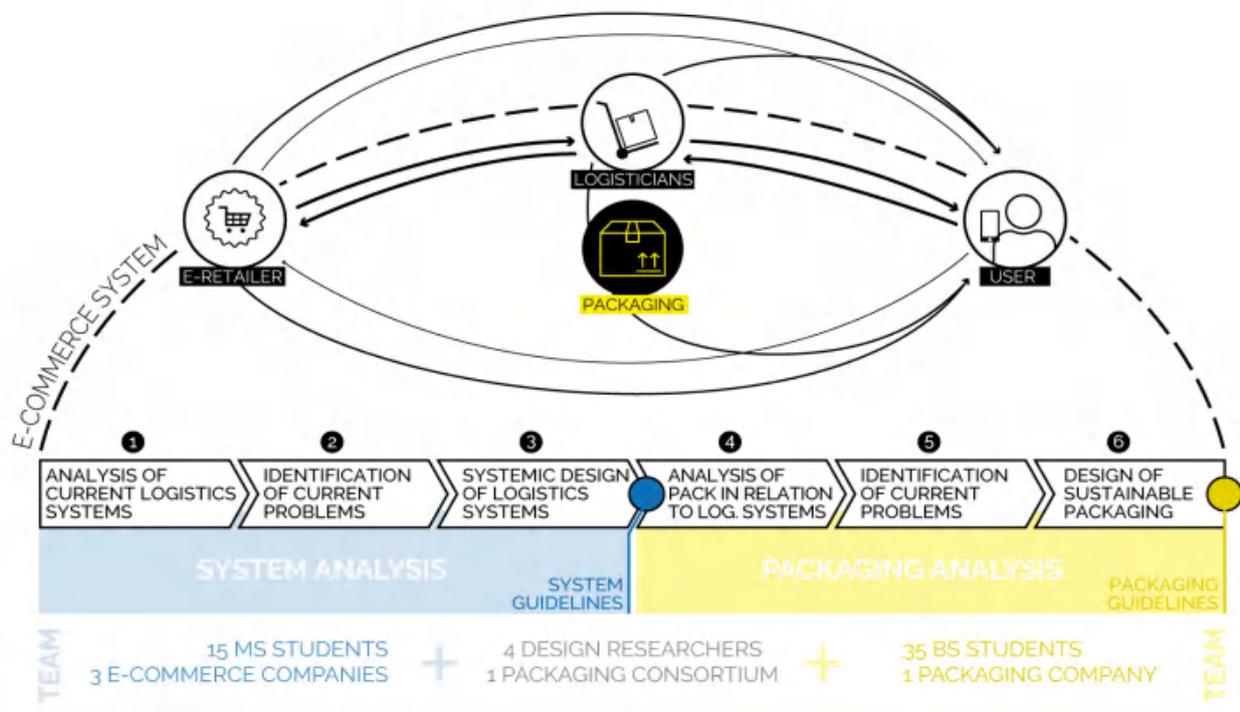
As outlined in the previous section, the complexity of the topic required to be approached at different design levels. The research project ran for one year and consisted of two phases: in the first one, a methodology based on the Systemic Design approach was used to define innovative future scenarios for the logistic management of e-commerce systems; in the second phase, different eco-design methodologies have been used to focus on the development of sustainable packaging.

Figure 1 illustrates in detail the six methodological steps that allowed to analyse e-commerce in depth, considering all the stakeholders involved and the two levels designers should act: the system and the product. Because in e-commerce we usually deal with retailers rather than manufacturers, the attention at the product level has focused on packaging, which represents a critical element as regards the environmental impact. Both in system and packaging, the analysis started from the current scenarios to identify the main existing problems from functional, communication and environmental points of view. After that, a design phase enabled us to give a response to the research questions through the definition of system and packaging concepts. The two levels of analysis are explained in detail in par. 2.1 and par. 2.2.

Moreover, the complexity of the topic required a multi-disciplinary team able to work and give feedbacks at different levels. A leading team of design researchers managed two groups of design students (enrolled in the op-

tional courses organised within the project) and kept regular contacts with different e-commerce stakeholders: the consortium COMIECO, three companies involved in the e-commerce logistics, and one packaging manufacturer. The stakeholders' involvement has been essential to give insights and get feedback on research achievements. Par. 2.3 provides a detailed description of the roles and tasks of the team.

[Figure 1] Visualisation of the methodological path of the research project



### 2.1. Analysis of the e-commerce system

The methodology adopted for the purposes of this research directly relates to the theoretical framework of Systemic Design (SD). Rather than a new discipline, we could define SD as a system-oriented design practice to tackle complex problems in complex systems. As Jones (2014) states, “Systemic Design is distinguished from service or experience design in terms of scale, social complexity and integration. SD is concerned with higher order systems that encompass multiple subsystems. By integrating systems thinking and its methods, SD brings human-centered design to complex, multi-stakeholder service systems [...]”. The methodological approach to SD developed at Politecnico di Torino especially focuses on the environmental sustainability of the system, addressing social and economic issues from a holistic perspective. Particular emphasis is placed on the flows analysis, assessing the inputs and outputs of the system and the complex links they generate: material loops are open to decrease environmental impacts and resource depletion (Bistagnino, 2011; Barbero, 2019).

As described in the previous section, e-commerce systems have the distinctive features of complex socio-technical systems: they are widening the geography of markets, crossing different supply chains and combining both material and immaterial levels. They affect production, package, distribution and use of products, by changing the current purchasing patterns and involving different actors with radically new roles.

It was essential to distinguish between three main types of logistics systems:

- Horizontal marketplaces sell products from a large number of categories at national and global levels;
- Vertical marketplaces sell products from a particular industry sector;
- Small-scale retailers are small enterprises that usually sell niche products or local products (in the latter case it is called hyperlocal e-commerce).

Three steps of analysis have been applied to the categories listed above

1. Analysis of current logistics systems. The first step is based on the analysis of the different types of e-businesses. The analysis considered the interactions between stakeholders (retailers, logisticians, users) and the flows of matter (with particular attention to packaging) and information (both digital and physical).

2. Identification of problems. The analysis allowed identifying the main problems considering the environmental, functional and communication impacts of different systems. This step of analysis also highlighted the stakeholders affected by each issue.

3. Redesign of logistics systems. The final step focused on the redefinition of flows, thus identifying possible design solutions to apply to solve the issues highlighted in the previous step (see par. 3.1).

### 2.2. Analysis of packaging for e-commerce

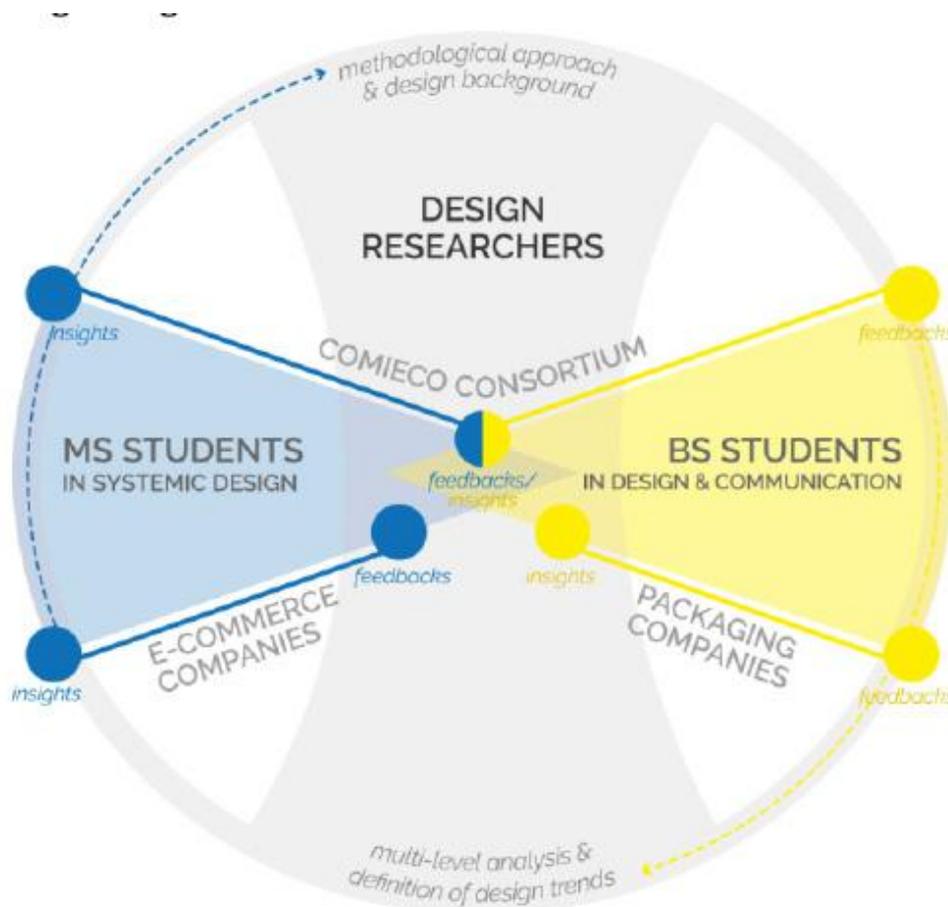
In e-commerce, packaging needs to meet new functional and logistics requirements, and it has to combine the func-

tions that in traditional scenarios are carried out by two different types of packaging (defined as primary and secondary packaging). In the e-commerce context, packaging has to complement the shopping experience, but it also has to answer the distribution requirements of an increasingly complex logistics.

The role of packaging is deeply interwoven within the e-commerce systems; therefore, the three-steps analysis started from the findings of the system analysis performed in the first phase:

- Analysis of packaging in current logistics systems. This step further expands the analysis of e-commerce systems focusing on the role of packaging within the system. It also assesses the interaction with intermediary users (in particular logistics operators) and final users.
- Identification of problems. The second step outlined the main problems affecting the environmental impact of packaging, but it also considered the functional and communication issues that may undermine packaging effectiveness concerning its logistics role and user interaction.
- Redesign of packaging. The last step set some key guidelines to advance the sustainability of packaging for e-commerce. The design of new concepts enabled to test the guidelines and start addressing the issues highlighted. The results achieved are presented in par. 3.2.

[Figure 2] The roles of teams and stakeholders involved in the project



### 2.3. Roles and tasks of the multidisciplinary team

As described in the introductory section, the complexity of the topic required a multi-disciplinary team able to work and give feedbacks at different levels (Figure 2). The leading research team was composed by four design researchers from Politecnico di Torino, that organised two training courses focused on Systemic and Packaging Design for e-commerce to enrol two groups of students from the Master Degree in Systemic Design and the Bachelor Degree in Design and Visual Communication at Politecnico di Torino. The leading team had regular contacts with the five stakeholders involved in the project:

- Consortium COMIECO: it represents hundreds of producers, importers and converters of cellulosic material and packaging. They are facing an increasing demand for cellulose-based packaging and are addressing the related problems of managing and recycling this type of waste.
- E-commerce companies: three companies working in e-commerce as retailers and logisticians are involved as direct stakeholders of the sector.
- Packaging companies: one manufacturer of packaging is involved as industrial stakeholder because of its interest in this emerging area.

The stakeholders provided valuable insights about e-commerce and gave technical and professional feedback on the students' work. The research team reinterpreted the stakeholders' observations to strengthen the design back-

ground of the project and included their feedback in the definition of the eco-guidelines.

### 3. RESULTS

In this work, we investigated the e-commerce sector from a design perspective, starting from the issues and potentials of different logistic systems to focus on the strategies to improve the sustainability of packaging. The analysis allowed to explore the two levels we examined (system and packaging): first, we set the leading design trends towards sustainable scenarios of logistics; secondly, we identified the main guidelines for designing sustainable packaging, that we tested through real concepts.

#### 3.1. Results of the system analysis

The analysis was carried out on three different logistics systems (horizontal marketplace, vertical marketplace, small-scale retailers) and identified three critical points that are common to all the systems analysed. Table 1 reports these criticalities, the related issues and the design trends we defined.

On the whole, there are many problems concerning the waste of material and packaging, the lack of communication and interaction, the environmental impacts due to transportation on a large-scale. In terms of sustainability, designers should work on the relations between the stakeholders, rethinking the system to enhance direct communications and greater attention to the local impact. Transparency and flexibility should characterise the new e-commerce systems to drive innovation from a systemic perspective and realise the potential of a sustainable digital economy.

[Table 1] The main criticalities highlighted in the system analysis and the related potentialities to address

CRITICALITIES OF E-COMMERCE SYSTEMS		POTENTIALITIES IN TERMS OF SUSTAINABILITY
Criticality	Related issues	Trends
Lack of a systemic perspective	<ul style="list-style-type: none"> <li>&gt; waste of material</li> <li>&gt; use of multiple disposable packaging</li> <li>&gt; anonym packaging</li> </ul>	Design a <b>PACKAGING</b> that considers all the steps of logistics and the needs of the actors handling it. Re-think the <b>PRODUCT DELIVERY</b> to optimize transportation and packaging
Lack of relations between actors	<ul style="list-style-type: none"> <li>&gt; lack of users' feedback</li> <li>&gt; reduced transparency of communication</li> <li>&gt; communication limits imposed by the scale</li> </ul>	Design a <b>NETWORK OF RELATIONS</b> between producers, retailers and users to enhance the transparency of the system
Lack of relation with the territory	<ul style="list-style-type: none"> <li>&gt; limited focus on local products</li> <li>&gt; transportation impacts</li> <li>&gt; disposal and reuse of packaging</li> </ul>	Design <b>MULTI-CENTERED SYSTEMS</b> widespread on the territory to add value to local resources while reducing the impact of transportation

#### 3.2. Results of the packaging analysis

The analysis concerned different types of packaging used in different logistic systems; the aim was to identify the common criticalities and the related issues. Table 2 summarises the main results and describes the six guidelines that we defined starting from the highlighted problems. The principal issues designers should address to improve the sustainability of packaging for e-commerce affect the functionality of use (flexibility, customisation), the interaction with the users (communication, awareness) and the management and disposal of the packaging (lifecycle and reuse, end of life).

[The team of bachelor students implemented these guidelines, testing them through different concepts of packaging that could fit the needs of horizontal marketplaces, vertical marketplaces or small-scale retailers (Figure 3). The industrial stakeholder gives periodical advice and feedback about the students' work: the resulting projects propose futuristic packaging that could be possible to produce on a medium-large scale.

### 4. CONCLUSIONS

The research contributes to the body of knowledge in the areas of Systemic Design and Packaging Design for sustainability, investigating the emerging topic of e-commerce that is raising concerns about the sustainability of future consumption patterns.

This study is an interesting case of a research project that jointly deals with the design of systems and products (packaging), also considering in the analysis the strong orientation of e-commerce towards service. It represented, therefore, a valuable opportunity to address complex problems that synergistically involve the three scales of design: system, service, product.

Table 2] The main criticalities highlighted in the packaging analysis and the related potentialities to address

CRITICALITIES OF E-COMMERCE PACKAGING		POTENTIALITIES IN TERMS OF SUSTAINABILITY
Criticality	Related issues	Guidelines
Non-joint design of product and packaging	<ul style="list-style-type: none"> <li>&gt; Use of multiple disposable packaging</li> <li>&gt; Waste of material</li> <li>&gt; Handling problems</li> <li>&gt; Functional issues</li> </ul>	1. LIFECYCLE AND REUSE: design new logistic strategies to adopt reusable packaging and/or to give a second life to single-use packaging. 2. COMMUNICATION: design the aesthetics together with the function; improve the “unboxing” experience.
Non-optimized shapes and volumes	<ul style="list-style-type: none"> <li>&gt; Oversized packaging</li> <li>&gt; Waste of material</li> <li>&gt; Higher impact for transport</li> </ul>	3. FLEXIBILITY: design for variable amounts and typologies of goods. 4. CUSTOMISATION: design for creation of customized packaging.
Lack of attention towards the end of life of packaging	<ul style="list-style-type: none"> <li>&gt; Widespread use of single-use packaging</li> <li>&gt; Waste of material</li> <li>&gt; Difficulties in recycling</li> </ul>	5. END OF LIFE: design for involving users in the management of the end of life of the packaging through the reuse or the recycling. 6. AWARENESS: design for increasing sustainable and informed purchasing behaviours.

The combination of academic research and training courses is an important means of achieving innovative results, facing the topic from different perspectives and free of technical constraints imposed by productive and organisational environments and structures. At the same time, the regular interaction with a National Consortium and several industrial partners allows to include the perspective of the stakeholders that are working at the coalface in the e-commerce sector. The results achieved have been thoroughly discussed within an interdisciplinary and cross-sectoral team; therefore, the findings of this multi-level analysis represent an effective design reflection and experimentation that set the trends to follow to bring e-commerce onto a sustainable path.

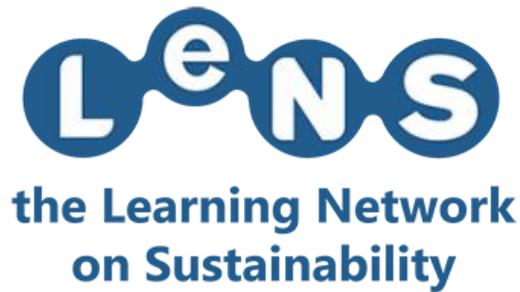
[Figure 3] Some packaging concepts designed by the team of bachelor students enrolled in the project



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## SUSTAINABLE INTERACTION FOR MOBILITY SYSTEM

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### ABSTRACT

Many studies report that the results of top-down policymaking approach are not enough and suggest that “sustainable development cannot be imposed from above. It will not take root unless people across the country are actively engaged” (UK DEFRA, 2002). The goal of this research is to combine the interaction and gamification strategy with a set of personal data in order to increase the users’ awareness of the impact of each action. The research context is the mobility system in which the increase in road congestion and the risk to compromise human well-being are just some of the critical points to be faced in the future. Possible solutions to these problems already exist, such as shared mobility and autonomous cars, But the change to be fostered is not only about business or technology, it must involve the citizens who will influence the future through their decisions and behaviour. The experimentation focuses on a case study useful for obtaining and analyzing the qualitative and quantitative research results. In particular the case study concerns the design of an interactive augmented reality game, that plays on board of a full self-driving car, in which user takes decisions as the leader of his fictional world; as result of his decisions the environment around him changes. The game continually reconfigures itself taking advantage of users’ personal information and data collected through different ways. Gestures, copywriting and other elements will follow the needs of each user. Instead of a more traditional approach that results frustrating and not very involving for the user, the game uses an ironic, surreal, and funny language in order to be more engageable, instead of a more traditional approach. The goal is to make conscious users towards the environment that surrounds him and his ability to affect positively or negative the system in which he lives.

## 1. INTRODUCTION

The efforts of all world's institutions compared with the pessimistic data concerning global environmental change has pushed the institutions to consider 'citizen-consumers' as key environmental actors. In fact actions of each citizen are crucial; thus, the citizen must be encouraged to make responsible choices and positive behaviors regarding sustainability. (Johnston, 2007; Spaargaren & Mol, 2008). Many studies report that the results of top-down policy-making approach are not enough and suggest that "sustainable development cannot be imposed from above. It will not take root unless people across the country are actively engaged" (UK DEFRA, 2002). Many researchers would suggest the necessity of creating a new approach to address behavior change. This new approach should consider and connect better sets of practices; "researchers should engage and work with practitioners to explore the practicalities of using alternative approaches that rely on complex and shifting understandings of behavior and practice" (Barr, S., Shaw, G. et al., 2011). According to that, the project aims to experiment an alternative strategy to engage people with sustainability issues. Those strategies involve the use of gaming elements, as fun, and an ironic language to engage and motivate people to act responsibly. The research context is the mobility system, and, the project is thought to be part of the user experience of the autonomous vehicle. Autonomous vehicles will provide many opportunities and advantages to users. The experience inside the vehicle will be completely different because users will be free from driving and will interact with the vehicle, the context and with other possible actors. One of the goals is to evaluate new technological integrations as a means and an opportunity for improving both individual and collective wellbeing. Starting from this concept, the research team develop an interactive augmented reality game, which the main purpose of engaging users into sustainability issues. This game will be played during part of the travel and will interact with each user differently. The game will change contents and configuration according to many factors, as the context of use and the characteristic of specific users. In order to achieve a very personalized experience, we acknowledge that collecting data from users could be a valid solution to learn more about them in order to create specific profiles that answer specific needs.

## 2. BACKGROUND

### 2.1 Behavior changes in the sustainability context

Sustainability is a big and very complex issue that involves three dimensions (Economic, Environmental, Social), "those dimensions are tightly coupled, and their interplay cause global systemic effects that cannot be fully understood or predicted based on local events" (Fabricatore, C. & Lopez, X., 2012). Addressing the complexity of sustainability requires equally complex strategies, it is difficult to define a unique way to face it. In this project we considered a voluntarist approach, it argues that, although attitudes and behaviour are driven by deep structures (for example economic structures), the structures are determined in part by how we live our lives. This approach opens the possibility to achieve sustainable development also through behavior change (Dobson, A., 2007). There are many forms to address behavior change and encourage people to act into environmentally beneficial, for example educating them or offering them financial advantages and penalties, but those latter strategies although could change behaviour very fast (Dobson, A., 2007), may not make people aware of real problem, and so do not solve the problems in long terms. In the process of behavior change design should educate people "for sustainability-related values (e.g., ethics, cooperation, respect for the environment, etc.) to influence individual decisions" (Bolis, I., N.Morioka, S. et al., 2017). In attempting to integrate these values in our society should be considered that our current development model encourages individualism (based on monetary evaluation), then one of the first ambitions for practitioners should be promoting societal values focused on improving the welfare of society rather than only the individual welfare (Bolis, I., N.Morioka, S. et al., 2017). Hence, communicating value as the respect of the natural environment, quality of life, altruism and sense of community could be the base to build sustainable development. In order to engage people with those values, they needed to feel involved and informed about the issue. The values, however, cannot be imposed, in this way, it would be detrimental (Bolis, I., N.Morioka, S. et al., 2017).

### 2.2 Autonomous cars and Sustainable mobility

The relevant interest of the scientific community and the world's most significant technological brands about autonomous cars lets us imagine that this kind of technology will become more widespread in the near future (Bishop, R., 2005). The autonomous vehicle probably will change the way we live the movement and experience the vehicle, they will also influence widely the whole mobility system. Many researches have analysed, for example, the efficiency of this technological shift regarding the sustainability of the mobility system, as an example the decrease of both accident and congestion (J.Fagnant, D. & Kockelman, K., 2015). Probably, the most important revolutionary factors remain the lack of human drive control in fully autonomous vehicles, this disruptive element will influence directly the in-vehicle experience offering an exploration of new forms of connectivity, as well the integration of entertainment and gaming contents (Meschtscherjakov, A., Tscheligi, M. et al, 2015). It will not just be a question of quantity of information and connections that system could provide to users that will enhance the whole user experience inside the vehicle, it is more about the quality and value of those contents and interactions. Relationships and interactions between user and vehicle will work very differently into the autonomous vehicles. The vehicles will

turn smarter than ever, their capacity to perform a lot of connections, elaborate information and take decisions it may cause a feeling of lack of control for passengers, and then ruins their experience. This trouble, however, is a big challenge for interaction designers, they have the responsibility to transform this safe technology in a cooperative and assistant system rather than reduce it as a distant and pragmatic autonomous driving system.

### **2.3 Learning sustainability through gaming**

Numerous empirical studies confirmed the effectiveness of games as educational tools in the last recent years. The reason why games are so important to cover this role are multiple: “the intrinsic motivation stimulated in games (Dieleman & Huisingsh 2006); the presence of pedagogic principles in game design (Becker 2007); and the access to shared social practices for the construction of knowledge (Gee 2007; Steinkhueler 2008)” (Fabricatore, C. & Lopez, X., 2012). In the context of sustainability learning, the element of fun in games could be very beneficial to decrease emotion like stress or frustration, supporting knowledge and skills learning.

Moreover, educating for sustainability demands approaches that support system thinking and complex environment, games in that way are perfect because they address complexity and push the user to face unpredictability and nonlinear development of the event (Fabricatore, C. & Lopez, X., 2012).

Improving the capacity to collaborate with a system of actors is crucial to achieve sustainable development, “games foster the collective construction of knowledge, collaboration and sense of belonging by stimulating players to discover and discuss within the gaming community how to tackle game mechanism, quests, rules and stories that define the game world (Steinkuehler 2008)” (Fabricatore, C. & Lopez, X., 2012).

Finally, games enable users to understand better phenomena through the process of “learning by doing”, the players can see just-in-time the feedback, affording a situated and systemic understanding of the consequences of their actions (Fabricatore, C. & Lopez, X., 2012).

## **3. PROJECT**

### **3.1 Experimenting a new education approach: a game for sustainability learning**

There is an urgent need to develop and experiment with new approaches for sustainability communication and learning. The direct approach that communicates to people what they do, or they do not in term of sustainable behavior, most of the time appear frustrating and annoying for them. We can suppose that people avoid some sustainable communication contents because they are not engaged in several ways with them. Our contribution consists in revalue actual approaches and try to communicate sustainability through an indirect way emphasizing fun as a lever for engaging people. Gaming environment is one of the famous places where people are engaged with fun, it is probably one of the most suitable means to transfer this kind of contents; games are also important in this context because they have the power to engage people in the long term. The literature analysis highlighted the lack of effectiveness for sustainable communication to engage people in the long term. For example, a team of researcher analyzed the impact of the film “The Day after Tomorrow” and discovered that this Hollywood disaster blockbuster “raised awareness of climate change and triggered anxiety among some viewers about the possible impacts as well as about other environmental risks.” (Lowe, T., Brown, K. et al., 2006). However, as their study has shown, “the effects upon the public psyche may be brief and quickly overtaken by more pressing day-to-day issues” (Lowe, T., Brown, K. et al., 2006). Games, differently from films, if they are engaging enough, they could keep the level of interest high over time because they involve users frequently and establish a more interactive relationship between users and contents. Furthermore, the game is designed to enrich a highly interactive environment as that of an autonomous vehicle. The cabin of a digital car for us is a powerful place where experimenting new interaction between human, machine and environment (both inside and outside the vehicle). Considering the element of the environment, in particular, the environment outside the vehicle, is crucial, because one of the significant risks, when we talk about the digital car, is that the digital contents immerse users in a virtual dimension that detaches them from the real world. The digital experience should instead exalt reality and help the user to understand it better rather than completely detaching him from it. This capability of digital cars to perform deep connection with the real context through smart technologies represents an excellent opportunity to strengthen the sense of belonging of the user towards a system of which he is a part and of which he too is responsible for the conditions.

### **3.2 Methodology**

The project is based on the use of systemic methodology, especially because the topic of sustainability cannot be addressed without considering relations between all the actors, if the goal is to generate significant changes. Economic, environmental and social actors are strongly interdependent, and they represent multiple nodes of a complex network that needs to be considered as a whole. ( Bolis, I., N.Morioka, S. et al., 2017). Systemic thinking is helpful to emphasize the connections and relationship between those different contexts, in a way that users can understand better how their impact act and influence through several contexts. In order to apply all these concepts to our project we started with a preliminary holistic investigation in the world of digital games and beyond, the purpose of understand state of the art and the relationship between sustainability and games. Many essential results come out from this first research; in particular, one important reference has strongly influenced the structure of our project.

This main case study is about “Reigns”, an award-winning digital video game set in a fictional medieval world where the player has the role of a monarch who rules the kingdom by accepting or rejecting suggestions from advisors.

A lead developer has claimed that the team wanted to “mock the way our societies tend to deal with complexity”. They used the swipe interaction to make people feel the disconnect between this simple gesture of answering to suggestions and the complex consequences of their decisions. Additionally, to that idea, we consider extremely important to immediately communicate to the user the importance of balance between the three dimensions of the system. In our project each action has consequences on all three dimensions, in this way, the system design combined with the interactive and game dynamics can trigger a self-reflection even in the face of unethical choices.

### 3.3 The game

The game immerses the player in a mixed world with elements of fiction and elements referred to reality. The main task of players is to take decisions interacting with this world in a several ways and experiencing a different kind of reaction as results of the interaction between him, the vehicle and the environment. The team created several fictional characters for this world, and the personality of each one is the result of field research. The field research qualitatively underlined the reactions of people in front of generic sustainability issues. A matrix with four variables (Active-Passive /Expert-Inexpert) has been created to characterize several kinds of people, based on their attitude. These characteristics have been used to create the characters. Those characters are significant for the game because their role is an advisor for the players. The player experiences this world as a leader, and he is the main responsible for the conditions of this world. The advisors ask, with an ironic tone of voice, to take decisions about matters that can appear strange, absurd or nonsensical. The suggestions will be customized for each user, as a result of the elaboration of personal data principally collect through the previous journeys. By the consequence of user’s choices the whole system changes constantly, and the player can monitor this changing, positive or negative, through many signals. The most important signal that player have to follow during the game to avoid the “game over” is the state of three bars that represent the three dimensions of sustainability. If one of this bar go over the maximum or minimum limits the game ends.

Others aspect that communicates the changing of the world are visible through augmented reality and involving the outside environment mixing virtual and real elements in order to create a specific effect, as an example environment deteriorates by a human-made disaster. The game is subdivided into levels, and the player should be motivated to overcome them discovering new characters, effect and additional element until to complete the game.

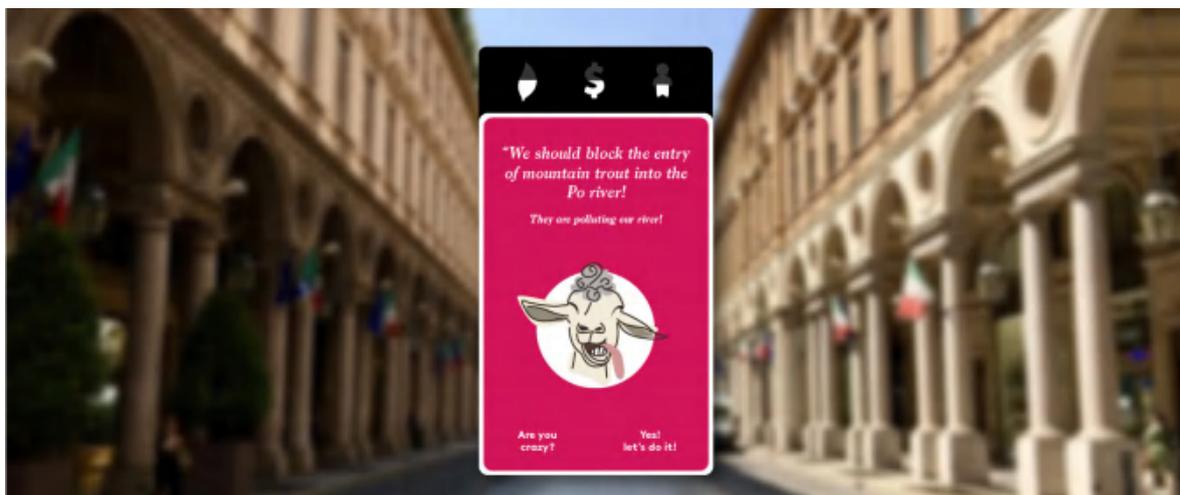
This strategy should principally have the user’s fun and stimulate their sense with special effects that connect him also with the outside environment. At the same time, the game pushes the player to think about complexly in front of suggestions avoiding the destroying of the balance system and overcome the levels to complete the game.

### 3.4 Prototyping

Considering the amount of complexity and technologies involved in this project we planned three-step of prototyping in order to have the possibility to experiment the concept more and more time improving and correcting the elements through user tests.

The three steps comprehend;

- First prototype [Figure 1]: consist in a basic interactive mock-up build with assembled screen composed by a limited series of cards (simulation of the first level’s game). Inside of each card a character suggests something to the player who has to decide between two answers. Our expectation for this prototype is to understand the effectiveness of the general approach and if this strategy could be both engageable and educative.



[Figure 1] Screen of the first prototype showing one of the cards of the game.

- Second prototype: the upgrade compared to the prototype is mostly about the interaction and the environment. If the prototype is thought to be experienced through a display, the second one will be tested in Virtual Reality (VR). The VR technology allows us to understand better how the game could work inside the autonomous vehicle context.

- Third prototype: the last version of the prototype will be very near to the real game. Now it is complicated to plan how to build it because it will be a result of previously experimentation. Our idea is to test the last one directly inside the autonomous vehicle and use all technologies we mentioned above.

### 3.5 Experimentation

The first experimentation was based on the first prototype and consisted in a user test followed by a survey.

As we explained in the prototype section, our main expectation for this experiment is to understand the effectiveness of the general approach, measure the engagement and the education capability of the game through a professional consult. We selected a sample of experts because we intended to obtain a technical and no-technical response. The users represent category of designers, and most of them are involved in the sustainable research field. We asked the user to test the prototype and answer to the survey about many game's aspects.

The survey was composed by eleven closed question and one open question for more consideration.

### 3.6 Results

For the users, the game appears easy enough to learn, but the objective is a little vague and not very understandable. Despite the firm limits in terms of interactivity, the prototype seems to have actively involved most users, some of them recognize these limits and consider that the application of other interaction modalities in future prototypes could improve the experience making it more engaging. The type of communication approach to the theme of sustainable education appears to be quite innovative for most users, although many of them can not define whether this strategy is counterproductive or supportive. In general, the sample has divergent opinions about the ability of the game to reflect on sustainable issues, but almost everyone agrees that the implementation of the structured game and the improvement of language can help achieve better this goal.

## 4. CONCLUSION

The response obtained by the expert users provided us with many insights for improving the prototype and the game as a whole. This first experimentation helps us to understand that the objectives of the game should be clearer for the users, and even if the suggestions by characters could appear deliberately no-sense, maybe the pattern of the questions should be more strategic. Another factor that influenced the test was the poorly interactivity of the prototype respect to the concept. Consequently, in the next prototype, we will concentrate our effort to implement this aspect including also more immersive technologies. Concerning the effectiveness of the education approach, we discovered that, although we involved expert users into the test, they were not able to evaluate precisely this aspect. Maybe in the next experimentation, the sample should also be extended to the non-expert users and should be taken into consideration the impact of the game in long terms to understand better the influence of these stimuli in everyday life.

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## DESIGN AND AGRIFOOD FOR NEW SUSTAINABLE LOCAL DEVELOPMENT

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### ABSTRACT

This paper is about the relationship between design and the prickly pear of Roccapalumba (Sicily), a product of the agrifood chain, considering it as a resource able to start innovative strategies for waste recycling and for a sustainable local economy.

The study examines the entire life cycle of prickly pear and, among the various outputs, considers the cladodes to obtain cellulosic fibres, mucilage for cosmetics and for restoration of cultural heritage, the flowers for infusions and the fruit seeds for an oil with nutraceutical properties to generate a second life of the prickly pear. This will lead to economic and environmental benefits in the territory, creating a network of companies with zero waste.

Key Words: Design, agrifood, circular economy

## 1. INTRODUCTION

This study is about the relationship between design and the agrifood chain of a territory to promote a sustainable local economic development.

The article examines the prickly pear cactus of Roccapalumba (Valle del Torto) and considers it, as well as for its organoleptic and nutritive qualities, also as a resource able to start collaborations and innovations within the Sicilian territory, to enhance the relationship between local actors and synergies between disciplinary areas belonging to different areas, and improve the waste management. The study examines the entire life cycle of prickly pear and among the various outputs considers the cladodes (commonly called shovel of prickly pear), the flowers and the seeds of the prickly pear fruit to generate a second life of the prickly pear.

The methodological approach follows a systemic vision focusing on the relationship between the actors of a territory and the territory in which they live, and is based on Systemic Design that contributes to the development of a circular economy (Cradle to Cradle). With this methodological approach we move from a production chain of the linear prickly to a system (output of a system becomes input for another), using the cladodes to obtain a wood fiber, the flowers for infusions and the seeds of the fruit for the oil with nutraceutical properties.

This interdisciplinary approach is fundamental to implement a systemic vision that can link the various activities through the recovery and the use of by-products of a supply chain in other productive fields and make the system zero waste. The research involves actors, researchers and SME who are interested in experimenting with innovative products related to the fruit of prickly pear and its by-products.

Interdisciplinarity and the involvement of various actors highlights the role of the design as mediator to achieve results that will demonstrate how the waste of a local resource can be transformed to develop new supply chains. These new supply chains will bring economic repercussions on the territory and with a focus on respect for the environment.

This paper is divided in two parts one about the design applied to the territory and the other on the investigation of the role of the application to agrifood sector of the Systemic Design methodology in order to generate a development of the local economy.

## 2. METODOLOGY

The aim of the research is to explore sustainable design practices related to zero waste of the prickly pear and the benefits that can be gained from implementing a circular economy, not only to the environment but also in economic local development.

Prickly pear cultivation is important for symbolic, historical, and territorial reasons and its study is analysed through, innovative productive techniques in order to increase consumption and to reduce disposal problems.

To do this, it is necessary to review the process that involves the entire prickly pear life cycle. So, through re-designing the processes of production, transformation and marketing of the prickly pear, is possible to start virtuous processes of innovation and valorization within the local territory, favouring its economic development with greater attention to environmental resources.

In fact, it is important to review the process from the production of the prickly pear to its distribution on the market, passing it from a linear to a circular production.

Circular economy employs principles from industrial ecology, reuse, repair, and recycling of the materials and products. In industrial ecology the goal is to reduce resources consumption, pollution in the environment and industrial metabolism refers of industrial systems that act as natural ecosystems (Ayres, 1989). Circular economy is an industrial economy that reproduces nature, optimizing the systems and following principles from nature (Ellen MacArthur Foundation, 2015)

This research shows prickly pear as a resource that, if redesigned according to the Systemic Design approach (Bistagnino, 2009) can identify new production chains that can interact with existing activities.

This methodology allows to design the flow of material and energy, transforming the outputs of one process into inputs for another, eliminating the linearity of the current production chain that generates waste, with the possibility of creating new value chains at the local level (Barbero, 2012)

This analysis clarifies the origin of what happens in all the processes, considering the inputs and outputs, the resources used for the transformation of waste and their final destination.

Furthermore, to understand the relationship between the parties involved and the context it is fundamental to identify the actors involved in the system, and their know-how.

To this end, research through the methodology of the systemic approach, investigates the production, processing and marketing of prickly pear with respect for the environment to generate local economic development. To achieve this goal, the phase of analysis of the production of prickly pear has used the methods and tools of Cycle Design (LCD). The study is based on a historical-cultural study of prickly pear, following which the production processes and the techniques used for cultivation and distribution were considered, highlighting where it is possible to make a redesigning intervention to move to a circular production

Furthermore, the study is based on a real case developed with the support of local producers that have made the designed solutions feasibility.

### 3. DESIGN AND LOCAL DEVELOPMENT

The design, in the past few years, has played a role in production systems and innovative models for the management of territorial resources. In fact, design has broadened its scope of action and can play a crucial role in the development of a territory, offering solutions for the growing demand of competitiveness, and creating new products and services. This is demonstrated by how the relationship between design and territory has been explored in the discipline of design, defining and bringing the succession of three different approaches (Parente, Sedini, 2017): “design in the territory”, “design of the territory” and “design for the territory”. Design, as proposed by Tim Brown (Cicoria, 2013), it has become an asset in any product or service in the market and a strategic tool in the landscape of innovation. Today Design is confronted with territorial, social and economic characteristics in the place in which it operates, and highlights those aspects that help to build a production identity in a specific territory.

Within of a territory, among his elements of identity other than natural and cultural heritage, there is also, agrifood which represents a primary good, a means of expression of community's traditions, a source of well-being and health and a symbolic element of socio-cultural and of identity.

In order to launch innovation processes with the goal of environmental sustainability, it is crucial to put the focus on the potentiality of territories based on the transformation of existing, economic, human, cognitive and cultural resources and role that different players of a territory. More specifically, to do that, is important to adopt an interdisciplinary approach where know-how, cultures, and techniques related to innovation can answer to new changes of cultural, social and economic paradigms.

The aptitude to power the typical resources, which is not possessed by others, is presented as competitive opportunity and change is determining factor in the fame of the place.

This suggests that design is becoming increasingly important in the field of innovation. It is becoming indispensable in the design process of any product or service, shifting its focus from the mere design of the product to the whole process and exploring new business models (Brand, Rocchi, 2011).

### 4 .ANALYSIS ABOUT PRICKLY PEAR

The prickly pear (*Opuntia ficus indica*), is a member of the Cactaceae family, originating from Mexico and distributed in America, Europe and Africa for the production of fruit, forage or vegetable. In Sicilian production and distribution areas, located in the San Cono Hills, South-West of Etna, Belice Valley, the Valley of Torto and to Roccapalumba in the province of Palermo, and that in 2009 established the consortium of producers of prickly pear, 'Roccapalumba and its flavors'. The bark of the prickly pear is composed of cladodes (commonly called pads) that branch in a tree-shaped. The cladodes form the stem of the plant, this stem is naturally modified to retain water. Cladodes contain water, carbohydrates and fibres, mucilage, proteins, minerals and a moderate amount of vitamin A and C. Scientific literature recognizes cladode components for use in the pharmaceutical, herbalist and cosmetic fields. The prickly pear after hand - picking is packed in cardboard boxes, the fruit and the inside of the skin, are used for the production of beverages, jams, mustards and a variety of food products. From study of the cycle of production of the prickly pear among the various outputs considers the cladodes, the flowers, mucilage and the seeds of the prickly pear.

### 5. NEW PRODUCTS FROM OUTPUTS OF PRICKLYPEAR

This study examines the outputs of the prickly pear: flowers, seed, mucilage and cladodes. *Opuntia ficus indica* flowers for the decoctions and infusions can be destined to the herbalist's shops while, as regards to the seeds that are an output from fruit is extracted an oil that represent an interesting cactus by-products. In fact, this oil has nutraceutical properties that is rich in polyunsaturated fatty acids and vitamin E content. These compounds are responsible of the antioxidant and hypoglycaemic effect mediated by the inhibition of carbohydrate-hydrolysing enzymes. Health benefits of fruit and vegetables came from additive and synergistic combinations of phytochemicals. (Am J Clin Nutr 78: 517S-520S). In this context *Opuntia ficus-indica* seed oil represent a promising source of healthy compounds useful not only as antioxidant to preserve lipid components in food preparation but also as functional ingredient due its hypoglycaemic effect. The scientific results on the seed oil for human nutrition, have been developed, with the collaboration of a research team made up of chemists, biologists and pharmacists of the University of Palermo, Reggio Calabria and Marche, and can be added to the best known use for cosmetics.

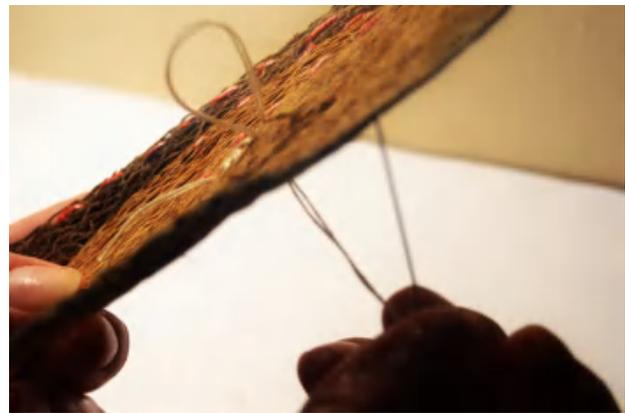
Mucilages of *Opuntia* are compounds of great potential to be applied in different fields, such as conservation of cultural heritage, pharmaceuticals, cosmetics, foods and biodegradable polymers. Mucilage is a polysaccharide generally composed by varying proportions of l-arabinose, d-galactose, l-rhamnose, and d-xylose, as well as galacturonic acid (Sáenz C. et al., 2004), and it tends to be negatively charged (Gibson and Nobel, 1990). Thanks to its natural viscosity, its ability to form molecular networks that are able to retain large amounts of water (Saag et al., 1975), and its capability of forming gels in water, mucilage can be used for the development of bio-based innovative products, like additive and organic binder to improve the mechanical properties of materials used for the conservation of cultural heritage or as an alternative for producing added-value industrial polysaccharide gums. For example,

in Mexican historical buildings nopal juice extracted from *Opuntia* spp. is often incorporated in lime mortars [ $\text{Ca}(\text{OH})_2$ ], it works as an organic adhesive that prevents the mortar from drying too quickly and helps to retain the necessary amount of moisture, transporting  $\text{CO}_2$  from the atmosphere that combines with the lime to form an artificial limestone, using the juice as an organic adhesive to restore and protect historical buildings (Cárdenas A. et al. 1998).

The cladodes, that come from the pruning serves to ensure the propagation of cuttings and the preparation of soil for new production, the remaining part decomposes due of the water present in the cladding, thus wasting the wood fibre within them that could be a resource. In fact to obtain the vegetable fibre it is necessary to extract it and to dry it at open air; the extraction procedure is manually carried out by the green cladodes. This extraction process is under patent phase; the extracted fibre (Figure 1) has a complex, texture and thanks to its plasticity, such as wood, it allows steam treatment or immersion in hot water at a temperature between 30 and 40°C, in order to take the shape of the mold. The natural fibre obtained from the cladode waste, has led to a return to manual work in the process of product realization. Through this approach design can coexist with local craftsmen who propose, artifacts that reveal a material and immaterial heritage. The embroidery was chosen to be used, where necessary, as an element of union of decoration and identity, thus bring back a local tradition (Figure 2). The embroidery, together with the art of processing, are the elements for a new dialogue between craftsmanship and design, which focuses on the identity of a territory through a new resource obtained from a waste. The project and context become inseparable, and the project and production activity are in close contact with the collaboration of the artisans from the Valley of Torto.



[Figure 1 ] Prickly pear fibre

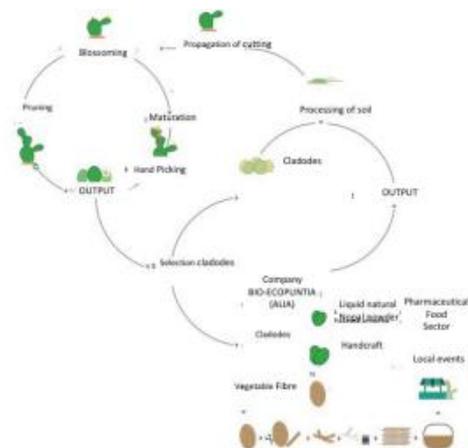


[Figure 2] Prickly pear fibre and embroidery

The prickly pear fibre was applied to make a basket to carry, expose, and contain the prickly pear (Figure 3). For the production of the basket prickly pear fibre was used, the olive branch for the handle and the embroidery to join and decorate the parts that make up the basket.

[The design a basket, as a first artifact, came from the necessity to expose and contain prickly pears during the XVIII edition of *Opuntia-Ficus Indica Fest, Sagra del Ficodindia* (Prickly pear Festival) in Roccapalumba.

Then the approach of Systemic Design has allowed to identify new productive chains that have led to the creation of the Bio-ecopuntia srl company. From the cladodes the Bio-Ecopuntia company is able to extract three natural elements: nopal powder, to be used as a food ingredient gluten-free, the natural liquid to be used in the pharmaceutical and cosmetic sectors, and the wooden lattice to be used as vegetable fibre; the cuticle (the external layer of the cladode) can be used as fertilizer or as food for animals. It is also possible to dry the flowers and to use them as phytotherapeutic products (Figure 4).



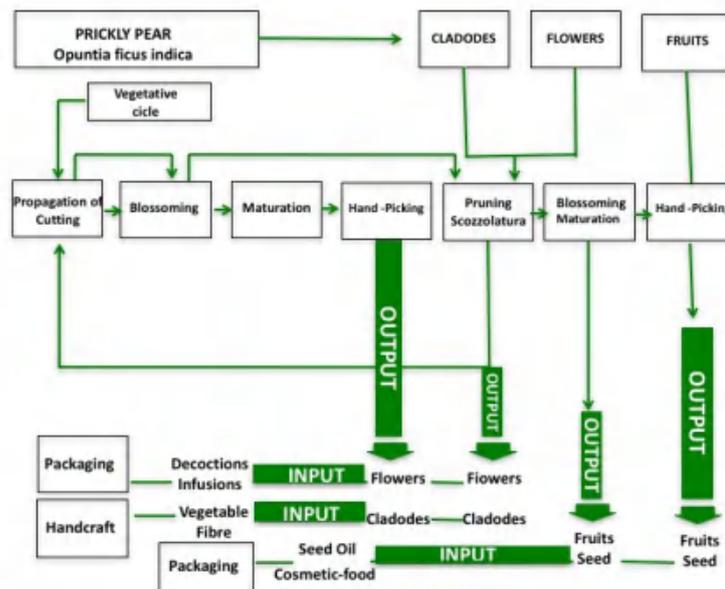


Figure 3] Basket with pricly pear fibre

[Figure 5] Scheme Prickly pear and output - input

[Figure 4] Scheme cladode output- input

## 6. OUTLOOK AND CONCLUSION

The results show that from output prickly pear there are some potentialities within the project and which could be further developed (Figure 5):

### Opuntia ficus indica seed oil

Actually used in top cosmetic products and beauty treatments, the *Opuntia ficus indica* seed oil could be shortly be produced for applications well beyond cosmetic, to become a new ingredient in nutraceutical, food supplement, sport drink and food.

### Opuntia ficus indica flowers

*Opuntia* flowers used as medicinal plant are astringent and are used for problems of the gastro-intestinal tract, colitis and irritable bowel syndrome. This flowers could be more valued as decoctions and infusions.

### Packaging

Packaging to enhance and distribute *Opuntia ficus indica* seed oil and *Opuntia ficus indica* flowers for the decoctions and infusions. This packagings, certainly, to reduce environmental impact will be design following certain guidelines to reduce environmental impact: single material to facilitate the separate collection, recovery, recycling or composting in end of life, used recycled and further recyclable material, to extend the useful life of the product by integrating new function coherent with the intended purpose of use.

### Vegetable fibre extracted from cladodes

The design of the basket to contain prickly pear marks the beginning for the development of different products.

The results show that, turning these outputs into resources for the territory will give new opportunities for local development economic. If we exploit the territorial resources we may boost a type of development that favours the local dimension and will allow to produce, supply and generate autonomously.

To conclude the study shows, through the Systemic Design and the multidisciplinary, the role of mediator of design to achieve results that demonstrate how the waste of a local resource can be transformed to develop new supply chain as: the possibility of designing new packaging to enhance and distribute prickly pear flowers decoctions and infusions and *Opuntia Ficus Indica* seed oil in the nutraceutical sector. It is possible to see a new path made by the interaction between design and craftsmanship development, that starting from a new local renewable material, and other products is able to bring innovation in the tradition.

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## **ZERO KILOMETRE PLANTS PRODUCTION. AN INTEGRATED DESIGN APPLICATION**

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### **ABSTRACT**

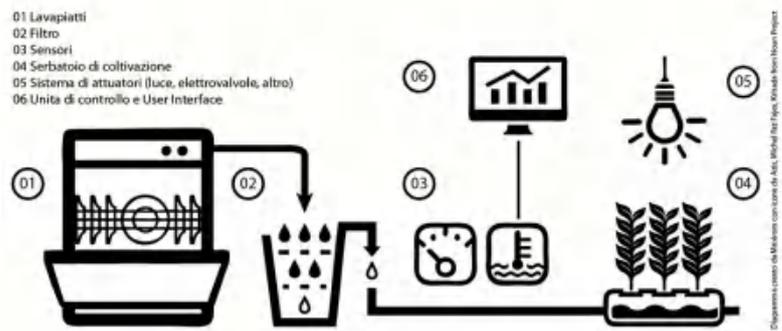
Interest in urban agriculture as well as the various forms of zero kilometre production for domestic use, necessarily passes through the redefinition of the parallel system of building components, both regarding technological and innovation level of the built space, towards their progressive integration: from independent solutions or simply superimposed on the building, towards increasingly hybrid forms, as expression of an increasingly integrated collaboration between architecture, agriculture and design. The result is the progressive replacement of traditional products with elements and components directly integrated in construction by composition and technology. The paper presents the first results of the design research whose objective is to experiment the possible applications to the contexts of the built space, to the different scales of the project, of a product system for the recycling of washing waste in a domestic environment for the production of plants. edible products underway at the Design Department of the Milan Polytechnic.

Key Words: sustainable gardening / waste water recovery / green integrated solutions.

## 1. INTRODUCTION

Environmental or ecological sustainability requires awareness of the natural resources. The impact of human activities and decisions on it is therefore of first interest in sustainability research deals with living spaces (architecture and construction activities). In this context an increasing research area of interest is focusing the consumption of water resources in household appliances, particularly all technological systems and/or solutions able to recycle dishwasher wastewater for the cultivation of edible and ornamental plants. However, there is still a significant gap concerning the possible application of these innovative technologies to the built space context. Therefore, the integration of the wastewater treatment system in kitchen furniture, with green or gardening architectural solutions as first application outcome of the research itself, can push a change in indoor growing modules design, as well as in user behaviours, while improving the domestic water use efficiency.

An in progress interdisciplinary research on Waste Water Food Converter (WWFC) by Department of Design of Politecnico di Milano, aims to study a product system for recycling wastewater in a domestic environment for the production of edible plants through an autonomous cycle, whose preliminary phases were<sup>1</sup>: characterization of wastewater, plant growth and functionality analysis, technical design of the remediation plant, product and user inquiry, participatory design for expert and user involvement in the system ideation and development, followed by the development of a functional prototype designed for indoor installation, equipped with a series of sensors and actuators for the control and regulation of the entire system, as well as a low emission system with low environmental impact [Figure 1]. The paper presents the first results of this system possible application at the built space context, and at the different scales of the project.



[Figure 1] Functional diagram and prototype

## 2. TOWARDS AN INTEGRATION OF THE SYSTEMS

Foreword to the project research was the collection and critical analysis of case studies on issues of vertical green, urban and indoor gardening, in the search for dependency relationships between application technologies and built space, useful in defining the related application strategies to apply into follow design phase. Two were the references adopted particularly: the development that over the years has taken place in the context of research on photovoltaic components, on the one hand, and the design experimentation of green solutions for roofing systems and façades, on the other.

Over years, their design solutions have experimented a path of progressive integration, from independent solutions and simply superimposed on the building, to increasingly hybrid forms for morphology and construction components, addressing basically three main types of applications, as summarized in the following Table 1 [1, 2].

<sup>1</sup> For more information on research see Aureggi, Carboniero, Costa, Perego, Pillan, Vignati “Design for sustainability and ICT: a household prototype for waste water re cycling”, also published among the acts of The LeNS World Distributed Conference – Designing Sustainability for All.

[Table 1] Towards an integration of systems - main application types

INDEPENDENT APPLICATION	APPLICATION BY OVERLAPPING	APPLICATION BY INTEGRATION
It does not act as a building envelope and the building presents itself as a simple support of technology (morphology that does not determine the arrangement of the components of the application).	It is characterized by standard technological elements that differ only for the type of support used. The envelope acts as a simple support (technology components anchored to the construction with a parallel and not far structure).	Hybrid nature of the constructive system that arises between architecture, nature, open space and because of a different interpretation of the organization of space in morphological, technological and thematic terms.
The application does not replace traditional building components (both the construction and the technology maintain their autonomy, functional and spatial) and its location with respect to the building partitioning system is closely related to the type of vegetation or technology.	“Superstructure” effect: technological elements that do not substitute envelope parts or sub-systems, but are limited to their overlap (second “skin” strictly dependent, which often contributes to increase the environmental and/or energy performance already achieved by the constructive component).	Technological-constructive components studied ad hoc and able to replace, incorporating, some or all the functions related to the elements of the partitions and the built space. The complex ensemble that results from it is not so easily divisible in its constitutive elements.
Simple, fast and economical solution, suitable for full or partial redevelopment processes.	Simple, fast and economical application, indicated in the retrofitting process.	It is applied in new interventions or in case of replacement of significant portions of an existing building.

The three emerged application strategies were the basis for defining the design hypotheses in which the WWFC system can be applied to the different scales of the project, with integrated solutions both in furniture design and in façade construction components, thus determining a functional and technological reinterpretation. To this goal, meta-design principles and generative rules have been explained [4], which in the form of spatial suggestions, have allowed to direct the design research as integration between architecture, agriculture and design dimensions [Figure 2]. The integration of the wastewater treatment system in kitchen furniture, first, and with the vertical gardening solutions, second, make it suitable for end consumer, giving the research a first application outcome, further developed into design scenarios, where the system can also implemented with additional water recycling sources.



[Figure 2] Generative principles and outdoor scenarios (Font: Authors)

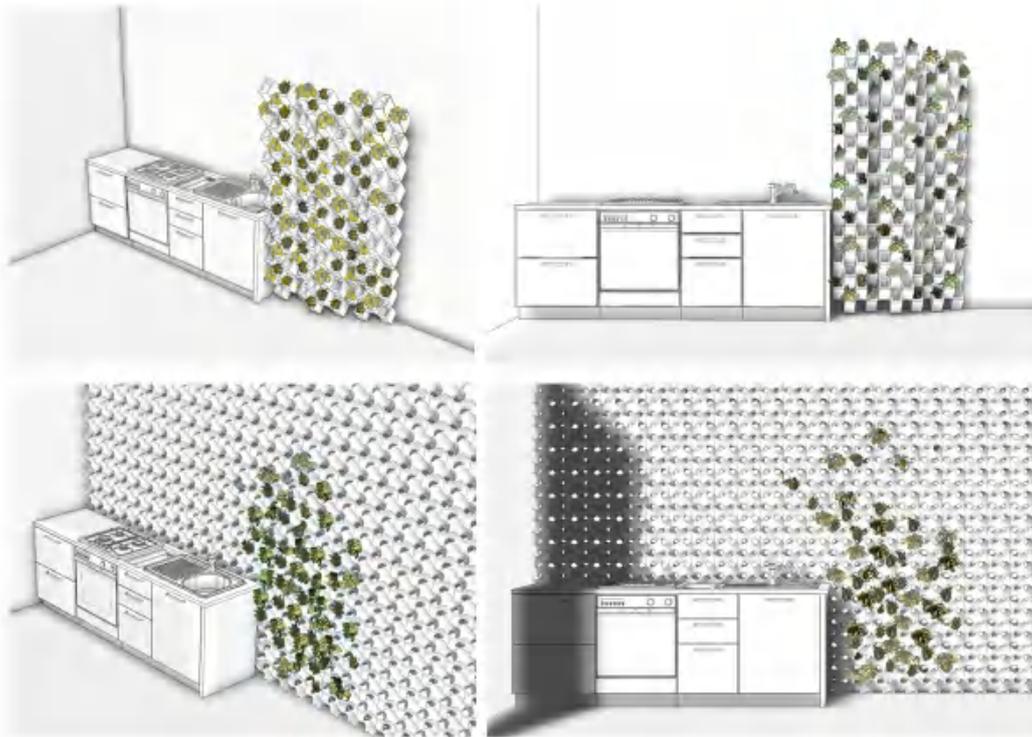
### 3. SCENARIOS

The industrial and profit-making logic that supported the modern food production system it considers food as a commodity to be produced and sold with the maximum cost-benefit ratio. This process creates situations of natural and energy resources unsustainable exploitation, incompatible with the continued world population growth. The debate has progressively expanded over recent years, involving not only researchers and politicians, but the entire population. The consequence is the emergence of a market promoted by conscious consumers, who buy not only for hedonic purposes, but with the awareness that buying and selling process also has a social and ecological impact. The focus is no longer just the price, but also to healthiness of the purchased food, to influence it has on its own health, to attention for sustainability of the production process in social and environmental impact terms.

From the results of the experimental research[5] a significant amount of useful surface to accommodate the various species of edible plants was emerged. Specifically: 80 lettuce plants equal to a consumption of 3.5 liters of water/day of waste recovered and filtered, equal to a surface of about 3 square meters, which make it possible to use the average waste production of an Italian family.

With the aim to direct the project development towards integrated solutions for technology and construction, the project requirements for the implementation of this phase have been defined as follow:

- modularity of the system \_ from the single base unit (in the study prototype represented by simple polystyrene vases of 60x20x18 cm, containing three plants each, mounted on a vertical metal frame) to their aggregation in functional sets;
- differentiation between structure / frame, with the related systems for irrigation and wiring of the sensors, and the modules for the support of vegetation;
- flexibility of cultivation, providing both the possibility of cultivating more edible species, each with a specific consumption of water, and the possibility of integrating the system with ornamental types;
- easy access, maintenance and movement of the elements (single and aggregated);
- implementation of the urban scale system in the redefinition of themes and functions, also focusing on issues of socialization and the redevelopment of living spaces.



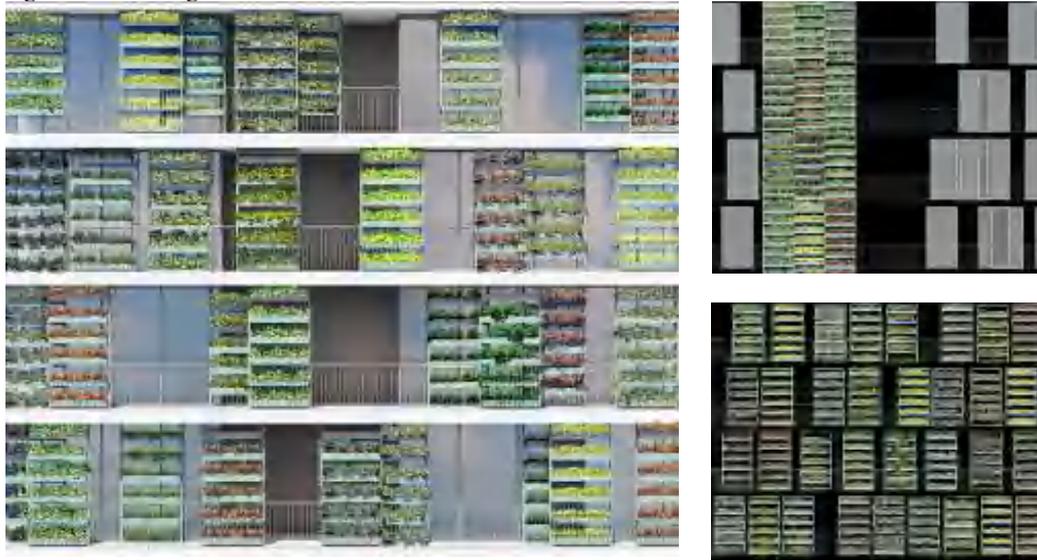
[Figure 3] Indoor scenario (Font: Authors)

Those listed are general features of the system which may have different repercussions depending on the implementation scale. In designing a system for domestic use it is necessary to consider food consumption practice as an action of meanings attribution, which contributes to build customer's personal identity[3]. There is therefore an attention that opens up new trends in domestic environment, in particular for the kitchen area [Figure 3].

Despite the sensitivity of potential consumers it's necessary the new system is independent and functional as possible. Contrary to outdoor vegetable garden, where time dedicated to cultivation is perceived as a hobby, in a domestic interior the system must subtract the user as little time as possible. Electronic devices will monitor growth protocols by regulating luminance, entrusted to particular LED lights (specifically modulated to optimize and accelerate different species life cycle), the temperature and the humidity required, no matter of the real conditions, at any latitude. The vegetables so cultivated do not undergo contamination with chemical substances or potentially polluting soils, allowing the consumption of fresh products that maintain their organoleptic properties unaltered[6]. Form is designed to integrate green in kitchen environment, satisfying the needs of different vegetal species through modularity, in adaptable and reconfigurable morphologies for limited spaces.

On an architectural scale, integration is instead shaped by the rethinking of a traditional module of vertical obscuration of the façade, to integrate the cultivation system of edible and/or decorative plants: a sort of brise-soleil, at the same time a technological element of façade and cultivation. The panels, modular elements equipped with a frame integrated with the irrigation system and a series of vases housing the plants, maintain the kinematic nature of the shading systems and can therefore run on tracks integrated into the façade, characterizing a dynamism appearance, both for the movement of the frames and for the growth cycle of the plants [7]. By exploiting the

surface of the panels, this solution allows you to create a small vegetable garden or vertical garden for domestic use and directly connected to it, flexible, implementable (from a few panels to an entire facade solution) and easily compatible with other spaces of the building, even in contexts where it is not possible to realize more traditional urban gardening solutions [Figure 4].



[Figure 4] Architectural scale scenario (Font: Authors)

At the widest scale of the open space, the project finally configures a shelf structure, supporting and housing vases for cultivation, conceived as an element in adherence to small / medium sized commercial activities and aggregative spaces, where to promote an idea of cultivated area not profitable, but open and shared, from which, with a parallel to what was promoted in the naturalistic field, it's name: "vegetable garden to lose"<sup>2</sup>. In addition to encouraging the recovery of more marginal urban spaces and environments, the recall effect of this solution, thanks to the commercial part's lever in the recovery of waste water produced by the established activities and in the more general promotion, cure and basic maintenance of the system, would help to promote socialization and caring of urban space [Figure 5].



[Figure 5] Urban scale scenario (Font: Authors)

#### 4. DISCUSSION

WWFC technology in future could change both building and space factors of green decoration to producing more resilience indoor and outdoor products, also taking into account the legitimate needs of users with regard to the satisfaction of both the food quality aspects and the aesthetics of the system as a whole. The scenarios are therefore not to be read as products to themselves, as suggestions inserted within a broader experimental research and whose goal is to anticipate the results of hypothesizing, in addition to the size of the product, the possible forms of application of the technology itself to the built context. In this sense, they are configured as meta-projects, solutions open to change deriving from what still needs to emerge from experimental research, able to fix some key aspects for the implementation of the system's application strategies, both indoors and outdoors. The design requirements of these scales, in particular, as well as the feasibility and application contexts, and their relationship with the functional as-

<sup>2</sup> Solution implemented in places where the fauna is damaged or in danger, providing the animals with help in the form of food. This form of protection also acts as a lure for other species of animals, in particular small invertebrates, which in a virtuous circle sometimes attract other species. Among the plants the strawberry, in particular, is very sought after and being a perennial plant it is possible to find it in the vegetable garden all year round.

pects of the technology for the recovery and filtration of wastewater, are in fact still configured as critical nodes from solve in the search. A multi-scale approach that considers a contemporary action to the dimensions of the product, as technology, and space, as application output, will then guide the next steps of experimentation.

In addition to the prototyping of the various solutions, development of the design research aims to study a further scenario on territorial scale, as an extension of the principles and requirements defined in introduction, thus moving from a timely dimension that binds the product of the WWFC technology to the building components of domestic space, to a more widespread and networked one, characterized by intermediate dimension between space of the neighborhood and that of interactive connections.

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## **DESIGN FOR CIRCULAR ECONOMY - A RE-THINKING PROGRESS IN THE WAY WE MAKE, BUY AND USE THINGS**

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### **ABSTRACT**

Circular Economy refers to an industrial economy that is aimed at restoration and regeneration by careful design. It requires a re-thinking progress to explore how we can re-design the way our economy works and how we can rethink and redesign products that we make, consume, use and discard. However, the concept is still relatively new and how we can introduce the concept in design education and what kinds of tools and methods can be used are still not well known. This paper is to share some teaching experience of Design for Circular Economy and its design process, and the tool Sustainable Product Matrix will be introduced. Two student projects were demonstrated how this tool helped them to gain deeper insights of sustainability problems and create a comprehensive solution. Finally, the challenges and opportunities of Circular Economy will be discussed, and some suggestions will be provided for this new kind of design thinking and doing.

Key Words: Circular Economy; Circular design; Cradle-to-Cradle; Life Cycle Thinking; Recycling; Sustainable development

## 1. INTRODUCTION

As global warming and climate change are getting more serious, the education of the young generation of designers to understand and apply sustainability development concepts in practice is important.

One recent concept of sustainability development is Circular Economy (CE), which refers to an industrial economy that is aimed at restoration and regeneration by careful design. The concept was derived from various concepts such as regenerative design, performance economy, Industrial Ecology, Cradle to Cradle design, lifecycle design and Biomimicry (Ellen McArthur Foundation, 2013; Kalmykovaa et al, 2018; Korhonen et al, 2018). The goal is to keep products, components, and materials at their highest utility in a closed-loop, at the same time, generate social, economical and environmental values. It requires a re-thinking progress to explore how we can re-design the way our economy works and how we can rethink and redesign products that we make, consume, use and discard.

The Ellen MacArthur Foundation (2013) suggests four main principles of CE include:

- Design out waste - design the components of a product to reduce wastage
- Build resilience through diversity - build diverse systems are more resilient in the face of external attack.
- Rely on energy from renewable sources - Systems should ultimately aim to run on renewable sources.
- Think in 'systems' - understand the parts and their relationships, how they are influence one another is important.

However, the concept of designing for CE is still relatively new, how can we introduce the concepts and what kinds of tools and methods can be used are still not well known. Moreover, the concept focuses more on the material and product production and consumption, but lacking the use and behaviour aspects. The author argues that design strategy for CE will not be successful without changing the consumption patterns and consumers' behaviours.

This paper is to share some teaching experience of Design for Circular Economy of an undergraduate module in Industrial Design discipline. It will start by discussing the design process for CE and followed by the tools and methods it used, especially the "Sustainability Product Matrix" is introduced. Two student projects will be demonstrated how these tools and methods were used to develop circular solutions. Finally, some challenges in Design for Circular Economy will be discussed with some suggestions is provided.

## 2. TOOLS AND PROCESS FOR DESIGN FOR CIRCULAR ECONOMY

This section is to describe the design process and some design tools and methods used in the teaching module to develop a better solution that eliminate waste and benefit to the environment and society in a circular economy.

### 2. 1. Design process

The class was a Design for Sustainability module in Year Four undergraduate Industrial Design programme. The module aims to offer students insights into the environmentally unsustainable aspects of consumer culture, and into the role product and industrial design play in this context. By introducing alternative concepts, and through design exercises, students develop, test and describe alternative design concepts with improved environmental impact. The module also aims to strengthen students' critical thinking and their ability to put forward well-structured arguments.

Six groups of students with each group of four students worked together. They were required to design a product and a system for different family contexts, for example, a family with a young child, an elderly living alone, two young women living together, a university student living in a dormitory.

The design process adopted the Circular Design concept with some modifications. Circular Design is a design concept derived from CE. A Circular Design tool was developed by Ellen McCarthy Foundation teamed with the design consultancy firm IDEO (Reigadoa et al, 2017). It employs the design thinking approach to guide "innovators, entrepreneurs and corporate change-makers" to explore new ways of "creating solutions for the circular economy that give businesses a competitive edge and are regenerative for our world." (MacArthur & IDEO, 2019)

The Circular Design Guide provides comprehensive design tools and methods to develop and implement circular innovation. but it did not suitable for a 14 weeks module so we only adopted the design process. In Circular Design Guide, the design process includes Understand, Define, Make and Release (MacArthur & IDEO, 2019). Nevertheless, Design for Sustainability and Circular Economy is about choice and trade-off - choosing the best alternative ways to achieve sustainability, either the choice of material or energy use, or the production methods, the way of doing business or manage the end of life of a product. It is important for designers to explore different alternatives to make better decisions. Hence, we modified the design process as Understand, Define, Explore, Make, and Release as the following in Table 2.1.

[Table 2.1] Design process in Design for Circular Economy)

Design process	Activities	Tools and methods
Understand	Understand user needs Research of the product life cycle Research materials Research existing products and competitors	User-centred research methods Online research of materials

Define	Analyse user research Analyse existing product system and competitors Define user needs Identify stakeholders Define sustainability problems and focus on which problem(s)	Stakeholder map System map Sustainable Product Matrix Design brief
Explore	Explore different alternatives and try to use the less harmful and most beneficial choices	Sustainable Product Matrix
Make	Brainstorming and concept generation Imagine new partnership/stakeholders Develop ideas and concepts	New stakeholders and System map Rapid prototyping
Release	Test and implement the design solutions	Story board Prototype Presentation

The Exploration stage is important since after designers have done research on user needs, materials and product life cycle, they need to explore the best alternatives in the choice of material, energy, way of production, consumption, use and discard that can reduce the environmental impacts and provide benefits to a wider context. This part goes beyond just concept generation but requires designers to gain deeper insights in different aspects to make better decision making. Hence, exploration in Design for Circular Economy is arguably an essential part in design process. The concepts can be developed during and after the exploration process.

In order to help designers to better understand the complex problems in product lifeless as well as identify design opportunities, a tool called “Sustainable Product Matrix” was developed and it will be described in more details in the next section.

The students started by doing research according to different family contexts, they interviewed the users and discovered their needs and the sustainability problems in that particular context. In order to provide more understanding of existing products and technologies, the students also conducted competitor research. They then used the tools and methods described in the Table 2.1 to analyse the problems, identify opportunities, general design concepts and build the prototypes.

## 2. 2. Tools and methods

The tools and methods used in the module including many commonly used methods in design process such as interview and field study for user research, brainstorming for generating ideas, and rapid prototype for user test and implementation, as well as business model canvas for developing sustainable business. Stakeholder Map and System Map, both are tools for Product-Service-System Design (PSSD), were also used for identifying stakeholders and their relationships in the system, as well as to understand how the product is produced, manufactured, delivered, used and discarded in the existing system. Both of these tools can also be used for developing new solutions. In this section, I will focus on introducing a tool specially developed for analyzing the sustainability impacts and exploring new alternatives for circular economy.

In CE, the knowledge of materials flow and the whole production and consumption process are essential to improve the efficiency and effectiveness of materials and recycle process (Kalmykova et al, 2018). Life cycle thinking is required to analyse the whole product life cycle from the sourcing of primary materials to the disposal of waste. According to Lehtinen et al (2011, p.5),

“Life cycle thinking enables us to identify both threats and opportunities in the life cycle of the product or service; to understand the trade-offs between the impacts at different stages of the life cycle, and to communicate the challenges and options to others. ...It is also useful in finding out where in the life cycle the major impacts arise as a starting point for discussing where the innovation targets could be set.”

Life cycle thinking helps designers to identify the major impacts and they would become design opportunities for new innovations. It is vital in design for sustainability and circular economy as the whole cycle of a product and its subsequent impacts can be examined and understood, which can help designers to make better decisions in developing the products and redesign the systems in a more sustainable way, as well as to avoid waste and damage during the process.

Life cycle thinking is also related to the concept of “Cradle to Cradle” design which suggests to designing product in a way that it can be easily reused or recycled at the end of their useful life, and the materials can be go back to the manufacturing process for new products (Braungart and McDonough, 2009). The Cradle to Cradle concept proposes to adopt ecological system that waste can become food and it emphasizes on eco-effectiveness, that is, make product good for upcycling and beneficial to the environment rather than just eco-efficiency on solely develop the product ‘less bad’ to the environment. It suggests that most products are composed of technical and biological types of materials, so designers can design accordingly for easily to be reused and recycled and it can avoid waste at the end of life. Cradle to Cradle design approach is a radical innovative design approach as it requires designers to rethink the existing product design and consumption process to redesign a new solutions.

Life Cycle Assessment (LCA) is a tool for analyzing the materials and energy use during the product life cycle (Lehtinen et al, 2011) and many digital tools have been available. However, LCA is very complex and highly technical (Lehtinen, et al, 2011), it requires the designers or engineers to know specific material components so as to calculate their impacts of the environment accurately, but most of the product materials do not include detail information unless it is provided by the manufacturers. Most of the products are also comprised of various materials and it is difficult to trace back the sources and the impact during the production, consumption, use and end of life. The terms of data usage also differ from database to database, it is very difficult to find relevant information for selected uses (Lehtinen, et al, 2011).

In addition to the above problems, LCA is mainly focused on the materials, but the economical and social impacts during the product life cycle is lacking. The tool only provides numerical information on the materials but how significant the impacts of the environment are and the information of social impacts is completely ignored. However, to achieve sustainable development by CE, the product or service should not only use a 'less bad' approach but provide mutual benefits and values to both the companies, the environment and the society. In our existing design process, this comprehensive way of design thinking is lacking and that is why many design solutions are partly contributing the environmental problems today. For instance, the invention and creation of plastic bags were to help people easily to carry things but it lacks of consideration of the side effects to the environment and the society. Moreover, the LCA is missing the cultural and contextual factors as the raw materials, production, consumption, use and discard are contextual base, for example, the energy of transportation from overseas will create more CO<sub>2</sub> then using local source, and the energy it produces can be wasted. So only numerical information is not sufficient for designers to develop a truly environmental products for sustainable development.

According to UNESCO (2019), sustainable development includes four dimensions – society, environment, culture and economy, which are intertwined and not separated. Therefore, only focus on environmental gain is not sufficient. However, during the whole product life cycle, the economic, social and environmental impacts are complex and it is difficult for the designers to know and identify the problems and opportunity to change. There are many tools for sustainability design and design for circular economy, but few of these tools includes all of the three areas for sustainable development. These existing tools are not sufficient to help designers to examine and gain comprehensive understanding and insights of the environmental problems and its impacts.

In this regard, a tool called "Sustainable Product Matrix" was developed which was based on the concepts of product life cycle and sustainable development, where a sustainability design should consider economical, social and environmental benefits. The purpose of the matrix is attempting to help designers to research and identify the problematic areas during the whole product life cycle regarding sustainability. The Sustainable Product Matrix (Table 2.2) includes two parts: on the left side is the product life cycle process and the top row comprise of the sustainability impacts including material, energy, water, economical impacts, social impacts and environmental impacts. The environmental impact is ranged from 1 to 5 being 1 is the lowest impact and 5 is the highest impact. So the higher the number, the more sustainability problem. Other than putting the numbers on the matrix, they can also mark down some keywords to help them to gain more ideas of the particular problems. The matrix helps designers to understand the relationships between the product life cycle, the resources and the impacts it creates.

[Table 2.2] Sustainable Product Matrix

Process	Materials	Energy	Water	Environmental Impact	Economic Impact	Social Impact	Total
Pre-production							
Production							
Packaging							
Distribution							
Use							
End of life							
Total							

The tool requires the designers to conduct some research to understand the impacts of a product from its raw materials to its end of life. It aims at helping designers to gain insights without focusing on too much detailed and exhausted information. It guides the designers to consider the material flow, production, delivery, consumption, use and end of life and their impacts in a clear and comprehensive way. It is suggested to use in a group to divide the workloads.

The designers can start by researching the raw materials of an existing product and the impacts of the social, economical, and environmental aspects during the pre-production phase to the end of life phase. For example, if the raw material is plastic, they should research about the sources of the material and the impact it made during the whole product life cycle. Then they mark the number from 1 to 5 to the matrix. They should also try to find the economical and social impacts during the whole process. As for the example of plastic, they can briefly understand that plastic is made of petroleum and it will create a lot of CO<sub>2</sub> and green house gas during the production process. In this process, although the economic benefit is high, it affects the environment because of the exploitation of the land and natural resources, and creates pollutions in many aspects. It also has great impacts to the environment at the end of life stage and many people are affected by it.

After they have completed the matrix, they can figure out which parts are most problematic or which parts they want to improve. The matrix can also help to analyse and compare with alternative materials or ways of production, which assist the designers to identify new design opportunities. The tool has been proved to be simple to use and effectively helped the students to identify design opportunities.

In the next section, I will demonstrate two student projects which have used these tools to develop the Circular Economy design.

### 3. EXAMPLES OF DESIGN FOR CIRCULAR ECONOMY

This section illustrates two student projects using the above mentioned process and tools. The six student groups tried to tackle the most pressing environmental problems in China, including baby toys and furniture, take-out table-wares, online shopping boxes, food waste, as well as fashion clothes. Two projects were selected to illustrate in this paper, they include: Redesign the baby beds and Take-out lunch boxes. The students needed to use a PSSD approach including to design a sustainability product with a system. Rather than focused on the products, they were encouraged to focus on the user needs since it can help to rethink a radical innovative solutions beyond just improving the existing product and system.

#### 3.1. Baby beds

The group of students started by doing some research and interviews of families who have a little child. They found that baby furniture is a big problem for many families when their child grows up. Some of them would give it to their relatives or friends, but most of them just discarded them. The user needs include: provide easier ways to sell and recycle their useless furniture; a more secure platform to buy second-hand children's goods; the furniture which can be kept to be functional longer with their children.

According to the finding, their goal was to extend the life span of the baby beds. They initially just focused on redesigning the baby beds and found that numerous baby bed designs have tackled this problems in the market. The idea was also not good enough to provide a sustainable solution.

By rethinking the questions “Where does the material come from?” and “How the product is made, sold and used?”, they conducted research about the product life cycle from raw material sources, pre-production, production, delivery, use and end of life. After they collected the information, they analyzed the information by using the Sustainable Product Matrix. They found that several areas were particularly problematic including the preproduction, production, and end of life. For instance, in preproduction, a large amount of trees are cut down in order to produce the timbers for the furniture which has impacts on the ecological system. In production, it creates plenty of dusts and wastes, which affects the health for the workers and carpenters who are working in the furniture factories. In the delivery and transportation, a lot of energy is used and plenty of carbon dioxide is generated. Finally, if the baby beds are discarded in the landfills, they will create many environmental problems. After this analysis, they realized that if they only redesign the baby beds, it can merely solve a few parts of the environmental problems.

The introduction of System map and Stakeholder map helped them to understand the interrelationships among the stakeholders in the complex system. They found that many stakeholders and processes are involved in the system which require the use of a large amount of energy and resources. After brainstorming and rethinking the production and consumption process, as well as the stakeholders, they came up with an idea of building a platform “Baby U” to line up with the local factories and consumers (Figure 1). The factories can sell the baby beds directly to the consumers. When the baby bed is no longer useful for the consumers, they can trade it back to the factories for repairing or upcycling into baby furniture, or they can sell it to the other consumers if the baby bed is in good condition. In this business model, the local factories can gain loyal customers, on the other hand, the customers can obtain personalized services and save money. Since the materials and products are from the local region, it reduces the intermediates and also saves energy in transportation. The idea achieves a win-win solution that is beneficial to the factories, customers and the environment. The sustainable development goals of economic, environmental, and social gain can be accomplished.



[Figure 1] Baby Furniture Sustainable System (Mobile application and disassembled furniture made of recycled baby beds)

### 3.2. Take-out lunch boxes

Take-out food is very popular in China. It's particularly popular for college students since they are very busy in their study and they seek a most convenient way to eat. However, when take-out food brings a lot of convenient, it also generates serious environmental problems since most of the table-wares are made by plastic and they are usually just discarded after used. So this group of students focused on reducing the use of plastic table-wares of take-out food for college students.

They found from their research that the user needs in this case was convenient, clean, healthy, and environmentally friendly. Although many university students are aware of the problem, they have no choice since it is a very convenient way for them and they do not know how to deal with this problem.

Similar to the previous group, they started by focusing on only redesigning the table-wares. They initially proposed to use biodegradable materials such as wheat for the new designed lunch boxes and table-wares. However, when considering if using wheat for the lunch boxes, it would detriment to the food system. Moreover, if the wheat lunchboxes are finally discarded in the landfill, it will not reduce the harm on the environment.

After using the Sustainable Product Matrix, they started to comprehend the complexity of the existing system and how impacts the material will be in the whole product life cycle. They came up with an idea to develop a recycling take-out tableware system called "Guava Plant" which included a non-profit company, a big online take-out food platform and the local restaurants. They designed a new lunch boxes and table-wares made of Polypropylene(PP), a white, mechanically rugged material and has a high chemical resistance, which can be used for thousands of times. The non-profit company sells the new lunch boxes to the restaurants and collects the used lunch boxes. After collecting the lunch boxes, they use sodium bicarbonate, which is a wide variety of household use material, for cleaning the table-wares, then sterilize them and deliver them to the restaurants to use again. Sodium bicarbonate has good effect on cleaning and diminishing odors, and it is considered to have low environmental impacts (HERA, 2005) The leftover food will be processed for manuring plants or feeding pigs. Moreover, the company will employ people to clean the table-wares which will create jobs in the new system.

To provide incentives, the colleges students pay deposits for the table wares and gain points by recycling the table wares. For the restaurants and the online food delivery platform, the environmental friendly practice can create corporate good will and better promote their businesses. In order to promote their environmental mission, the non-profit company can also provide company tours for the public. The company activities and environmental information is also provided on the company's website and WeChat official account to promote the environmental message to the public and their customers (Figure 2). In this case, the new solution also provides mutual benefits for different stakeholders and the environment.

Both examples demonstrated that the students developed a more holistic design thinking of the product/system by deeper and thorough understanding the whole life cycle of a product from the raw materials to its end of life. Their design concepts include the considerations of the sources of raw materials, production process, delivery, consumption, use and discard. Through this project, the students learned to search for alternative materials and rethink the existing production and consumption processes that are problematic.



[Figure 2] Take-Out Food Tableware Recycle System (Lunchbox and Online Food Delivery Platform)

## 4. DISCUSSION AND CONCLUSION

In this paper, I have described how I used Circular Design and Life cycle thinking in teaching a Design for Sustainability module. In the design process, I argue that 'Exploration' is an important part in Sustainability design as well as for Design for Circular Economy since designers need to consider different aspects and trade-off the less favorable options by analysing different alternatives to make better decisions. The exploration process also helps designers in creating new solutions. In this process, designers have to gain sufficient knowledge and information due to the

complexity of the materials, practices and the system in a product life cycle. Therefore a tool “Sustainable Product Matrix” was developed to help students gain better understanding and insights.

The Sustainable Product Matrix is attempted to guide designers to develop a life cycle thinking and provides a comprehensive tool for them to research and analyse the existing system of a product life cycle. It helps students to see the problems clearly in the process and identify the areas they want to solve. The matrix can also help to find a better solutions by comparing different materials and ways of making, delivering, using and discarding. By using the tool, the students learned to think about the origin of the materials and how a design can have impacts on the environment, economy, and society in the whole product life cycle.

They also learned to think in a system and understand their design has impacts on many stakeholders and the environment. As one student wrote in his reflection of the online delivery box project:

“I learned how to get deeper understanding about one product. Because one product can have many users and stakeholders in its life-circle. So designers should consider each aspect to make a design. Even an express box, when design it, designers should think about the workers, collectors and paper mill workers. Because each of them has different duties, so if designers can think more, the workers can be more convenient to package the boxes, the collectors will make more money, the paper mill workers will save more time and energy to recycle these boxes. Also, the environment will be better, the trees will be more.”

So the design methods guided them to think more holistically in their design, including the stakeholders and how the new design could provide benefits to all the stakeholders involved, not only the users.

The tool is new and it has some disadvantages, for example it does not help designers to analyse very detailed and technical information such as how many materials and energy they need to produce a plastic bag, or how much they damage the environment or how much economic gain or loss in the process. However, the tool is intended to guide the designers to research and understand the relationships of each aspects in the product life cycle, so it aimed to make it simple and easy to use. The matrix, although not very detailed, provide deeper insights for designers to reflect and rethink the existing process and make better and innovative decisions. The above projects have showed that the tool has effectively achieved the purposes.

During the design process, some shortcomings and hurdles were identified for Design for Circular Economy. First of all, CE cannot be successful without changing the consumers’ attitudes, behaviours, and the way of consumption. For example, the reused or exchange of baby beds concept would encounter barriers if the consumers’ perception of using this service is negative. As Korhonen et al (2018, p.43) state, “If the current consumption culture will not change, CE will remain as a technical tool that does not change the course of the current unsustainable economic paradigm.”

The CE concept is mainly focused on the production side rather than from the users’ needs and perspectives which only created process innovation sometimes. Hence, in the student projects, students were encouraged to focus on the user needs and rethink a new way to satisfy the needs. For example, parents just want to buy a good and safe baby bed for their baby, and they would like to handle it when the child grows up. So the material, in this case is wood, does not need a completely new one. To focus on user needs and rethink the process, the students come up with an idea of working with local factories and recycling the baby beds after used. By working with the local factories and involving the customers in the process, they can tailor their own needs for the baby beds and they know where and how the beds are made and recycled, which can reduce their uncertainty. Therefore, focusing on users needs, providing values, as well as promoting behaviour change could help to develop radical innovation for system change.

Secondly, CE proposes to use renewable energy to develop a design. It is a good vision and should be pursued. However, in reality, the technologies of the renewable energy are still not very efficient and too expensive to use. It

lacks the motivation of product manufacturers as well as consumers to adopt the technologies. Moreover, using renewable energy technologies, such as solar energy or wind energy, requires special technical supports and a multi-disciplinary team is necessary to make the design concept feasible.

Thirdly, CE is complex for its interdependencies of materials, energy flows, and activities. As Korhonen et al (2018) identifies there are six limitations and challenges in the concept of CE regarding environmental sustainability alone, such as thermodynamics, definition of CE system boundaries, management of the CE-type interorganizational and inter-sectoral material and energy flows, even social and cultural issues of waste and waste management. Many corporations still reluctance to adopt new modes of practice due to the risks and uncertainty. Nevertheless, several examples from around the world have implemented circular business models and showed to be successful to some extent (Guldmann, 2018; Valavanidis, 2019).

CE is one of the promising solutions for sustainable future but the road to completely achieve it is long. Design for Circular Economy is still in its infancy and the approach, tools and methods will surely be developed and evolved in the coming future. The design process and projects shared in this paper are just a first attempt to introduce the CE concept to design students and the tools and methods still need to be enhanced in the future. But it has showed that the methods it used has effectively helped designers to gain deeper insights of the sustainability problems and redesign more innovative and comprehensive solutions.

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## **DESIGNING SUSTAINABLE AND HEALTHY FOOD SYSTEMS THROUGH CATERING: THE ROLE OF DESIGNERS**

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### **ABSTRACT**

Our food system is responsible for some of the world's greatest environmental and societal challenges from climate change to chronic diseases linked with global dietary transition. As the trend of eating out increases, catering has a great potential to lead the transition toward more sustainable food systems. As professionals, designers involved in food service systems design and menu planning not only have to consider environmental impacts through Life Cycle Assessment (LCA) but also have to consider the health impacts of different types of meals. Dietary guidelines may be used for this purpose, however, relying solely on them to compliment LCA will not lead to menu offers with the least environmental impact and the greatest health benefits. As individuals, designers may also choose to facilitate the transition toward more sustainable food system by acting as role models and consuming less animal-based meals both at home and at work.

Keywords: food service system design, sustainability, catering, health

## 1. INTRODUCTION

Climate change is one of the most pressing global environmental challenges we face today. Changes in the climate system, caused by the global-scale transformation of the composition of the atmosphere due to anthropogenic greenhouse gas (GHG) emissions, and the widespread impacts on human and natural systems are already evident (IPCC, 2014). Our food system is estimated to be responsible for 19 to 29% of global anthropogenic GHG emissions (Vermeulen et al., 2012).

Livestock production alone accounts for 14.5% of the emissions (Gerber et al., 2013). Without addressing the increased trend in meat and dairy consumption that has been observed globally in the past few decades (Scanes, 2018), an 80% increase in global agriculture GHG emissions is predicted by 2050 (Tilman and Clark, 2014). As so, global mean temperatures will likely to exceed 2°C, even with major emissions reductions from other sectors (Kim et al., 2015). Furthermore, animal agriculture is not only a significant contributor to climate change but is also a highly intensive and inefficient user of resources. It is the largest use of land, using 30% of the total land surface of the Earth and consumes 70% of fresh water (FAO, 2006). In addition, one third of total arable land is used to produce feed crops for livestock (FAO, 2006).

Animal agriculture is also linked with the emergence of zoonotic infectious diseases (Greger, 2007), and a notable rise in chronic diseases such as increased risk of cardiovascular disease and mortality (e.g. Walker et al., 2005; Huang et al., 2012) diabetes (e.g. Barnard et al., 2006; Vang et al., 2008) and some cancers (Huang et al 2012; Mitrou et al., 2007). Moreover, there is a positive association between meat consumption and obesity (e.g. Wang and Beysoun, 2009, Rosell et al., 2006). Since the scope of this paper is not to give an extensive overview of the health implications of meat consumption, readers are encouraged to follow up references and review papers synthesising the great amount of scientific literature and results of various studies and clinical trials (e.g. Tuso et al., 2013 or Satija and Hu, 2018). Nevertheless, the results all point to the same direction: the health benefits of consuming whole, plant-based foods (primarily fruits and vegetables) and minimising the consumption of animal-based products (e.g. meat, eggs and dairy).

There is a strong case for reducing the consumption of animal-based products and moving towards the consumption of plant-based foods both from an environmental as well as from a public health point of view. As the trend of eating out is increasing in our societies, the catering sector is becoming a growing component of many economies and a significant part of urban food systems (Edwards, 2013). As a result, the catering sector has an increasing potential to shift our food systems towards sustainability. Designers involved in food service systems design and menu planning have an important role to play by facilitating this transition both as professionals and individuals.

This paper will examine the role of designers in facilitating transitions toward truly sustainable and healthy food systems through menu planning and food service offers. A special focus will be on the role of Life Cycle Assessment (LCA) and dietary guidelines in facilitating the design of environmentally sustainable and healthy catering offers.

## 2. METHOD

A systematic review was conducted to examine the latest trends of using LCA in the catering sector (e.g. to facilitate the design of environmentally sustainable offers amongst others). In total, 35 papers were identified in which LCA was applied to assess environmental impacts of the catering sector and LCA-based interventions were used to improve sustainability. In this paper the results of only a subset of the 35 studies papers will be discussed which specifically focused on the LCA of different ingredients and meals. The results of these studies can be used to inform designers about what truly constitutes a sustainable catering offer and thus some of the key trends from these studies are briefly described in Section 3.2.

Based on the results of the systematic review, which indicated a lack of inclusion of health impacts associated with different types of meals in the LCA, further desk-based research was conducted to find ways to incorporate health criteria into menu design. Food-based dietary guidelines of seven countries were reviewed. These included Brazil, Mexico, India, China, Italy, South Africa (selected especially because of their relevance to this conference) and Canada (selected so that at least one country from each geographical location is included in the review). Food-based dietary guidelines were accessed from the website of the Food and Agriculture Organization of the United Nations (FAO, 2019).

Information on the specific content of dietary guidelines (restricted to information available in English) of different countries were extracted using a pre-determined data extraction form. Information on: publication year, the authorities responsible for the development of the guidelines, target audience, food categories included in each country's food guide, whether or not they encourage or discourage the consumption of certain types of foods (e.g. fruits, vegetables, grains, meat, dairy or processed food) and if any lifestyle recommendations or reference to sustainable eating and food culture are included in the guideline were extracted. Data were then coded and analysed according to common themes, which will be briefly discussed in the next section.

### 3. THE ROLE OF DESIGNERS

#### 3.1. As professionals

Food systems are inherently interconnected and dynamic systems (Eriksen, 2008) and require professionals who have expertise in using system-based approaches to address specific challenges within the food system. Life Cycle Assessment is one such approach, allowing designers to effectively assess the environmental impact of different meal options and avoid the burden shifting of impacts. With regards to the environmental impacts of meals, an overarching conclusion amongst different LCA studies is that vegetarian meals generally have significantly lower emissions than average meat-based meals (e.g. Pulkkinen et al., 2016, De Laurentiis et al., 2018; Saarinen et al., 2012). However, that is not necessarily always the case as some vegetarian meals rich in animal-based ingredients such as dairy have environmental impacts as high as average (meat-based) meals (De Laurentiis et al., 2018; Pulkkinen et al., 2016). From an environmental point of view, the most sustainable meals tend to be made with low or no amount of animal-based ingredients. This is because the environmental impacts associated with the production of meals using animal-based ingredients (whether meat or dairy) are significantly higher than those made of plant-based ingredients. Furthermore, the production method of ingredients also matters (i.e. whether they were grown organically or conventionally, in greenhouse or sourced locally or regionally) (De Laurentiis et al., 2018).

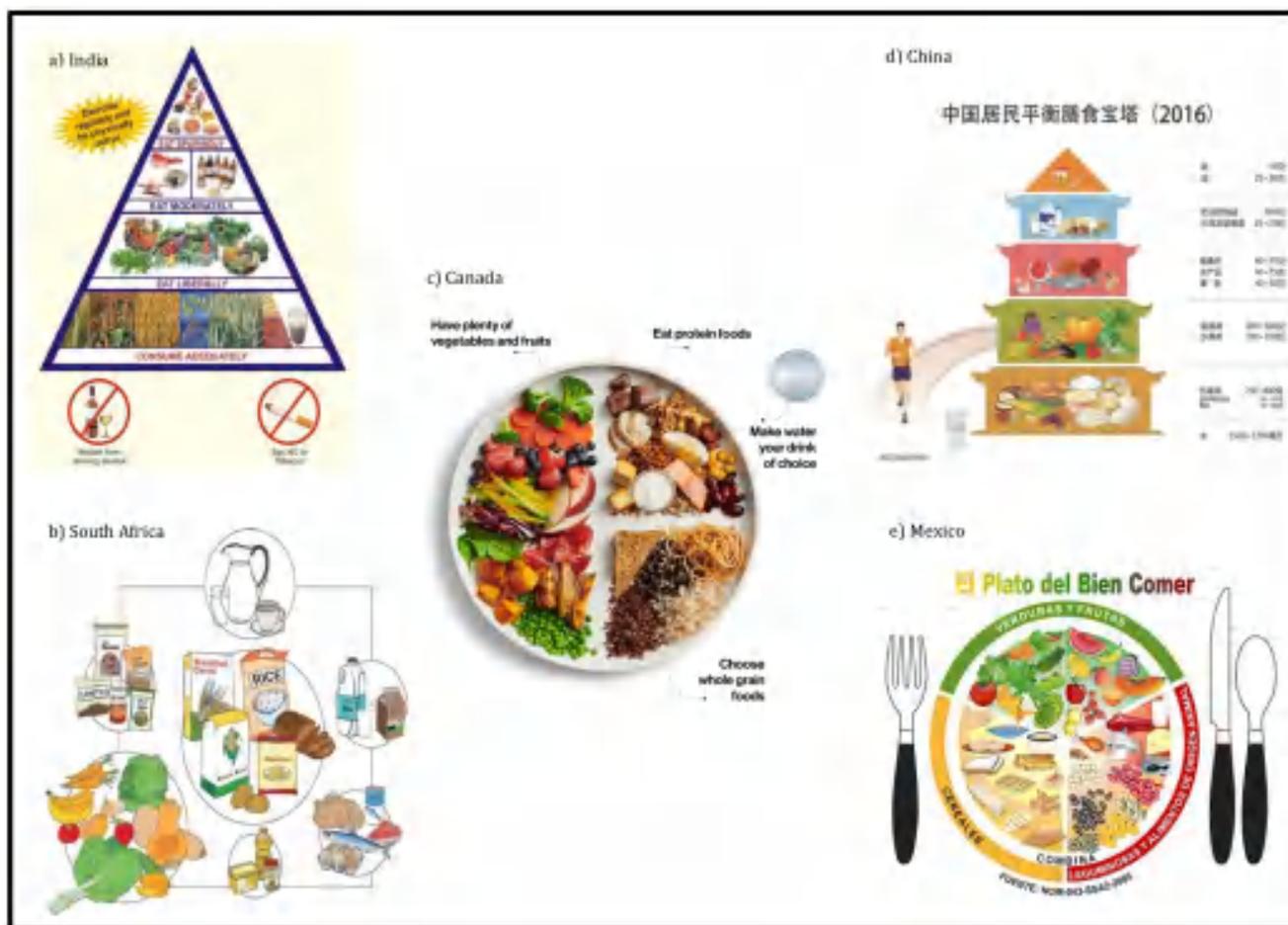
Sustainable food service systems design and menu planning does not end with the consideration of environmental impacts of meals. The role of designers, besides assessing the environmental impacts of meals, is to also carefully consider the health implications of each meal and to assess the trade-offs between health and environmental sustainability. To date LCA studies that included health and the assessment of the nutritional quality of meals either use single parameters such as energy or nutrient intake of macronutrients (e.g. protein, fat or carbohydrate content; Schaubroeck et al., 2018; Benvenuti et al., 2016) or both macro- and micronutrients (e.g. fibre, calcium, iron or different vitamins; e.g. Ribal et al., 2016; Wickramasinghe et al., 2016). Although these parameters are useful for ensuring that the overall nutrient intake from meals is sufficient, they tell us little about the healthiness of meals from a disease fighting and preventing point of view.

Generally speaking, meals with low environmental impact also tend to be healthier, however, there are exceptions to this as well (see Visschers and Siegrist, 2015). Such exceptions highlight issues with using terms like vegetarian and vegan that are commonly used not only in LCA but many nutritional and health studies. As also suggested by Tuso et al (2013), moving away from terms like vegetarian or vegan and starting emphasising the consumption of whole, plant-based foods (primarily fruits and vegetables) while minimising the consumption of animal-based products (e.g. meat, eggs and dairy) could be useful. Such distinctions between animal-based (which include vegetarian meals) versus whole, plant-based meals (which may include vegan meals but not the processed vegan meals) may lead to more consistent results across LCA studies both in terms of environmental and health impacts. In summary, although LCA is a well-established tool for assessing environmental impacts of meals, the assessment of health impacts of different types of meals is less often considered as part of the LCA and comprehensive nutritional criteria are lacking (Benvenuti et al., 2016). Designers therefore may turn to dietary guidelines to inform the design process of menu planning. But will adhering to dietary guidelines be sufficient to design menu offers that are truly healthy and sustainable?

Although the reviewed dietary guidelines overall encourage the consumption of plant-based foods (e.g. they all recommend eating plenty of fruits and vegetables) they differ in their recommendations regarding the consumption animal-based products. Milk is a good example that shows variation between countries. Certain countries (e.g. South Africa and China) see the consumption of milk and dairy as an essential food group to be consumed on a daily basis, while guidelines in other countries (e.g. India, Mexico and Italy) do not put emphasis on the consumption of milk. Canada is one of the countries that recently removed dairy completely from its food guide diagram and no longer considers milk and dairy as an essential food group to be consumed on a daily basis as part of a healthy diet (see Figure 1).

The phrasing of guidelines regarding the consumption of animal-based products also varies from country to country. Dietary guidelines in South Africa and China are phrased in a way that suggest the daily consumption of animal-based products is an essential part of a healthy diet. On the other hand, countries like Brazil encourages people to make natural or minimally processed foods the basis of their diet, in great variety and mainly of plant origin as these support socially and environmentally sustainable food systems. Somewhat contradictory to this statement, the Brazilian guideline then is continued with a sentence encouraging the consumption of animal products such as milk, eggs and meat along with cereals, legumes, nuts, vegetables and fruits as part of a varied diet.

Other countries such as Canada also encourages the intake of vegetables, fruit, whole grains and protein-rich foods, especially plant-based sources of protein. Italian guidelines also seem to put more emphasis on eating more plant-based foods such as cereals, vegetables, tubers and fruits than animal-based foods. Although this is not a common practice, but some guidelines also encourage certain life style behaviours and include sustainability dimensions of food consumption, with messages like “Eliminate waste and develop a new ethos of diet civilization” (China) or encouraging the purchase of locally grown fruits and vegetables that are in season, and if possible grown organically (Brazil).



[Figure 1] Food guides of different countries: a) India, b) South Africa, c) Canada, d) China and e) Mexico. Note: Brazil and Italy do not use food guides hence these countries do not appear in this figure. Source: FAO, 2019.

From these observations, dietary guidelines may serve as useful tools for designers to develop healthy meal options, however their recommendations must be taken with a pinch of salt as the following question arises: If dietary guidelines are developed according to the latest evidence-based scientific knowledge on food, nutrition and health, how is it possible that some guidelines include dairy for example as an essential food group while others don't and why some countries put more emphasis on the consumption of plant-based foods than others? This is an interesting discussion that involves food politics, power relations and the role and power of the food (and even pharmaceutical) industries in influencing the recommendations of dietary guidelines. However, due to lack of space, these will not be discussed here in detail. Relying solely on dietary guidelines as health criteria for menu design, without reviewing evidence from the field of medicine and nutrition at first hand, may not always yield the most optimal solution if the aim was to create the most environmentally sustainable meals with the most health benefits. Inclusion of the results of academic studies, with a careful consideration of the funding sources of studies as suggested by Lesser et al. (2007), could give additional insights to healthy menu design.

### 3.2. As individuals

Designers do not only play an important role as professionals in creating more sustainable food systems but also can influence food systems for the better as individuals. They can serve as examples and leaders by changing their own lifestyle behaviours and adopting more sustainable and healthy dietary choices both at home and at work and asking for healthier and more sustainable plant-based options in catering facilities, university cafeterias and at professional conferences and meetings. After all what is there to lose? If the side effects of eating whole, plant-based foods are the possibility of decreased risk of cancer, reduced risk from heart disease, lower body weight and reduced number of medications people have to take daily to treat a range of chronic conditions (Tuso et al., 2013) while at the same time our impact on the planet would become smaller, wouldn't it make sense to encourage people all around us, including ourselves, to take up such eating habits?

## 4. CONCLUDING REMARKS

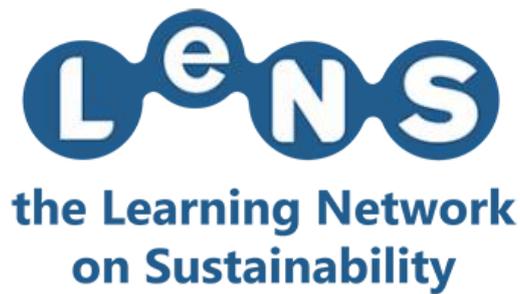
Given the considerable contribution of the food sector, especially the animal agriculture sector, to climate change, environmental degradation and the promotion of chronic diseases, replacing animal-based menu options with

healthy plant-based options should be a priority in food system design. Designers can play a significant role, both professionally and individually, in ensuring the long-term sustainability of our food system. As professionals, they can use a systems-based tools such as LCA to facilitate the design of environmentally sustainable menu offers without burden shifting environmental impacts. Furthermore, designers also ought to assess the health impact of meals along with their sustainability. Relying solely on dietary guidelines in evaluating the health impact of meals may not always be sufficient and therefore drawing on the expertise of multiple disciplines such as nutrition and medicine directly may be necessary. Lastly, designers may also choose to shape our food system by acting as role models and setting an example by consuming less animal-based meals and more plant-based meals both at home and at work.

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## **SYSTEMIC DESIGN DELIVERING POLICY FOR FLOURISHING CIRCULAR REGIONS**

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### **ABSTRACT**

Systemic Design expertise is rising as relevant on Policy Design fostering better governance towards Circular Economy. On that journey, a current coordinated work between universities, local authorities, associations and public administration where the Systemic Design is anticipating the future economy actions through policy design is RETRACE Interreg Europe project. The aim of this project is to drive regional policies towards a Circular Economy applying the Systemic Design approach developed by the research group of the Department of Architecture and Design at Politecnico di Torino. This paper describes the role of Systemic Design on the future challenges on Regional Governance towards a Circular Economy through the outcomes of the RETRACE and discusses the opportunities and wicked problems of this expertise on policymaking. Becoming a milestone on the way to a deeper awareness of the impact the implementation of Systemic Design on Policy Design processes in Europe.

Key Words: Systemic Design, Policy Design , Circular Economy , Territorial Development

## 1. INTRODUCTION

We live in a world that is in the midst of interconnected megatrends such as rapid urbanization, climate change, resource scarcity, changes in global economic power, technological breakthroughs and erratic demographic/social transformations, carrying out an unprecedented complex revolution (PWC, 2017). Consequently, this phenomenon has brought many increasingly pressing challenges threatening society's well-being and economic prosperity. Proving that today more than ever the world is rapidly going towards several tipping points as humanity is consuming the equivalent of 1.7 Earths (NGF, 2010). Such megatrends will have several implications on the ways mankind consumes, certainly shaping the types of products, services, and technologies that will be designed, developed and used in the future. This scenario represents a serious challenge for EU regions, which are dependent on most of the resource supply from raw materials from international markets.

Nowadays linear economy has raised the exposure of unpredictable hazards as resource prices, job instability, and supply disruptions. These situations are complex and interconnected, which means that addressing one could have positive implications towards the others. By 2030, tackling sustainability will be essential considerations in the design and development of products, services, and technologies. On that view, the transition to a Circular Economy (CE), is a chance to generate competitive advantages on a sustainable basis with the potential to generate an income benefit of EUR 1.8 trillion by 2030 (EMF, 2015) and over 1 million new jobs across at EU level by 2030 (EPRS, 2017). From a foresight perspective, applying CE principles across all sectors and industries could decrease environmental, social and economic pressures globally, and increase the EU regions strategic autonomy (EC, 2019).

These erratic shifts are underway on a vast scale with transforming economies, governments and societies in complex, interconnected in unpredictable ways. The nature of such global trends, claim to redesign the current public policy conditions in order to be more future-oriented on the way to sustainable development. The need for and the potential of innovation has never been greater.

Today is not possible to conceive or solve the so-called wicked problems individually (Jones, 2014). Mainly because the volume and complexity of such problems are growing so fast that governments are unable to catch up with them, failing with the citizen trust and business confidence. Indeed, these interconnected challenges require a structure of interconnected solutions and change-makers able to understand and visualize complexity. Given that the nature of design in encounter wicked problems, shifting an existing complex context into a new one. However, this doesn't mean that designers generate solutions to wicked problems. Instead, designers reformulate those scenarios to generate different possibilities and relationships (Rittel and Webber, 1973). From that point of view, designers could respond to this need on new anticipatory approaches on governance from a holistic and systemic point of view which fosters a cohesive transition to a CE.

To be able to conquer innovative approaches in governance, the aim of the design processes has turned into a key tool for the shaping of decisions. In the last decade, the design as a discipline has assumed an important role in the field of policy-making. Since that moment, it has been inevitable to compare both design and policy-making as they are considered problem-solving processes (Blair, Cunningham, 1999). Because of this, more and more design has been comprehended as an important and practical component in the formulation of better policies and governance strategies. So, in order to solve the current wicked problems: How design can innovate in policy planning for sustainable development and the growing of circular economies?

To the best of our knowledge, the Systemic Design (SD) methodology tackles the complex phenomena delivering new relations between the local actors, through specific design tools which highlight the hidden potentialities of a scenario boosting active collaboration among the components of a system (Bistagnino, 2011). The SD expertise is rising as relevant on Policy Design fostering better governance towards CE (Barbero & Giraldo Nohra, 2018). An exemplification of this is the RETRACE Interreg Europe project (A Systemic Approach for Transition towards a Circular Economy funded by the Interreg Europe, <https://www.interregeurope.eu/RETRACE/>) coordinated work between universities, local authorities, associations and public administration where the SD is anticipating the future economy actions through policy design. The aim of this project is to drive EU policies towards a CE applying the SD approach developed by the research group of the Department of Architecture and Design at Politecnico di Torino.

This paper describes the role of SD on the future challenges on Regional Governance towards a CE through the outcomes of the RETRACE project such as the CE Regional Action Plans (RAPs). Also, discusses the opportunities and wicked problems of this expertise on policymaking. Focusing on how the SD approach fosters interregional experiences towards an integrated territorial development through the promotion of future productive activities and effective policies to enhance CE. Proving that at European level this expertise for policymaking will be vital to support key policy instruments Smart Specialization strategy, Corporate Social Responsibility, and Cohesion Policy.

## 2. SYSTEMIC APPROACHES FOR POLICY DESIGN

The last decades have demonstrated that most of the methods and tools used traditionally for public policy have not kept up with the speed of shifting in economies and societies. Even though it is true that governments are clearly adapting, progress is often done from reactive measures and sporadic rather than fostering preventive policy systems. Also, it is undeniable that as wicked problems grow exponentially, it is vital to adopt the right fore-

sight actions on governance that take policy planning one step forward.

To approach this kind of policy planning it is essential that bottom-up and top-down approaches coexist with a common goal (Krauz, 2016). In this sense, all the actors involved in this process should be able to communicate and work together with the same clear objective. Design for sure has an increased capacity to facilitate and mediate different competencies (Celaschi, 2008).

Design for sustainability has gained momentum delivering a contrasting vision on the role of the design. The discipline has shifted from a product-oriented design process towards dematerialization designing approaching solutions for complex social, environmental, and even political problems (Papanek, et al., 1972). Making the designer an active role in the optimization of resources and minimizing political, social and cultural disruption ensuring a more resilient solution (Barbero & Giraldo Nohra, 2018).

The design applications on the field of policymaking is growing exponentially. There is an increasing recognition from the public sector in acknowledging the designer's approach as effective in improving the ability of governments to manage public issues (Bailey, 2017). Supporting it with a qualitatively different approach to the process of policymaking, delivering more effectiveness and innovation. On that view, design for policy addresses a different perspective on policy issues. This is due to the combination of different research methods from systems thinking; anthropological to scientific databases, generating transdisciplinary collaboration teams that through design elements can make policy-making processes more tangible (Bason, 2014).

To achieve this, the SD method recognizes territories to be acknowledged in a profound overview, through the creation of new relations between actors of a context enabling the visualization of the so-called "sleeping assets" (Bistagnino, 2011). Fostering horizontal dialogues among the actors of the territory enabling innovative and productive decision-making strategies. As a result, this will generate a new scenario of collaboration that can enhance future productive activities sustainably. This strategic thinking process leads to the definition and implementation of effective policy planning. Anticipating better governance for major local and regional development targeting environmental, social and economic benefits (Barbero, 2017).

Such situations the designer inside SD undertakes the role of "designer mediator", (Celaschi et al., 2011). On these active processes, the systemic designers have the key responsibility to enable the co-creation of strategies to foster territorial cohesion that can encourage relations between all the involved actors. Hence, the SD delivers tools that can achieve new scenarios of economic profit and cooperation in order to guarantee sustainable development (Barbero, 2017).

As SD is effective on the conceptualization of systems, it also demonstrates that is the more suitable expertise to deal with complexity at the scale of government, but also to comprehend on a wider scenario a particular policy or intervention. Furthermore, through tools like the Holistic Diagnosis (HD) through the process of problem finding by system mapping (Sevaldson, 2011), it is delivered a different starting point of analysis for the development of policy (Battistoni, Giraldo Nohra, 2017). From this detailed comprehension of systemic context, the HD delivers innovative opportunities for intervention, opening the spectrum of possibilities according to each territory.

These approaches on an EU governance scale could boost territorial cohesion and EU public policy planning process for sustainable development. On that perspective, the SD approach for territorial development includes actors from different sectors/backgrounds to co-create within a trans-disciplinary scenario from governments, civil society and the industry with the goal of creating effective policies for circular regions.

From that point of view in the case of RETRACE project, the SD enables a deeper comprehension of the complex industrial systems through the HD of each participant region. Focusing on identify potentialities to transform the system into a more circular one. It is true that within the design for policy field, the application SD has much more to explore as emergent expertise but the following will expose how it is turning in to a key element on the policymaking scenario.

### **3. RETRACE REGIONAL ACTION PLANS FOR CIRCULAR REGIONS**

There are different paths in which the EU regions can transition to a CE these could be revolutionary or evolutionary. The EU has targeted that by 2030 most of the industry should have a transition towards a circular industrial model, so in that scenario, the current policies will have to promote a cohesive transition in EU regions (EC, 2017). A current example of this priority is the RETRACE Interreg Europe Project (2016-2020) which aims at promoting SD approach for local and regional policies to move towards a CE, according to which waste from one productive process becomes input in another, preventing waste to be released into the environment. This project includes 8 private and public partners and more than 70 stakeholders from Piedmont (IT), Basque Country (ES), Nouvelle Aquitaine (FR), North-East Romania (RO) and Slovenia (SL) to promote collaboration among EU regions towards a CE.

Cases like RETRACE a project lead by systemic designers, prove their ability to coordinate these transdisciplinary teams in order to tackle complex problems for designing innovative policies. The SD perspective enabled a wider overview of the regional systems and a profound comprehension of the complex phenomena through the HD executed for each region (Barbero, 2017). This evidence was featured through the results of the 5 Regional Action Plans (RAPs) in CE for each partner region one of the main milestones of the project (Barbero & Giral-

do Nohra, 2018). This document defines the regional priorities addressing a range of CE Policy Gaps in the 5 regions. Also, it includes planned measures and support actions the implementation period (2018-2020) and beyond. These future orientated vision actions are pointless if not followed by a real implementation. The success of them relies on the quality of the path that led to RAPs' definition which was defined by the SD.

In order to elaborate a RAPs for each region, there was an assessment of the regional context on relation to the CE. Therefore, each Region regarded their current Smart Specialisation Strategies (RIS3) and development goals, among them a low-carbon CE. This led to the identification of Policy Gaps to be overcome; a process defined by the HD and 7 Field Visits on best Good Practices CE across Europe. This analysis allowed regions to highlight their hidden assets and criticalities that could act as leverages to deliver more effective policies for CE (Battistoni & Giraldo Nohra, 2017). Despite the fact that certain potentialities and challenges are particular from each Region, the RAP approached 6 Policy Gap (PG) common to the partner regions. These ones emphasized the different aspects that implied the transition to a CE in such regions. Moreover, they explore the fields of intervention that could be tackled to support a CE (Pallaro & Pereno, 2018). The identify 6 PG where the following:

- Support collaboration between sectors: This gap was related to the eligibility rules for the open industrial calls which in many cases forbid actors from different sectors to participate. Preventing the generation of local value chains from the output-input principle and the technology transfer among actors.
- Raise and knowledge of operators concerning CE: There is a scarce amount of actions for operators to raise their participation, awareness, and knowledge on CE. This emerges as an important issue as it jeopardizes the development and success of CE related projects.
- Policy regulations on CE: The analysis delivers the unclear and disharmonized policy regulations on CE, specifically on by-products production conditions, at (regional, national and European).
- Tailored policy measures on CE: In the current European funding schemes it is clear that the CE is a transversal topic, however, it emerges from the analysis that there is required to create tailor-made policy measures and calls that address CE directly.
- Policy in support to business and market development for CE activities: At the side of executing CE projects, it is required to promote the creation of a business model for CE activities, in order to foster the market to the reuse of by-products. These actions are key to solve waste management issues towards the success of the CE.
- Policy focused on Small and Medium Enterprises (SMEs) and micro manufacturing: This aspect addressed two main issues; the one is the limited tailored support on CE for SMEs transition and the other is the scarce assistance for the generation of micro-manufacturing processes sized on the local context.

To achieve a successful outcome it was key the strong engagement of all actors of the territory in order to generate tailor-made policy measures. In that way the SD ensures the delivery of policies were all participant parties can oversee the progress of the multiple actions on CE within a short, mid and long term, where the short and medium ones are designed in order to foster future implementations. Specifically, on the long run, the execution of the RAPs aims to shift important policies instruments for regions as the EU regional operational programme, Smart Specialisation Strategies (RIS3), waste management plans, industrial development plans and Corporate Social Responsibility (CSR) (Barbero & Giraldo Nohra, 2018). Such process reveals the "actionable and proactive" mindset of designers that combine with a foresight vision, can deliver tangible outcomes in the short term while pointing to activate broader actions in the long term.

#### **4. RETRACE SUPPORTING EU GOVERNANCE**

There is a considerable part of EU policies towards a CE already ongoing as the Circular Economy Package, EU Bioeconomy Strategy and the EU Plastics Strategy (EC, 2019). Nevertheless, they still require to be put into practice in an integrated across all EU regions. On the view, it is to put in action these strategies it necessary holistic understanding of the territory that can activate systematically on the promotion of sustainable local value chains. An example of how to achieve such transition is the RETRACE's CE RAPs which deliver a systemic policy approach for an effective CE policy-making, including the combination of several policy interventions to stimulate the cooperation among different actors over networks (Barbero & Giraldo Nohra, 2018). To enable this EU strategy on CE, the SD expertise for policymaking will be vital to support key policy instruments on regions such as RIS3, CSR and Cohesion Policy (EC, 2017).

Considering the ambitious goals of the EU towards a CE implying tackling poor institutional management which diminishes the competitiveness and sustainable economic growth (EPSON, 2018). Therefore, it is necessary a cohesive regional development that achieves major environmental-economical-social advantages fostering a CE. In response to that, the SD creates strategies through a territorial thinking process for an effective decision-making process. In the case of RETRACE, such Policy Design processes lead by an SD approach can support Cohesion Policy or regional policies on CSR at different levels in EU regions through a holistic overview from regions enabling a better comprehension of the needs of the territory, to consequently deliver an effective implementation of innovative regional strategies.

Hence, the RETRACE's RAPs actions propose an effective way for regions to achieve productive invest-

ments on RIS3, CSR and Cohesion Policy, to avoid wasteful investments to foster CE. These actions clarify how CE strategies can be scaled up at the European level, fostering interregional cooperation. More specifically, the RAPs are aligned with the Cohesion Policy a policy instrument that considers a long-term vision to guarantee sustainable development over time. To reach this goal the SD delivers a deep systemic understanding of EU regions allowing an appropriate diagnosis of the gaps and potential assets that can impact a sustainable development towards a CE (Pereno & Pallaro, 2018).

## 5. CONCLUSIONS

Transitioning towards a CE is amidst the most pressing challenges Europe has to face. Given the current panorama, actions are needed at all levels from governments to all EU Member States and institutions will have to be on board. Tangible results will be only possible through key change drivers as cities, municipalities, and regions. At the same time, it will require multidisciplinary teams from citizens, businesses, social partners and the research community. The RETRACE project has exemplified that does dynamics are disruptive but truly transformative, contributing to this collective effort in promoting the implementation of an SD approach as a practical methodology to boost the CE transition.

In order to accelerate local development towards a CE, it is essential to set up a dialogue and common ground between all the stakeholders of the policymaking process, to reach a complementarity between bottom-up and top-down making them coexist with a common goal. Ultimately, the final purpose of embrace a synergetic approach is to strength strategies and policies towards a CE (Lambi et al., 2013). Inside the project framework of RETRACE, it was possible to experience these synergies within the first two years of the project (2016-2018) across the research process with policymakers, governments, communities, industry and many innovators across Europe. This journey involved different points of view from many actors who are fostering a CE in their regions, to eventually accomplish a common ground inside the regional context of policymaking. This outcome was clearly reflected on RAPs that reflects an inspiring path across Piedmont, Biscay, Nouvelle Aquitaine, Slovenia, and North-East Romania, also by all those collaborators who have contributed their experiences to foster effective and more sustainable governance.

Through this paper has been highlighted that RETRACE's outcomes contained several successful components that could be extended into other EU regions to transition towards a CE in EU regions. The RAPs explained above acknowledge that a transition towards CE will not be possible without essential changes in fields such as :

- multi-governance coordination: focusing in synergies across different administration levels (from regional and national governments).
- multi-stakeholder collaboration: reinforcing relations between different sectors in industries clusters and value chains .
- consumption and production patterns: emphasizing in the resource efficiency preventing the production of waste, to encourage secondary raw materials.

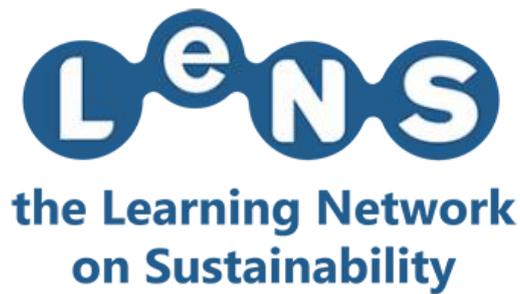
The EU strategies as the CE Package, EU Bioeconomy Strategy and EU Plastics Strategy, underlined the important role Regions play in achieving the European transition to a CE a reality. Nevertheless, Region's challenges in this process are similar, even if the answers are multiple still this transition will carry several implications in EU regions given the various economic, productive and social contexts that will have to be addressed. On this perspective for the RAPs are relevant to underline the role that interregional cooperation for policy planning, their goal is to spread and communicate the outcomes of RETRACE beyond the internal process of the project.

More and more SD is turning into key expertise to generate effective CE strategies promoting a cohesive territorial development for Europe. On that view, the RETRACE project outcomes should not be missed on the way. By the contrary, they should be valorized to spread deep awareness on how the SD is becoming a milestone in the implementation of Policy Design processes in Europe. Also delivering an overview of the disruptive character towards the traditional paradigms on governance and new ways for territorial cohesion and EU policymaking for sustainable development.

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## **SUSTAINABLE CYCLE DESIGN AND EXPLORATION BASED ON TRADITIONAL GARBAGE COLLECTION MODEL**

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### **ABSTRACT**

With the increasingly severe environmental problems, more and more people pay attention to the concept of sustainable design, looking for the design method to let people and nature live in harmony. Due to the acceleration of urbanization and the large amount of waste surge, the traditional waste recycling technology can not adapt to the requirements of urban waste recycling. There are still some defects in the design of waste separation and recovery facilities, so it is urgent to redesign them. The design of the article is based on sustainable design concept and systematic design method, the current situation of garbage sorting recycling, municipal waste recycling research, customer demand research, recycling label design way, garbage collection, garbage recycling facilities design and other aspects of practice and explore, from the each link of recycling, gives a kind of high efficient, beautiful, sustainable urban garbage sorting recycling system.

**KEYWORDS:** Municipal solid waste, Sustainable development, Garbage classification and recycling, Design and research.

## 1. INTRODUCTION

The research goal of this paper is mainly to improve the classification of waste by design, to attract and improve people's environmental awareness with novel design, to carry out targeted design according to different occasions, so as to make its waste disposal space characteristic, so as to provide effective help for the sustainable development of garbage. Through the effective analysis of the classification design of excellent garbage, the biggest difference with the simple garbage bucket setting is that it can communicate with the garbage collection space to a greater extent, improve the awareness of environmental protection classification, and improve the quality of sustainable development. Choosing three types of space, commercial, cultural and residential, as the basis of investigation and practice, commercial space mainly understands the situation of garbage collection in commercial buildings. The main choice of cultural space is large museums, art galleries, as well as kindergartens, secondary schools, universities, mainly from the perspective of the educated, will design guidance awareness, the sustainable development of the idea to continue to develop. Residential space Select some old communities and new communities to compare and learn about sustainability in everyday life. Design facilities and spaces that are more conducive to harmony between human beings and nature.

## 2. DESIGN FOR SUSTAINABILITY

At present, the country's annual emissions of various types of garbage will be nearly  $1.0 \times 10^{10} \text{t}$ , the largest amount of waste produced in the United States, more than  $2.5 \times 10^8 \text{t}$  per year, Germans produce garbage 541-609kg, annual output of 50 million T. The speed of China's waste production can not be underestimated, urban solid waste treatment and recycling problems are becoming more and more serious, China's average daily production of 0.8-1.1kg waste per person, and still 8%-1.1% of the annual rate of growth, the country's annual production of domestic waste  $2.0 \times 10^8 \text{t}$  around. The total amount of municipal waste accumulated over the years is up to 7 billion T, and two-thirds of the country's cities will be surrounded by rubbish. The treatment of waste waste rationalization has yet to be perfected to further promote the development of green construction in cities.

### 2.1 Domestic and foreign garbage recycling treatment methods and current situation

Common household waste is divided into recyclable waste, kitchen waste, construction waste and so on. Garbage collection is based on garbage classification, according to the properties of garbage, its resource utilization. At present, there are several ways as follows: 1. Direct use as raw material; 2. Compost treatment for degradable waste; 3. In the case of rational disposal of garbage, the incineration of domestic garbage in China has developed rapidly in the past decade. In coastal cities with rapid urban development, developed economy, large population and limited land resources, the incineration process is relatively faster. However, the recycling rate of garbage in China is still lower than that in Japan and other countries.

On waste recycling work, China has experienced decades of time, garbage sorting recycling equipment in China has not fully popularization, the city garbage sorting facilities, citizens are not classified garbage consciousness and habit, even if there is garbage classification, since there is no set up sorting center, a lot of junk in the mixing process, the simple sanitary landfill or burned, has not been optimized processing, resulting in the new environment pollution. Waste a lot of recyclable "garbage resources". From the perspective of government managers, although various measures have been taken, such as the performance assessment standards for waste recycling efficiency in demonstration cities, the problems have not been fundamentally solved. In fact, in the process of garbage disposal, not only human and material resources, and the effect is not very obvious. From the perspective of researchers, there is a lack of in-depth research on the efficiency of urban garbage recycling. No innovative garbage classification and recovery system has been discussed.

Germany and Japan have the highest garbage disposal rate in the world, which is closely related to their scientific classification model. Japan has made great efforts in legislation to clarify the types of garbage to be classified, as well as clearly stipulate the subjects and methods of garbage disposal. In Germany, a market-oriented sorting mode is adopted. Industrial associations are used to play a role in garbage disposal such as packaging and batteries, and the power of market mechanism is flexibly used to promote garbage classification and disposal. China's waste production is small, but due to the backward treatment methods and the lack of effective classification mechanism, leading to serious problems. China can draw lessons from the experience of Japan and Germany, to explore the national conditions of waste disposal mode.

### 2.2 Status of waste recycling facilities at home and abroad

Garbage bins as the basis of classified garbage collection system, there are many shortcomings in the design, China's design is mostly the use of metal materials, long-term use is easy to produce sharp edges and corners, and cuboid box type and narrow garbage inlet is very easy to scratch littering pedestrians and cut garbage bags, lack of safety, And make a lot of slightly larger garbage difficult to put into the inside of the box, causing a lot of rubbish to be discarded around the dustbin. In addition, the classification and labeling of garbage collection is not obvious, it is not easy to be widely recognized, which leads to the recovery and classification of garbage,

the function is not strong, its appearance defects, and the coordination with the surrounding environment. Japan divides waste into combustible items, non-combustible objects, resources, large garbage and other large categories, and further refinement, respectively, paper cups, combustible objects, plastic garbage bins, each garbage is also used in English, Japanese, Chinese, Korean and other languages to mark, and specify the color code of garbage classification, such as: Green on behalf of recyclable garbage, Blue means non-combustible garbage, red for combustible waste and so on. The United Kingdom uses green, red and grey as the classification and recovery management of domestic waste.

Many countries combine the recycling of waste and the design of environmental design, industrial design and so on, and successfully developed the solar energy Environmental protection garbage Collection box at MIT, using solar energy as the driving force to automate the classification of garbage. The new waste collection and recycling system, which is put into use in Dunedin, New Zealand, is made of recyclable materials. The bin receives cans, glass and steel bottles and cans, recyclable plastic bottles, cardboard plastic sheets and so on. From the garbage collection system of these countries, all belong to industrial product design, and combined with the actual situation of cities in different countries to carry out the design work.

### 2.3 Significance of the research

The redesign of sustainable garbage collection space for the increasingly serious urban waste disposal problem is mainly aimed at the lack of clarity in the classification of urban waste in China, the defects in recycling facilities, and the reasons for the inefficiency of waste recovery brought about by the user's many inconveniences in use, based on the concept of sustainable design, through data collection, Qualitative analysis, model construction and other methods to design the garbage collection space. Adhere to the concept of sustainable design as a and Xing, the formulation of a design strategy can be implemented, the current urban garbage collection system in China to improve and innovate the problems, so as to better achieve the urban solid waste recycling rate to improve and enhance the urban living environment to contribute.

To ensure the practical function at the same time, further to the garbage collection products and space for visual art promotion, so that garbage collection products from the past dirty, ugly image, its design into the environment, but also can become a bright landscape of the environment, the use of the garbage bin beautification, Yes, citizens are more actively engaged in the ranks of waste recycling. Through the research, we can call on more designers to pay attention to the concept of sustainable design, all aspects of consideration in the background of low-carbon green environmental protection conditions of sustainable design from the concept to the practical application of the strategy, to explore the concept of sustainable design to the final practical design of the design method.

### 2.4 Research ideas and contents

Through the study of the domestic and foreign status, according to the analysis of the current situation of China's municipal solid waste recycling, for the design and exploration of garbage recycling space has important theoretical and practical research significance. The current recycling facilities research is still in the stage of independent study, for the design of the whole space garbage collection and research is very scarce, to the user as the center, improve the practicability of recycling facilities and convenience in scale, through the atmosphere of whole space build and recycling facilities guide, actively participate in the garbage recycling activities. Through background investigation and data collection, we can understand the new city, generation, collection and treatment of garbage, deeply understand the main garbage treatment methods and technologies in China at this stage, and analyze various problems in garbage recycling.

Three types of urban commercial, cultural and residential Spaces are selected as the basis of investigation and practice. The investigation is carried out from the aspects of garbage recycling of commercial buildings, large museums and art galleries, schools and communities, etc., so as to understand the sustainability in daily life from three perspectives and reflect the value of analogy. According to the situation of the investigation and reasonable analysis, the final design.

## 3. RESEARCH ON THE STATUS OF URBAN GARBAGE RECYCLING, USER DEMAND SURVEY

The most USES is non-biodegradable garbage bags of materials and not recycled materials, and adopted by the color and size are different, the quality of the bag is also good and evil people mixed up, in the process of recycling use no guide to help effect, while carrying garbage, oneself also become a part of the garbage. However, the garbage bags loaded with medical waste in hospitals still have eye-catching signs and clear colors to distinguish them at a glance. Field surveys of shopping malls, residential quarters, school, found that is currently in indoor garbage cans on the morphology and size is a big difference, even have the user use waste oil drums as bearing of garbage, even if some of the trash can design a simple, but they are not fundamentally to the garbage recycling work.

From the source of the garbage collection will increase the difficulty of the staff, in the garbage can on the use of materials, the use is more mixed materials, such as the metal material, on the surface of metal material wrapped with paint, it is difficult to remove and clean, in accordance with the sustainable design concept, materials on sustainability issues still exist many problems, increased the difficulty of garbage collection.



(Figure 1: indoor recyclable trash can) (Figure 2: indoor non-recyclable trash can) (Figure 3: indoor trash can without signs)

Outdoor trash cans are divided into two categories, one is used to receive the whole bag of household garbage, the other is used to receive scattered street garbage peel. Although relatively very uniform in shape, belong to the appearance of the rectangle, armrest and roller equipped with push and pull, capacity can meet the needs of recycling, accidentally and group member early strength is not enough, poor durability, investment and remove all difficult, drainage insufficient consideration, design form and management mode of ill-considered congruent factors caused certain limitation and the difficulty. But at present, there is no obvious sign on the classification trash can, even if there is, it is not obvious, and the color of the shape is also very dim, which is difficult to adapt to the surrounding environment.



(Figure 4: garbage can in landscape area)(Figure 5: garbage cans in the block)(Figure6: smoke extinguishing trash can)

The short-distance garbage transport mainly USES the small tricycle, the volume is small, the efficiency is low. Garbage transfer stations are mostly located in the living area, where the environment is quite dirty and the smell is quite unpleasant, which is quite abrupt and disharmonious in the living area. Garbage recycling label does not make a unified standard, most of them are only with simple recycling and recovery are identified, recognition degree is low, in the case of wear and damage to judge identify relevant content, while others use very figurative expression, to a certain extent, the lack of aesthetic feeling, not good to attract consumer attention, and can't accurate judgment of garbage classification.

To sum up, in the current market, recycling facilities also is uneven, the quality of the facilities also remains to be proven, failed to play a good role in the process of waste recycling, trash can set the quantity is too little or too much, configuration location selection is not reasonable, plus the lack of space garbage collection, as well as the negative images of the filthy, the garbage collector efficiency is very low.



Figure 7: garbage collection area



Figure 8: garbage truck parking

User survey can be divided into two plates, a family as a unit, the other is individual as a unit, the majority of users think of the government's measures is not perfect enough, trash hardware facilities there is a certain extent, the design defect, hope can have a more clear and easy to understand the classification of the said, for recycling categories of design, can achieve more scientific and more to understand the classification of the reason. According to the statistics of garbage production, the output of kitchen waste is the largest, followed by the recyclable waste such as glass and plastic, and the output of hazardous waste is the smallest. For the later garbage recycling frequency, it is necessary to increase the recycling frequency of kitchen waste and reduce the recycling frequency of toxic waste. The vast majority of users find the fixed point of recycling has adopted recycling garbage recycling bins are seldom found outside, just a lot of people will be discarded garbage in the greening of life, therefore in the process of implemen-

tation of the strategy should be to increase the number of recycling garbage classification of living area, and need to be more reasonable arrange recycling bin and the number of points. Many users hold a supportive attitude towards garbage collection and utilization.

However, due to the lack of a good recycling environment and scientific recycling system design, people have the idea of “if other people do not classify, it will be useless for me to do so alone”, which reduces the efficiency of garbage collection. If the problem of garbage collection is divided into many links, the user is only a relatively small link, but it is a small link, if handled well, it can greatly promote the completion of the following links.

#### 4. DESIGN OF GARBAGE COLLECTIN SIGNS, GARBAGE COLLECTION METHOD DESIGN, GARBAGE COLLECTION FACILITY DESIGN

In the design of garbage collection signs, to solve the problems in the current situation, or in the concept of allowing users to more clearly identify the specific classification signs. Use different color, and USES the bold entity, short text, using the form of point, line and plane, let more evident in the middle of the label, whole body using rectangular fillet processing, can be adjusted properly according to the size of the box body, interior label smaller, outdoor signs larger doubled, in paste, the use of the stickers, adopting sustainable coating, avoid to cause secondary pollution to the environment.

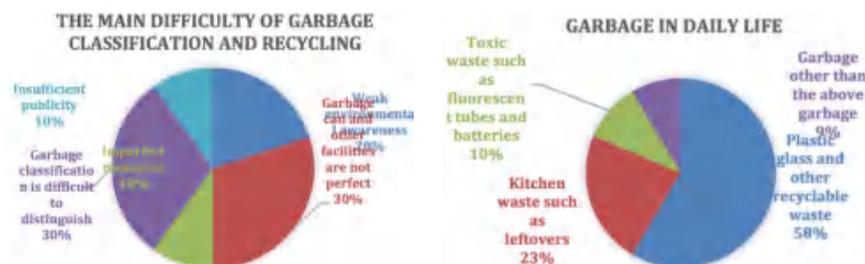
Garbage recycling is the best way to recycle is no longer as garbage, every type of garbage will have corresponding, can form the recycling of fixed and circle, household waste produced in Japan, will be sent to different depending on the nature of garbage resources sorting center, part of the garbage was sent to incinerators, the heat generated is available for power generation, environmental protection and save the economic costs. Large garbage is sent to the sorting center for crushing. Iron is sorted in this way, and available resources are sold to market enterprises. In this situation, garbage recycling can turn 90% of garbage into a reasonable resource. According to the research, we should recycle kitchen waste every day, recycle other garbage every other day, and clean up hazardous garbage in one week. It is because of the reality of Chinese cities that most families put their garbage in the garbage bin at 5:00 PM. Therefore, the general garbage truck will be in the garbage bin before 5-6 o'clock in the afternoon, the amount of kitchen waste production in the end, and easy to damage the environment is prone to decay, cause disease, so every day regular cleaning, and other garbage due to rapid decay can be recycled every other day.

Indoor classification recycling bin: based on the concept of sustainable design, urban living space is short, to the number of a family if they want to put a lot of trash can, largely wasted the usable floor area, a certain amount of inconvenience, modular and flexible design method of assembly will be a single garbage cans can be flexible organization together. On the one hand can achieve the purpose of classification effect, on the other hand can save a lot of space. In the structure, a vertical support rod is used to organically combine the separate garbage cans for classification, so that they have overlapping parts. When the garbage can below is to be opened, the garbage can be rotated to put the garbage into it. The flexible combination of the trash can determines its function. To a certain extent, the garbage can and the garbage can cover can be decomposed into modules, which can be disassembled flexibly. When the trash can needs to be recycled, it can be processed quickly according to different types, reducing the time consumed by the secondary classification of garbage. Improve the recovery efficiency from the source. In the shape of the use of natural elements, the shape of bamboo to the design, the use of circular cylinder, can maximize the solution to the problem of dead Angle, and recycling bin and nature mutual integration, small and smart image is also very pleased. In color, green represents recyclable waste, red represents toxic waste, yellow represents kitchen waste, and blue represents combustible waste. Color can be matched according to the preferences of users.

Outdoor classification recycling bin: due to the different environment, problems to be solved are also different, relative indoor, outdoor environment need to be more durable, the first problem to be solved is waterproof and drainage, on the design of the dustbin body, at the bottom of the set has a small hole, can prevent a lot of water in barrel, the top lid inspired by building roof, the curved dome shape, and the lid of the coverage area is slightly larger than the cylinder body, the better will rain discharge in a timely manner. The shape of the whole trash can is small in the middle and small in the top. It is small and beautiful. A trolley is used on the handrail, with rubber material attached, so that the garbage collector can have a better working experience. In terms of appearance modeling, it changes the previous upright modeling and adopts round shape with artistic design, which gives people a more intimate feeling and enables more people to take the initiative to recycle garbage in an orderly manner. In the past because of the size of the dustbin is too large to cause a greater workload. The size and specification of the trash can are set at 360L, which reduces the difficulty of cleaning under the bearing strength.

Intelligent design of garbage collection box: the addition of intelligence can reduce the difficulty and improve the efficiency of the whole garbage collection process. Solar power supply design, use weak current system, avoid electric shock and fire. The intelligent clamshell system can reduce the secondary pollution of garbage, prevent rats and insects from entering the trash, and reduce the infection of diseases and bacteria. Language prompt design can better remind users, actively and consciously put the garbage into the trash can, in a long time imperceptible process, let users develop good habits. Communication monitoring technology can effectively enable environmental protection workers to know the use of dustbins and whether the garbage is full, which reduces the process of manual confirmation. Scientific calculation of the use of dustbins in each area can also enable the environmental protection department to arrange manpower more reasonably, virtually reducing a large amount of human waste.

Garbage collection space design: the originally thin trash can design often fails to meet people's needs. Lack of communication, people and space to a certain extent, affect the efficiency of garbage collection, the concept of recycling space for MSW treatment is no longer seem to be thin, from the visual and psychological, contains of the space, can make the person has better spatial experience, under the specific environment atmosphere, people will automatically classifying rubbish, and there will not be thrown into the trash can around the phenomenon. From the perspective of ergonomics, the improvement of the sense of scale is enhanced to enhance the sense of color composition. Under different occasions, each garbage space is treated artistically according to cultural background factors. Fully through the concept of sustainable design, in the details of the design of waste recycling space, improve the fun of space interaction, is the user is willing to accept and implement the concept of sustainable, reasonable garbage recycling treatment, with management personnel management and supervision, publicity. Diversified and experience the charm of sustainable design.



## 5. CONCLUSIONS

The increasingly serious environmental problems, we every designer should think about how to make a conforms to the concept of sustainable design, recycling recycling should be more around the concept of sustainable design, deep research on sustainable and applied research results in actual design, for every attention to ecology, environmental protection, the experience of the designers of the human and the nature harmonious. As for the design method and design style of garbage collection facilities, there are many words, but the most important thing is to take the practical function as the premise, so as to better serve the users under the premise of satisfaction. Comprehensive design of garbage classification, garbage facilities, garbage recovery system, and strive to meet the requirements of sustainable design to the greatest extent, while maintaining its beautiful appearance and efficient use function. In the design to meet the user's personalized needs for appearance, color, and reasonable to meet the layout of facilities, convenient to meet the user's behavior habits and mentality.

Although in the rapid development of science and technology, sustainable design concept never go out of style, only in this way can the human and the nature harmonious get along, be truly sustainable can bring the world good, sustainable design concept also has the very big development space in the design of the future, for recycling facilities, look forward to the most sustainable recycling will be not waste the concept of "abandoned", abandoned itself will be the beginning of another production cycle.

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## WHAT REALLY MATTERS? SYSTEMIC DESIGN, MOTIVATIONS AND VALUES OF THE CIRCULAR ECONOMY COMPANIES IN ITALY

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### ABSTRACT

Since 2014, the Circular Economy (CE) concept is gaining an important role in the European context thanks to the specific direction given by the EU policy. This research wants to frame Italian companies who are working on CE context to understand mainly which is their approach and awareness to CE and if the design is playing a role in this transition. At the beginning of 2019, an online questionnaire was sent to the actors present in the app database 'Mercato Circolare' who, since March 2017, is mapping the Italian situation collecting the actors related to the CE selecting companies, events and experiences of circular citizenship. Despite the response rate was 14%, the results are interesting: 100% are SMEs; 21% are not aware to work on CE; >52% identified difficulties with value appreciation; design competencies are present in the 66% of realities and in 29% the designers by formation are founders.

Keywords: circular economy, Italian SMEs, design

### 1. CONTEXT

Since 2014, the Circular Economy (CE) concept is gaining an important role in the European context thanks to the push coming from the European Union with the document EU (2014a). Following the study conducted by Zamfir et al. (2017), the country is the most important factor which influences CE development. In this case, the country of reference where the research was conducted is limited to Italy due to the database chosen to investigate the topic. In the Italian context, the app 'Mercato Circolare<sup>1</sup>'(MC), of the homonym innovative start-up<sup>2</sup>, since March 2017 is mapping the Italian context collecting more than 250 actors related to the CE selecting companies, products, events and experiences of circular citizenship.

This research wants to frame the role of these actors in CE, understanding mainly which is their approach and awareness to CE and if the design is playing a role in this transition.

### 2. DESIGN, CIRCULAR ECONOMY AND SMES.

The main motivation behind this research is to understand how the design can contribute to the transition to a CE and to define and push an alternative and sustainable model of production and consumption to the linear one within the regenerative model Blue Economy (BE) by Pauli (2015). As Ellen Macarthur Foundation remind, the CE is "economy that is restorative and regenerative by design"<sup>3</sup>. This means that the entire system should be redesigned or designed by intention, considering many different factors, the complex system. However, in the scientific literature (scopus database), many contributions are narrowing the role of designer to product design, dealing with re-manufacturing or eco-design. However, in the review on CE by Lieder and Rashid (2016), design is mentioned "crucial to the development of the new economic model of CE" and "product design is identified as crucial in the design of sustainable circular systems, especially in connection with critical materials research". Bocken et al (2016) remember "integrating circular economy concerns at an early stage in the product design process is important" and shift the attention to the design of resources loops. They suggested two main design strategies: for slowing resource loops and for closing resource loops. For Andrews (2015) "Designers now have the opportunity to lead the paradigm shift and in addition to designing for the 'closed loop' they have the potential to influence business and consumer behaviour and consumption by extending actual product life and increasing perceived value of products." De los Rios and Charneley (2017) arguing on the skills and capabilities for a sustainable CE, they claim for a changing role of designers given that "the standard approach for creation, fabrication, and commerce of products is challenged". They reported the categorisation by Go et al. (2015) on the different design approaches for a sustainable industry: from the design for life cycle, to the design for environment (preventive) to the whole systems design. In fact, design in the lastly has seen an evolution: as stated by Ceschin and Gaziulusoy (2016) it has passed from product innovation to product-service system innovation to spatio-social innovation and to socio-technical system innovation.

About the designers skills, for Go et al. (2015) they pass from the understanding logistics, distribution processes and engineering functions, to services design and user experience, to perception of value. Andrews (2015) adds that to reach sustainability "some designers need to change their practice while others need to change their practice and thinking". As designer decisions can influence all the value chain (Braungart and McDonough, 2009), different training and skills for designers are required to meet the need of sustainability, especially in the manufacturing sectors which required it as stated by Garetti and Taisch (2012). Along Cradle 2 cradle design (C2C) (Braungart and McDonough, 2009) which now is also a product certification, Systemic Design (SD) (Bistagnino, 2011; Jones, 2018) and Design for product-system sustainability (Vezzoli, 2007) are recent approaches and education method for design for sustainability that are enlarging the focus from product to the system where it is embedded.

Previous studies have tried to frame the CE concept in European enterprises. Zamfir et al (2017) referring to Italian SMEs stated: "SMEs from Italy display a very heterogeneous behavior in adopting circular economy practices....SMES that activate in the manufacturing sector are the most active in the field of circular economy...the openness of Italian SMEs from services and industry to circular economy is also influenced by their total turnover...". The Flash Eurobarometer 441 (EU, 2016) in a questionnaire requested by the European Commission DG Environment on European SMEs and CE showed that almost three quarters of companies undertook some CE related activity (in Italy the 67%).

### 3. METHODOLOGY

After a literature review about the relationships between CE concept and the design role, we defined and sent, at the beginning of 2019, an online questionnaire to each entity in MC database (MCd) which are 276 in total. Specific and mainly closed questions were asked to raise the response rate. The open (OQ) and close (CQ) questions (listed in tab. 1) first want to frame the identity of these actors, after focus on their awareness on working on CE concept and on the different scientific approaches related to CE, and at the end look for the presences of designers and their

<sup>1</sup> English translation: circular market.

<sup>2</sup> Othe author, Nadia Lambiase, is the founde

<sup>3</sup> <https://www.ellenmacarthurfoundation.org/> . Last consultation 10/02/2019 .

roles and main competencies.

[Table 1] Questionnaire questions

n°	Motivation: understanding ..	Typology of data	Collection method	References
<b>ENTERPRISE IDENTITY CARD</b>				
1	..the principal sectors in which the enterprises are working	Productive Sectors	OQ <sup>1</sup>	statistical classification of economic activities NACE <sup>2</sup>
2	..the principal area in Italy	location	MCd	
3	..the age of the phenomenon	Foundation year	OQ <sup>3</sup>	
4	..which are their clients	B2B or B2C	MCd	
5	.. the typology of enterprises working on CE	Enterprise size	CQ <sup>4</sup>	
		n° Innovative Enterprise and start-up	CQ <sup>6</sup>	Italian law on 'innovative enterprise and start-up'
		n° start-up		
<b>APPROACH TO CE</b>				
6	..which approaches are known	Awareness on scientific approaches related to ce	CQ <sup>7</sup>	Approaches defined by authors
7	..their awareness on being into the CE concept	Ce awareness	OQ <sup>8</sup>	
8	...the most common CE principles	Ce principles	CQ <sup>9</sup>	Principles are base on an elaboration of Ellen MacArthur foundation principles
9	...the level of education about CE	Investment in training on ce	CQ <sup>10</sup>	closed answers mainly based by authors experience and EU (2016)
10	...the solutions and strategies adopted	Solutions to transition to ce	CQ <sup>11</sup>	closed answers mainly based on EU (2016)
11	..the most common problems faced to work on CE	2 main problems in ce implementation	CQ <sup>12</sup>	closed answers mainly based on EU (2016)
<b>IDEA CREATION, COMPETENCIES AND ROLE OF DESIGN</b>				
12	...how the idea behind the enterprise was born	Idea creation	CQ <sup>13</sup>	closed answers based by authors experience
13	..presence of Designers (by formation) in the company	Design presence in founders and company team	CQ <sup>14</sup> ; CQ <sup>15</sup>	
14	...if designers (by formation) are entrepreneurs	Design presence in founders	CQ <sup>16</sup>	
15	understanding principal competencies involved in CE	Competencies by team and founders	CQ <sup>17</sup> CQ <sup>18</sup>	
		External consultants	CQ <sup>19</sup>	
16	..if they are cooperating with other realities and are they public or private?	Partnership	CQ <sup>20</sup>	

#### 4. RESULTS AND DISCUSSION

The response rate to the questionnaire was of 14% (38 on 276) in 1 week of time availability. The data collected were processed and aggregate.

**IDENTITY CARD:** The answers came mainly by enterprises that are 87% (30 and 3 social cooperatives). The other 6% are represented by 3 sole practitioner designers or artisan, 2 association/non profit and 1 research centres. Between the enterprises, 19 are micro, 11 are small and 3 are medium. This means that 100% of the enterprises are SMEs which is perfect in line with the Italian average situation as demonstrated by Pedone (2016). This data confirm also as the micro and small enterprises are playing a role as the subject for the change (Barbero, 2016). Moreover, 21 entities state to be innovative (as the Italian law definition<sup>4</sup>) and precisely 8 are innovative start-ups and 13 are innovative enterprise (start-ups 5 years old). 55% works with clients (b2c), while 40% with other business (b2b) - no data about 5%.

The foundation year frames the phenomenon in time. 22 were founded from 2012 and 2018, 10 between 2000 and 2012, and 6 from 1960 to 2000. The increase from 2012, with a pick in 2015, reflects the period in which Europe Union starts to talk about the CE.

The ateco code provided in addition to the company description in MCD for the one who doesn't have a code, let define that the 42% are involved in manufacturing sectors. Precisely the main ones are: traditional manufacturing activities (8 cases); 'design and produce' (8 cases) - will be referred as manufacturing activities along the paper -; informatics (4 case) and energy (3 cases). 4/8 'design and produce' are sole practitioners.

55% of the total entities are located in the north of Italy (21 cases, especially in Piedmont, Lombardy and Trentino); 32% in the centre (12 cases especially in Emilia-Romagna, Lazio and Toscana); 5% in the south (2 cases). This reflects the situation about the total entities present in MCD.

**APPROACH TO CE:** Surprisingly, 8/38 state that they have never always been aware to work in this context. Many of these answers provided came from companies born before 2001. Regarding the 8 entities that 'design and produce', 2 don't know CE approach but 7/8 know the eco-design approach and 2 the C2C. Among all the 16 manufacturing activities only 3 know the SD approach and they are located in Piedmont region: this reflects the low diffusion of the approach in the manufacturing sectors outside the territory where it is a master degree (Torino, IT). Considering all the cases, after CE approach, the most known are: eco-design (16), BE (8), c2c (6) and SD (3). Only one reality know all the 4 approaches proposed. Approaches as Design Thinking, Sustainability, Green Economy, LCA and sustainable development were proposed voluntarily by 8%.

In the questionnaire 45% declare to have internal competencies about CE, while 30% have not yet invested in a training course on CE.

To frame which aspects of the CE they are implementing, we decided four main principles, which come from our interpretation of the Ellen MacArthur principles: 'generate value from waste'; 'use natural input or from second raw material'; 'design for the long-lasting duration'; 'prefer use to property.' In this specific research, many answers included more than one principles. The most cited was the 'generate value from waste' (33/38) and in 18 cases it was mentioned with the 'use natural input or from second raw material' which was cited in total 23 times. 9 state to work on 'design for the long-lasting duration' and 3 on 'prefer use to property'. Only 3/8 of 'design and produce' category are working for long-lasting duration of objects and 8/8 are generating value from waste.

About the actions taken as solutions or strategies in the last three years, 50% have done anything (9 are 'manufacturing activities'). Among them, 11 are micro enterprises. While about the other 50%, 10 have done an analysis of their fluxes and 6 a LCA, 4 have obtained environmental certification, 3 have re-design the product and 3 have environmentally improved their plant.

To understand the difficulties that they encounter frequently to work on CE, we have asked the main 2 problems. More than 52% identified difficulties in making the value added appreciated by the market, and about the 40% difficulties in accessing fundings. However, as the Flash Eurobarometer 441 state, one of the problems can be that in Europe "just over a third of companies are aware of government financial incentives for activities related to the circular economy" (EU, 2016).

**IDEA CREATION, COMPETENCIES AND ROLE OF DESIGN:** One of the most interesting aspect emerged is that 11/38 (30%) answered that CE is their philosophy of life. This reflects that the CE is not only a business opportunities, but a high percentage of people consider it as a cultural paradigm.

About the creation of the idea, almost the 50% choose the reason 'to solve a society problem', 37% 'from a personal need', 30% 'from a previous working experience'. 7 were born between colleagues in another enterprise, 5 from scientific research, 2 to answer a call and 2 from a family enterprise. 11 of the total had an experience in Business Incubators. In 47% of cases they have external partnerships and in 47% of cases they haven't. 4 declare to have partnerships with research centres.

With the goal to investigate the role of design in the CE, was asked to define the competences of the founders and the employees. 21/38 has stated to have internal competences in design. To frame better this concept, it was asked if there are designers by formation in the team. In this case, only 1/3 of these 21 have answer positively. The

4. Legge 17 dicembre 2012, n. 221 (DL Crescita 2.0- artt. 25-32). Retrieved online from <http://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:decreto.legge:2012-10-18;179?vig=>

reason behind this double question can be found in the lots of meanings of the term 'design'. In fact, lacking an official register, design is intended as a capacity possessed by many people and not a specific profession which corresponds to a particular bachelor degree. The designer by formation are working in 12 of the 38 identities analyzed and in 11 cases they are founders (in enterprise founded after 2001). This reflects the abilities of designer as entrepreneurs (Margolin, 2002). Designers are working in 7/8 in the 'design and produce' category which reflects the skills of 'designer as producer' as demonstrated by Margolin (2002).

Along the competencies in design (45% between founders and present in 25 entities), the main one are: business and marketing (33), communication (27), financial (19), social science (16), engineer (15), ICT and development (14), natural science (10) and legal (9). It's important to underline that communication and legal services are mainly also delegated to external consultants, in addition to management one.

## 5. CONCLUSION

The results better define the Italian context on the CE, previously framed by other studies. Despite the response rate was of 13%, the main results are interesting: 79% are micro and small enterprises; 21% are not aware to work on CE; more than 52% identified difficulties in making the value-added appreciated by the market; 21% are 'design and produce' realities; design competencies are present in 66% of realities and in 29% the designers by formation are founders. Although, the results do not highlight the designer with a role in the design at the system level, as one of its emerging skills (see SD). This can let start a reflection on the need to spread this message out of the academia and research sectors, to change really the business practice over the sustainability aspect.

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## **IS DESIGN PLAYING A ROLE IN THE REALISATION OF CIRCULAR ECONOMY PROJECTS IN EUROPE? A CASE STUDY ANALYSIS.**

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### **ABSTRACT**

Thanks to the strong push coming from the European Union to fight waste production, the Circular Economy (CE) has gained an important role in Europe. Following this trend, many institutions nowadays state to work on the CE implementation or supporting the transition to a CE. However, are they including design approaches and practices? The design phase is starting to be considered the crucial point to obtain a CE as it required a profound radical change from the beginning of the process and at system levels. After framing the CE concept, we performed desk research to identify which are the players in the CE projects implementation. Afterwards, a multiple case study analysis were performed to the most proper one to understand the presence and the role of design in the implementation process. The results placed the actors in a very fragmented framework and seem to lack almost completely the design presence.

Keywords: circular economy, Europe, design, implementation

## 1. DESIGN AND CIRCULAR ECONOMY

Since 2014, with the relevant statement about the Circular Economy (CE) from the EU with the document EU (2014a), the scientific literature about CE has seen an exponential increase in contributions over many aspects as definition (e.g. Millar et al., 2019), implementation barriers (e.g. Kirchherr et al., 2018), case-studies (e.g. Principato et al., 2018). What seems to miss in this literature review are the actors that are working to support the CE implementation. One of the reason can be little interest by the academic/research sector on this topic or the not involvement of the academic/research sectors. However, the innovation model expects the involvement of three actors: industry, government and academia (triple helix model).

Another gap is the role of design (D) in the transition from the linear to a CE. However, the decision made by designers (Der) can influence all the value chain, so it is the base of the manufacturing sectors. As stated by Garetti and Taisch (2012), the manufacturing sector currently is one of the most involved in this transformation to meet the requirement of sustainability. The D phase is starting to be considered the crucial point to obtain a CE as it required a profound radical change from the beginning of the process and at system levels. As the Ellen MacArthur foundation stated, CE is 'is restorative and regenerative by design' <sup>1</sup>. This foundation, which is playing a very important in the training and in the spreading of the CE concept, with a collaboration with IDEO, an international known D company, has well recognised the role of D as an essential building blocks of CE<sup>2</sup>, along new business models, reverse cycles and enablers and favourable system conditions.

They developed in 2017 the Design Circular Guide following this reason: "Who we're designing for has expanded from a solitary user to an intimately connected web of people, spanning the globe" <sup>3</sup>. However scientific literature seems to be concentrated in the role of D only related to the product D process and closing circular resources loops (Lieder and Rashid, 2016; Bocken et al., 2016). D has more times demonstrated to the worlds its role in the creation of new opportunities and innovation (e.g Bertola and Teixeira 2003; Franzato and Celaschi, 2017). In the last years also its role in the creation of eco-innovation as demonstrated by different approaches to D for sustainability and the recent review by Ceschin and Gazilulsoy (2016) showing its evolution from product innovation to product-service system innovation to spatio-social innovation and to socio-technical system innovation.

As stated by Go et al. (2015) in fact the D practice in sustainability area has passed from D for life cycle, to the D for environment (preventive) to the whole systems D. The result is that D has changed its role, providing skills and capabilities to sustainability and CE (De los Rios and Charneley, 2017). Moreover, as stated by Celaschi (2008) Der can have the role as mediator between the competences thanks to his/her competences in dealing with many actors for the success of the project.

## 2. IMPLEMENTATION ACTORS

Arguing about who are the ones that support project implementation nowadays, the most recognized are the Business incubators (BIs). This recent phenomenon, mainly American, has emerged in the European framework. They are promoted as accelerators of entrepreneurship and able to create economic development with a bottom-up approach (CSES, 2002) focusing on the creation of new ventures (start-up). Although they are mostly focused on the technological aspects and the economic sustainability of the project, and not the environmental one (Battistoni and Barbero, 2019). Among them, in recent years, many other actors have emerged which performed similar services to BIs as business model review and providing fundings, addressing new projects implementation in existing enterprises.

One example are the regional innovation poles (referring to Europe) which are clusters of innovative start-ups, SMEs, big enterprises and research institutions, and are supporting innovative projects among existing enterprises, but with top-down approaches through institutions of calls. All these actors, are playing an important role in projects implementation, although is not clear enough their role in CE implementation and environmental sustainability. However, its clear the role of the eco-parks, mainly mentioned in the scientific literature, which represent the Industrial Ecology in action.

## 3. METHODOLOGY

Initially, to find the actors playing a role in the CE implementation was performed a literature review on Scopus database with the keywords "business incubator\*" and "CE" in 2018 and, unfortunately, has zero results. For this reason, was also conducted research with more informal methods as desk research on Google and the social media Facebook to find the actors and both the main events related to CE to individuate more actors. A snowball approach was applied. Once the main actors were identified, we perform a multiple case study understanding their central role and which typology of actors they are. Besides, the actors that are focusing mainly on the business implementation

<sup>1</sup> <https://www.ellenmacarthurfoundation.org/circular-economy/concept>.

<sup>2</sup> <https://www.ellenmacarthurfoundation.org/circular-economy/concept/building-blocks>

<sup>3</sup> <https://www.circulardesignguide.com/>

on CE where selected for further studies. A format with few answers were sent to them by emails to collect the data that are not present in the website of each actor to understand better their role, the services provided to support the implementation and the presence and the role of D in their services and staff/mentors.

## 4. RESULTS AND DISCUSSION

### 4.1. CE IMPLEMENTATION ACTORS

During the review on the CE concept in the document by the EU commission, EU (2014b) mention that the main actors which were just started before the 2014 to support CE implementation in companies are: the Ellen MacArthur Foundation (supported by McKinsey) that were presented some case studies and reports; the cradle2cradle Products Innovation Institute, which was giving the certification on cradle2cradle products considering their entire life-cycle. Another important source of information to find out cases was authors' experience as involvement in BE networks, Systemic D research network<sup>4</sup>, RETRACE project<sup>5</sup>. In addition the event 'Circular Economy Hotspot'(CEH), which took places from 2016 in various places: the Holland in 2016<sup>6</sup>, Luxemburg in 2017<sup>7</sup> and Scotland in 2018<sup>8</sup> (SCEH).The last one was attended by authors. The results are represented in figure 1.

The 24 actors, for their principal goal can be divided into main categories:

- Business Incubators for new start-ups: Ville Durable Programme<sup>9</sup> by Paris&Co. (Google); Blue City 010<sup>10</sup> (authors involvement in BE Network); Circular Economy Transition<sup>11</sup> (CEC<sup>12</sup> Group); 2i3t<sup>13</sup> - university BI (Authors'city); Green Garage<sup>14</sup> (EIT Climate Kic - Europe's leading climate innovation initiative);
- Organizations with services to support existing enterprises: Zero Waste Scotland Limited<sup>15</sup> - Government's Lead Agency (SCEH); Clever<sup>16</sup> - Innovation Pole (Authors'city); Advance London<sup>17</sup> - programme by LWARB (contact in SCEH); Fit 4 Circularity<sup>18</sup> (LCEH) -programme by Lux Innovation cluster; Circular Economy Lab<sup>19</sup> (Authors'country - Not Yet In Action);
- Consultancy: Metabolic<sup>20</sup> (Climate Kic summit 2017); Copper 8<sup>21</sup> (contacts in NL); Circle Economy<sup>22</sup> (SCEH) - Circle Design Programme and Nederland Circulair!;
- Communication and training: Ellen Macarthur Foundation<sup>23</sup> (EU, 2014); C-Creators<sup>24</sup> (contacts in NL); Circular Glasgow<sup>25</sup> (SCEH); Circular London<sup>26</sup> (LWARB); Circle Lab<sup>27</sup> (mentioned by Circular Glasgow); C-Beta<sup>28</sup> - ex Circular Valley<sup>29</sup> (RETRACE);
- Network Creation: Circular Change<sup>30</sup> (SCEH); Circul'r<sup>31</sup> (mentioned by Circle Lab);

Particular Cases: Cradle To Cradle Innovation Institute<sup>32</sup> (EU, 2014; Braungart, 2003) focus on product certification; Symbiosis Center Denmark<sup>33</sup> (Focus On Industrial Symbiosis).

<sup>4</sup><https://systemic-design.net/sdrn/>

<sup>5</sup><https://www.interregeurope.eu/retrace/>

<sup>6</sup><https://hollandcircularhotspot.nl/en/>

<sup>7</sup><http://circularhotspot2017.lu/#ui-id-53-148093256354091>

<sup>8</sup><http://www.circulareconomyhotspot.scot/>

<sup>9</sup><http://villedurable.parisandco.paris/Economie-Circulaire/Startups>

<sup>10</sup>[www.bluecity.nl](http://www.bluecity.nl)

<sup>11</sup>[https://www.cetransition.ch/?fbclid=IwAR23kZVD42Lux2N\\_pAc8XHR8gvzi9B2uyOPyIyvoQQ\\_Qadso1tF\\_YUATG1](https://www.cetransition.ch/?fbclid=IwAR23kZVD42Lux2N_pAc8XHR8gvzi9B2uyOPyIyvoQQ_Qadso1tF_YUATG1)

<sup>12</sup> Circular Economy Club

<sup>13</sup><http://www.2i3t.it/>

<sup>14</sup><https://eit.europa.eu/newsroom/climate-kic-green-garage-germany%E2%80%99s-first-climate-innovation-incubator-opens-door>

<sup>15</sup>[www.zerowastescotland.org.uk/](http://www.zerowastescotland.org.uk/)

<sup>16</sup><https://www.poloclever.it/it/polo-energy-and-clean-technologies/>

<sup>17</sup><https://www.lwarb.gov.uk/what-we-do/advance-london/>

<sup>18</sup><https://www.luxinnovation.lu/innovate-in-luxembourg/performance-programmes/fit-4-circularity/>

<sup>19</sup><https://www.cariplofactory.it/intesa-sanpaolo-e-fondazione-cariplо-lanciano-il-primо-laboratorio-per-la-circular-economy-in-italia/>

<sup>20</sup><https://www.metabolic.nl/our-work/ventures/how-we-work>

<sup>21</sup>[www.copper8.com/en/](http://www.copper8.com/en/)

<sup>22</sup><https://www.circle-economy.com/>

<sup>23</sup><https://www.ellenmacarthurfoundation.org/>

<sup>24</sup><https://c-creators.org/>

<sup>25</sup><https://circularglasgow.com/>

<sup>26</sup><https://www.lwarb.gov.uk/what-we-do/circular-london>

<sup>27</sup><https://circle-lab.com/>

<sup>28</sup>[c-beta.nl](http://c-beta.nl)

<sup>29</sup><https://www.circularvalley.com/>

<sup>30</sup><https://www.circularchange.com/news/>

<sup>31</sup><https://www.circularchange.com/news/>

<sup>32</sup>[www.c2ccertified.org](http://www.c2ccertified.org)

<sup>33</sup><https://symbiosescenter.dk/en/>

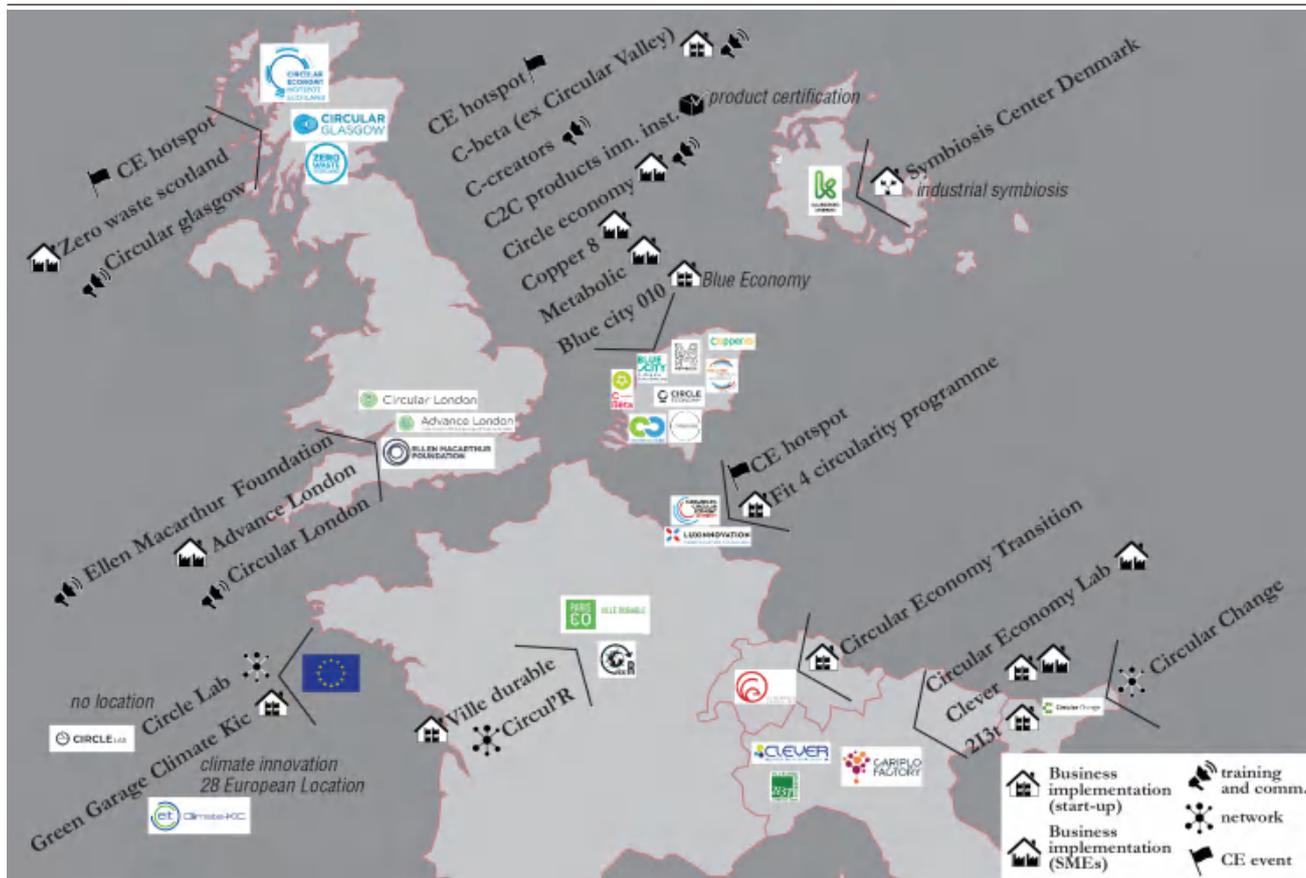


Figure 1 European CE implementation actors

The actors identified (img 1) show a very fragmented framework however, the one in the first two categories can be defined as ‘business implementation’ actor for their goals, although someone concern SMEs and other new ventures/start-ups. Moreover, some actors have a larger focus than CE: 2i3T on technology transfer but has a section on environment and energy; Green Garage on climate innovation; Metabolic on systemic thinking; Copper8 in sustainable breakthrough; Clever on energy and clean technologies however they have a particular section on CE. They were included in this analysis as their goal represent a subsection of CE however, many other realities as they can be present in Europe.

From a first analysis on the services performed by the actors, seems to lack almost the D presence, except for particular cases as the Cradle2Cradle innovation institute (the one that released the cradle2cradle certification for product and materials); Metabolic as a D studio and the Circle Economy which, with its particular programme, spreads circular D thinking. For this reason, was conducted a deeper analysis of the ‘business implementation’ category.

#### 4.2. CE IMPLEMENTATION ACTORS AND DESIGN – DEEP ANALYSIS

To investigate the role of D and Ders in CE implementors, the 10 actors on business implementation were selected and contacted directly by authors. Unfortunately, 6/10 never reply or were not available or did not show any interest in responding. In this case, information was collected from websites. Results are shown in tab 1. The phenomenon, in general, seems to be very recent as the one only focuses on CE were founded after 2014, reflecting the EU behaviour. The results prove that all the actors provided many services to support business, although D is considered just by few actors. However, projects (PR), as the literature demonstrates, should be designed from the beginning to meets really the sustainability requirements of the world current environmental situation, before being implemented. If this is not checked or stimulated by implementation actors, the risk is to support businesses which are not providing a good impact at environmental level. Many Ders have received the education for sustainability, as the Lens conference<sup>34</sup> wants to demonstrate, and have the skills both to contribute in eco-D for products both for services and systems. The Ders which are providing services are mainly working in traditional roles as user experience and prototyping, although many answers are missing. Moreover, their presence among the staff is only in 4/10 and between mentors almost. Unfortunately, this answer doesn't say anything about Der role because only 1 actor specify it as required by the question. Moreover, it wasn't find any evidence of Der presence in mentors. Another interesting result is the almost wholly unawareness about the presence of Der in the PR implemented. One reason can be found in the not interest shown by actors to map the skills involved in PR. However, this aspect is very interesting to be analysed in the CE phenomenon as it is a multi-disciplinary concept.

<sup>34</sup>.by the LeNSin, the International Learning Network of networks on Sustainability European project (2015-2019). Lens conference <https://lensconference3.org/index.php#about>

Actor	foundation year	n° PR supported	Is D a service?	Is there any service provided by Der	Is there present in staff?	Is Der present in mentors?	Is Der Present in PR founders?	Is Der present in PR team?	Reference
Ville Durable	2016	>28 startups	No	n.d.	No	n.d.	n.d.	n.d.	website
Zero waste Scotland - business support service (depper focus)	2014	13 cases	Yes, improve current product D processors	n.d.	Yes*	n.d.	n.d.	n.d.	website
Advance London	2018	50 SMEs	No	n.d.	No	n.d.	n.d.	n.d.	website
Copper 8	2013	25 PR	No	No	No	No	No	No	contact*
Metabolic (depper focus)	2012	3 ventures	Yes	Yes*	Yes*	n.d.	n.d.	n.d.	website
Blue city 010	2013	8 stratups	No	n.d.	Yes, from Superuse Studios*	n.d.	n.d.	n.d.	website
Green Garage (depper focus)	2010	> 1500 start-ups	No	No	No	No	No	No	contact*
Clever	2016 (2009 polight)	29° inn. PR	No (Yes from 2009-2015)	Support in new product development *	No	No	Don't know	Don't know	contact*
213t (depper focus)	2007	8 startups/ 82coal startups	Yes	Testing activities, usability. Service and Product implementation on prototyping	Yes, 1 with communication role	PD,C, UX	Don't know	>25 (PD,C, UX)	contact*
Fit 4c.	2014	4 inn. PR ( 1 in 2017, 3 in 2016)	No	n.d.	No	n.d.	n.d.	n.d.	Website and annual report*

[Table 1] results of the investigation part on business implementation actor

\* information deducted

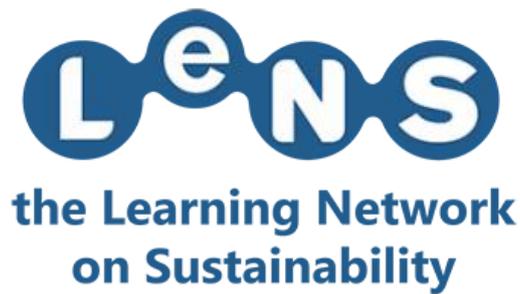
## 5. CONCLUSIONS

The actors identified show a very fragmented framework, both in their goal and in their categories: from governmental agencies and cities board, to innovation clusters and traditional business incubators, to consulting agencies and digital platforms. However, everyone can be defined CE implementors for their goal, although someone concern SMEs and other new companies/start-ups, someone have a broader goal. An exception is presented by the digital platforms which have the goal to increase the visibility and the relationships between the actors and the exterior. Although also their role its very important in increasing awareness on CE concept about citizens, which seems to lack in many cases. Another research by authors is focused on this aspect (Battistoni et al., 2019).

Although many answers from the deeper analysis are missing, the results show a very interesting picture of the D role. Der in the last years were educated for an active role in meeting sustainability requirements. However this aspects seems not clear outside academia, and in the business world they remain known as the one that can only create beauty (both in product than in graphics).

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## **“THE SEVEN TREES SIGNIFICANCE”. THE BENEDICTINE MONKS’ AGROSILVOPASTORAL PRODUCTIVE SYSTEM**

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### **ABSTRACT**

The relationship between the Benedictine monks of the Camaldolese Congregation and the forest around the Italian Hermitage of Camaldoli in Arezzo can be considered as special case of sustainability. The agrosilvopastoral productive system established and managed for over eight centuries by the monks is a tangible example of multifunctional, flexible and sustainable management of environmental resources, and of socio-economic development. However, this relationship suggests an inner development chance for everyone, besides having a spiritual significance for the monks. All the activities performed by the monks had a meaning that transcended the practical dimension.

The paper aims to explain Camaldolese Forest Code, The roots of sustainability, an initially project launched by Collegium Scriptorium Fontis Avellanae in 2003 that has undergone further development. Moreover, it wants to suggest new approaches within the sustainability culture starting with a reinterpretation of the monks’ agrosilvopastoral productive system to save the environment, saving the human.

Key Words: forest management, sustainability, Forest Code, multi-functionality.

## 1. INTRODUCTION

Umberto Galimberti, an Italian philosopher, says: "It does not aim at a purpose, it does not open the scenarios of salvation, it does not reveal the truth: the technique functions. And since its functioning becomes planetary, the [...] concepts of individual, identity, freedom, salvation, truth, meaning, purpose, but also those of nature, ethics, politics, religion, history of the pre-technological age, and that now, in the age of technology, will have been reconsidered, abandoned, or refunded by the roots". (Galimberti, 2007). Sustainability" concept is also a result of the "technique primacy" age. How do we can escape this hegemony? What do values we should pursue to humanize the sustainability?

The relationship that over the centuries has linked man, his productive activities and his socio-economic and cultural development to natural resources (with particular reference to forestry), has encountered in the last two hundred and fifty years the deepest crisis.

In the last decades more and more civil society, and not just the scientific community, has become aware of how the development of human civilizations is today and at these unbearable rhythms. The theoretical principles of "sustainable development" (economic development, social equity and respect for the environment), expressed in the concise definition of the Brundtland Report (Wced, 1987), have therefore taken shape.

These remain however difficult to apply, above all for the too anthropocentric vision, focused on the essential human needs, of the related problems. Since then, however, the term "sustainability is inextricably present not only in European, national and local development policies, but increasingly also accompanies the daily choices of society.

The debate that the definition of sustainable development has opened demonstrates however that the need to maintain economic development compatible with social equity and ecosystems, must necessarily operate in a regime of environmental balance, that is, a balance between man and ecosystem. "Sustainable development" therefore becomes more likely, that "development that offers basic environmental, social and economic services to all the members of a community, without threatening the operability of the natural, urban and social systems on which the supply of such systems depends. services" (ICLEI, 1994). In this sense, the term sustainability is not a novelty in the history of the Italian mountains and in particular for the Apennines.

There is a deep and fascinating relationship between monks and the wonderful forest around the Hermitage of Camaldoli in Arezzo, on the Tuscan hills. This is explained in a book dating from 1080, *Le Regole della Vita Eremitica*, written by Rodolfo IV, prior of Camaldoli. In the chapter titled "The significance of the seven trees" - those listed in the Book of Isaiah in the Old Testament (cedar, acacia, myrtle, olive, fir, elm, box) - Rodolfo tells the monk: "You yourself can become...a cedar of Lebanon, which is a plant of noble fruit, of incorruptible timber, sweet-scented: you can become fertile in good works, eminent in chastity, sweet in name and reputation; ...you can also become an acacia, thorny yet useful; ... solitarily pungent, suited for making hedges, ...not seeking to blunt the sharp points of your novices...but rather correcting them and pricking them on...Moreover you will grow green as the myrtle, which is t of sedative and moderating virtues; so that you will do all things modestly and with discretion...". Seven trees, seven virtues: the singular view of Nature arising from this monk-tree relationship can indicate us a new path, freeing sustainability from the hegemony of Technique. So, you can create the conditions to promote an across-the-board sustainability, inter-subjective, more human, and also more effective than the present one.

## 2. THE PROJECT "CAMALDOLESE FOREST CODE, THE ROOTS OF SUSTAINABILITY"

The agrosilvopastoral productive system established and managed for over eight centuries by the Benedictine monks of the Camaldolese Congregation is a tangible example of multifunctional, flexible and sustainable management of environmental resources, and of socio-economic development for many local communities of the Italian Apennines and beyond.

Here the environment, natural resources and particularly forest resources, have been profoundly transformed by the prolonged action of man, becoming the product of a historical and cultural process, of interaction between social, economic and natural factors. Understanding the basic principles, analyzing their dynamism and actualizing their meanings are the objectives of the "Camaldolese Forest Code, the roots of sustainability". Today this project and its results are at the attention of UNESCO to attribute universal value to the principles of forest management and the sharing of land management by local communities.

The project idea originated from the Collegium Scriptorium Fontis Avellanae, which in 2008 signed an agreement with the Forest Observatory of the National Institute of Agricultural Economics (INEA). In particular, the project focuses on the Monastery of Camaldoli in Arezzo (Tuscany) and on the Venerable Hermitage of Fonte Avelana located in the Umbria-Marche Apennines, respectively for the management of the Casentino woods the first and for the management of agricultural lands the second.

In the first few months of 2009, the recovery of historical documents concerning the management carried out by the Camaldolese Congregation began, through a meticulous digitization of the documents kept at the Camaldoli library and other books, funds, scattered sheets and letters kept at the the State Archives of Florence.

The recovery of the "Camaldolese Forest Code", consisting of a complex series of rules and provisions, is not only linked to the testimony of deep harmony between spiritual research and the care of the forest with which the monks

have managed and protected their forests for centuries. It is also a matter of researching the traces of the modern concepts of "developmental sustainability" and in particular of "sustainable exploitation of natural resources".

### 3. FOREST MANAGEMENT OF THE CAMALDOLESE MONKS

Monasticism was decisive in the development of western rural civilization of the first centuries of the second millennium and in the definition of the landscape that we know and protect today. Since its birth, the Benedictine Order, with its monasteries, led to a radical transformation of the economy and the rural landscape, not only for deforestation, tilling and numerous reclamation for agricultural purposes, but also for innovative techniques management and forest utilization undertaken. The balance in the management of resources, by the Benedictines in the Apennine-Tuscan-Umbrian-Marche arc since the eleventh century represented a constant in the way of using nature, generating self-sufficient local models and economies, which is still perceivable today. presence in the landscape, in toponyms, in the local culture.

The different religious families (Camaldolese, Vallombrosian, Franciscan), settled around the year 1000 in the central Italian Apennines, have over time and with different methods used the forest with a far-sighted approach that went well beyond the strictly economic needs of the moment. In particular, for the Community of Camaldoli, if initially the approach to the management of forest resources was only dictated by spiritual needs, over time it has been enriched and adapted to the needs of the local populations and the economic needs that the historical period required.

With a meticulous activity of replacing the beech with new plants of silver fir, already present in a relict form, the monks have combined the ascetic spiritual symbology to an essence particularly appreciated on the market, defining a new stable ecological balance. The progressive diffusion of the fir tree, born therefore from an "environmental violence", is pursued over the centuries with cultural interventions, cuts, sowing and plantations up to delineate the landscape that everyone now recognizes as a unique environmental heritage.

The management of the woods, originally transmitted orally, officially falls within the rules of the daily life of the monks with the first written rules to protect the integrity of the forest as early as the thirteenth century, until it is incorporated into "The rule of life eremitica" of Paul Giustiniani in 1520, commonly and erroneously known as "Il Codice Forestale". The first publication of the project took place during the analysis of this volume, in the Tuscan translation of 1575 by the monk Silvano Razzi.

It is important to underline that in this Rule, as in others that preceded and followed it, the words "to guard" and "to cultivate" come back with insistence, having a double meaning closely related and of interest in the current world. From the religious point of view, with these words the Creator entrusts mankind to the earth (Genesis, chapter 2:15), re-emerging the biblical dimension of the divine plan to be realized in harmony with the whole Creation. But these two terms are also an integral part of the silvicultural language and in particular of the most modern principles of sustainable forest management, today so much desired and a fundamental basis for the socio-economic development of mountain areas.

From the studies carried out on the scattered sheets, the books, the deeds, the permits, the concessions and the "invoices" of timber sales (about 40 thousand pages), a responsible and attentive administration of the territory emerges and an extraordinary technical capacity. The analysis of historical material made it possible to discover the real "Forest Code" and to make a first reconstruction of the complex and efficient Camaldolese forest management system that lasted for almost nine centuries.

A rare example of balanced forest management. The studies, collected in three publications, have highlighted, on the one hand, the evolution of the communities that have inhabited, and that inhabit these places and that still today proudly claim their past. On the other hand they have highlighted how the presence of an environmental and landscape heritage of inestimable value is the result of a centuries-old and daily relationship between man and nature. Thus demonstrating how productivity and environmental protection can coexist in a "sustainable balance".

The research work also focused on the Venerable Hermitage of Fonte Avellana, located on the slopes of Mount Catria in the Italian region of Marche. Here the Camaldolese monks have built an agropastoral system of revolutionary impact in the social relations of the high and low Middle Ages. The project analyzed the transcripts of deeds, trades and contracts between nobles, monks and people, where the originality of the agricultural management practiced by the monks emerges.

Here, in fact, a cultural and economic growth of the local populations, of those peasants considered for the first time "men" and not "servants" as was customary in the Middle Ages.

This project, in addition to collecting and making historical sources available, has also highlighted how the respectful and mutual relationship between man and nature that has developed over the centuries can still be a valid basis for an economic model, that sustainable model that is invoked as much as it is eluded. if it is a matter of passing from words to deeds. From the studies carried out emerges a surprising reciprocity: the monks guarded a forest that guarded them. Generation after generation, they guaranteed the life of the forest by ensuring the resources necessary for the development of a local economy, and at the same time the forest guaranteed them the silence they needed to listen to the voice of God and of men.

Today there is a need to rediscover and put into practice the right balance between economic development and

environmental protection. This balance is based on a respectful and reciprocal relationship between man and the environment, through which, with man and through man, the precarious balance between environmental, productive and social aspects takes shape. This historical research shows how it is possible.

The affirmation of Nelson Henderson is extremely topical, according to which: "the true meaning of life is to the plant, under the shade you do not expect to sit".

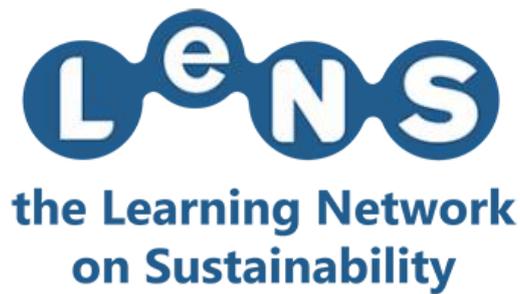
#### 4. CONCLUSION

The project wanted to "enhance the historical and cultural heritage of the Camaldolese monks". The project has dealt with a series of activities of research, collection and recovery of archival material of interest both forestry and agriculture, promoting dissemination actions and dissemination of knowledge to young people (through educational activities in schools), forest operators and institutions, so that the heritage of acquired historical knowledge can become a starting point and direction for the new generations and for the planning and management of the territory.

The knowledge of our history can help us find the right way to achieve a sustainable future for the forests and communities not only in the Apennines. We hope that it can be a stimulus and an extra foundation for those who study, work, attend, discover and live the forests, thus contributing to enrich the wealth of knowledge and the wealth of useful experiences for the present of future generation".

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## **ECOLOGICAL DESIGN THINKING FOR THE 21<sup>ST</sup> CENTURY**

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### **ABSTRACT**

Over this century we continue to look for the ideal conditions to generate sustainable ways of education. Many of the significant actions lie the ways in how education relates to design and ecology. The new way of ecological design thinking here proposed constitutes three fundamental aspects: reconnecting with nature, rediscovering nature and reflecting on the ways in which we forecast our designs. The Symbiotic Design Practice provides a flexible integral methodological framework for configuring teaching-learning elements that approach the new ecological profile that the designer should have.

Keywords: Ecological design, Symbiosis, Design Thinking, Nature Centered Design

## 1. INTRODUCTION

In the beginning of the 21st century we continue to look for the ideal conditions to generate a sustainable balance. Thanks to the ecological thinking inherited during the second half the 20th century, new movements are beginning to take shape. To name a few 'degrowth' (Weiss & Cattaneo, 2017), the 'circular economy' (Webster, 2015), 'eco-linguistics' (Stibbe, 2015) and 'learning from nature' (Sagarin, 2012) are vivid examples of a collective effort to project a virtuous behavior that reconnects human beings with their original creativity towards a 'symbiotic consciousness' (Kelly, 2014) with the rest of the web of life. These ecological manifestations require the establishment of educational methodologies that integrate strong ecological principles in order to project an organizational, experiential and behavioral action.

According to researchers of the Schumacher College in England the thought of ecological design or Ecological Design Thinking is a creative process that integrates environmental, economic and social aspects (Schumacher College, 2018). Teachers of this leading school emphasize that most schools or design courses follow a traditional form of design focused on the human as a user, guided by technological trends or following industrial processes which replicate the same problems we are trying to solve. This and many other design-environment centered schools, stress that today it is required to transmit to students and practitioners of design not only the design process, but a systemic thought in which tangible and intangible aspects centered on the ecosystem dynamics of our planet can be solved integrally.

We are still looking for an amalgamation in the ecological design philosophy but also looking for a consolidation in the ecological pedagogy or ecopedagogy (Kahn, 2010). Several eco-philosophical and eco-pedagogical precepts have been emerged in the last three decades. For example, the idea of deep ecology (Naess, 2010), the integral theory (Wilber, 2008) and the biophilia hypothesis (Kellert, 2012). These have set the basis of action for the academy with a strong eco-philosophy. The implementation of an eco-pedagogy combined with the design process such as the 'Symbiotic Design Process' (Sánchez Ruano, 2016) allow the action of teaching-learning for the development of an effective sustainable, biomimetic, regenerative or symbiotic projects. This example of eco-pedagogy implemented in design allows for the generation of a new profile for the 21st century designer.

## 2. DESIGN EDUCATION AND THE RADICAL ECOLOGIES: AN AGE OF ENLIVENMENT

Recognizing the need of designing hand by hand with nature interrelates the action of deep ecology which emphasizes "the intrinsic value of all beings and appreciates all cultural and biological diversity (Naess, 2010). The way in which our creative being shows love for creating conditions that generate more life lies in a genuine identity that the designer seeks to acquire. This self-interest in learning to be part of nature through what is designed is a virtue that each design academy must pursue in its curricula. This ecopedagogy involves questioning each purpose as planetary beings.

We have transcended the Age of Enlightenment, where science provoked a rational ordering of human affairs, to a liberated Age of 'Enlivenment' (Weber, 2013) where the sciences and the arts interrelate to give better answers about human intentions. This change of era is not only prompting new moral behaviors, but also collective planetary ethics. We look to nature for answers, but also for help to structure our questions about such an ethic (Riechmann, 2006).

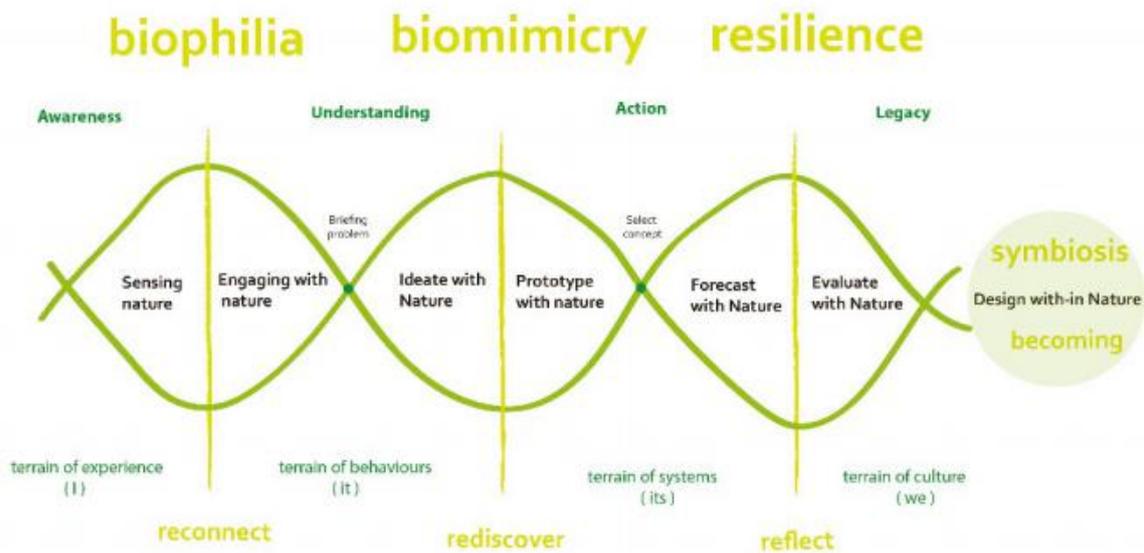
In the Age of Enlightenment, the power to manipulate the natural world and to separate mind and body brought technological intentions, many of which damaged the natural world. As we transcend the Age of post-Enlightenment through ecological design, it appears that our arrogance is decreasing. A mutual emancipation is happening, through the Age of Enlivenment. It is moving from the shallow ecology of the Enlightenment to the deep ecology of the Enlivenment. Here, anthropocentrism dissolves or is acknowledged at a different level. We see our design powers as gifts that need to be deeply rooted in empathy, kindness, humbleness and a modesty that life itself inspires. Moreover, we seek to take into account the intrinsic symbiotic relationship between humans and nature.

We need to consider how nature is constantly informing us how to design. To do so, we need to stimulate a sense of learning from all living things. This kind of vocation exists in all of us. If we are to move to a truly sustainable future, then all designers will need to be familiar, not only with designing with nature (McHarg, 1996), but 'with-in' Nature. As we open up to learning from nature and design with nature, with such a realization, we can begin to acquire new knowledge. As Ivan Illich (in Goldsmith, 1996, p. 336) points out, 'most learning is not the result of instruction but rather the result of unhampered participation in a meaningful setting'. This "meaningful setting" is our living Earth, and ultimately it is what inspires us to design.

## 3. RECONNECT, REDISCOVER AND REFLECT WITH NATURE THROUGH THE DESIGN THINKING PROCESS

There are principles, metrics and tools that make up the new eco-pedagogies required for this century. The Symbiotic Design Process (SDP) can be considered as an effective tool in the teaching-learning of design disciplines. The SDP process explicitly integrates the Design Thinking process (Plattner, Meinel, & Leifer, 2013) and the quadrants

of Integral Theory (Wilber, 2008) which are reinterpreted through three steps: reconnect, rediscover and reflect which reaffirm three concepts that ecodesign has been acquiring and conforming through the last decade: biophilia, biomimicry and resilience. In this way, this ecopedagogic proposal can then be reinterpreted as a process of Ecological Design Thinking (Figure 1) which is explained below.



[Figure 1]. Simbiotic Design Process. Sanchez Ruano (2016)

The reconnect with nature phase, includes studying the origin of biophilia as an initial or preparatory strategy. Within this phase, awareness exercises such as Goethean observation (Irwin, 2004), ecosomatics (Enghauser, 2007), meditations and visits to spaces where nature can be explored can be implemented. Within this phase curiosity and a naturalistic lens is activated allowing us to get involved in the meaning of being nature, we are aware of it and we understand it.

The rediscovery of nature phase is when the details begin to emerge through the study of patterns, rhythms, forms, ecosystem actions dictate a true language. Here the use of biomimicry as methodology which allows us to go beyond the study of mere aesthetic, but a functionality and efficiency of other organisms in solving human problems and seek creativity to create conditions conducive to life. This conscious imitation of the geniuses of nature, is a way to consult them and thus implement their intelligence in design concepts. This imitation is given through various tools such as biomimicry thinking (Baumeister, 2013), biotriz (Vincent, Bogatyreva, Bogatyrev, Bowyer, & Pahl, 2006), biodesign process (Egido Villarreal & Universidad, 2004), among others.

A third step, allowing reflection on the design process by the hand of nature will be the impact of our creation, a strategy of resilience as practice. Resilience thinking then helps to forecast and evaluate what effect our design proposals will have on the world, acquiring a true ecological ethic to project a significant legacy. In this last phase, prospective tools and reflective evaluations can be implemented to capture a critique of actions that open a gap to a symbiotic consciousness. The whole process concludes in the realization of learning design centered on nature, being part of nature as we design.

This process is consolidated as the tradition of the Design Thinking Process format of the DS School Stanford (Curedale, 2013) and the Double Diamond Process (Design Council, 2015) where ecological design thinking diverges and converges through those techniques and exercises properly tested and analyzed by students and teachers forming a meta-methodology.

#### 4. THE NEW PROFILE OF THE ECOLOGICAL DESIGNER OF THE 21ST CENTURY

As we approach the transformation of the education system through ecological wisdom, what then will be the profile of the designer of the 21st century? Designers can be seen as ‘synthesizers whose craft is to respond to the various design requirements in integrative and holistic ways’ (Vol 1 A-H Encyclopedia of creativity., 2011, p. 525). As ecological design permeates a shift in worldviews. Precisely is how aspirations and intentions confront how we are teaching ‘to be critical about narrow or holistic worldviews’ (Wahl & Baxter, 2008) as a design pedagogy.

There is still the problem of integration of ecological thinking into design education in forming the new profile of the designer. We can identify 4 elements that help to reveal the new profiles:

- 1). Individuals recognizing the self as natural beings
- 2). Individuals and groups willing and open to learn from nature
- 3). Acting in uncertainty and complexity as part of the Earth community
- 4). Becoming one with the world in every creation

As the design academy fosters creatives, it also needs to form wise individuals by developing several new characters. Emergent positions for design in the 21st century were studied by a group of researchers from different universities in the UK (Inns, 2007, pp. 11-26). Through this initiative, four new emergent positions and six emergent roles were postulated for the designer. The new emergent roles for the designer in the 21st century, as suggested by Inns, are described as follows:

- Designer as negotiator of value: Here the designer has an important role to play in negotiating decisions within complex situations.
- Designer as facilitator of thinking: The designer will need to know how to mobilise and energise the thinking of others.
- Designer as visualizer of intangible: Although the contemporary designer already visualizes and synthesizes future possibilities, they still need to make association with the visualization of the abstract and the intangible (systems, experiences, emotions and so on) and to find ways to communicate these intangible concepts with others.
- Designer as navigator of complexity: The designer can help others to understand complexity, but also an appreciation of complexity theory will help designers to understand their own role.
- Designer as mediator of stakeholders: Increasingly the designer is able to become a mediator of solutions for multiple stakeholders who often have different perspectives, needs and expectations.
- Designer as coordinator of exploration: The designer has always played a leading role in planning future outputs, including, for example, concepts, prototypes and plans for future implementation and production. The 21st century designer must be able to coordinate exploration of ideas between the technical, the ecological and the contextual.
- Through analyzing these emergent profiles of the designer of the 21st century and, by correlating them with the ecological techniques presented earlier, we can postulate four other emergent profiles as follows:
- The biophilic being. To engage the individual self with nature, we open our minds and organic bodies to receive the teachings. Becoming an ecological designer implies a preparatory stage that is immersive and experiential, thereby allowing the worldview to change.
- The biomimetic practitioner. As we are more open to learning from nature, we begin to enhance our creativity by developing concepts and solutions inspired by the wisdom and interrelationships with a more-than-human world.
- The resilient thinker. As we face uncertainty, we begin to realise how resilience thinking is fundamental to allow the designer to picture design ethics along with the visions of the future in every design that is created.
- The symbiotic designer. This profile occurs when the designer's ecological integrity is recognized when designing becomes meaningful. The individual self and the collective self become one with the living world and with the universal truth, flourishing along with life.

These four profiles will be considered as the integrated essence of the new profile of the ecological designer. The need now is clear. The design academy needs to make a transition or revitalization of its design pedagogy by bringing new alternative and conventional practices together. The eco-techniques suggested here might be the ones that provide that transition to theory and praxis for ecological design and the acquisition of new profiles.

## 5. CONCLUSION. THE VITALITY OF THE ECOLOGICAL DESIGN AND THE NEW SYMBIOTIC PERSPECTIVE

The Ecological Design Thinking skills are aimed at facilitating an interdisciplinary dialogue, providing a holistic/systemic perspective for questioning human paradigms informed by natural patterns and promoting the pragmatism here in the present with all available resources. As an educator, it seeks ecological wisdom and provides the students with a critical inquiry on intentionality. As a biophilic being, a biomimetic practitioner and a resilient thinker, the designer becomes proficient in creating not only objects, buildings, systems, communications or services but an expanded worldviews and provide a meaningful and hopeful heritage.

What can the design academy (lecturers, researchers) do with this? For a design educator, these strategies may present an appealing image for the design schools of the 21st century, where our recognizable ecopedagogical frameworks promote life itself. Establish programmes, modules and the formation of design communities will help to consciously bring about a fundamental basis for promoting a flowing change within nature and the limits of technology, thereby crafting a meaningful human presence on planet Earth. This should ignite a vital consciousness, encouraging design professionals and academic practitioners to 'design with and within nature'. The more conscious we become of the revelations that biodiversity embeds within our symbiotic consciousness, the healthier our society will be.

By incorporating the SDP, the design academy should be able to build ethical values, strengthen creative practices and provide critical views on decision-making about technology, but most importantly, it will be able to develop an integral worldview by acquiring a symbiotic consciousness.

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## **DESIGN FOR SUSTAINABILITY TRANSITIONS AND SUFFICIENT CONSUMPTION SCENARIOS:A SYSTEMATIC REVIEW**

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### **ABSTRACT**

Considering that sustainability can completely modify the design practice, we raise the questions: how the role of design for sustainability transitions change the current design praxis? What would be the role of design in a sufficient consumption scenario? We so attempt to review academic papers about sufficient consumption and design for sustainability transitions to understand the role of design and identify the praxis emphases and gaps. We searched for international peer-reviewed articles published in the last ten years throughout a systematic review, carried out in the Portal de Periódicos da Capes database using two search strings: “sufficient consumption” AND design; sustainability AND transition\* AND design. We identified 25 articles that show this is an area of research still recent. However, while it’s necessary to develop better the sufficient consumption concept, there already are research projects working empirically in the design for sustainability transitions field.

Key Words: System Design. Sustainability Transitions. Sufficient Consumption.

## 1. INTRODUCTION

Sustainability requires a radical transformation of production and consumption patterns in conjunction with culture and economy. Therefore, some authors (e.g., Vezzoli et al. 2014; Ceschin & Gaziulusoy, 2016; Santos et al., 2016) point out the evolution of design for sustainability since an initial approach, based on the product level, to a more complex one: the socio-technical system level. In this evolutionary path, the designer act as an agent for the transition to sustainability scenarios, changing not only lifestyles towards sustainable ones but also the broader systems. There are already researchers focusing on the new levels of design for sustainability (DfS), addressing issues as product-service system (e.g., Vezzoli et al. 2014), but there seems to be still no clear understanding of what would be the last evolutionary level of DfS. For instance, some authors refer to it as a lifestyle change towards sufficient consumption (Santos et al., 2016), while others emphasize the importance of design for system innovations and transitions (Ceschin & Gaziulusoy, 2016), focusing on technological, social, organizational and institutional changes.

Furthermore, considering that design for sustainability is a different kind of design practice (Ruttonsha, 2017), we can argue that the differences are even more significant when acting in its last levels. So the following questions arise: How the role of design for sustainability transitions change the current design praxis? What would be the role of design in a sufficient consumption scenario? To answer that, we carried out a literature review aiming to understand the role of design and identify the praxis emphases and gaps regarding sufficient consumption and design for sustainability transitions.

## 2. METHOD

To explore the research about sufficient consumption and design for sustainability transitions, we undertook a systematic review of academic literature adopting a mixed approach: quantitative and qualitative. For that, we followed the instructions of Conforto, Amaral, and Silva (2011). To carry out the searches, we chose the CAPES Portal de Periódicos (CAPES Journals), a Brazilian database whose collection gathers more than 15,000 international journals with complete text. First, we tested different search strings and settings, until we set those in Table 1 that also shows other search parameters settings.

[Table 1] Search Parameters Settings

CAPES Portal de Periódicos (CAPES Journals)		Database
any field	“sufficient consumption” AND design	Search strings
on the subject	sustainability AND transition* AND design	
October 30, 2018		Search date
Peer-reviewed article Published in the last 10 years (2008 – 2018) Written in English Qualification criteria		Inclusion criteria
Addressing the issue of sufficient consumption OR relating sustainability transitions to the design field		Qualification criteria
Only mentioning the topics researched (see the qualification criteria) approaching them superficially or without making contributions to these fields (sufficient consumption or sustainability transitions)		Exclusion criteria
Filter 1: analysis of title and publication data Filter 2: abstract reading Filter 3: reading of introduction, method, discussion and conclusion		Filters adopted

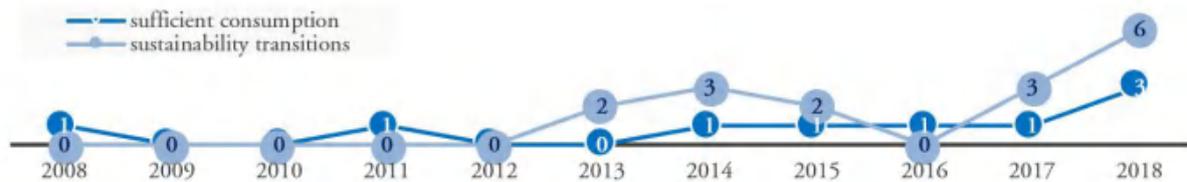
We registered all data resulting from searches in spreadsheets, including the preselected papers’ data like journal and year of publication, authorship and authors’ country. After the Filter 2 application, we saved the selected article files in the reference management software Mendeley. For the papers’ analysis, we created comparative tables where we registered the main information following these codes: aim/proposal, main themes, focus on design (yes or no), method/methodological procedures, results/contributions, (design for) sustainability transitions or sufficient consumption definition, definition of other related concepts, relevant quotes, observations and main references about sufficient consumption or design for sustainability transitions.

## 3. RESULTS AND DISCUSSION

After reading the introduction, method, discussion, and conclusion of the papers preselected on Filter 2, 25 articles form the material for systematic review. There are papers from 13 different journals of which attract attention Journal of Cleaner Production (44%). Regarding the nationality of the authors’ institutional affiliation, we can feature Australia (n=6), United Kingdom (n=5), Netherlands, Finland and Germany (n=4). This last one stands out for papers about sufficient consumption, while the others address sustainability transitions especially. European countries represent 64% of overall articles, while there are only two from emerging countries: Brazil and Indonesia.

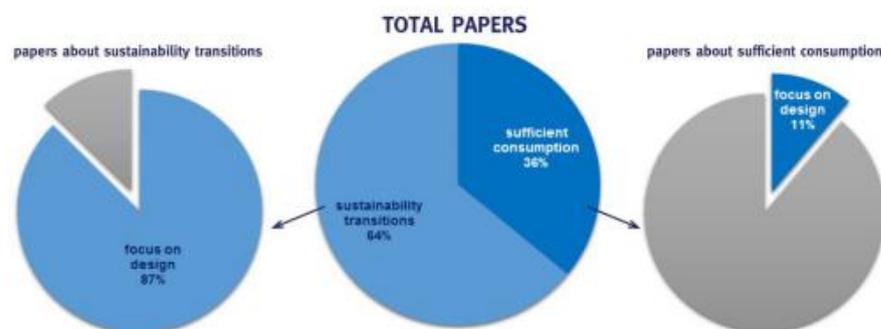
Among the authors, we highlight Alcott (2008, p. 775) as a pioneer with an economy article in which he coined the sufficient rebound concept, defined as follows: “in constituting a drop in demand, it initially lowers prices, and this in turn raises others’ demand, so that in the end some of what was ‘saved’ through non-consumption is consumed after all — merely by others.” Thereby, strategies to achieve sufficient consumption must be systemic, i.e., not focusing only on individual consumption.

However, as Figure 1 shows, the first articles on sustainability transitions arise only five years later. Gaziulusoy et al. (2013) present a new scenario method for generating innovation pathways for product development to respond to systemic changes towards sustainability, while Bos, Brown, and Farrelly (2013) focus on the design and organization of experimentation intended to generate social learning aiming at sustainability transitions. Therefore, the timeline in Figure 1 suggests that researches on sufficient consumption have been conducted for most time than investigations on sustainability transitions. Nevertheless, these last ones have grown at a higher rate since 2013. Both, however, are more representative in 2018. Thus, it is possible to imply that these research fields are still recent and in development: 56% of the papers date from the last two years (since 2016).



[Figure 1] The spread of articles included in the review based on year of publication

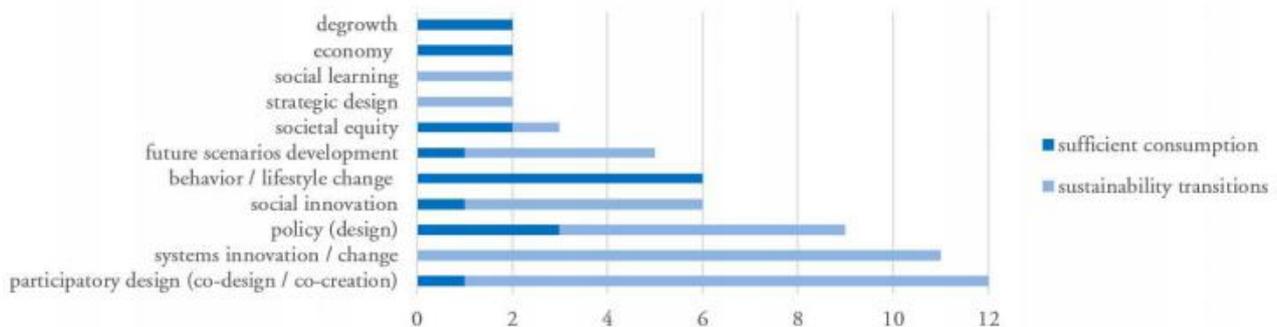
Although both fields are recent, sustainability transitions more than sufficient consumption, there are more articles about the first one (n=16) among the overall selected, as shown in Figure 2. There is furthermore a higher ratio of papers with a focus in design among the ones about sustainability transitions (n=14) than those about sufficient consumption (n=1). Hankammer & Kleer (2018) are the only ones that relate sufficient consumption to the design field. According to them, sufficient consumption is part of the degrowth concept and could be achieved by new enabling technologies (e.g., 3D printing) and participatory approaches such as mass customization, crowdsourcing, modularity, co-design/co-creation, and commons-based peer production. However, the authors evoke Alcott’s (2008) sufficient rebound, by highlighting that these technologies and approaches can actually stimulate consumption if they are not used according to the goals and requirements for degrowth. They are the reduction of overproduction and obsolete production capacity, the increase of the meaningful lifespan of products, potential to promote sufficient consumption, the need for resilient and highly self-sufficient local economies, collective and democratized downscaling. Among the papers about sustainability transitions, Idil Gaziulusoy stands out as (co)author of 44% of them (n=6). Her articles focus on the design field, approaching themes as scenario methods (Gaziulusoy et al., 2013), a research agenda for future research on design for sustainability transitions (Gaziulusoy, 2015), a conceptual framework that integrates design with sustainability science, system innovation and transitions theories (Gaziulusoy & Brezet, 2015), and design visioning/roles/contributions in transition projects (Gaziulusoy & Ryan, 2017a,b; Mok & Gaziulusoy, 2018). Another author to highlight is Ceschin (2014), whose paper about the design approaches and capabilities required to work with sustainability transitions was cited in another article from the review.



[Figure 2] The ratio of articles according to the research field and focus on design

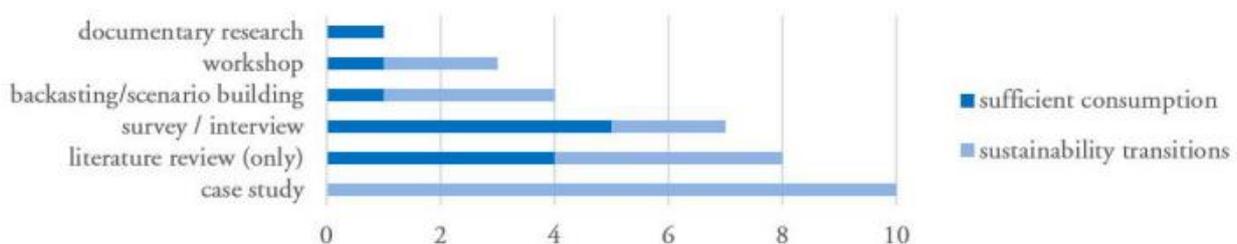
Figure 3 shows the main themes addressed in the articles about sustainability transitions and sufficient consumption. The analysis indicates that both domains deal with participatory design, policy design, social innovation and future scenarios. However, systems innovation/change, strategic design, and social learning are topics that seem to be related notably to sustainability transitions, while behavior/lifestyle change, degrowth, and economy are questions that appeared particular on papers about sufficient consumption. Although papers from both research fields address societal equity, Chapman and Pambudi (2018) stand out for focusing specifically on this issue. They investigated the sustainability and social equity impacts of the ongoing transition toward a low carbon society in Japan

to assess the merits of top-down and bottom-up approaches. As a result of their research, the authors point out that householder participation (throughout liberalization to choice the energy source) is a more important factor within social equity than a policy approach. Other themes that emerged are product development (Gaziulusoy et al., 2013; Gaziulusoy & Brezet, 2015) and product-service systems (Ceschin, 2014). The areas in which the papers focus vary from eating habits (n=1), to the company system (Gaziulusoy et al., 2013; Gaziulusoy & Brezet, 2015), urban systems (n=6), farming/agriculture systems (n=3), and aquaculture systems (Mok & Gaziulusoy, 2018), including also university partnerships (n=1).



[Figure 3] Main themes addressed on the articles

As well as themes, there are other differences between the researches about sufficient consumption and sustainability transitions. Figure 4 reports the methods adopted in both research fields. Although there are some correspondences regarding scenario building, workshops, and surveys, we highlight there is a larger ratio of papers about sufficient consumption that undertakes literature review exclusively as the method: they represent 44% of the articles about this subject, while 25% of papers about sustainability transitions adopt only bibliographic research. Furthermore, case studies appear solely on the articles that address transitions. These findings may indicate that investigations about sufficient consumption concentrate more on theoretical exploration, while (design for) sustainability transitions would be a field more advanced in praxis, balancing theory and practice. That is an interesting observation considering that this research domain seems to be more recent than sufficient consumption, as Figure 1 shows. However, the vital role socio-technical experiments play in sustainability transitions (Ceschin, 2014) may explain the prevalence of case studies in this field.



[Figure 4] Methods adopted to undertake the researches reported on the papers analyzed

Regarding the role of design, Hankammer & Kleer (2018) highlight the importance of participatory design approaches to support the transition to sufficient consumption. We can imply that this position is similar in sustainability transitions since Ceschin (2014) underline that the designer acts as a facilitator, not to mention the roles as a communicator, networker, and negotiator. Nevertheless, the primary purpose of design in this context is “influencing changes at the sociotechnical system level” (Ibidem, p. 16). For that, the designer needs to not only conceive sustainable innovations but also consider “the technical, socio-cultural, institutional and organisational contextual conditions that might favour or hinder the societal embedding process” (Ibidem, p. 15; Gaziulusoy & Ryan, 2017a). Furthermore, “the key design activity in transition projects is process-oriented design rather than output-oriented design” (Gaziulusoy & Ryan, 2017a, p. S1922). All these tasks require new socio-technical system design skills, as stated by Ceschin (2014): a strategic attitude (e.g., Mok & Gaziulusoy, 2018), a co-design approach (e.g. Gaziulusoy & Ryan, 2017a), a dynamic design and management attitude (e.g., Gaziulusoy & Ryan, 2017a; Ruttonsha, 2017).

Likewise, Ruttonsha (2017) reassess the role of design in processes of systems transformation, emphasizing its complexity (e.g., Gaziulusoy & Brezet, 2015; Gaziulusoy & Ryan, 2017b). She describes three design approaches to design-like thought and action: adaptive response (everyday design-like decisions of “nonexperts”), creative agency (outdated conceptions of creative visionaries) and emergent engagement (decentralised and participatory approaches). In this last one, the professional acts as systems designer turning “attention towards influencing contexts just as often as we create forms” (Ibidem, p. 12). Gaziulusoy and Ryan (2017b) similarly highlight that the roles design can play in sustainability transitions vary from tangible/technical (e.g., generating visualizations or outputs) to intangible ones related to inquiry and process (e.g., how problems and potential solutions are framed and how knowledge is acquired and synthesized).

Hence, to work in transitions projects, designers need skills and knowledge that is not part of traditional design

education, the reason why there is a need for new curriculums development in design education institutions, identifying best-practices in terms of learning goals and teaching methods (Ibidem). According to the literature review, the other two requirements for the improvement of design for sustainability transitions field are: 1) “integrating theories of socio-technical and socio-ecological transformations with theories of design and design education in general and design for sustainability in particular” (Gaziulusoy & Ryan, 2017b, p. 1306), as well as system innovation and transition management theories (Gaziulusoy, 2015); 2) “development of frameworks and associated tools and methods for design, innovation and decision making to help design and innovation teams in product, service and strategy development for achieving systemic transformations to sustainability” (Gaziulusoy, 2015, p. 376).

#### 4. CONCLUSIONS

Aiming to understand the role of design in a sufficient consumption scenario and the changes brought by design for sustainability transitions, we analyzed 25 international peer-reviewed papers from the last ten years. The results suggest both research fields (sufficient consumption and design for sustainability transitions) are new and under development. There is, consequently, a lot to explore regarding the role of design in both of them. However, it is already possible to highlight research emphases and gaps. First, there seem to be more advances regarding sustainability transitions than sufficient consumption, considering the number of papers, including those focusing on design, and the methodological procedures adopted. While the research about sufficient consumption has mainly explored the theory, there are already several case studies about sustainability transitions, suggesting that there is already a praxis under construction. Secondly, there are some connections between both fields: they address the participatory approach and future scenarios development, as well as the importance of social innovation and policy design. There are not, however, an integration of sustainability transitions and sufficient consumption, what could be achieved by combining their conceptual framework related to degrowth, behavior change, social learning, systems innovation/transition theories, and strategic design.

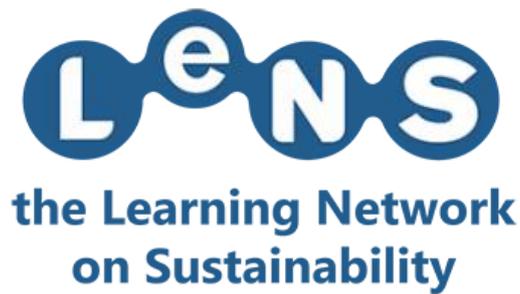
The pieces of work reviewed confirmed that the roles of design in these new scenarios and approaches are quite different from the contemporary. The designer in this level of design for sustainability is no more an object maker, but a facilitator, communicator, networker, and negotiator. The objective of his or her activity is not only the output, and this last one is not limited to physical objects. Instead, the aim of design is to change the sociotechnical system, and doing so the process can be even more important than the output. The design practice thus is more complex and require some skills and knowledge different from the traditional design curriculum. Here we have a gap regarding design education. There are others related to frameworks, methods, and tools, as well as the role of design in a sufficient consumption scenario (this would be the same as in sustainability transitions?) and the differences that these roles and systems change processes can play in developing countries.

The results presented here can have limitations associated with the database chosen to carry out the searches and because the analyses were restricted to the articles of the literature review, not expanding to other sources. Nevertheless, we hope that this systematic review contributes to the establishment of theoretical bases, which can be used as a reference for future research and further reflections about the design practice shift in a scenario of sustainability transitions and sufficient consumption.

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## **SUSTAINABLE DEVELOPMENT: CREATING A VIRTUOUS PRODUCTION- CONSUMPTION CYCLE**

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### **ABSTRACT**

Asian Tiger economies grew on the “consumption = development” paradigm. However this leads to development that is not sustainable environmentally and economically as evidenced by rising environmental degradation and inequality. We need a new paradigm of Conscious consumption that can lead to sustainable development. In the emerging economies of the world, most workers do not earn enough to consume the goods they produce. Can producers making sustainably sound goods, earn enough to be the next wave of consumers who are conscious in their consumption habits and create a virtuous production-consumption cycle that is sustainable by its very nature? There is a case therefore, to build an ecosystem known as the “6C Model” that enables these producers to be consumers next. Mobile technology allows for distributed manufacture and design at a global scale with the so far ignored informal sector being at the forefront of sustainable development.

Key words: Producer-ownership, Distributed design & Manufacturing, Conscious-consumption, Sustainable-development

## INTRODUCTION

A purely consumption = development model as followed by the Asian Tigers, is so high on material, human, and environmental cost that it cannot be the option for burgeoning youth populations of South Asia and Africa. Can a new paradigm of “Sustainable Development through Conscious Consumption”, with a virtuous production-consumption cycle with ecosystem support, replace it? Further with increases in automation, machine learning and artificial intelligence, labor, without creative input could soon be an anachronism.

One way to achieve sustainable livelihoods is a Creative Manufacturing system that leverages cultural creative skills to link previously underserved populations to engage with modern, mainstream markets. A professionally managed ecosystem can support sustainable, distributed, grassroots, producer-owned enterprises.

The food, fashion and lifestyle industries conventionally serve big customers placing big orders on big producers who use efficiencies and economies of scale to deliver at low prices. The digital revolution allows smaller entities order smaller volumes from decentralized units that deliver profitably. These buyers are discerning about quality, customization, ethics, fairness and environmental footprint. Such production enterprises can be majority owned by producers who earn from fair wages, profits of production, market and brand.

Currently, the industry is poised perfectly for this shift as there is a growing trend of conscious consumption, light living, slow food, fashion and up-cycling. Design to meet customer needs and aspirations is key along with training of professionals and leadership.

Tapping into conscious consumerism, using a more inclusive production framework creates an opportunity for producers to move to being conscious consumers themselves, creating a flywheel effect.

The professionally managed ecosystem provides for a supply chain that is digitally connected, transparent and traceable with full visibility across the value chain ensuring and maintaining standards.

A ‘6C ecosystem’ framework has been developed to guide this ecosystem building which consists of building channel (markets), create (design and innovation), access to capital, capacity building (training), construct (aggregation and mobilization) and digital connect.

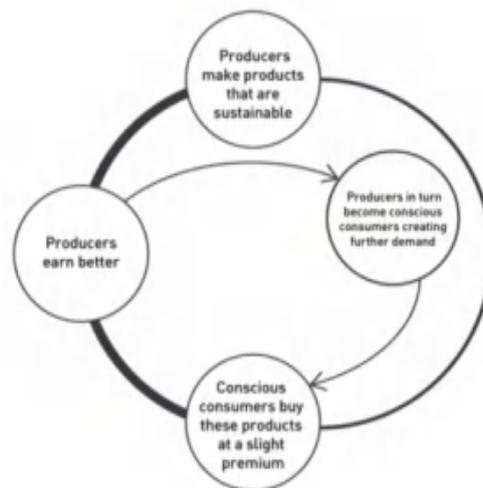


Fig 1 Producers become conscious consumers

Most supply chains lie in the organized sector and are recognized by financial institutions with institutional mechanisms of credit, have codes of conduct and instruments that are recognized, enforceable and protected by law, yet very little enables the informal sector although in emerging markets informal economies constitute a significant part of the economy.

In recent years even the organized sector especially in fast moving fashion is increasingly found to have parts of its supply chain embedded in the informal sector where forced labor and exploitation is rampant. Small wonder then that in several developed market economies there are talks of legislation that will require organized sector players to pay heed to unfair practices deep within their supply chains. UK passed the Modern Day Slavery Act in March 2015. (House of Parliament, UK, 2015)

Another recent debate has been over the payment of “fair living wages” to all the players in a supply chain. Hyper-competition among brands has triggered a race to the bottom as far as wages to producers are concerned. One bright spot however, could be a coalition of fast fashion retailers who are coming together to agree not to compete on fair living wages. (Chua, 2018)

Industree’s 6C model creates an ecosystem in which formerly informal sector producers can earn steady incomes through decent and equitable work, gain access to consistent demand for their products, and thus lift themselves out of poverty and attain social empowerment. The model seeks to address the neglected rights of producers at the sub-contractor level by using a decentralized approach, where each producer, even in the smallest enterprise, is still a willing and documented participant in a compliant value chain.

## THE 6C MODEL

The 6C model seeks to bring the informal sector in conformance with formal sector practices, in order to create supply chains that are traceable, transparent and have complete visibility across the value chain. This is done not through mere regulation and enforcement but through creating an enabling ecosystem. Central to the 6C model is the concept of the producer owned enterprise, where producers earn from their labor, from the profits of production and if there is ownership of a brand then from the profits of the brand.

The 6c model operates in two modes,

- Deep Hand Holding (DHH) where in mobilization of producers, forming an enterprise with professional management support done in a very hands-on way.
- Light Hand Holding (LHH) each of the locations where an enterprise in the DHH mode is created acts as a hub for LHH. In the LHH mode independent entrepreneurs, family groups and master artisan led enterprises can tap into the 6C enabling ecosystem that has been created for the DHH mode.

The mix of DHH to LHH producer owned enterprises will eventually be in an 1:4 ratio. The ability to serve enterprises in the LHH mode will depend on a fairly wide geographical spread of DHH enterprise hubs and the use of mobile-based technology.

This model takes into account the key elements required to establish sustainable supply chains:

### 1. Construct:

Mobilizes producers into groups that bring in economies of scale albeit at a micro enterprise level, it's the aggregation of these micro enterprises that allow the informal sector to interface with the formal sector. The construct element brings together producers who can typically walk up to work or take a small commute to work making migration for work unnecessary. The concept is about taking work to people and not people to work. The challenges that need to be overcome, range from availability of built infrastructure, access to roads and uninterrupted energy. Professional Management Teams handhold the ecosystem with high-level administrative support and mentorship, leveraging digital tools to create a traceable, transparent value chain. The professional management layer operates as the hand holding implementers, ensuring development and production of new designs, competitive costing through productivity improvements and access to well negotiated bulk raw materials, quality and timely supply hence ensuring customer satisfaction and repeat orders, and access to a wide variety of markets and working capital. Formal sector players' difficulty to interact with informal without a network of middlemen and intermediaries who also distance the primary producer from the organized sector user, can be offset by Professional management teams.



Fig2 The 6C model

India's largest dairy co-operative AMUL distributes what is called a patronage bonus to its 3.6 million farmer owners. A professional management cadre who are in effect employed by the coop members runs AMUL. AMUL has an annual revenue of USD 4.5 Billion, and is growing with new product launches. (Amul, 2011)

In this day and age co-ops have become unwieldy and susceptible to political agendas, with lax governance structures are prone to interference from vested political influence and from excessive government control rendering them less than nimble to face the dynamics of a modern market economy. A more promising model is board-run private companies with producers or producer groups as shareholders. In India a new class of companies called producer companies were created for the agriculture sector but are now finding application in non-farm sectors too. They bring together the advantages of producer ownership with the discipline of a private enterprise.

For example GreenKraft a producer company that makes natural fiber products predominantly out of banana bark, (the waste from trees after the bananas are harvested) has largely women producers. Through a professional management layer these rural women are able to supply to global players like IKEA and H&M. (Ikea, 2012)

**2. Create:**

Designing product, system, services that are desired by the market, designers study what customers and end users need and want, not even what they say they want. The 6C ecosystem approach brings together a range of designers who want to work in the sector. Among these are students who are seeking experience and the very real possibility that some of their design work will materialize. The Impact Edge lab in Srishti has engaged more than 120 students from the undergraduate program work with social enterprises in a rather fertile interaction. (Srishti, 2014). The second are young professionals who are looking to build a portfolio of work especially built work. The third are mature professionals who want to give back to society. Connect, where a mobile app codenamed I Got Design is being built, based on other apps in the I Got X (IGX) series developed by Mindtree Consulting.

**3.Capacity:**

Training in skills, improved technology and professional leadership capability. Three levels of training and skilling are carried out, one for the producers or micro entrepreneurs and micro entrepreneur leaders through the Grass Roots Business Academy (GBA). Curriculum has been developed and is being delivered and refined continuously with iterations in both content and delivery method. The GBA curriculum covers

- Life skills called 5Y (You, Your Family, Your Work, Your Community and your Impact, a 5 part modular course that aligns women Micro entrepreneurs towards essential life skills that range from food and nutrition, awareness of rights, gender equality issues, education for their children, financial literacy and leadership.
- Entrepreneurial Skills, PROVEB-T (Productivity, Value Addition, Business Processes and Technology) Productivity is key to be able to compete in modern markets, and the adoption of lean manufacturing adapted from the automobile industry reduces wastage, increases throughput of quality product and helps meet deadlines at predetermined costs.
- Training of paraprofessionals. Emulating Amul, and its founder Verghese Kurien, who set up IRMA (Institute of Rural Management Anand\*) to train the professionals required for the dairy sector and the
- development management sector. Industree Foundation has chosen to partner with Srishti Institute of Art Design and Technology to develop entrepreneurially inclined professionals to serve the Creative Manufacturing Sector in India.
- Cadre of Entrepreneurs: Leadership Training. The Professional Practice in Impact Entrepreneurship, a two year Master of Arts program is currently being piloted in Srishti. Based on the feedback this program will be disseminated across more colleges in India and some of the material will be migrated onto “moocs” courseware as part of the platform initiative.

**4.Channel:**

Connecting enterprises to buyers, creates the market channels and awareness. The model goes through two stages of market development. Initially the focus is on getting up to speed in terms of quality and productivity when the market focus is on business to business (B2B) customers. As expertise is built up business to consumer (B2C) will be taken up. Industree has already been through the B2C cycle, having incubated Mother Earth, a B2C brand but with experience of the really deep pockets and time required to break into the B2C market advocates a ladder approach now.

Channel is considered along 3 markets, the local, national or regional and international. The international market needs the most handholding and professional support to ensure conformance to compliance and standards. The delivery to market will be omni channel and one of the delivery modes is an online market place called Hastti. Hastti will be very useful when it comes to the light hand holding model that will help independent craft enterprises to participate in the market channel.

**5.Capital:**

Access to capital, de-risking products and wealth creation instruments. The 6c model is funded by a blend of grants, debt and equity. Most mainstream businesses are able to access long term seed and working capital at rates of interest between 8% and 14% per annum. Producer owned enterprises however are subject to the usual micro-finance rates of interest which are usually at a low of 18% and going up to 27% rendering it difficult for them to compete with mainstream enterprises often with collateral for loan guarantees. The capital C looks at aggregating loans and providing the necessary guarantees through the form of first loss guarantees to enable these enterprises to borrow money internationally, hedge currency risks and yet deliver capital at acceptable rates of interest which would be the higher end of the spectrum for mainstream enterprises.

**6. Connect:**

Building an information technology backbone that provides transparency and traceability in supply chain, financial and environmental dimensions.

Supply chain transparency is vital to solving issues of substandard working conditions. In order to develop this, leveraging technology is crucial to gain access and visibility into each step of the value chain. This tech intervention is in the form of mobile and web apps to monitor value chains, or at a larger level, a platform that provides a space for the ecosystem players to interact and develop independently. The same technologies that are employed for traceability of payments and supply chain can also be used to provide verifiable data on carbon footprint, water footprint

and even gender footprint along with precise information on how much of the purchase price paid by a customer actually reached the producer. As today’s customers seek more meaning and experience in their shopping this level of transparency can be a powerful tool of competitive advantage.

**PLATFORM BUILDING**

The technology backbone of this model is what ties it all together bringing in ease of interaction, high level of transparency and traceability, efficiency and the ability to scale. To this end, the creation of a digital platform makes the ecosystem accessible to producers and service providers and allows for the scaling up of impact.

A digital platform will enable the producers to run an end-to-end business. The platform enables key functions in the areas of production and supply chain, value addition and market. The technology platform supports the producers in designing portfolios, periodic interventions, risk management, gap assessment, skilling, and micro-entrepreneurship and market linkages. It is a multi-sided, multi-stakeholder approach, which enables multiple stakeholder interactions. Combined with technologies like block chain traceability and transparency up and down a supply chain can be made full proof with distributed ledgers that cannot be altered or tampered with.

**BUILDING NETWORKS**

The success of this system depends highly on the relationships between the various players that form the end-to-end value chains. The identification of the various stakeholders in the value chain can be broken down into the 6Cs identified earlier.

This 6C model takes into account the key components of building a successful enterprise. Each of the components has the input and expertise of different ecosystem players contributing to completing the entire value chain that will enable small, decentralized enterprises to cater to consumer driven market demands efficiently.

The key challenge with multiple players is enabling interaction in a smooth and free manner such that the relationships built will serve the overall goal. Here, building networks between each of the ‘C’s can be enabled through technological interventions by bringing them on to a common platform to interact. For example, designers would need to interact with the market to gauge what trends to focus on, and would also need to interact with trainers to ensure that producers are trained accordingly. The technological platform makes constant and simultaneous interaction a possibility.

**BUILDING EFFECTIVE SYSTEMS**

Lean manufacturing is associated with the automobile sector; in 2015 as an experiment Industree introduced it in GreenKraft Producer Company, in artisanal manufacturing to see if the principles worked in crafts as well as they do in industrial situations.

Overall wastage from over ordering, cutting wastage, rework and rejection dropped from 30% to less than 10% in about 2 months of adopting lean processes in Green Kraft producer company. By month 4 of adopting lean process, wastage was contained within 5% and in some standardised products as low as 0.2%.

**BUILDING SCALE**

The overall goal is to reach more and more producers and provide support to increase incomes and generate livelihoods. This scale can be achieved through connecting with wider networks and enabling the ecosystem for larger numbers with the support of these networks. Technological intervention plays a key role in helping achieve this scale. Digital access can be achieved by equipping producers and stakeholders with the necessary technology tools.

Industree’s Basket Case	Labour cost of one basket	INR 100	
1 Skilled basket weaver	Can make 2 baskets a day	Earns INR 200 a day	1X
Using lean manufacturing methods of matching skill to operation teams were formed in a pilot			
Team of 5	Make 40 baskets a day	Earns INR 4000 a day	8X
Unskilled helper normally earns I 100 a day	Splices banana bark	Earns 400 a day	4X
2 Semi skilled weavers	Do bottom of basket on a jig	Earn 600 each a day	3X
2 skilled basket weavers	Do sides and top tie of basket	Earn 1200 each a day	6X
In actual production in the field the minimum a team of 5 achieved was 25 baskets a day and the maximum was 45, the higher earnings of semiskilled and skilled weavers worked as an incentive for the unskilled weaver to practice and move up the earning ladder.			

Table 1.Production efficiency with lean manufacturing Industree’s basket case

## DESIGN FOR SCALE : CASE STUDIES IN ACTION

Two producer owned companies - Greenkraft and Ektha Apparel Producer Companies were established as pilots of the described ecosystem. Greenkraft supplies natural fibre products globally, with IKEA as a major customer and has a distributed manufacturing base of close to 1,000 grassroots micro entrepreneurs enabled with professional managers. In the current year this number will go up to 2000 to include banana farmers who will earn at least 50% more than what they do currently without having to grow more but just utilizing the waste from their plantations. In addition Design, Research and Development is being carried out to explore how fibre from the banana tree bark can be extracted and woven into fabric creating more employment and at the very least doubling incomes for farmers extracting the fiber. Green Kraft currently has production units in Tamil Nadu, with one outside Madurai, four units in Kalpakkam, Tranquebar, Chinnangudi and Nagapattinam along the East Coast where the bulk of the producers are fisher folk. Mobilizing of producers was done by HOPE a local NGO that enjoys the trust of the local people. In all 13 discrete producer groups have a strength of 1020 producers. The other 5 units are operated by NGOs or farmer producer companies. Industree Foundation has provided the 6C ecosystem support creating a network of enterprises that reaches back into the value chain. Social impact studies have indicated that the majority of the selling price ie from 58% to 68% goes directly to producers, instead of the usual 25-30% of product value that makes up the labor cost. The big shift is that labour is not treated as a commodity but on par with capital.

Ektha supplies garments to national brands in India, and works in an aggregated but decentralised model. The units are currently designed to employ from 25 to 225 people and 3 units with 100 -150 women have been set up in the last 6 months. Another 4,000 members are poised to be added over the next two years in the southern Indian states of Andhra Pradesh and Karnataka.

The proof of concept has now shifted to mission mode where scale up is being piloted to impact 30,000 producers, and will then grow with the help of a digital backbone to movement mode that aims to impact 1,000,000 people and then finally into platform mode where it will impact a potential 100,000,000 people. Producers who move up the sustenance to wealth creation stages are surprisingly generous when it comes to how they can help others who are in the situation that they were in. Consider the Ektha Producer Company in Kyathumgere, a village outside Mandya in Karnataka. Ektha Producer Company has a 25-member garment-making unit. The members of the company over the last year have been through a training and production ramp up stage. Today, they earn from both wages from labour and from division of profits in proportion to the contribution of time and labour. At the end of every month, they set aside the fixed costs and costs of labour and from the gross profits set aside:

- A reserve fund to see them through difficult times or slack periods
- Payback of assets and training costs including paying forward for other people who might want to embark on the same journey as themselves. This fund will be utilized towards training others.
- The balance is distributed as a profit share.

The expansion of the model is currently funded by blended capital, a mix of philanthropic grants, debt and equity. The fact that women producers are also contributing to the expansion funds is a huge moral boost that Industree's investors recognise.

A social Impact study done on two producer companies indicate the following impact.



## THE VIRTUOUS FLYWHEEL

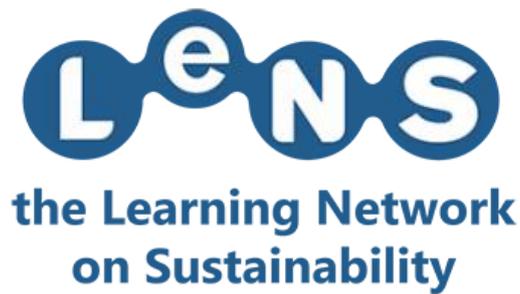
Creative Million Mission will recruit a million women in both DHH and LHH modes into producer owned enterprises. Each of them will directly influence the members of their family in their consumption behaviour and in turn will indirectly influence at least another 5. The training that each of these women receives in sustainable production also covers conscious consumption and the effect that they will have as they enter the consumption economy through increased and sustained earnings will be profound.

For example, a major cause of plastics pollution is the use of small serving sachets that are aimed at low income populations that usually do not have the means for proper disposal, awareness of these consumption practices are part of the training that these producers undergo. The more producers there are and as the model expands the more conscious consumers and their families will be generated creating a positive flywheel of change.

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## **DESIGN FOR A SUSTAINABLE INNOVATION OF THE ITALIAN COMPANIES: THE ECODESIGNLAB EXPERIENCE**

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### **ABSTRACT**

Since its foundation, the “School of Architecture and Design of Unicam” has been characterised by a particular sensitivity towards the environmental character of the project. This allowed the development of specific skills in the field of environmental sustainability, which led, in 2013, to the foundation of the spin-off “EcodesignLab srl”. Its mission is to increase the capacity for innovation, and the competitiveness of companies in the direction of environmental sustainability, through the application of the criteria and methodologies that characterize the design for sustainability. The results of these five years of activity are represented by the development of new eco-innovative product concepts for small and medium-sized companies belonging to different business areas. The paper presents, through the case studies developed by the spin-off, the methodologies, the good practices but also the difficulties of the commercial implementation of design for environmental sustainability within the national industrial network.

Key Words: design for sustainability, eco-innovative products, transferable research results

## 1. INTRODUCTION

The design for environmental sustainability is one of the main areas of research of the School of Architecture and Design of the University of Camerino, which has produced numerous projects and research into products and systems with reduced environmental impact; this has allowed to mature a wide range of specific skills, further strengthened by the creation, in 2007, of the Master in “Eco-design e Eco-innovazione di prodotto”.<sup>1</sup>

The purpose of this specific training path is to generate new professional figures who are able to manage the life cycle of a product, in order to reduce its environmental impact from the early design stages.

First master on eco-design in the Italian university system, foresees a development methodology which is characterized by the use of intensive design workshops as a participatory process between universities, companies and designers. Nowadays, the Master has produced 23 workshops with 13 partner companies, 40 graduate students and around 160 projects of eco-sustainable products, which were developed during the workshops and master’s theses. It is from this cultural background and human resources that in May 2013 the university spin-off “EcodesignLab Srl”<sup>2</sup> was born, which offers integrated eco-design and eco-innovation services for the development of products that are both innovative and environmentally sustainable.

Founded on the technical-scientific skills of researchers of the School of Architecture and Design of Unicam, eco-designers grown within the Master and a network of external expert consultants, EcodesignLab aims to increase the capacity for innovation and competitiveness of Italian companies, especially SMEs, supporting business strategies and good practices in the direction of environmental sustainability, through the application of the criteria and methodologies that are typical of the eco-design. Today, EcodesignLab is a strategic actor in the transfer of research results - developed in the School of Architecture and Design of Unicam - to the business world through specific design services tailored to each individual customer and, at the same time, always aimed at tangible innovation, in the short, medium and long term.

## 2. ECO-DESIGN IN ITALIAN COMPANIES: VERY APPRECIATED BUT LITTLE REQUESTED

That design can represent an instrument for the improvement and qualification of the industrial product, - not exclusively in terms of aesthetics - has now become a more or less consolidated acquisition in the Italian entrepreneurial culture and the designer is commonly called to make his own contribution to improve products already on the market, under the influence of economic and cultural factors, and to make their production more profitable.

Among these, it happens rarely (unless it is imposed by national or international regulations) that it is the theme of environmental sustainability that motivates an entrepreneur to improve his product. The phenomenon is determined by an incorrect perception of eco-design, considered a specialized, expensive tool, which can only be used in niche marketing and commercial contexts or suitable only for large companies. In reality this is not true and the need to innovate products in a sustainable key, although not clearly expressed, is often easily deduced from the demands of a company, but still commonly latent nowadays, in the awareness of the national entrepreneurial average.

The “Green2Desk”<sup>3</sup> line of office accessories, with reduced environmental impact, is an effective example of this statement. The line consists of five products, each of which is developed according to the criteria of eco-design: desk drawer, letter tray, magazine rack, pen holder and waste basket. Starting from the company needs to drastically reduce the amount of material used to contain the costs of production and management of each individual product, to maintain production in Italy and to create a recognizable and identifiable family line, the project has come to the ideation development of five accessories that innovate - for functionality and aesthetics - the type of reference product, achieving, at the same time, a significant improvement from an environmental point of view of the entire line compared to the previous collection (considerable reduction in the amount of material used for each type of product). All the strategies of Life Cycle Design and reduction of the environmental impact implemented in the design of the “Green2Desk” line, have substantially contributed to a general containment of production costs and product management.

Starting from the finding of the raw material in production, to packaging and distribution, the environmental benefits have generated parallel economic benefits, as required and clarified by the client, allowing to keep the Made in Italy brand production and to safeguard the jobs. At the same time they have produced tangible and quantifiable results, with regard to the environmental profile of new products, which have allowed the company to focus its communication and marketing strategy on the need strongly felt by the market (provided the economic convenience of the product) of new and performing green products, which, moreover, fully respond to the Green Public Procurement policies by type and characteristics.

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<sup>1</sup> The Master is now in its fifth edition, more information is available on the website [www.masterecodesign.com](http://www.masterecodesign.com).

<sup>2</sup> EcodesignLab Srl is a spin-off of the University of Camerino established in Ascoli Piceno, Marche Region (Italy). More information on the company’s activities is available on the website [www.ecodesignlab.it](http://www.ecodesignlab.it).

<sup>3</sup> Green2Desk office accessories, developed by EcodesignLab Srl, is produced and marketed in the national and international market by the Fellowes Leonardi SpA company in Camerano (AN), Italy. For further information, visit the websites [www.fellowes.com](http://www.fellowes.com) or [www.ecodesignlab.it](http://www.ecodesignlab.it)



[Figure 1] The Green2Desk accessories collection designed by EcodesignLab and manufactured by the Fellowes Leonardi SpA Company. Above you can see specific data about the reduction in consumption of materials and transport volumes and storage thanks to the design strategies adopted for the letter tray.

Through design strategies, aimed at optimizing the use of materials, the reduction of transport and storage volumes and the correct disposal of individual products at the end of their life, it was also possible to obtain reductions in CO<sub>2</sub> emissions equivalent to values between 9% and 62%, in addition to a total recyclability of the materials used. Finally, the line of black products was entirely made of 100% recycled polypropylene and polystyrene.

To ensure that the environmental communication of the new products could not be subject to interpretation or distortion, the Green2Desk line was subsequently validated by an LCA analysis according to the UNI EN ISO14040 standard, considering the system boundaries, starting from the production of the raw material up to the distribution of the finished product, with the aim of certifying the results achieved through an Environmental Product Declaration (EPD).

Currently, these mass market products, made exclusively in Italy and marketed in Europe, allow an excellent profit margin and a clear commercial recognition to the client company, which is now also characterized by the sustainable nature of this green product line.

### 3. A STRATEGIC INNOVATION LEVER STILL TO DISCOVER

The world of clothing is a universe of constantly changing artifacts, subject to rapid and programmed obsolescence. To this dictat still escapes the merchandise sector of professional clothing, whose products must meet specific technical and functional needs and must represent, often more than for other items of clothing, the image of a brand or simply of a trade.

Starting from these assumptions and identifying in the theme of environmental sustainability a strategic lever of innovation and marketing for the reference market, the “Apron Design”<sup>4</sup> project had the objective of devising and developing new professional aprons with reduced environmental impact, for a catering context evolved and qualitative, which did not express the concept of green through the simplistic - and often overestimated in environmental terms - use of organic cotton.

4. The project was conducted in collaboration with the professional clothing company Toma Srl in Appignano (MC), Italy - [www.tomayouniform.it](http://www.tomayouniform.it)



[Figure 2] One of the concepts developed in the Apron Design project context and designed in collaboration with the company Toma Srl, characterized by the use of cork, hemp and linen fabrics.

Instead, the project began with a thorough analysis of the performance requirements, the use contexts, the formal constraints and the environmental profile of the product, and then finally defined the design development parameters. Based on the research conducted, two scenarios of project development were constructed, polarized between the dichotomous approaches of a long-lasting product and a short-term product, defined for different types of clientele, from the professional to the amateur, and for different use contexts (hall, kitchen, cooking show, etc.), but all characterized by the driver of environmental sustainability innovation.

For each scenario, we have identified and grouped - using consistency and respect towards established criteria - sets of materials that are suitable for use and which allow a correct management especially of the end of life of the product. Of the more than fifty materials identified, the main national suppliers were identified and the samples required for the subsequent analysis phases, for the tests and for a further selection made by the company were requested. Through the strategies of modular composition, substitutability of parts and / or components and the total monomateriality of the product, 11 concepts have been developed of new aprons with reduced environmental impact, which consciously use materials, both natural and artificial, to respond to the better to the technical, aesthetic and expressive needs of this product in relation to the different defined user and use targets.

The use of this approach in this specific project context, not yet sensitized on the issue of environmental sustainability, is still today a unicum from which the company can gain a real competitive advantage, compared to its direct competitors, demonstrating once again how the eco-design can play a fundamental role in the process of developing new products, real innovation and differentiation on the business market, even and above all where this has never been taken into consideration.

#### 4. A STRATEGIC INNOVATION LEVER STILL TO DISCOVER

Roland is a Japanese company whose division DG is specialized in the production of peripherals for visual communication such as plotters for cutting and printing of large format, engravers, modeling cutters and three-dimensional scanners, mainly addressed to the world of digitalized craftsmanship and of design.

The project “Refreshing Design Workshop”<sup>5</sup> developed for this company by EcodesignLab was aimed at stimulating and encouraging the birth of new creative enterprises through the design and implementation of an innovation platform characterized by a multi-stakeholder approach that allowed a process of cross fertilization between design, craftsmanship and Roland DG technologies. With an intensive two-week design workshop carried out in a two thousand square meters industrial context and with all the machines produced by the company available, 32 designers, 6 makers, 11 technological craftsmen and 4 traditional artisans were called upon to devise and develop new

5. The term Refreshing Design indicates a design activity that refreshes, reinterprets, reactivates and regenerates a manual craftsmanship that is innovated with the use of low cost digital technologies and with the facilitated sharing of intellectual resources and innovative contents through the web 2.0.

products and services able to renew the concept of “craftsmanship” through the use of Roland DG technologies and waste materials and products to be regenerated.



[Figure 3] Some images of the Refreshing Design Workshop held on 27 October to 7 November 2014 at the Roland DG Mid Europe in Acquaviva Picena (AP), Italy.

During the workshop, the working groups have given life to 13 product and service ideas, resulting from the merger of the various sectors of expertise, the manual skills of craftsmen and the use of low-cost production technologies available for the transformation and reuse of waste materials and components. In order for the process to produce results in such a short time, the cultural alignment of all the participants regarding the themes of the reuse project but also the desktop personalization and modification technologies present in the workspaces was fundamental. The coordination group made up of the EcodesignLab team, then developed a full-bodied and detailed dossier, distributed one month before the start of the work, to all the participants, in which the fundamental themes of self-production, reuse techniques and services offered from the individual machines they were made explicit.

The result of the intense planning activity has seen the selection by the company of the three ideas considered to be the best and able to move on to the subsequent phases of business incubation and support to the commercial launch as a start-up. At the base of the methodological and scientific success of the project, as strongly believed by the company, there is certainly a critical reading of the process that uses the theme of environmental sustainability as a strategic lever for the birth of new entrepreneurial reality, further amplified to the use of by now pervasive rapid production technologies, that allow the further approach of the design theme to the one of handicraft production and small series in general.

## 5. CONCLUSIONS

The phenomenon of “greenwashing” and the advertising campaigns of companies that have declared “green” their products without having the objective and verified characteristics, have proved to be heavy boomerangs, because the theme of environmental sustainability does not admit the character of subjectivity, but makes use of specific and transparent tools and methodologies. Every action that is carried out and every design choice has a precise consequence, quantifiable numerically and verifiable by anyone.

This has been a deterrent for many companies to take actions aimed at the sustainable development of their products, citing the motivation of not being able to afford the investments necessary to change their production activity in the direction of environmental sustainability. The innovative approach that EcodesignLab proposes is to adapt to the potentials, expectations and real capabilities of the companies that address them, strategies and design actions for environmental sustainability, developed and tailored ad hoc for each specific business reality and for every design challenge.

This means not proposing a standardized methodological design process, through the offer of service packages or the use of predefined tools, but rather: dynamically analyzing company needs and the real motivations behind a new green product or service and developing innovative solutions that combine the highest environmental performance with the best opportunities for economic and social growth.

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## **DESIGN AND TRANSITION MANAGEMENT: VALUE OF SYNERGY FOR SUSTAINABILITY**

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### **ABSTRACT**

This paper aims to understand the value of synergy between the field of design and that of transition management for sustainability. Six potential values of synergy are identified: (1) enriched methods of retrieving knowledge of current objects and current systems; (2) providing boundary objects in transition arenas beyond language games; (3) actively envisioning the effect of design things during and beyond their lifetime; (4) intensified reflexivity in design practices and projects; (5) more prototyping activities to leave traces of transition activities in everyday life; (6) greater focus on building interactions through a broader range of co-creation activities. The paper also identifies four possible pitfalls of synergy between the two practices. The paper is grounded in literature but is meant to be a stepping stone towards experimentation in practice; where knowledge, approaches, methods and experience of both fields are combined to intensify the impact on sustainability.

**KEYWORDS:** Sustainability, Transition management, Design methods, Co-creation

## 1. INTRODUCTION

We are at a moment in time that design for sustainability and transition management, coming from different academic and practice backgrounds, have gone through similar stages of development and arrived at the mutual interest of sustainability and transitioning towards that goal. Design for sustainability and transition management both deal with complexity and sustainability in research and practice, they are concerned with changes in society and the factors that shape our future. The challenge of systemic change is recognized and tackled in both fields. However, the practices and approaches of the two fields differ due to their specific roots and historical backgrounds. Transition management is a governance approach developed in the field of transition studies. Recently, institutional structures are being developed for transition studies and this institutionalization of the field signals a new phase for the transition community (Markard, Raven & Truffer, 2012). This is believed to create opportunities for more intense collaboration and contributing to the legitimization of the field. This paper gives an idea of how to extend the invitation for collaboration to the field of design. Within the field of design, different movements are emerging and maturing that place sustainability central to their processes, often gathered under the general term design for sustainability. For a comprehensive overview of the evolution of the different approaches of design for sustainability see Ceschin and Gaziulusoy (2016). The field of design for sustainability is rooted in both design engineering and the applied arts while transition management has its origin in complex systems theory and evolutionary theory (Sengers, Wieczorek & Raven, 2016). In these roots one can already identify a fundamental difference. Where design is often cornered as well as praised for being solution oriented, transition management is understood as using goals while not aiming to control the future (Kemp, Loorbach & Rotmans, 2007, p.87).

The goal of this paper is to recognise the overlap and differences between the two fields and identify possible values of synergy in practice. Hereby adding to the young and emerging field of transition design (Irwin, Kossoff, Tonkwise & Scupelli, 2015) that also recognises the potential combined value of both fields. In this field the ideas of transitions (not transition management specifically) and design (not only design for sustainability) are coming together but are not necessarily combined in their practices. Some efforts have been made to identify roles of designers in sustainability transitions (Gaziulusoy & Ryan, 2017). But, it is found that the in literature envisioned coordinating and strategic role of designers is not always realised in practice (Sumter, Bakker and Balkenende, 2017). Therefore, this paper aims to understand how to combine both practices to maximise the combined value towards sustainability, rather than re-inventing a new practice all together. The aim is to enrich both fields with the presented insights, to ultimately inspire and support all of those working on sustainability transitions. The paper is based on literature but is meant to be a stepping stone towards experimentation in practice where knowledge, methods and experience of both fields are combined.

Up next, a short overview of both fields, their main challenges and their practices. The discussion section of this paper then presents six potential values and four pitfalls of potential synergy. Last, in the conclusions, some initial recommendations are given of how to establish this synergy in practice. The paper is by far from complete in its understanding of the differences and overlap nor does it try to be. It is set up to provide enough background to understand the possible value of synergy.

## 2. DESIGN FOR SUSTAINABILITY

In the works of frontrunners in the field of design today, ideas of both design for sustainability and design thinking are coming together. With these future forward thinkers, it is hard to distinguish between design and design for sustainability because they are implicitly or explicitly assumed inseparable. These include the emerging fields of transition design and systemic design (Ryan, 2014; Jones & Kijima, 2018) as well as the frontrunners in the field of participatory design (Bjögvinsson, Hillgren & Ehn, 2012) or DesignX (Norman & Stappers, 2015). In all these, complexity is embraced instead of dealt with, the focus is on societal challenges and the aim is to create societal impact through systemic change (Mulder & Loorbach, 2018). Designers are then the ones who shape systems or infrastructures for others to design their own (sustainable) futures, referred to as design after design (Redstrom, 2008), framing (Dorst, 2011), emerging design (Manzini, 2016), infrastructuring or staging (Bjogvinsson et al., 2012). This means that design faces the challenge of being continuous while anticipating or envisioning potential design that takes place during use. This means indeterminacy and incompleteness have to be deliberately designed into the infrastructure, leaving space free for unanticipated events yet to be (Bjogvinsson et al., 2012). Next to that, human needs and desires are no longer the central focus point of design but systems are, also referred to as socio-material assemblies. Systemic design is a developing field that addresses both challenges of infrastructuring and designing for systems. Still, a large part of the design community has not yet moved from designing objects to designing socio-material assemblies and regards the design process as closed-ended with a fixed solution at the end. This top-down perspective “hinders adaptation to changing conditions, the hierarchical structure adverts “legitimate” participation, and the specifications become inflexible” (Bjögvinsson et al., 2012, p.104).

Today, designers work in very diverse fields, they apply their methods and ways of thinking to a wider variety of subjects and blend and complement their knowledge with that from other fields. Design methods are catered to collaborative and multidisciplinary ways of working because the process includes various people at different

moments in time, in participation and co-creation. This makes the design practice rather diverse. Still, it is mostly diffused through design education, by experiencing the process and acting out the role of designer in small projects (Cross, 1982, p.222). The design process consists of different diverging and converging steps, that traditionally have names like “analysis,” “design,” “construction” and “implementation” (Bjögvinsson et al., 20012). The latter making it an interventionist and transformative discipline (Dalsgaard, 2014). During these steps, different possible frames or solutions are modelled, constructed and experimented with, often from human-centred perspective. The process is often steered by problem-solving, while dealing with ambiguity and uncertainty (Shah & Millsap, 2012; Lewis & Bonollo, 2002). It is a co-evolution or a gradual process of the ill-structured problem and design solution, regarded as pattern synthesis, rather than pattern recognition (Dorst & Cross, 2001). The solution is not simply lying there among the data; it has to be actively constructed by the designer’s own efforts (Cross, 1982, p.224). This makes that a design process is also characterised by the designer and its attitude or mindset, next to the more traditional design skills, such as visualizing, sketching and reading and writing in ‘object languages’ (Cross, 1982).

### 3. TRANSITION MANAGEMENT

Transition management (introduced by Rotmans, Kemp and Van Asselt (2001) and further developed by Loorbach (2007)) is a governance approach to sustainable development and recognized as one of the key frameworks in the field of transition studies. It is based on notions of complex systems theory, such as variation and selection, emergence, coevolution, and self-organization (Rotmans & Loorbach, 2009). It deals with persistent problems, the superlative form of what Rittel and Webber (1973, p.160) refer to as “wicked problems”. Persistent problems are related to system failures in our societal systems and that, contrary to market failures, cannot be corrected by the market or current policies (Rotmans & Loorbach, 2009). The aim of transition management is to create space for short-term innovation and develop long-term sustainability visions linked to desired societal transitions (Loorbach, 2010). In the context of complexity theory, this means influencing the process of change of a complex, adaptive system from one state to another. In the process new products, services, business models, and organizations emerge, partly complementing and partly substituting existing ones (Markard et al., 2012, p.956). Managing such a transition process means using disequilibria rather than equilibria (Rotmans & Loorbach, 2009, p188). It is understood as guided by a paradox derived from complexity theory: radical change in incremental steps. The idea is that structural change is needed to obliterate the existing deep structure of a system (in the field referred to as the incumbent regime) and ultimately break it down. Not disrupting the system, to avoid a backlash because of its resilience, but allowing the system to adjust and build towards new structures that fit the new configuration (Rotmans & Loorbach, 2009, p.189). The difference with previous work on niche experiments is that transition management is not limited to technological change or environmental sustainability (Van den Bosch, 2010). However, the challenges are similar. Experiments are often isolated events that slowly become forgotten without any effects on current structures (Hoogma et al., 2002). When there are low levels of government support some states might get lost in a labyrinth of experimental paths (Sengers et al., 2016, p.9). Also, the question is raised whether experimentation naturally occurring in our modern society can be modulated, let alone steered, in a sustainable direction (Schot & Rip, 1997). Last, some say that in the practice of transition management too little attention is given to change associated with everyday life, and that it lacks the conceptual resources to do so (Shove & Walker 2007).

The practice of transition management explores alternative social trajectories in an adaptive and anticipatory manner (Kemp, Loorbach & Rotmans, 2007). The first step in such a process is an integrated system analysis and selecting actors. This makes that it has a rather steered and defined starting point but the intention is to be co-creative in the accomplishment. It consists of four different clusters of activities: strategic, tactical, operational and reflexive. These activities can be considered the practices of transition management. They are acted out by transition scholars together with the frontrunners of specific systems. *Strategic activities* take place in a transition arena. Arenas are temporary constructs where frontrunners are brought together around a certain transition topic. The inclusion of frontrunners is deliberate. It is believed that to generate emergent structures certain competencies are needed, such as a creative mind, strategic qualities and visionary capacity as well as not depending on the structures, cultures and practices of the current system (Rotmans and Loorbach, 2009, p.189). People can be part of different arenas, also at the same time. A sustainability vision is developed and pathways derived. Generic principles are translated into specific concrete settings and captured in transition images and a transition agenda. *Tactical activities* are about finding new attractors for the system as well as creating coalitions and new networks around the transition agenda. The goal is to guide niche development and stimulate the formation of niche regimes. *Operational activities* mostly consist of transition experiments, set out to create diversity. These specific type of innovation projects are inclusive, practice-based and challenge-led. The aim is to pro-actively explore new ways to meet societal needs and promote system innovation through social learning under conditions of uncertainty and ambiguity (Sengers et al., 2016, p.9). *Reflexive activities* of monitoring and evaluation are needed to develop an adaptive strategy while the system is changing, anticipating on future trends and development. Hereby complying to sustainable development as redirecting development and not as an identifiable end-state (Kemp et al., 2007).

#### **4. DISCUSSION: THE VALUE OF SYNERGY FOR SUSTAINABILITY**

The background, challenges and practices of both design for sustainability and transition management were discussed. Six potential values of synergy are identified.

##### **4.1 Enriched methods of retrieving knowledge of current objects and current systems.**

Design has its own distinct 'things to know, ways of knowing them, and ways of finding out about them' (Cross, 1982). Through different design methods, such as contextual inquiry or context mapping (Sleeswijk-Visser et al., 2005), designers can add knowledge of current objects, of current systems to transition arenas.

##### **4.2 Providing boundary objects in transition arenas beyond language games**

Transition arenas rely heavily on words and discussions but also aim to produce images of futures, something designers are equipped to do. Designers can also bring it beyond images, towards an evolving boundary object, such as a mock-up, prototype, or design game. These could bind the different language games, often entangled with different perspectives, together and allow for transference and commonality while acknowledging that different stakeholders might at the same time hold very different views (Bjögvinsson et al., 2012).

##### **4.3 Actively envisioning the effect of design things during and beyond their lifetime**

Connecting design to practices of transition management would allow for more heavily embedded practices of envisioning the future and anticipation of future trends and development. Transition management principles can help designers to think about and really be part of a transition as well as realizing the power they have of shaping the future (so also the potentially negative power they might have if they use their power wrong). Hereby possibly advertising the danger of "optimizing the "wrong" systems by not fundamentally questioning the need for certain industrial production or the levels of consumption associated with these systems" (McDonough & Braungart, 2002).

##### **4.4 Intensified reflexivity in design practices and projects**

Embedding transition management activities of monitoring and evaluation in design processes can help designers reflect on their practices, their experiences and ways of working during their main way of learning: experiencing the process. This reflexivity could stimulate the maturation of the transition design practice and formulating as well as understanding the new role of the designer.

##### **4.5 More prototyping activities to leave traces of transition activities in everyday life**

Professional designers can be understood as leaving traces, obstacles, objects, and potentially public things for users to "enact" in their everyday activities (Bjögvinsson et al., p.107). Following this understanding, design could add value to transition strategies, not only through the apparent value in operational activities during experimentation but also in strategic and tactical activities; leaving traces for people, beyond frontrunners, to enact in their everyday activities.

##### **4.6 Greater focus on building interactions through a broader range of co-creation activities.**

Both in design and transition management there is emphasis on co-creation and participation, the two fields could learn from the diverse methods and experiences of the other. In participatory design, the focus is traditionally on envisioning use before use but moving towards design after design where other people will have to act. In this, there is much to learn from the tactical activities of transition management where the focus is on creating interactions and coalitions.

##### **4.7 Possible pitfalls of synergy between design and transition management**

Besides the promising values, there are pitfalls not to be overlooked. First, the role of design could be dumbed down. Designers can be treated as the visualizers of visions of transition managers and not involved in the higher-level abstract thinking. Similarly, design could be only used for generating new ideas in the experimentation phase (the most obvious role for design) and not throughout the whole process. This will not result in cross over learning: designers will not learn from practices of creating a long-term future vision and interactions for it, nor will transition managers benefit learning from boundary objects and leaving traces in connecting to every-day life. On the other hand, the synergy could result in transition management being overly focused on every-day life and operational activities. This would make it too concrete, losing some of the ideology of the long-term future visions. Also, when there is a greater focus on experimentation, transition management could be criticized too much on the execution part, because too much is being expected from the experimentation in the preceding transition arena. Disappointment of the level of experimentation or implementation reached in a later phase might then spur disbelief in the transition path all together.

#### **5. CONCLUSIONS**

In short, the potential value of combining the practices of design and transition management is promising, but joint practices need yet to be established and experimented with. The emerging field of transition design also sprung from seeing this potential. To be able to fully understand the joint value, collaborative projects need to be set-up to

experiment with different combinations of methods; the processes and outcomes of joint and separate projects need thorough evaluation; and, more cross overs need to be established between education programs as well as joint programs developed. Last, the developments in transition design and other movements of design for sustainability are carving out a sort of meta-field, requiring meta-skills and meta-thinking, as in overarching. A question that needs to be addressed is whether this shift is not attributing too much power (and responsibility) to designers and the field of design. It could lead to a framing of designers as almost impossible omnipotent human beings, that no other can match. This is rather daring. Other fields have equally valuable contributions to make to sustainability, such as transition management; claiming rather similar qualities, addressing similar issues and in some ways using similar methods as design for sustainability. Therefore, this paper is both a reminder of humility for designers as well as advocating the use of design for sustainability transitions.

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## **DESIGN AND NATURE: NEW WAYS OF KNOWING FOR SUSTAINABILITY**

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### **ABSTRACT**

This paper explores how we can know in ways that promote new relations between design and nature, for futures of sustainability. The paper shares observations and reflections made over four years in the collaborative process of editing a book (*Design and Nature: A Partnership*, in press). During the process, we have synergistically tried to explore and manifest what knowing in a paradigm of a more sensitive and careful relationship between design and nature can entail. Insights include the intersectionality of gender discourse with nature and design relations, the opportunities and risks of leaving academic conventions, the centrality of collaboration in pursuing new ways of knowing.

**Key Words:** Nature and design, experiential knowing, feminism, care, beyond design-for-sustainability-as-usual.

## 1. INTRODUCTION

This paper is concerned with design's relationship with nature, and specifically how this relationship can play a significant part in futures of sustainability. We explore how humanistic lenses embedded in design cause dangerous power imbalances in this relationship. We ask what other lenses can be nurtured for design so that design actions can relate respectfully, sensitively and humbly in relation with nature. The paper draws on reflections and observations made over four years in the process of editing a book (*Design and Nature: A Partnership*, in press). This paper is not about the book per se, but rather it explores what we learned both about the practice and the process of design and nature in the course of its bringing it, its 25 chapters and 34 authors together. Our journey into design and nature was a journey to world outside of design-for-sustainability-as-usual, and was by turns a magical, electrifying and an itchy, uncomfortable experience. We have more than 75 years' experience of working in design for sustainability between us, yet often we felt like novices when working on the book, unsure where to begin and tentatively feeling our way into a new relationship between design and the natural world. The theme of this conference is *Design For All*. In this paper, and taking our lead from Val Plumwood (2009) and Maria Puig de la Bellacasa (2017), we seek to put forward a larger frame of 'All', of care in design that moves beyond human centredness and considers instead where humans are but one of many focus points. In this paper, we set out what we learned, what we enjoyed and what we found difficult in our explorations of design and nature as partnership. We try to match the ideas it conveys and the form of the text: writing in first person, revealing the relationships between things, bringing awareness of who we are, and drawing on our own experience and the evolving conversation between us.

## 2. DESIGN RESEARCH POSITIONING

We; Kate, Louise and Mathilda, share the position of the need for design to form new relations with nature. This stems from the, man- and in many ways design made, crisis of ecological systems (e.g. Crutzen et al. 2007). Pragmatic responses, for example product level design interventions, to this systemic and paradigmatic situation are insufficient. Therefore we locate design as synergistically in play at levels of product, systems, paradigms, with license to intervene also in ways of knowing (Tham, 2014). We work at different institutions in the global north, and we are all white women. We represent a range of social class backgrounds. We are also friends, mothers, teachers, students and makers. It is in the nature of the paradigm which we seek to embrace - ecological relationality - to also challenge epistemological hierarchies, that is hierarchies in ways of knowing. This includes standing up for the knowledge we generate through, for example, the experience of being in nature. It also means that we resist the convention and pressure to always legitimize (see also Akama, 2017) such 'less valued knowing' with 'more valued knowing', typically represented by facts and figures and white Western male academics which both dominate the sustainability discourse and emulate the paradigm that created the problems. Our journey has resulted in a rich material from which some key themes have emerged, including: challenging design's position as a hero - a legacy of the modernist project; examining the role of direct experience in design; exploring design development as slow awakenings; sensing as a core design capacity - drawing design closer to living species; experiencing awe as a way of design engagement; developing a practice of working within integrated relationships.

## 3. WHAT IS DESIGNING FOR ALL?

One possible interpretation of designing for all is that of literally shifting design practices to determine and attend to the needs of other than human 'clients': cedar trees, red foxes and monarch butterflies. But this assumption of knowing what is needed, even knowing of a process to apply, falls within the conventions of modern thought, a convention that we are questioning. We are wondering what design really is, when we think about designing with, for and within nature. How do we know and how do we learn? The conventional design process, which has been developed for industry, in the context of modernity, needs to be disrupted. Recently, design researchers at Emily Carr University initiated a project with the primary aim to explore design with nature (Desis Lab n.d.). The secondary and more public aim was to enhance habitat for a local species of rockfish. Rockfish, including Red Snapper, are found around the world. On the Pacific West Coast of Canada, species are declining. During early research in windblown rain on rocky shores the team explored questions of how to connect with the natural world, but within a few weeks the momentum of the design process began to steer the project. Our primary aim of designing with nature became obscured by the more familiar activities of design. The three faculty members and thirty-eight students interviewed biologists, collected facts about rockfish, observed the area (some even went diving), did nature journaling, all to culminate in prototypes of modular habitat. Rockfish exist within a complex and fragile ecosystem: single fix artefact solutions derive from a fragmented view of the natural world rather than a holistic one. Pressured by deadlines, we found it took conscious effort to maintain the holistic and spiritual perspectives that we began with. Design is inherently a modernist act, and without careful attention, design gravitates to what it knows, even when attempting to 'design for all'. Design for all is not a matter of transposing existing design practices onto a new type of client. Design itself needs new methods, ways of knowing, and ways of understanding the world if we are to support other-than-humans. Finding ways to collect ourselves during the design process, retuning regularly to spiritual and holistic ontologies as an ongoing practice throughout the project can therefore be an important part of designing for all.

#### 4. PROCESSES AND PRACTICES OF A NEW PARADIGM OF DESIGN AND NATURE

What are the ways in which we can go about designing with and within nature? In the course of compiling the book, we used a number of design, research and writing methods for the sometimes dirty, sometimes delicate, work involved. These included autoethnography, drawing, making and reflexive practice, among others. Further, the work foregrounded collaboration. The book was only possible because it was, quite literally, done together. The collective mind was more surprising, richer and unpredictable than any of our individual ones. This is not to say we always agreed with each other, but we explored our viewpoints and grew understanding with debate, jokes and laughter along the way. The collaborative ethos was also extended to the contributing authors through the set up of collaborative writing groups and process. In the collaboration, we draw on action research (e.g. Heron and Reason, 2001); participatory design (e.g. Binder et al., 2015); research traditions which recognise the intrinsic value of working with others to affect change. Another process that we invited the book's contributing authors to focus on was direct experience. Some authors were nervous about this, because writing in first person and using our own finite experience as the basis from which to develop understanding sit at odds with academic traditions. In fact, we took the reluctance to write from direct, sensory experience as an indication of the ongoing power of the academy to privilege certain sorts of knowledge. At one point, we asked some of our contributors to limit their academic sources and refocus their writing on their own experience. A few asked us to clarify publicly that we had requested this form of writing, so that it would not appear that they were stepping 'out of bounds' without due cause. For some people writing outside of the conventions of academic writing was a liberation, a gift to move freely; but for others, it was scary. It is hard to know how to proceed when the usual way that things are done in is thrown out of the window. Life writing or autoethnography was also a feature that we encouraged in our contributing authors' work. We wanted to take up the challenge set out by Rainer Maria Rilke in his poem *Archaic Torso of Apollo*, "... for there is no place that does not see you. You must change your life" (1908). That is, we wanted to challenge design to be concerned with the places we inhabit, to be present there and to honour all living species. We were inspired by Husabe et al. (2009) who position life writing as a subversive praxis and part of the building of a counter narrative to modernity on which sustainability depends. "Writing autobiography is a self-reflexive and self-critical act; it enables the writer to critique and theorize within the autobiographical text rather than outside of it. Through autobiographical writing, the writer can educate her attention to the lifeworld, where she dwells and with whom she dwells in that world; she can develop her direct sentient engagement with that world and all its ecological relations." (op cit: 29). In life writing, the writer describes and reflects on individual experiences so that her audience sees their relevance beyond that one instance, to all lives. This makes possible new ideas and forms of action. Lusabe et al. go on to ask, "Where might these stories come from? The ones that conduct our attention deeper and deeper into the world where we dwell, the ones that help us to do what is appropriate for where we live, to do what is right for those with whom we live?" (op cit: 43). We contend that the stories come from a closer relationship with ourselves and the world around us. This requires a different sort of writing than that which passes for academic design writing. Sometimes it is personal reflections, other times it is poetry, other times still it is sharp, grounded, cited text. Indeed we embarked on the project on making this book with a patchworked vision of new – or new-old – relations between design and nature. We realized that how we know is very much core, not what we know, or how many sources we can collect. The whole editing process -- which started out with the drafting of a book proposal, then a call for abstracts of possible contributions, then selection of submissions, multiple rounds of editing and final compilation into a book, took place through skype and email, across three time zones, and a difference of nine hours. Through this process, we always sought to locate ourselves in dailiness and specifics; whose children were ill, the scent of the *Daphne odora* on Louise's walk to work, the spring that Kate saw the swallows arrive early, the brutal noise of ambulances and police cars in Mathilda's busy street. We chose to work from the ground up, always maintaining it within its context. For to do its opposite: to strip away the background, we reduce design to a practice that has few consequences and for which we absolve ourselves of responsibility. By holding the context, we maintain that design can fulfil its ethical duty in terms of responsibility to others. In the following section, the paper weaves from specific moments of revelation and cruxes that we encountered during our recent experience of collaborative book editing to asking questions about what it means to know and act in a paradigm of a partnership between design and nature.

#### 4. HIGHLIGHTS AND CRUXES

##### 4.1. Changing physical things in order to change what we think

When we started out making a book about design and nature that sought to promote multiple perspectives in design, not purely human centred ones, there was a good deal of work that we had to do to first throw off old habits of thinking and writing. Some of these we shed quite easily and with pleasure. Others proved more difficult to overcome. For instance, when we embarked on the drafting process for the book proposal, we found that the only way we could do this was to write with our eyes closed. We had to, quite literally, block out the world-as-usual in order to start writing about the world-as-unusual, a world in which design activity is based on a differently encoded relationship with nature. Indeed, it was only when we worked to switch off the thinking mind and allowed the

senses to intuit what needed to be said -- to work from what needed to be felt and done -- that we made progress. Interestingly perhaps, frank discussion of such challenges is rarely had in public. Yet it is an important part of the process of designing for all because it raises to the surface all manner of epistemological questions, about what it is to know about this area. For us, knowing about nature and design meant untangling the default thought processes in which we were schooled and shedding our skins of modernity. It meant recognising both how little we know and the role of humility in building new understanding. It took us down a different path, and one which finds little correspondence with the academy as it is currently run. What does academic work look like when it is reliant on direct experience, when it is written on in first person, when it puts forward no grand universal ideas or theories of how to act, of how to design? We don't know the answers to these questions. We would like to ask you, what do you think? We also included spending time outdoors as part of the writing process. While getting up from a desk and stepping outside is often not recognised as productive work in a strictly 'accounting for your time' work-efficiency sense; we found it to be a predictable source of changed perspectives and rich ideas, albeit ones that were typically hard to pin down. Whatever was happening outside, in the real world of rushing air and changing light conditions (for we are not talking here about places of wilderness or especial beauty, but outside in alleyways, between buildings or at the edge of a muddy path), forced us to enter the world more physically, and this made a difference. Being less 'in your head' and more 'in your body' precipitated a change in experience that kept spinning a thin thread between reality (and all its attendant environmental challenges) and the abstract world of ideas. This spilt over in an important way in the book. It kept us bringing design back to actual natural conditions. Over time and with frequent trips outside, this thin thread of direct experience becomes a string, which then becomes a rope. It is what we used to haul ourselves up and back into the real world where natural systems are the context for all design actions. We realised that the work of design and nature is never just the work of the logical mind. And perhaps for this reason -- because it is also the work of the physical real world, the body and the senses -- that it has particular ramifications for design. It is also an example of 'staying with the trouble' (Haraway, 2016) instead of seeking fast and neat solutions. The realisation that design needs to be situated and draw on many senses is, of course, not new, but easily forgotten when deadlines kick in and when quantifiable points award prizes.

#### **4.2. Diversity of contributors to the book**

We had hoped for a great diversity of contributions to be submitted when we made a call out for prospective chapters to the book; from the Global South, for racial diversity and gender diversity. On many counts, we simply failed. Specifically on gender, Mathilda recalls counting down a column of self-declared genders, and finding the number of males outnumbered by females by 5:1. We could find no way to balance the genders in this book: this discourse is currently dominated by females. Had we somehow increased the likelihood of the gender imbalance in our call to contribute? We note that in the field of fashion and sustainability in particular, a field that Kate and Mathilda know well, the gender imbalance is even more acute. There may be many reasons for this. Within design, work with nature is considered fringe activity, on the edges of credibility, probably partly because it goes against biases towards intellect and productivity. Historically nature has been perceived as female: earth is a mother, wild, emotional, fecund, of service to men (e.g. Merchant, 1982). However, when Louise researched the history of design's relationship with nature, she found that the early discourse was dominated by males. Only when the terms of the engagement of the design and nature debate began to shift to practices of care, decentering the human, and slowing down the design process, did women begin to lead the conversation. That of course, is the context of the book; to move away from academic norms, to focus on new ways of sensing and knowing. The question of gender is interesting, given Carolyn Merchant's scholarship about the twinned oppression of women and nature in history (1982).

#### **4.3. Encountering privilege**

At one point in the writing of this book, we became acutely aware of our own privilege. Louise wrote: "...we are each writing about nature from very privileged positions. There we are: I am meditating on a mountainside, Kate is taking breakfast in a meadow, and Mathilda is on holiday in the woods". We wondered if acknowledgement of this and apology for it, an expression of our earnest desire to learn was enough. Was this acknowledgement an attempt to 'move to innocence' (Ford and Blenkinsop 2018) to leverage own humility as evidence that we are not part of the problem? These questions demand serious personal reckoning for all of us; a deep facing of ourselves. They are questions that cannot be answered quickly or easily, and instead must surface again and again. How is my privilege playing out in this project, in this research, in this initiative?

#### **4.4. The need to find keys to unlock doors to the new paradigm**

Working in new territory is always hard. Often we get hijacked by habitual ways of thinking. These can lead us to stumble and by the time we stand upright again, we have already lost our bearings are no longer sure of which way to head. We found that particular phrases acted as useful keys to unlock doors to a new relationship between design and nature. Terms like human centredness/ mastery/exceptionalism, mechanistic thinking, rationalism and control sharpen our critique of the dominant lens through which design activity is viewed. Other terms, such as interdependence, humility and relationship, act as guides to a different sort of understanding. Language is not neutral. It is a constitutive part of how we see the world, including the natural world. Basic concepts of our worldview determine what we see and the way that we see it. Changing concepts changes what we perceive. And so it is with design and nature. We are refocusing our lens onto design for all.

## 5. CONCLUSION

This paper has shared insights from the collaboration of editing a book which explores new partnerships between design and nature. Throughout the process of editing the book, we have tried to synergistically explore and manifest a new paradigm of knowing, which we sense that this partnership requires. We cannot know this paradigm, but we can discern dimensions of it, and we can take part in designing it. Key principles of such a framework of design and nature include challenging: human centricism and human exceptionalism in design; bias towards theoretical knowing, in order to embrace many ways of knowing; solutions and answers focus in design, in order to hold many layers of complexity and support humble learning together. The current dominant features of design that we seek to challenge are such strong legacies of modernist, progress and growth oriented design that they can be hard to see and harder to transcend. Our journey of during the process of editing demonstrate many stumbles. Especially when under time pressure (and when are we not), we tend to turn towards the tools, processes that we know well. Yet, we also have experienced moments when we feel that we have transcended a dominant paradigm of designing. These have arisen out of earnest meetings in our collaboration, particularly when we have found the courage to speak up about awkwardness and shame of, for example, our own privilege. They have also arisen when we have concertedly positioned ourselves outside the reach of dominant knowing, such as with our eyes. Throughout this journey, we have reflected that the work emerging around a new partnership between design and nature is interwoven with feminist ways of knowing, and is dominated by self-identified female researchers. We discern early conceptualisations of nature as female, with later hierarchies in knowledge production as probable and at least partial reasons for male dominance throughout modernity. Yet, we see the contemporary bias towards female participants in this work as an important area of investigation. Design for all, design with all, needs all species, disciplines, genders, sexes, ages, ethnicities – and more. The process of editing the book *Design and Nature: A Partnership* has provided us, along with the many contributing authors, a temporary space and license to venture beyond conventional academic boundaries and conventions. This has been liberating, hard, joyful, and awkward. We see an important remit for design education, design research and dissemination ahead to open up many such spaces of exploration. This entails also opening the academic institution to broadening world making and ways of knowing.

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## CO-DESIGNING A COMMUNITY CENTRE IN USING MULTI-MODAL INTERVENTIONS

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### ABSTRACT

The rural-urban migration of young people leaves the elderly in a vulnerable position that threatens the social sustainability of rural communities. This article presents an innovative and multi-modal design approach utilised within a community engagement intervention conceptualised with the Lotlhakane<sup>1</sup> village community in the North West Province. The intervention is designed to specifically support the elderly, also, revive and disseminate sustainable indigenous knowledge and practices. The aim is to collectively, in collaboration with the community, develop and design a community centre that will support the above, in addition to advocating for the transferral of indigenous knowledge and practices to the next generation.

Key words: Participatory Action Research (PAR), Indigenous Knowledge Systems (IKS), sustainability, community engagement.

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<sup>1</sup> Lotlhakane is a rural village situated in Ditsobotla municipality in the North West Province of South Africa.

## 1. INTRODUCTION

Participatory Methods in action-based research are considered to be enabling mechanisms that allow ordinary community members to play an active and critical role in decisions that affect them. By so doing Participatory Methods challenge the conventional relationship between the researcher and those being researched; focusing on democratic and non-coercive research with and for participants (DeFour-Howards, 2015).

Indigenous knowledge defines the foundations of traditional beliefs and practices. Traditionally, this knowledge is transferred by word of mouth and through ritual ceremonies, from one generation to the next. However, with the current lack of viable opportunities and employment in rural areas there is the challenge of retaining young people in non-urban areas. As a result, the elderly and frail are left alone without adequate care. In addition, indigenous medicinal knowledge for healthcare and other socio-cultural purposes is disappearing, due to modernisation and because it is not recorded. The migration of the youth to urban areas further endangers indigenous knowledge because it leaves the elderly without anyone to transmit or transfer the knowledge.

In this paper, we present innovative and multi-modal design approaches within a community-engaged intervention. Our aim is twofold, firstly to collectively design and develop a community centre for the elderly that cares for the frail and values, disseminates and sustains indigenous knowledge (cultivation and management of medicinal plant resources) and practices (building and house decoration techniques). Secondly, our aim is to promote and support the transference of indigenous knowledge from one generation to the next.

The principal purpose of collaborating with a community is to offer a paradigm of research and learning using a Freirean premise that inverts the academic notion of power and knowledge. Each phase requires the design of an iterative action cycle that accommodates participatory practice and evaluation from community partners. This methodology accommodates failures, or challenges, in each intervention and ensures that the voice of community members leads the action. Although we are advocates of Participatory Action Research (PAR), bearing in mind the possible socially and environmentally just solutions it can derive, we are also aware that in certain instances PAR can reproduce the very same binary power relations it seeks to challenge, thereby threatening sustainability (Kendon, Pain & Kesby, 2007).

In the sections that follow, we will discuss the theoretical backdrop that informs our perspectives within the designed intervention, i.e. PAR, indigenous perspectives in research and community engaged learning in higher education. Thereafter we will discuss the first two phases of our intervention and the methods we used in these phases. We will pay particular attention to the method of using arts as a collective process and means of engagement, citing both the homestays and community-engaged arts practice as transformative activities that can cultivate intercultural understanding. Lastly we will discuss and analyse the data collected, particularly the impact and learning experiences derived by the students through the homestays and community-engaged arts practice.

## 2. THEORETICAL PERSPECTIVES

PAR presents a counterhegemonic approach to research, challenging traditional research objectives and embracing multivocal perspectives, particularly those previously marginalized, oppressed and excluded (Kendon, Pain & Kesby, 2007). In this way PAR can fit into an indigenous research agenda, prioritizing self-determination, the socio-economic growth of communities and the restoration of traditional practices and materials (Berman, 2017, p. 11). Hence, co-designing a community centre using both indigenous and contemporary approaches by way of Participatory Methods allow visitors to the site (students and staff) an opportunity to listen, envision translate, as well as visually record a scenario envisaged by the community elders.

Traditional medicines are utilised extensively in tribal and rural areas for primary healthcare, at times these are the only healthcare systems accessible (Monakisi, 2007). Traditional medicines are significantly cheaper than Western medicines and for this reason are more a feasible alternative, particularly in areas where primary healthcare services are inefficient or inadequate. In this way indigenous knowledge, in the form of traditional medicines, can provide sustainable and environmentally sound approaches to agriculture and in particular the management of natural resources. It is well known that development activities that work with and through indigenous knowledge have important advantages, particularly the ways in which indigenous knowledge and traditional ways of learning are pivotal to the maintenance and sustainability of a community. For instance, indigenous perspectives on ways of living together and using resources sustainably can have a profound effect on the reduction of CO<sub>2</sub> emissions.

Action and reflection cycles in complexity-sensitive community-based research create praxis and generate meaningful evidence. Visual arts are considered to be a powerful approach within a collective process, fundamentally because the visual is threefold and “can serve recursively as a mode of inquiry, as a mode of representation, and a mode of dissemination” (Mitchell, 2008, p. 378). In the aforementioned statement, Mitchell (2008, p. 378) draws on the connotative meanings attached to objects, i.e. those drawing from autobiography and memory, as well as denotative history. The purpose of teaching in service of the public good and teaching for change remains a challenge for ourselves as academics, researchers, teachers if we are to accept our role in graduating critical, responsive and caring students who have agency in their communities. Community “engagement, facilitated in a genuine manner can be transformative, leading to change on the part of institutions, community partners and students, as it requires

ongoing reflection and evaluation strategies designed for continuous improvement” (Norvell & Gelmon, 2011, p. 265). According to the philosophy of transformative arts-based learning, excellence in teaching involves engaging students in the structures of deep learning, the outcome of which is personal agency.

In Sustainability (2013), Thiele defines sustainability as “a coherent set of interrelated beliefs and values that establish how collective life might be better organised”. The Brundtland Commission 1987 further extends on Thiele’s definition, stating that sustainability is “meeting the needs of today without compromising the ability of future generations to meet their own needs”. The latter definition, incorporates social justice practices, ecological integrity, economic growth aspect which we envisage for the project, unlike many orthodox research projects, our endeavour will have a lasting contribution on the Lotlhakanecommunity.

### 3. METHODOLOGY

A participatory and user-centered design approach is used to gather data and assess community needs, as well as for the design and development of the centre. The aim is to collect the narratives and stories from the elders and advisors in the community and for them to be archived and shared, preserving traditional indigenous knowledges. Given the importance of ethical considerations and respectful engagement in conducting research, all participants who contributed to the project signed an informed consent form. Also, all guidelines stipulated by the Department of Science and Technology with regards to the protection of information about the medicinal use of indigenous plants and its knowledge holders will be adhered to.

This paper presents only the process of the first two cycles, setting the stage for the next phase of co-operative design. The centre is proposed to also revive and use indigenous knowledge systems (IKS) in the development and building of the structures through the application of local and eco-friendly building materials in collaboration with local artisans. The initial needs assessment was conducted on site during the pre-phase using an adaptation of Asset Mapping. Asset Mapping is a community-centred process that uses a visual methodology to determine needs and possibilities from community members (Delones & Rahimi, 2017, p. 154- 155). It involves breaking into groups of community members according to the themes/concerns identified, e.g. healthcare; land (and site); and indigenous and sustainable use of materials. Thereafter the community’s resources and obstacles are plotted on a map of the site, through drawing and painting. The visual map showing the strengths and deficits of the potential sites for the centre, such as the river, the clinic, fertile land and the proximity to resources, is presented back to the group, and provides sufficient needs analysis to the Kgosi<sup>2</sup> for him to determine a suitable site for development.

Before embarking on a community action students are required to attend workshops on art- and design-based approaches for development and social action. These workshops include an experiential learning module for community-engaged arts practice comprising of an introduction to PAR, ethics of engagement, sustainable development as well as art-based approaches that may include design thinking and design for social development. Participatory Methodologies of PAR (Reason & Bradbury, 2013) , Most Significant Change (MSC) (Davies & Dart, 2005), Appreciative Inquiry and Visual Narrative are some of the underlying methodologies aimed at producing knowledge and action that is directly useful to a group of people and empowering people to construct and use their own knowledge (Reason, 1994, p. 335; See Berman & Allen, 2012).

Community narratives inform all stages of the project, starting with the terms of engagement. Narratives are harvested through Photovoice, a process where community participants produce photographs to tell vivid stories about their lives (Berman, 2017, p. 14; Delgado, 2015, p.19). Photovoice has proven to be a valuable method to generate data and build relationships across population groups and diverse settings (Delgado, 2015, p.18). It is a visual research method that uses photography and stories to investigate a problem with a group of participants. The Photovoice interviews were conducted at homestays and proved to be an important tool in facilitating learning and exchange.

Cultural immersion was used as a method to introduce students to understanding the quality of life of participants and which lead to more intimate encounters and exchanges with the local community. Each student was invited to stay two nights with ‘home parents’. Students were organised into groups of two to four, ensuring at least one Setswana speaker for translation in cases where the ‘home parent’ does not speak English. During debriefing sessions, through conversations and reflective essays, students often express awe at the level of strenuous work by the ‘home mother’, the generosity and hospitality of their hosts and the desire by the hosts to both teach and learn from the students. This created a greater equality for mutual exchange and co-learning. The students contribute something to the household, each home received an agreed fee per student.

Students used their experiences and understanding, acquired through the Asset Maps, Photovoice interviews and personal exchanges in the homestays, to draw out scenarios and engage in a processes of ideation to present to the chief and elders in the fourth coming visit. The three students whose designs were chosen followed the brief that incorporated an aspect of the community’s narrative history and traditional weaving, house decoration and irrigation. The community feedback was collated to support the next phase in 2019.

Students experience structured learning opportunities with real-life problems through community change proj-

<sup>2</sup> The Paramount chief (Kgosi) in this instance is in a position to allocate the site that is deemed suitable by his advisors which are also the elders participating in the needs assessment workshops.

ects using IKS and employ cultural fluency as a mechanism through which sustainability is valued as a socially-just outcome. The long-term impacts of the project would be a Community Centre that is responsive to the cultural and social requirements of the community elders and the NGO Lebogang Thuso Kopano (LTK) who are the initiators of the collaboration between the University and the Lothlakane community.

### 3.1. RESULTS AND ANALYSIS

Measures or indicators may change as an evaluation process unfolds. Evaluators or researchers work with project participants and leaders to co-create evaluation approaches and tools that are both useful and match the local context. PAR uses a double-loop learning cycle of participatory action research which encourages individual and organizational learning. The notion of double loop learning initially introduced by Argyris and Schon (1978), pushes researchers to challenge the norms and assumptions that frame their practice. In this way double-loop learning can also support organisations to question what they do and interrogate the list of assumptions that drive their work (Popplewell & Hayman, 2012, p. 6-7). In this intervention, we extend this exchange of learning to participatory evaluation. We see the purpose of evaluation is to improve and support the flourishing of projects in which evaluation becomes a developmental and collaborative process.

2017: Pre-Phase Visit: Writing the proposal and business plan

A 4-year business proposal and budget were compiled with the University of Johannesburg and submitted to the National Lottery Foundation in North West Province.

2018 April

Phase One Part One: Student and staff field visit to the site

- Site visits
- Photovoice interviews
- Presentation of history and context by the Kgosi
- Home-stays
- Group workshop on imagining a centre
- Painting the mural in the Kgotla<sup>3</sup>

2018 October

Phase One Part Two: Reporting on results and outcomes

- Photovoice interviews consented to and consolidated
- Presentations and feedback: Group workshop to discuss and provide further direction
- Architecture design brief: Four designs selected for presentation
- Visual Art and Industrial Design: Photovoice interviews transcribed and translated

2018: November:

- Designing class briefs for the next phase of 2019 student interventions
- Designing and printing Photovoice booklets and publishing the results of the four designs for distribution to the community and students for further analysis and to design the next phase

## 4. CONCLUSION

Inclusionary, complex and community-motivated projects present opportunities for transforming paradigms of education and research. Boyte (2014) defines this mode of teaching as renewing the student-centered tradition of “educating for democracy” that develops “civic agency through public work”. This paradigm understands citizens as “co-creators of the world, more than deliberators about the world, and democracy as a society, not simply an electoral system” (Boyte, 2014, p. 3). This is the premise that unravels the notion of hierarchies of knowledge and power in the academy and engages students in different ways of being and acting in the world.

Apart from the ways in which students’ participation in this project destabilised their prior conceptions about rural communities and sustainable ways of living, particularly the perception of the ‘inferior nature’ of indigenous medicines in comparison to western medication, it became clear that there is much to be learnt from IKS. The domains of academic, personal and civic learning came together most directly in questions relating to cultural identity and positionality, and the responsibility that comes with privilege in an unequal society. In this way students were also motivated to become more active citizens in their own communities. Community engagement that is research driven, problem focused and theoretically informed is crucial in achieving sustainability by transforming the educational experience and providing significant value to communities and the organisations it serves. It does so by allowing the students and educators involved to see how their ideas matter in their social application. In turn students have felt empowered to bear the responsibility of tapping into the knowledge of others to contribute to collective participation in efforts that deepen democracy.

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<sup>3</sup> A Setswana word, meaning a public meeting place or community council or traditional law court where the council (lekgotla) often meets to discuss community matters. A kgotla is predominantly found in rural areas.

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## **CRAFTING SUSTAINABILITY THROUGH SMALL, LOCAL, OPEN AND CONNECTED ENTERPRISES ON THE CANADIAN PRAIRIES: THE CASE OF MANITOBAN CRAFT BREWERIES**

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### **ABSTRACT**

Craft beer is the fastest growing network of enterprises in the craft food and beverage sector of Manitoba, Canada. Craft breweries are emerging as a space that potentially links urban consumers to rural producers through ingredient sourcing chains. Our research considers whether craft breweries are resulting in small, local, open and connected (SLOC) craft food and beverage systems.

Through a series of interviews with craft brewers we found that there is a desire to source ingredients locally but that barriers exist. Challenges include a lack of consistent supply of regionally produced quality ingredients and the industrial scale of malting barley, which makes it difficult to preserve the identity of barley produced by small farmers. While craft brewers are supportive of a sourcing network linked to farmers in the region, this transition requires attention to adequately scaled malting enterprises and increased production by farmers of hops and barley in the region.

Keywords: craft brewing, small-scale food systems, biocultural design

## 1. INTRODUCTION

This paper considers the role of craft breweries in creating a Manitoba craft food and beverage system within the Prairie region of Canada. It is part of a larger project considering innovation in small scale food systems cases (Davidson-Hunt et al. 2017). We consider innovation through the emerging conceptual framing and practice of Biocultural Design (Davidson-Hunt et al. 2012; Janzen et al. 2017; Kuzivanova and Davidson-Hunt 2017). Biocultural design, in short, is rooted in relational ontologies of place and considers innovation to be an emergent creativity of an epistemological practice of collaborative making through the intersection of people, values and biological materials of a place (Ingold 2013). Recently, we have been engaging with Manzini's (2015) ideas on social innovation and Irwin's (2015) on transition design. In particular, the way by which they have centred the idea of cosmopolitan localism and distributed networks that are small, local, open and connected (SLOC). This informs the central focus of our work on craft breweries in Manitoba in considering the role they might play in transitions to sustainable food and beverage systems in the Prairies.

Small and local food producers and processors can contribute to sustainable futures but recent work has cautioned against too singular a focus on scale as the solution (Born and Purcell 2006). Brinkley (2017) has suggested that a relational approach would provide an understanding of the linkages amongst rural producers/processors, urban processors and consumers who have shared value sets. In highly urbanized countries, such as Canada, these relational networks include spaces in urban settings that gather consumers interested in specific values they want to support creating a flow from the rural to the urban of food and beverage products; farmers' markets and food hubs being the best known of these insertion points of the rural into the urban. The reverse is also possible as some rural producers create sites that attract urban visitors to learn and experience about the food and beverages they produce. Such relational, or topological approaches, bring to light that values are not only shared within bounded spaces but also across space through the linkages that are created. This has led to calls for attention to be paid to multidimensional sets of values that can create a shared identity and goals for food and beverage systems to support transitions to sustainability (Cleveland et al. 2014). There is a need to think about new ways by which significant levels of demand for agricultural production can result in rural revitalization through networks of shared values. Multidimensional value sets will need to think beyond just scale and start to consider the inputs utilized to make processed products, increase interaction of consumers and farmers, increase consumer knowledge, create economically strong small scale farmers and rural communities as well as viable urban food and beverage businesses, and think about how capital can be retained in communities and regions.

The question we pose in this paper is whether the craft brewery, brew pub or tasting room is emerging as one of these urban spaces that create linkages with the rural and whether their value sets consider, as Ballantyne-Brodie and Telalbasic (2017) put it, the weaving together of a relational network. A craft brewery is a small and local production site that transforms biological materials produced by rural farmers into something desired by urban consumers. The terms craft, and artisanal, are used for a way to produce food and beverages in small batches, with care and attentiveness to technique and cultural traditions, attachment to place all of which results in a distinct and quality product. What we wanted to know is whether their craft included attention to the source of the ingredients they use. Is a relational network emerging with rural producers who share similar values of craft production and, if not, what are the barriers? After briefly describing our methods we turn to what we found out from Manitoba craft brewers before ending with some concluding reflections.

## 2. METHODS

This research was undertaken as part of a larger set of cases which follow a similar methodology described in Davidson-Hunt et al. (2017). Following regional scans of innovation in small scale food systems cases are chosen that are underrepresented in the literature. One such innovation was identity-preserved sourcing by urban food and beverage processors of inputs from regional small scale farmers. In particular, we were interested in craft producers and whether the values of craft extended into their sourcing of ingredients. Along with a review of existing literature and reports we met with government and industry representatives to create a production model for craft breweries and the types of ingredients that are needed, an overview of the size, growth and current actors of craft brewing in Manitoba, and from this developed a semi-structured interview guide. Approval was obtained from the Joint Faculty Research Ethics Board to carry out the interviews, which we did with five craft brewers, or 35% of the current total. Following pre-testing of the interview and modification of the script, interviews were conducted on-site at breweries and were followed by guided tours of the facilities during which follow-up questions were asked and photos were taken. Interview data was transcribed and coded using general themes of biocultural design (materials, values and techniques) along with specific codes to identify values and barriers to regional sourcing.

## 3. FINDINGS

### 3.1 Who are craft brewers in Manitoba?

The term, 'craft brewing', is ambiguous and hard to define in a Manitoba context as, unlike other jurisdictions, there

has been no process to create a legal or industry association definition. As B. Wescott of Barnhammer Brewing says “you kind of know it when you see it” (Interview, Feb. 12, 2019). The five Manitoban craft breweries included in this research (Barnhamer, Torque, Nonsuch, Halfpints, and Farmery) brewed 58 different beers including seasonal, limited run, or flagship at the time of the research. Each craft brewer was asked what makes their beer craft and from the transcripts we distilled five key values: Ingredients Used; Ownership; Locality; Diversity of the Product; Production Process. The quality of ingredients was seen as important as was local and independent ownership. Local had the added values of being locally/regionally distributed and sold. Diversity of the product emphasizes values of craft brewing related to creativity, taste, flavour, fun, and exploration and is related to the process by which they brew, which is small scale allowing to play around with creating different types. There is a notion amongst craft brewers of the values held although they have not moved to codify these at this point in time; in essence craft brewers are those who say they are and are recognized by their peers as being so.

### 3.2 Do craft brewers value regional sourcing?

Through our interviews it became clear that as a general principle craft brewers recognize the value of sourcing from farmers within Manitoba. Key values that they held in relation to local sourcing of ingredients were: non-homogenous; differentiated in terms of identity and flavours; reduction in the distanced travelled; local flavours; preference for buying local; freshness; reciprocity (if we ask others to buy local we should buy local); creating connections with farmers (we know who we are buying from, not just from a faceless corporation); attention to detail of local producers; and knowing the reputation of who you are buying from. In terms of valuing local sourcing of ingredients, it was clear that most craft brewers considered this as part of their core value set.

### 3.3 What have they been able to source locally?

While most of the craft breweries are urban there is one, who consider themselves as an estate brewery, that is located in a rural community. They are the one example in which the key ingredient, barley, is sourced from not just Manitoba but their own farm. As they have expanded, this has led to positive discussions with farmers in their immediate region producing barley that they could then purchase (E. Warwaruk, Interview, Nov. 8, 2018). Not only are they producing barley in Manitoba they also selected from heritage varieties that had been produced over the last one hundred years in Manitoba and sourced seed from local seed producers (E. Warwaruk, Interview, Nov. 8, 2018). Other ingredients that have been sourced regionally by brewers have been minor ingredients; quinoa, strawberries, honey, and hemp, although only in small quantities. One ingredient that has shown promise is Manitoba grown hops as they yield well on the prairies, are relatively easy to process and the craft brewers are creating a consistent demand. C. Young, brew master at Half Pints, hopes to use locally grown hops as the main hop in one of their flagship beers, Little Scrapper; however, achieving this goal requires having a year’s supply of consistent quality hops. He feels that this should be achievable in the short term (Interview, Feb. 7, 2019).

### 3.4 Barriers to and Opportunities for local sourcing

The barriers that breweries encountered for sourcing local ingredients varied from brewery to brewery and depended on aspects such as brewery type, size, and amount of ingredients required per batch.

The barriers that Farmery identified were unique to them, as they are the only estate brewery operating in Manitoba, and some of the barriers they identified were associated with the farming end of the operation. In particular, they saw the scale of available farming equipment as a barrier. Most farming equipment is designed and priced for large-scale farming, but Farmery grows all of the barley they require for two years on a ¼ section (160 acres) and they produce the hops they need on an additional 20 acres (E. Warwaruk, Interview, Nov. 8, 2018). This is in comparison to the average prairie farm size of 1,668 acres (Statistics Canada, 2011). Therefore, finding the appropriate scale of farming equipment has meant that Farmery has had to rely on old, unreliable equipment needing a lot of maintenance (E. Warwaruk, Interview, Nov. 8, 2018).

The issue of scale also translated into the realm of local ingredient production for other brewers. For instance, some of Winnipeg’s breweries have tried to use local hops in their beers and they have praised the quality of local producers, but due to the lack of required quantities, they are only able to make limited runs of beer that use these hops or mix them in with other, non-local hops during the brewing process. The low quantity of hops has also meant that they typically sell at a premium, which is a difficulty for brewers who have to keep the prices of their beer consistent (C. Young, Interview, Feb. 7, 2019; B. Westcott, Interview, Feb. 12, 2019; J. Heim, Interview, Nov. 20, 2018).

Finding malt barley has also been difficult for Winnipeg brewers. The only malter in the province, Malteurop, produces malt in quantities not designed for local small scale breweries and when some brewers have tried to source their orders of base malt from there, they have had limited success in making contact and placing orders; assumedly because Malteurop focuses on larger clients and volumes (B. Westcott, Interview, Feb. 12, 2019; E. Warwaruk, Interview, Nov. 8, 2018). Farmery has their barley malted at Malteurop; it’s shipped to the facility in railway grain cars, and they have been told that their barley is kept separate from the other barley being malted there, thus preserving its identity. However, E. Warwaruk believes that Malteurop is doing Farmery a favour by malting their barley and he feels that the arrangement with Malteurop is tenuous, he does not believe that Malteurop works with Farmery as a money making venture and therefore does not consider them a priority (Interview, Nov. 8, 2018). Lastly, Winnipeg brewers do not believe that local (Canadian) malt has reached the quality and consistency of the malt that they can source from Europe (B. Myers, Interview, Nov. 20, 2018).

Lastly, product pricing represents a barrier to the use of local ingredients. Based on the format and type of beer that Manitoban craft brewers are producing, they must compete with craft-style beer made by large beer producers. Although taste and identity play a role in what beer people buy, price also plays a large factor. As the Farmery has discovered, the identity of their beer, being made of nearly all local ingredients, does not translate into the ability to charge a much higher price for their beer, otherwise it would not be competitive (E. Warwaruk, Interview, Nov. 8, 2018). This speaks to a pricing barrier represented by using local ingredients. If a craft brewery must pay higher prices for local ingredients, then that cost will translate into more expensive beer. Emphasizing the use of local ingredients (like Farmery), using larger format bottles and alternative narratives (like Nonsuch), or producing stronger beer (most breweries in Manitoba produce a strong beer), may be adequate to justify more expensive beer, but there are challenges when competing in a market that uses homogenized ingredients and large scale brewing while still using the craft narrative, especially if consumers place a high value on the cost of the beer that they are buying.

As with the barriers to local sourcing, Farmery is able to capitalize on unique opportunities for local sourcing by being an estate brewery. This may be a niche opportunity for small farmers in Manitoba since the quantity demanded and the production methods may not be of interest to large industrial farms. The Farmery, for example, has been able to produce all of their barley on a small amount of land and their familiarity and access to scale appropriate farming equipment (e.g. small combines and grain silos) has enabled them to harvest and store their barley. However, given the lack of a small scale malter (see below) there is a need to produce a minimum volume of barley for a malt production run in order to preserve the identity of the barley source and for the malting process financially viable.

The next opportunity identified was the regional flavour of barley. Being located in the barley producing region of Canada could bring the advantage of being able to access different malt flavour profiles, the way wine regions produce different grapes and flavours. This is seen as a potentially alluring to discerning customers (C. Young, Interview, Feb. 7, 2019). Craft brewers also recognize that traditional-style beers can be made with traditional ingredients along a spectrum of flavour profiles. Diversity and flavour are values held by the local craft industry, so even if local malts differ in flavour from European specialty malts, making good beer with them is still seen as a possibility, the beer will just taste different (B. Westcott, Interview, Feb. 12, 2019).

The size of craft breweries and their malting quantity requirements may also provide an advantage for locally sourcing ingredients. For instance, a local malter would not have to produce large-scale quantities of malt in order to satisfy local demand. Local brewers believe that with Manitoba's cheap utilities, proximity to barley producing areas (i.e. lower shipping costs), and the consistent demand for malt would make a local maltster viable (J. Heim, Interview, Nov. 20, 2018; B. Westcott, Interview, Feb. 12, 2019; B. Myers, Interview, Nov. 20, 2018; C. Young, Interview, Feb. 7, 2019). In addition, Winnipeg brewers have recognized that people are willing to pay for specialty and small batch beers, which means that there is a potential market for premium malts that can be used for making these beer types (J. Heim, Interview, Nov. 20, 2018; B. Myers, Interview, Nov. 20, 2018). Another way that brewery scale can play a role in utilizing local ingredients is batch size. Brewery batch sizes range from 1200 to 3000 litres, which is the low end of brewery volume size in Canada. Breweries such as Torque are also equipped to produce 350 litre batches of specialty brews (J. Heim, Interview, Nov. 20, 2018). This small batch capacity means that the volume of local ingredients required is scalable. Limited runs, small specialty batches, or consistent amounts of small scale produced ingredients may be supportable by this scale of brewing, as it does not require the large amounts of inputs needed by large-scale breweries.

Lastly, the unpredictability and costs of shipping ingredients from distant locations was brought up as a challenge in the current ingredient sourcing system. Ingredients must travel across the country in trains and trucks, sometimes spoiling or degrading along the way. In addition, some ingredient's availability and delivery times can be unpredictable, which can be problematic when trying to plan out a brewing schedule (B. Myers, Interview, Nov. 20, 2018; J. Heim, Interview, Nov. 20, 2018). For small breweries, the majority of the costs of brewing come from the labour involved, it's only in large-scale brewing where ingredients become a significant proportion or a beer's costs. If local ingredients were available and good quality, then any additional costs associated with them would only moderately affect the costs of brewing, while the savings in shipping ingredients over long distances may balance out other costs (B. Westcott, Interview, Feb. 12, 2019).

### 3.5 Clients, Markets, and Local Networks

Manitoba's craft brewers have been unable to source a significant amount ingredients for their beer; however, they still maintain a local ethic in sourcing other things they use in their breweries, brew pubs and tasting rooms. Tables and bar tops are made from salvaged Winnipeg Elms, bottle openers included in beer packs are handcrafted by a local blacksmith, they partner with local food makers to include their beer in fudge and beer nuts, they host barbeques with local butchers, and participate in local markets and popup shops (e. g. Third and Bird, Alleyway).

The efforts of Manitoba's craft breweries to participate and include aspects of Winnipeg and Manitoba culture in their marketing and engagement demonstrates that they see the caché in the narrative of local and community. The craft brewing community itself is still relatively small and close knit, with many start-up brewers beginning their life in the brewhouses and fermenters of established breweries. The local craft industry is not so competitive that these breweries see each other as opponents. They participate in local beer festivals, put on by the Manitoba Brewers Association, and describe how they are able to call up their neighbouring breweries if they are short on par-

ticular ingredients (J. Heim, Interview, Nov. 20, 2018; B. Westcott, Interview, Feb. 12, 2019). These breweries are leveraging more than the flavour or local brewing of their beer, they are actors and contributors in the local community and they understand the power that the term 'local' embodies. While backward linkages with rural farmers are incipient and thus craft brewers have had limited impact to date on rural revitalization in Manitoba they do see the value of linkages and the formation of relational networks to support a regional food and beverage system. It is just that there has not yet been enough time to establish the relationships with small scale farmers and the possibilities of local malt barley production.

#### 4. CONCLUDING THOUGHTS

In Manitoba, craft brewing is experiencing rapid growth with the number of breweries doubling in the last few years and, as in Canada in general, establishing a significant market percentage. All but one of the craft brewers in Manitoba are urban with the one rural brewery representing itself as an estate brewery as they produce most of the ingredients they use themselves from their own land or obtain minor ingredients from other local farmers. There is an emerging identity of craft brewers, demonstrated by the establishment of their own association based in Winnipeg and, as seen through our interviews, as a set of values related to the practice of craft brewing, which focuses on localness, quality ingredients and products, the process by which their beer is made with more hands-on attention and smaller batches, ownership by local people, the ability to make diverse, unique beers, and also due to batch size, all of which responds to emerging desires of urban consumers. In the urban setting craft brewers are forming small, local, open and connected networks amongst themselves and with other local food and beverage actors by inviting them to events at their sites or working jointly to host festivals.

In this sense there is an emerging SLOC within the urban setting and the one estate brewery is creating a different set of linkages by drawing people out to the rural to experience the production of beer from the field to the final beverage. However, outside of the estate brewery, what appears to be more challenging is the formation of linkages backwards to the rural farmers in the region as many of the ingredients are coming from not just outside of Manitoba but Canada. This suggests that while a product may be local it is not enough to pay attention to how far the product travels but also the ingredients utilized to make it and who is producing those ingredients. This is a possible intersection for a design approach interested in transition to sustainable futures and craft production of food and beverage products.

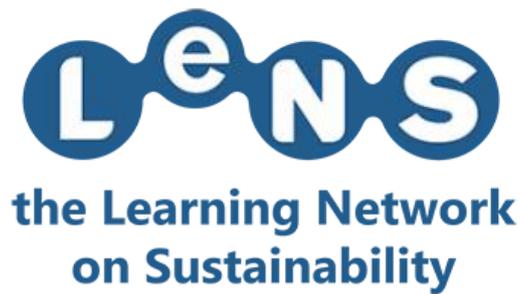
As noted from our interviews with craft brewers there is an aspiration to form linkages with rural farmers but this is restricted by two main impediments. First, the emergence of what we might call 'craft farmers' who share values with craft brewers for producing quality barleys at a scale significantly smaller than the current model of production agriculture in the prairies. Second, a 'craft malter' who can retain malt at a scale that matches the production of barley in smaller amounts with the quantity and quality of malt needed by craft brewers for their smaller batch sizes while retaining the identity of the source of barley. As Ballantyne-Brodie and Telalbasic (2017) and Brinkley (2017) note, a relational framing to understand food systems can reveal what hinders and what enables the emergence of the networks that will be needed for transitions to sustainable futures through a cosmopolitan localism. There is an opportunity to leverage the interest of urban consumers in craft food and beverage products and for design to play a role in thinking through the emergence of networks that go beyond the craft brewery itself and creates linkages with like-minded farmers in rural regions.

A potential avenue that emerged through our review of the sourcing of ingredients by craft brewers, is the use of the term craft to identify relational networks that would link rural farmers through to food and beverage craft products. There is also an unspoken tension, recognized by some craft brewers themselves, in that a craft brewery may buy ingredients from an industrial farmer or a multinational malting corporation and see this both as necessary and unproblematic. As Cleveland et al. (2014) note there is a need to identify a value-set that goes beyond the single dimension of local and while small-scale may be another dimension there are other values such as the care and attentiveness to the way something is produced, who produces it, how it contributes to building urban and rural places and connections amongst those places, the quality of what is produced, transparency in what a product contains and where it comes from, amongst others, that could be captured in an identity of craft food and beverage products that linked rural farmers through to urban spaces of consumption (Donald 2009).

Craft production signifies a practice of making that stands in tension to the industrial. It opens the possibility of a relational authenticity emerging through reflection and meaning-making when internal dichotomies are resolved through discursive processes. By moving beyond a marketing discourse to a more substantive reflection on the relations amongst materials, between materials and makers, amongst makers, and between maker and consumers can create a relational authenticity recognized by members who identify with the craft value set (Kettley 2016). Unlike food and beverage systems, which are characterized as being alternative, local, or small-scale, craft opens the possibility of thinking about relational systems rooted in ways of knowing, making and consuming with multidimensional value sets. This relationship between craft, design and transitions to sustainable futures has been explored within more traditional craft domains (Zhan et al. 2017). It is this type of rich conceptualization and debate that is missing from the practice of craft brewing and limiting its potential to contribute to sustainable futures in Manitoba.

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## **CASULO VERDE PROJECT: A SYSTEMIC APPROACH TO DESIGN MANAGEMENT.**

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### **ABSTRACT**

In the last centuries, we have been presenting modification and destruction of natural resources. The establishments of Conservation Units (CU's) have been approached as a way to minimize biodiversity losses. Recently, the relation between Conservation Units and human population that live in them is one of the biggest challenges in the CU's management, as the imposing of new controlling mechanisms for their use. In this context, this article has as objective to present the Casulo Verde's pilot project, having as its object of study the Serra do Tabuleiro's State Park, located in Santa Catarina State, Brazil. Through a systemic approach of design management, the project aims to improve the community's relationship surrounding the CU's and the visiting experience for tourists. From design management techniques, it has been possible to understand the main problems of the Visitors Center of the Serra do Tabuleiro State Park, as well as identifying viable opportunities.

Key Words: Systemic Approach. Design Management. Social Innovation. Conservation Units.

## 1. INTRODUCTION

The release of “Growing Limits” report by The Club of Rome in 1972 had a huge impact on the society by making the environmental and social issue public. It has provoked a discussion on the need of new and more sustainable lifestyles. Ever since, sustainable development started being approached in an international level.

The evolution of design culture has promoted the idea that design can develop not only products but also alternative answers to the most significant problems of today’s society. Design management by its own transdisciplinary nature tends to adopt an holistic approach aiming to facilitate and foster the best solution possible for all parts involved. The adoption of a managed-by-design approach broadens possibilities for project creation and execution, contributing for the future and bringing as many benefits as possible (without any negative impacts, such as environmental damage or community separation) (BEST, 2012).

The adoption of a broader and more dynamic view of a project, according to the systemic perspective, enhances Design Management (Krucken, 2009) In Big Complexity Problems Involving Several Characters. A Systemic Approach develops collaborative and transdisciplinary projects, widening relationships between characters, abilities and knowledge itself (Krucken, 2009), as well as considering all the possible implications, impacts and solutions that designing can provide (Mozota, 2011).

The establishment of CU’s has been a political practice adopted internationally, as a way to minimize biodiversity loss. However, many of these CU’s were set where there had been human settlements beforehand, who didn’t have the opportunity to participate when new mechanisms of use control have been imposed to these protection areas. In Brazil, the CU’s have been established from 1937 on, by government initiative and it corresponds approximately to 18% of the Brazilian territory (Embrapa, 2018). According to NUPAUB researches, about 88% of the selected CU’s surroundings have traditional population (49%) and non-traditional (88%) that, somehow, relate to these Units.

Currently, the social interaction between management and human population that live over there is one of the biggest management difficulties. With an eye to a sustainable development, the importance and efficacy of the CU’s surpasses the need for biodiversity protection alone. It is more and more necessary a deeper understanding of the population who relates to those CU’s, looking for solutions regarding the conflicting dichotomy between nature and human being.

In this context, this article aims to present the pilot study of Casulo Verde Project, with Serra do Tabuleiro State Park as its object of study in Santa Catarina State, Brazil. Through a systemic approach of design management, Casulo Verde Project aims the relationship of CU’s surrounding communities’ improvement, as well as the visiting experience in the Visitors Center improvement.

## 2. METHODOLOGY

From the point of view of its nature, this scientific research classifies itself as applied, since its objective is to create knowledge for practical use of solving specific problems (Silva; Menezes, 2005).

As for the aims it characterizes as an exploratory research, it aims to provide wider acquaintance about the problems and to make it explicit or building new hypothesis (GIL, 1991).

As for its approach method, it is a qualitative research, because it aims to analyze and interpret deeper aspects, describing human behavior complexity. It justifies in this research, for being adequate to understanding the nature of a social phenomenon (Richardson, 2008).

As for its technical and applied procedures it is an applied research, having as a study object the Serra do Tabuleiro State Park in Santa Catarina State, Brazil.

## 3. A SYSTEMIC APPROACH TO DESIGN MANAGEMENT

A systemic thinking is the comprehension of a phenomena inside a bigger context, establishing the nature of its relation (CAPRA, 1998). A systemic approach allows one to notice the interrelation of the whole and not only isolated events coming from “organization relationships” from parts of the whole - which means, from a configuration of ordained relationships. Systemic thinking refers to dynamic interaction patterns, as well as presumes procedural requirements, matter, energy and information flows, which perform or generate the interactions that wire the existence of the whole. Systemic thinking is always a procedural thinking (Andrade et al., 2006, CAPRA, 1998).

The adoption of a wider and more dynamic project perspective comes to strengthen design management, according to the systemic perspective. A systemic approach develops collaborative and transdisciplinary projects, widening relationships among characters, abilities and knowledge itself (Krucken, 2009).

## 4. APPLIED RESEARCH

### 4.1. Casulo Verde Project

Casulo Verde Project aims to understand CU’s from the systemic approach of design management, using research, analysis and diagnostic tools which can contribute to social interaction between CU’s and surrounding community

relationship improvement. The project intends to improve the CU visiting experience aiming to provide sustainable maintenance and, consequently, preserve the species present in the CU; raise awareness about these ecological interest areas importance; integrate the community from new local producing arrangements that could raise the CU marginal families' income as well as raise visitor's number in the place. In figure 1 it's shown the visual identity developed for the project:



[Figure 1] Casulo Verde Project's identity.

#### 4.2. Serra do Tabuleiro State Park

The object of the pilot study of Casulo Verde Project was the Serra do Tabuleiro Park, located in Santa Catarina state, Brazil. The Park was created in November of 1975, mainly for protecting the region's wide biodiversity and hydric sources which supplies the region of Grande Florianópolis and the south of Santa Catarina, by its role as climate regulator, and its touristic, educational and scientific potential. Nowadays, the Serra do Tabuleiro State Park is the biggest conservation unit of the state, occupying approximately 1% of the state's territory.

From 2004 on, conflicts have arisen between the surrounding community, environmentalists and private sector interests. Its insurgence is due to, mainly, fund installments of Maciambu (localized in the surroundings), the lack of park boundaries and lack of an operating plan.

The Park has a visitors center, located in the city of Palhoça, rich in fauna, flora and educational hiking. The administration of the park happens via co-management. Currently, the Çarakura Institute is the co-manager of the park, establishing a partnership in management and implementing projects aiming environmental education and social inclusion.

#### 4.3. Design Management Tools

For better understanding of specific needs of the case presented three different tools have been used: SWOT analysis, stakeholders map and brainstorming.

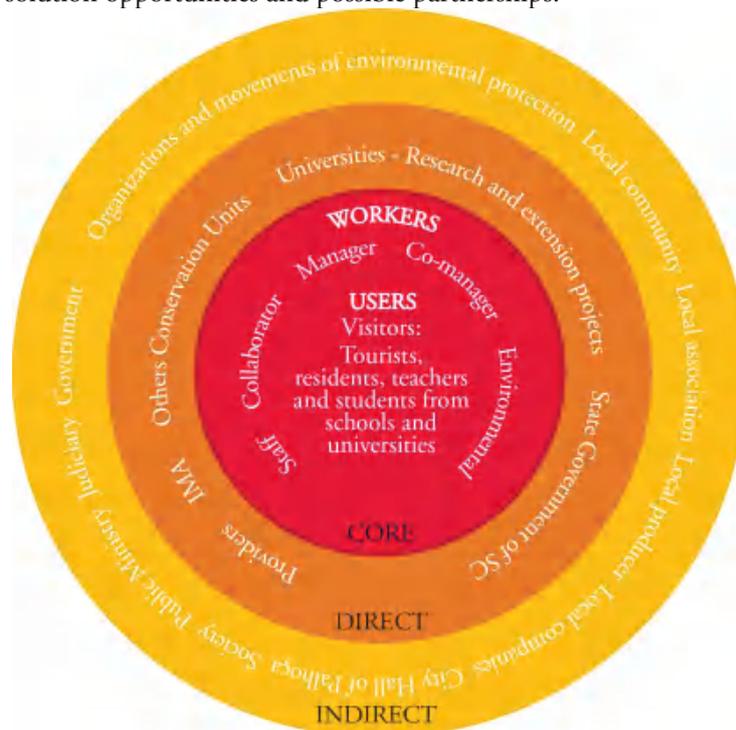
The SWOT analysis aims mapping the internal strengths and weaknesses as well as the external opportunities and threats (Kotler; Keller, 2006). The analysis (Table 1) happened for the Visitors Center of the park and it has occurred from bibliographic and documental research about the object of study, from information collected in the technical visits and non structured collective interviews with the strategic leaderships of IMA (Institute of Environment) and with staff and collaborators of the park's Visitors Center.

<p><b>STRENGTHS</b></p> <ul style="list-style-type: none"> <li>Human resources</li> <li>Large Physical Space</li> <li>Important geological patrimony</li> <li>Group of children involved in the park</li> <li>Free visitation</li> <li>Diversity of public</li> </ul>	<p><b>WEAKNESSES</b></p> <ul style="list-style-type: none"> <li>Little contact with local community</li> <li>Unattractive to the public</li> <li>Reduction in visitor numbers</li> <li>Few projects running</li> <li>Reduction of local fauna</li> <li>Communication</li> <li>Lack of income generation</li> <li>Lack of convenience space</li> <li>Idle space</li> <li>Ecological corridors</li> <li>Lack of unified management of visitor centers</li> </ul>
<p><b>OPPORTUNITIES</b></p> <ul style="list-style-type: none"> <li>Itinerant visitors center</li> <li>Innovation center</li> <li>Partnerships with local public and private institutions</li> <li>Space for workshops, lectures, cinema, scientific and cultural events</li> <li>Experience Design at the Visitors Center, especially on the trail</li> <li>Donation requirements list</li> <li>IMA - UFSC partnership</li> <li>Surrounding community</li> <li>Thematic Subzoneamento</li> <li>Service Design</li> <li>Monitoring by VANT'S and drones</li> </ul>	<p><b>THREATS</b></p> <ul style="list-style-type: none"> <li>Growth of the urban area near the park</li> <li>Domestic animals threatening protected species</li> <li>Anthropic actions</li> <li>Lack of partnership with the local community</li> <li>Difficulty of school visits</li> <li>Constant change of park management</li> </ul>

[Table 1] SWOT analysis of Serra do Tabuleiro State Park Visitors Center.

A stakeholders map visually represents the involved ones in the system and clarify the complex environment visualization that surround most of the services, allowing to understand the way groups relate and interact to each other revealing motivations and interests of each group (Stickdorn; Schneider, 2010). From the information collected in the exploratory phase and from non structured collective interviews with the leaderships of IMA and staff/collabora-

tors of the Visitors Center, it has been elaborated the stakeholders Serra do Tabuleiro State Park map of the Visitors Center, as seen in Figure 2. This map presents user and worker's core, as well as characters who impact directly and indirectly in this service. From its interest's analysis and the way that these groups relate to each other it was possible to identify latent needs, solution opportunities and possible partnerships.



[Figure 2] Stakeholders map of Serra do Tabuleiro State Park Visitors Center.

After the analysis completion described above a session of brainstorming was made. This technique is widely used in design processes. It consists of an exercise that aims to stimulate group discussion and inspire many ideas generation (Stickdorn; Schneider, 2010). The objective of this brainstorm session was to generate solutions based in the problematic. As a result, it has been established the main areas of work: design acting as user experience inside the Visitors Center and the development of a new social interaction with the Visitors Center surrounding community through the creation of an open innovation environment in the Serra do Tabuleiro State Park Visitors Center.

#### 4.3. Open innovation environment in Serra do Tabuleiro State Park Visitors Center.

After the analysis, a solution was suggested: the creation of an open innovation environment developed through design (Figure 3). Projecting products, services and technologies that improve the visitors' experience and collaborators of the CU, and promote the local environmental and cultural patrimony conservation generating income and awareness, fostering local and sustainable development. The creation of this innovation environment aims to empower new social entrepreneurs in the local community from:

- Identification of new services and products to be developed and cocriated by local community;
- Empowering of the local community via workshops that aim cocriating new environment education products/services and products for a future thematic store at the Park;
- A support skilled employee available and all the equipment needed for the development of these new products and/or services;
- Public and private sector partnerships;
- Empowerment of sustainable companies for local development.
- Broadening knowledge, with the availability of an event location for social, artistic, cultural and scientific education events.

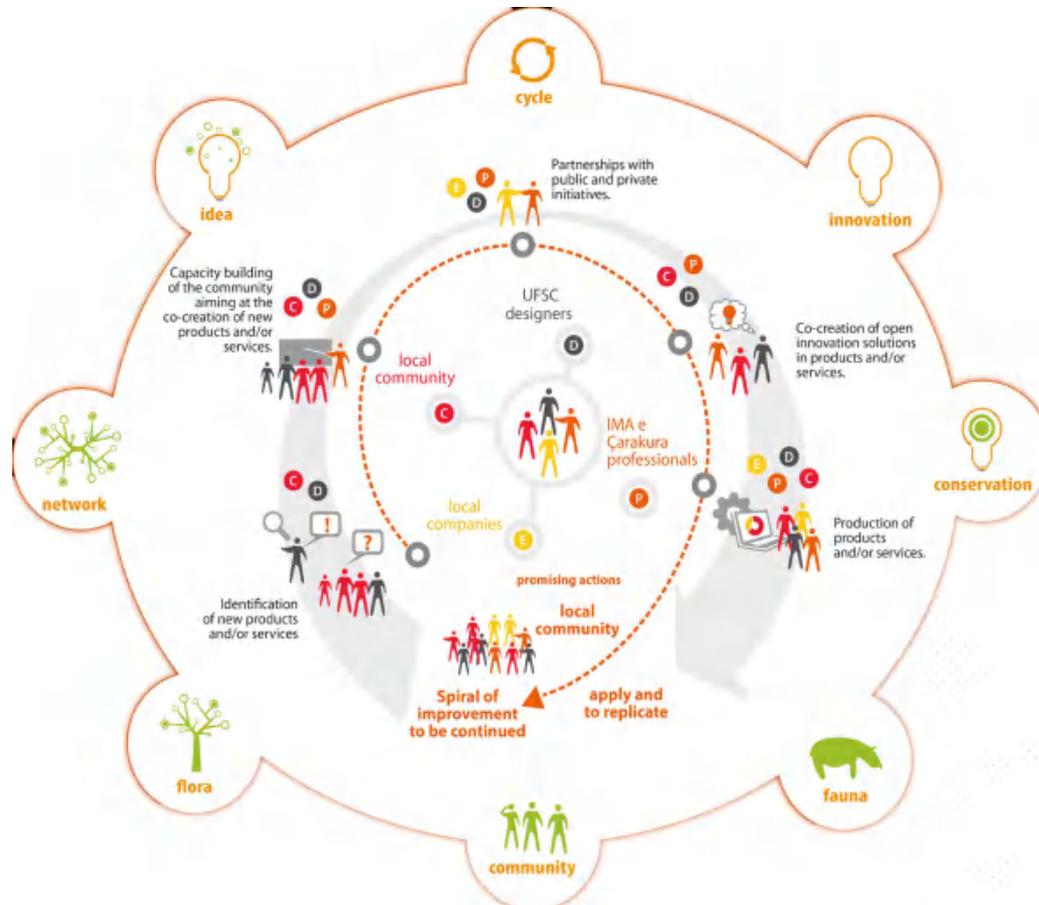
Because of the complexity of the challenges faced in the CU management, it is necessary the construction of a partnership among the society segments, aiming to explore all the social innovation potential (Howaldt et al, 2017). In this case study the segments involved are:

- Public sector: represented by IMA and UFSC (Federal University of Santa Catarina), which promote new ways of organization, coordination and knowledge and establish a network of providing partners of services and resources. The university participates in a strategic and operational way, aiming to tighten the bonds between the community and the Park. The IMA contributes with environmental management knowledge and CU's management. This partnership is fundamental for an adequate and responsible innovation in the CU's.
- Private sector: regional entrepreneurs, providing resources and developing new forms of economic interchange.
- Community sector: local residents of Serra do Tabuleiro State Park Visitors Center region and local com-

munity associations, contributing through their talents and skills in the cocriation and coproducing of new products and/or services (Pradel Miquel et al., 2014), using their skills to promote change through the ability to project what everybody has inwards (Cipolla; Moura, 2012).

- Third sector: Çarakura Institute, an NGO and an OSCIP (Civil Society Public Interest Organization), contributing with their experience in environmental education and CU's management.

This whole process should be conducted in a cocriative way, having the design an important role of connection and viabilization of a new possible scenery, valuing knowledge and stimulating the skills of all stakeholders involved (Manzini, 2017).



[Figure 3] Open innovation environment in the Serra do Tabuleiro State Park Visitors Center.

## 5. CONCLUSIONS

In this research, the systemic approach has potentialized a broader view of project, considering the wider implications and impacts that its solution might have in the system as a whole. With this in mind, it was necessary to analyze the inter-relations and the interdependencies and to involve employees, collaborators, partners and local community in a collaborative way, widening the skills and knowledge of the characters involved (BEST, 2012; Krucken, 2009). From the inter-relation and interdependency analysis it was possible to potentialize the creation of collaborative local networks.

The contribution of a systemic approach has occurred as means for a better understanding of the context, composed by complex problems that involve multiple variants, such as: environmental, social, cultural and economic factors. It has also promoted the identification of opportunities, found in the interactions and relations among characters involved and in the local resources, as well as in the pursuit for sustainable solutions. The systemic approach is particularly interesting in social innovation, since it can potentialize a collaborative process, the value cocriation, new networks and partnerships, and in new local product production. The possibility of skill utilization, abilities and resources of the own community tends to be a more effective and durable solution in social innovation.

According to Buchanan (2001), the complexity of contemporary challenges such as the CU's problematic has offered designers to work in higher intervention scales in a strategic level. The design management contributes in the identification of opportunities from discovery and interpretation of the involved subjects, and in the formulation of a strategy (Mozota, 2011; BEST, 2012). For this purpose, some strategic tools have been used, such as: stakeholders map, SWOT analysis and solution brainstorm.

With the cocriation of an open innovation environment in the Serra do Tabuleiro State Park Visitors Center it is expected a new relationship between the local community and the Park, oriented by harmony among environmental, social and economic interests.

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## **MAPPING & CLASSIFYING BUSINESS MODELS TO REPLACE SINGLE-USE PACKAGING IN THE FOOD & BEVERAGE INDUSTRY: A STRATEGIC DESIGN TOOL**

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### **ABSTRACT**

Ocean plastics is threatening marine life and entering the food chain. Single-use packaging (SUP) represents a major share of ocean plastics, thus intervention is necessary. This paper explores Product-Service Systems (PSS) business models to replace SUP with reusable packaging (RP). Literature shows that RP offers environmental advantages over SUP. However, a classification system of RP business models is missing. This paper aims to fill this gap. Case studies of RP business models are analyzed. A theory building approach led to developing a classification system and clustering case studies in archetypal models. Then it's tested with 12 design students to validate it as a strategic design tool. The outcome is classification system and 15 archetypal models of RP systems, that provides an overview of RP solutions and is usable as a strategic design tool. The tool can be used by companies and designers to identify business opportunities and aid in shifting business models from SUP to RP systems.

Key Words: Product-Service Systems; Ocean Plastic; Single-use Packaging; Reusable Packaging; Business model

## 1. INTRODUCTION

The presence of packaging in the ocean represents a global system failure. The Ellen MacArthur Foundation (2016) estimates that by 2050 there will be more plastics in the ocean than fish. Plastic pollution is causing physical/chemical contamination, posing risk to human and environmental health (UNEP, 2014). Plastic packaging is a major source of ocean plastics (UNEP, 2014), an industry that is almost entirely single-use packaging (SUP) (EMF, 2016). Several strategies have been proposed to address this problem. Among these, it is considered crucial to shift from single-use to reusable packaging systems (RP), and thus preventing plastics to be released into the environment. WRAP has set targets of making 100% of plastic packaging produced by the UK reusable, recyclable or compostable by 2025. And, to “eliminate problematic or unnecessary SUP through redesign, innovation or alternative (re-use) delivery models” (WRAP, 2018).

The European standard BS En 13429:2004 defines reusable packaging as “Packaging component which has been conceived and designed to accomplish within its life cycle a minimum number of trips or rotations in a system for reuse” (EUR-Lex, 2004). Previous studies (Albrecht, Broedersen, Horst, & Scherf, 2011; Golding, 2002; Wood, G., Sturges, 2010) reported that RP possess great advantages over SUP if it is efficiently designed for this purpose. The more RP is circulated, the higher the environmental benefit will be as it eliminates the need for new packaging (Albrecht et al., 2011), and use less resources (Albrecht et al., 2011; Bader Babader, 2015; Golding, 2002; Lee et al., 2008). If the re-use system is continuously intensified, the business operators can reduce operation and disposal costs because they are economically incentivized to reuse and recycle more. However, there are some limitations associated with RP, such as that the containers most often need to be collected, transported and washed between every trip, with linked water and energy consumption (Albrecht et al., 2011).

In this context it is promising to look at the concept of Product-Service system (PSS), defined as the “result of an innovative strategy that shifts the centre of the business design and sale of physical products only to systems offering products and services that are jointly capable of satisfying a given customer application.” (UNEP, 2002). While there are emerging innovative PSS that provide food and beverages RP systems, a comprehensive classification system is missing.

This paper aims at filling this knowledge gap by putting forward a classification system, and by exploring how this can be used to support companies and practitioners in ideating RP systems. The assumption is that this classification system can provide support in understanding the wide variety of RP systems and enable decision making and strategic design thinking.

The paper is structured as follows: Section 2 describes the methodology adopted in this research. Section 3 and 4 present, respectively the classification system and its archetypal models. Section 5 discusses applications of the classification system and its design implications. Section 5 provides some concluding remarks.

This paper is based on a master's dissertation thesis conducted at Brunel University London (Mansour, 2018).

## 2. RESEARCH METHODOLOGY

Three main research activities were conducted. Firstly, 21 case studies were collected and analyzed to identify their key characteristics. Secondly, different versions of the classification system were developed using the identified key characteristics of PSS and RP. Each version of the classification system was evaluated and used to develop the final version of the classification system and the archetypal models. Thirdly, the new classification system was then tested in a pilot study with 12 design students to assess its usefulness and usability. Results were analyzed and used to refine the classification system. In particular, the methodology was structured as follows:

- Development of the classification system: Case studies collection and analysis on PSS that use RP: To understand the different characteristics and variety of existing models, a diverse number of 21 existing and pilot case studies were collected. Classification system development: The key characteristics of the case studies' PSS models were analyzed and used to develop the first version of the classification system. Case studies population: Collected cases of RP were positioned in the classification system. Clustering and identification of archetypal models: Cases with similar characteristics were grouped in clusters defining archetypal models of PSS applied to RP (15 archetypal models in total).
- Testing of the classification system: A workshop with design students was conducted and activities were structured as follows. Testing ease of use: Participants were asked to position existing case studies on the classification system, in order to provide evidence that the classification system can be easily used to correctly map cases. Testing the usefulness: Participants were given the brief to replace a SUP solution with a RP system. They were asked to use the tool to identify market gaps and opportunities, and brainstorm alternative RP systems.
- Refinement of the classification system: After collecting feedback from participants, the classification system was developed further.

### 3. THE CLASSIFICATION SYSTEM

The proposed classification system [Figure 1] was developed to include the key identified primary characteristics of RP directly related to the offer being provided to the end-consumer. The characteristics were identified based on the unique features that differentiates each case study. The features were extracted, mapped out across all the case studies, and grouped together according to the feature type. This led to discovering the key characteristics that identifies a RP system. The key selected characteristics are: container ownership, delivery method, location, consumption context, value proposition & payment structure, and environmental sustainability potential. It was found that the six primary characteristics can be arranged in two groups.

The first group was placed on the y-axis and it includes: container ownership, value proposition & payment structure, and environmental sustainability potential. The container can be owned by the ‘consumer’, the main service ‘provider’, or a ‘business’ that is a client of the provider and deals with the consumer.

The second group was placed on the x-axis and it includes: the location and context of consumption. The location of the end-user during purchase has a great impact on the context the food/beverage is consumed, and user behavior regarding use and disposal. For example, stores and open public environments are mostly characterized with on-the go and having unpredictable consumption habits and thus provides more challenging collection. While home and closed public environments are mostly characterized with on-site consumption. The delivery method was included as an add-on characteristic to simplify the classification system’s layout due that it can be implemented in any location. For example, automated dispensers can be used at home or in open public environments.

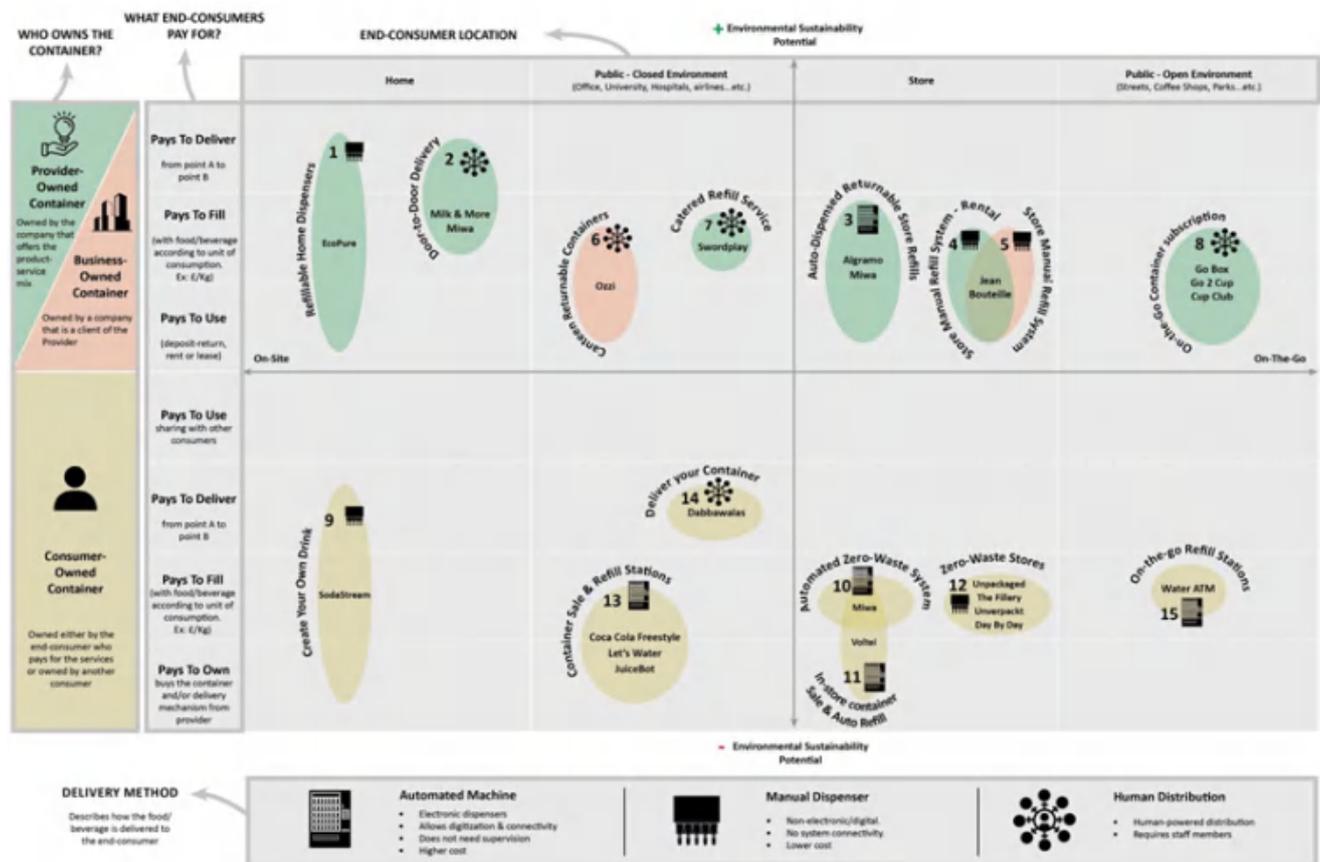


Figure 1 Classification system with case studies clustered in archetypal models.

### 4. THE ARCHETYPAL MODELS

The ‘archetypal model’ is a term that describes a model of a certain pattern of ideas with similar particular characteristics, and it is used in this research to describe a certain type of business models. After the classification system was developed, it was populated with the collected case studies. They were grouped in clusters depending on their offer model. This led to the identification of 15 archetypal models of PSS using RP in the food and beverage sector [Table 1]. The cases within each archetype are not exactly identical. However, their key characteristics, such as the value proposition, context of use, container ownership, delivery method and location grouping are similar. Cases that provide more than one business offer can be positioned in different places on the map. Each archetypal model was illustrated using a stakeholder system map, showing the stakeholders involved in the system and their relations. As an example, here we provide a more detailed description of archetype #8, and its stakeholder system map [Figure 2].

Table 1 the identified archetypal models and their summarized description. (Mansour, 2018)

No.	Archetypal Model	Consumer pays to:
1	Refillable Home Dispenser	Use, fill & deliver provider-owned container at home through manual dispenser owned by the provider. E.g. EcoPure(Ecopure, 2018)
2	Door-to_Door Delivery:	Fill & deliver provider-owned container in user's home through human distribution managed by provider. E... Milk & More(Milk&More, 2018)
3	Auto-Dispensed Returnable Store Refills	Use & Fill provider-owned container at the store through automated machines owned and managed by the provider. E.g. Algramo(Algramo, 2018)
4	Store Manual Refill System Rental	Use&Fill provider-owned container at the store through manual dispenser owned and managed by the provider.
5	Store Manual Refill System	Use & fill business-owned container at the store through manual dispenser owned by the store, and services managed by the businessand providerE.g. Jean Bouteille(Jean Bouteille, 2018)
6	Cabteen Returnable Containers	Use & fill provider-owned container in closed public environments through human distribution managed by the business provider Eg. Ozzi(Ozzi, 2018)
7	Catered Refill Service	Fill provider-owned container in closed public environments through human distribution. E.g. Swordplay (Yoo, 2017)
8	On-The-Go Container Subscription	Use & fill provider-owned container in open public environments through human distribution. E.g. GoBox (GO Box, 2017)
9	Create Your Own Drink	Own, fill & deliver container at home through manual dispenser owned by the consumer. E.g. SodaStream (Soda Stream, 2019)
10	Automated Zero-Waste System	Fill consumer-owned container at the store through automated machines owned and managed by the provider. E.g. Miwa (Miwa, 2018)
11	In-Store Container Sale & Auto Refill	Own & fill container at the store through automated machines owned and managed by provider E.g. Voltrei(Broliato 2017)
12	Zero-Waste Store	Fill a self-owned container at the store through manual dispensers owned and managed by the provider. E.g. Unpackaged (Unpackaged, 2017)
13	Container Sale & Refill Station	Own & fill a container in closed public environments through automated machines owned and managed by the business. E.g. CocaCola Freestyle (CocaCola, 2017)
14	Deliver Your Container	Deliver the consumer's self-owned container in closed public environments through human distribution managed by the provider. E.g. Dabbawalas (Henderson, 2017)
15	On-The-Go Refill Station	Fill the consumer's self-owned container in open public environments through automated machines owned and operated by the provider E.g. Water ATM (Purohit, 2015)

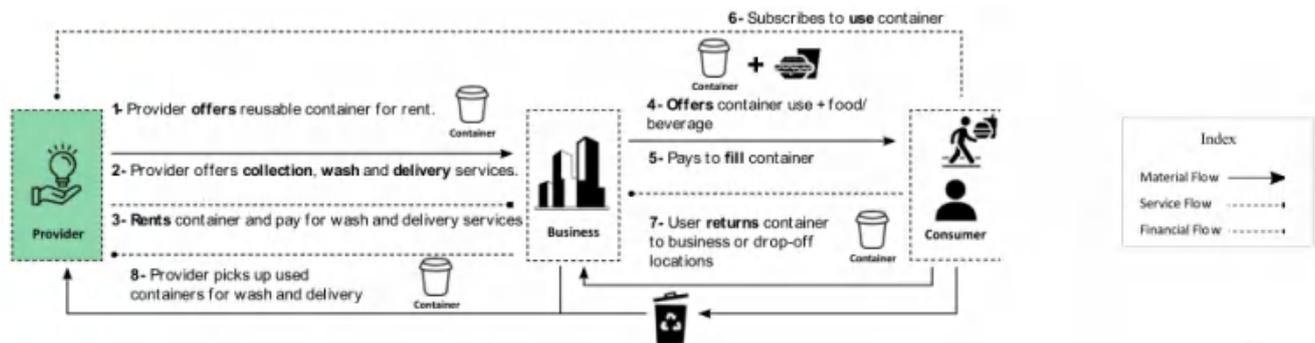


Figure 2 Archetype 8. Offering containers and food sale on-the-go in public open environments through human distribution. The PSS provider offers reusable containers to businesses that provide on-the-go food/beverage to consumers in open public environments (e.g. coffee shops and streets). The business pays the provider a regular subscription fee for container use, while the provider maintains ownership of the containers. The provider provides the services of wash and delivery. Consumers pay the business for the food/beverage and the provider for the container use. Consumers return the used containers to the business or drop-off locations set up by the provider, who then collects, washes and re-delivers the containers back to the business. ‘Go Box’ is a practical exemplification of this archetypal model.

### 5. POTENTIAL APPLICATIONS OF THE TOOL

The pilot study with 12 design students provided an initial validation of the potential applications of the classification system to support companies and designers in shifting the business model of a company from SUP to a PSS with RP. In particular the classification system can be used as a strategic design tool to:

- Get an understanding of the different RP systems and their characteristics.
- Identify opportunity areas in a market through positioning existing offers and identifying gaps.
- Develop possible alternative delivery models to deliver the food/beverage to consumers through a RP system.

Users of the classification system can be companies who are looking to shift from SUP to RP systems or enter into new markets, or start-up businesses who are looking to enter the market and position themselves to fill market gaps. Moreover, designers who are working with food/beverage manufacturers, packaging manufacturers or retailers can use it to inform their design and decision-making process.

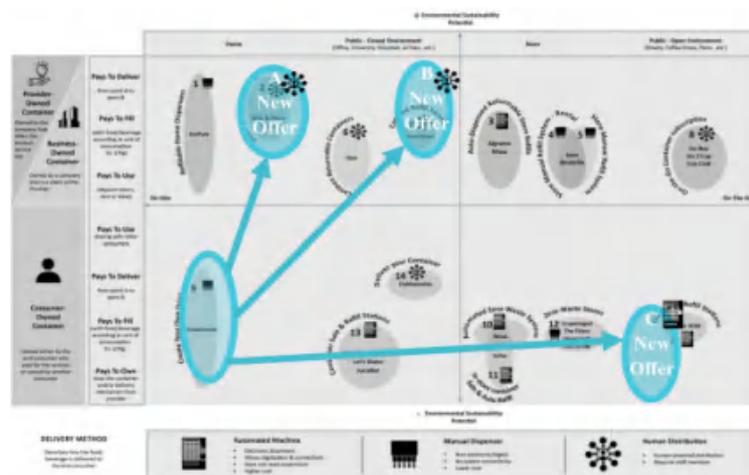
Reflecting on the workshop results, the classification system can be used to reposition existing offers into other parts of the map, generating in this way new offers [Figure 3]. For example, the company ‘SodaStream’, which sells soda-making machines to users for home use, can enter new markets by offering:

- Delivery and collection service of pre-filled company-owned containers to the users’ homes (Archetype #2).
- Delivery and collection service of pre-filled company-owned containers to consumers at offices (closed public environments), with the consumer paying for the delivery and the beverage content.
- Automated machines on the street (open public environments) with users paying to fill their own containers, or buy a container from the machine to be filled when desired.

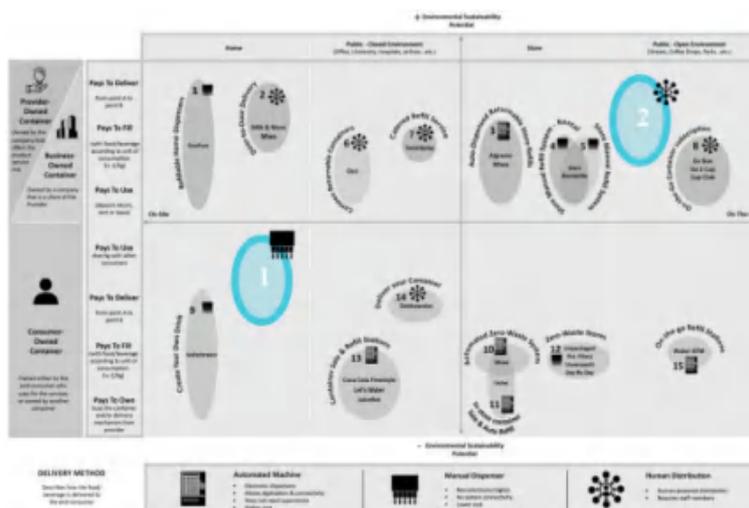
Moreover, the classification system can be used to generate new concepts for RP systems [Figure 4]. For example:

Concept 1: Stores can deliver food products to the consumer’s home using manual dispensers in a minivan and the consumers dispense the amount of food needed in their own containers and pay to fill and deliver only.

Concept 2: Providing on-the-go meals in an open public environment (e.g. park); the consumer orders the ready-made meals and the provider delivers the food in a provider-owned container. The provider then collects the container once they are done with the meal.



[Figure 3] Example of how the classification system can be used to reposition an existing offer and generate new types of RP systems.



[Figure 4] Example of how the classification system can be used to generate new value propositions based on RP systems.

## 6. CONCLUSION

This research aimed at identifying and mapping existing RP alternatives to replace single-use food and beverage packaging, as well as exploring how a classification system can be used as a strategic design tool.

Case studies of food and beverage RP systems were collected and analysed. Main characterising dimensions were extracted from each case and used to create a classification system capable to comprehensively capture all potential RP business models. Case studies were then positioned on the classification system and grouped together into

clusters. This led to the identification of 15 archetypal models of RP systems. The pilot study provided an initial validation of the effectiveness of the classification system: despite the lack of a visually and graphically developed step-by-step user guide, most participants were able to successfully classify the provided case studies.

The pilot study also provided promising indications about the ability of the classification system to support practitioners in: understanding the variety of RP systems; perform market analysis by positioning existing competitor offers; identifying market opportunities to move away from SUP and supporting the generation of new ideas for RP systems. All participants evaluated the classification system to be very useful in providing an overview of possibilities to help eliminate SUP and in finding market gaps and supporting idea generation. Participants generated a multitude of concepts from the use of the classification system and the archetypal models.

Building upon the basis of this pilot study, the next step is to engage with practitioners and companies in the food/beverage packaging sector to provide a more in-depth assessment of the classification system and its applications.

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## **CLIMATE SWITCH: DESIGN LED SYSTEM RESPONSE TO CLIMATE CHANGE INDUCED BY CONSUMPTION**

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### **ABSTRACT**

The paper looks at Climate Change as a wicked problem through the lens of Systems Thinking as part of an academic course. The aim of the research was to understand the underlying causes of climate change and find innovative ways to approach the problems caused by the existing consumerism driven industrialization and societal mentality. The resultant solution was the utilization of social movement and a framework of behaviour change models contextual to each individual for maximum impact. It would enable and nudge the common masses towards the path of sustainable consumption.

Keywords: Climate Change, Design for Behaviour Change, Systems Thinking

## INTRODUCTION:

The goal of Systems Design Course was to apply systems thinking and design thinking to real world problems and explore opportunities through an organic explorative manner. The course was carried out as a part of the coursework for Masters of Design (Product Design) at National Institute of Design (NID) Ahmedabad, India and had a duration of 12 weeks. The course usually culminates in a varied outcome right from methodologies to working prototypes. The result of the course is not governed by tangible or intangible outcome but focuses more on creation of new knowledge, methodologies and ways of tackling a wicked problem.

## RESEARCH PROBLEM AND GOALS:

The initial direction started with the problem of human generated waste, at close quarters in the city of Ahmedabad, India to perceive how a systemic intervention can play a role in the improving the situation. The problem shortly opened unto a macro level wherein industrialization, consumerism, climate change came into the radar of the research. The research problem started with the problem of waste in general, slowly divulging into waste and the ecosystems which generate it and are affected by it. The final research brief was to conduct extensive research that would help devise a framework that can bring about behaviour change in both consumers and producers, through education and awareness to combat climate change. In terms of the eco systems which are affected by waste, natural as well as man-made ecosystems (culture, economy etc.) were analysed. Waste is residue or by product of any process. In this context, the process of human progress over the years has created greenhouse gases leading to climate change along with polluting the earth's systems of water, soil and air. Whereas, there is no waste in nature which have inspired the concepts of cradle to cradle and circular economy. After studying varied sustainable options available as opposed to the wasteful way of linear economy, it was established they are not widely in practice to counter the climate change. The resistance was due to the economic risk which it poses by shifting the business models or company policies. It was hence ascertained, there is an urgent need to shift the way we produce, consume and dispose goods. This shift has to be initiated ideally by the industry and government. However, in the face of inaction and lack of consensus by these parties, the paper explores how consumers can bring about this change.

In this light, to develop an intrinsic motivation for consumers, theories and methods in behaviour change were explored. The solution ecosystem was drafted keeping in mind the prominent ongoing trends in fields of social, geological, political and economic fields. The goal was to create a conceptual ecosystem of solutions which would demonstrate how consumers could be nudged into sustainable consumption and in turn drive the government and industry to follow.

## THEORETICAL BACKGROUND:

Systems thinking<sup>1</sup> can be explained as a disciplined approach for examining problems holistically and accurately. It encourages insightful questioning and not superficial solutions. Systems thinking often involves observation of events and data, to identifying behaviour patterns, and finally surfacing the underlying structures that drive them. By understanding and changing structures that are not serving well (including mental models and perceptions), one can expand the choices available and create more satisfying, long-term solutions to wicked problems. In general, a systems thinking perspective requires curiosity, clarity, and the willingness to see a situation more fully, to recognize that everything is interrelated. If the problem is chronic, not a one-time event, if the problem is familiar and has a known history or else if people have unsuccessfully tried to solve the problem before. The principles of systems thinking suggest that there are no perfect solutions; and that the choices will have an impact on other parts of the interconnected system. By anticipating the impact of each trade-off, one can minimize its severity or even use it to one's advantage.

This paper aims at understanding the accelerated growth of industrialization and how it's altering Earth's surface, atmosphere, oceans and systems of ecological recycling at an unforeseen rate. In this Anthropocene age, the lack of firm commitment to reduce and reverse the effects of climate change have been rigorously discussed by several concerned groups ranging from NGOs, private organisations to governments. However, these efforts have been criticized for not meeting either the urgency of the crisis or the volume to which it needs to be addressed. In cases where they are successful, they seem to be insufficient to mitigate the problems. UN Report<sup>2</sup> (IPCC 2013) states an alarming evidence that with current efforts we are not only going to pass the amicable two-degree target but cross three degree change by 2100. The world stands at a crossroads of adopting sustainable choices for development or facing adverse climate changes with the current status quo. At the same time, the ever-growing middle class in India is being empowered for consumption, where 1/10th of the world population resides and effectively 1/5th of the world population will be middle-class consumers by the year 2030. Current annual expenditure growth will make

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<sup>1</sup> Systems thinking – Why, What, When, How by Micheal Goodman, [www.systemsthinker.com](http://www.systemsthinker.com) (13th March, 2019)

<sup>2</sup> IPCC, 2013: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp.

India the third-largest consumer market by 2025<sup>3</sup>. The projection stands true for similar unprecedented expansion of the global middle class that will put a tremendous strain on the natural resources available. The situation arose as a result of globalization and improved technology which drives the masses for consumption.

In this light, the paper suggests an alternative to the ongoing burgeoning efforts being taken by industries and governments. It shifts the onus to consumers who are in a state of disavowal and aims to enable them to practice and spread sustainable consumption. This in turn will push the industries to respond to the demand of sustainable products by changing their wasteful linear setups. The framework designed to enable this switch in the consumer's consumption is based on BJ Fogg's Behaviour Model<sup>4</sup> and design for behaviour change principles. The Fogg Behaviour Model shows that three elements must converge at the same moment for a behaviour to occur: Motivation, Ability, and a Prompt. When a behaviour does not occur, at least one of those three elements is missing.

## **ACTION RESEARCH:**

To deep dive into this problem, the case studies in India related to climate change were extensively studied both in-situ and through secondary means. These ranged from tanning factories in Kanpur\*, India, land encroachment in Assam – Kaziranga, burning coal mines of Jharia in Jharkhand\*. Some very interesting multidimensional linkages were uncovered. For example, the expanding tea gardens in Assam<sup>5</sup> leading to deforestation; reportedly have very poor sanitation and hygiene conditions for women workers. This also causes them to be subject to verbal, physical and sexual abuse. Industrial tea plantation can causally be linked to poor social well-being of women. Another example studied how, green revolution ushered into India, increased sugarcane production. However, this led to stress on the local water resources and the local politicians accumulating wealth. More case studies<sup>6</sup> unfolded throughout different regions in India - burning of forestlands in hill country, feeble electronic waste management systems in industries and instances of exploitation of cheap labour in slums where the workers had little to no idea what their means of livelihood was doing to their body. Most case studies were from the India, this more or less was a geographical system boundary for observation.

A few of such case studies which were in and around Ahmedabad, were taken up for slow ethnography to understand the nature and interactions within the micro-systems. Amongst them, Alang<sup>7</sup> (Gujarat), world's biggest graveyard of decommissioned merchant ships witnessed a conversion of a peaceful agrarian village into a noisy and polluted industrial town. Few miles away from Ahmedabad, Pirana, a mountain of waste accepting 3600 tonnes of waste every day provides unfamiliar toxic jobs of rag picking to migrants as well as natives jeopardizing their health and hampering social development. Inquiring further, Indroda, a village based on the banks of river Sabarmati lost its agricultural cropland due to urbanisation which led to a wicked cycle of sand mining mafia, unemployment of farmers and destruction of river bed. The interview with the stakeholder's uncovered more aspects to these problems. It was observed at Alang and Pirana sites, the population of migrant workers from Bangladesh and Uttar Pradesh was alarmingly high, they reported their daily struggle of livelihood.

India amongst many other developing nations has experienced rapid unplanned growth in many sectors. This was driven by aggressive local or global policies for accelerating growth – leading to a sudden rise in consumption. This adoption of rampant global consumption in a local infrastructure which isn't capable of handling the consequences was devastating. An example for this could be how the fast food culture has been on a rise. Fast food is resource intensive compared to healthier fresh cooking practices. Initially introduced only for the higher class, the fast food chains soon were looked upon as aspirational symbols. Many years later with price tactics, a large population from the middle class affords and consumes fast food too. Leading to a drastic change in the food ecosystem.

Interviews with the stakeholders across public, industry, government and academia testified how all of them are connected to climate change. The first-hand experiences drove a very deep understanding and empathy to the research. A movie screening of the movie "Home" <sup>8</sup> by Yann Arthus-Bertrand was held to garner reaction of people who are perhaps not subject to such intensive exposure to these case studies and gauge the reaction of the audience. A cinematic compilation of areal footages and strong narratives, this documentary is the depiction of how Earth's problems are all interlinked. Based on this learning, a questionnaire/survey was designed for mass circulation to gather more responses from users.

## **SYNTHESIS & INFERENCES:**

All of these studies revealed a generic pattern. This pattern was of disparity, wastefulness and turmoil, a resultant mainly of human wants. The ever-increasing wants and needs of consumers that thrusts the industry to produce

<sup>3</sup> Singhi A., Jain N. (2017 March 17) The New Indian: The Many Facets of a Changing Consumer from <https://www.bcg.com/en-in/publications/2017/marketing-sales-globalization-new-indian-changing-consumer.aspx>

<sup>4</sup> BJ Fogg (2018) What Causes Behavior Change? <http://www.behaviormodel.org>

<sup>5</sup> [https://www.academia.edu/12764834/The\\_Socio-economic\\_and\\_Health\\_Challenges\\_of\\_Labourers\\_in\\_the\\_Tea\\_Gardens\\_of\\_Assam](https://www.academia.edu/12764834/The_Socio-economic_and_Health_Challenges_of_Labourers_in_the_Tea_Gardens_of_Assam)

<sup>6</sup> Ghawde.P (2017 November 28) from <https://climateswitch.wordpress.com/category/uncategorized/>

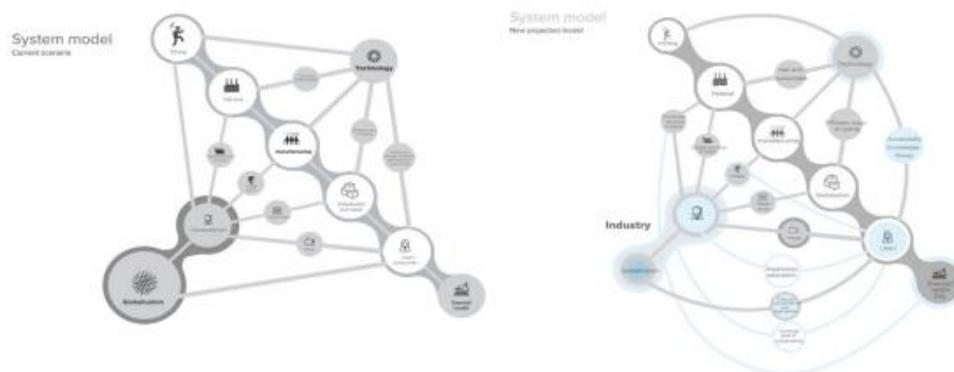
<sup>7</sup> Lloyds T. (2016 November 18) Breaking Bad? The Story of Alang Ship Breaking Yards <https://www.tuscorlloyds.com/alang-shipbreaking-yards/>

<sup>8</sup> Home documentary by Yann Arthus at [www.culturechange.org/cms/content/view](http://www.culturechange.org/cms/content/view)

cheaper, faster and more to meet the consumer demands. This was a trend identified in western countries too, during the Industrial age\* wherein the ease of production of good led to reduced prices. This in turn increased the consumption of these goods driven strongly through improved media channels. Hence, Consumption was then targeted to be studied as a design problem, wherein the who, why, where, how were studied to understand how the consumerism movement gathered stronghold. Consumerism is a social and economic order that encourages the acquisition of goods and services in ever-increasing amounts. With the industrial revolution, but particularly in the 20th century, mass production led to an economic crisis<sup>9</sup>: there was overproduction—the supply of goods would grow beyond consumer demand, and so manufacturers turned to planned obsolescence and advertising to manipulate consumer spending

Synthesizing the above case studies through visual mapping and analysing inputs from different stakeholders, led to an organic process of inferences. A system of solutions emerged towards individual-level decision making. A paradigm was established, wherein there was a need to bring design-led reaction of these consumers. Linkages of current influences in consumer's consumption between globalization, consumerism, manufacturing and technology was understood. The above four being the major facets of the economy, a conceptual model around the process of manufacturing, logistics, production, marketing, consumption and disposal of the goods the world consumes was formulated. This resulted in the current system's map and helped in coming up with an ideal model where the users play an active role as in fig. 1.

The aforementioned exercise of the public screening of documentary led to three major insights. Firstly, the lack of in-depth knowledge about the climate change issue, secondly the inability to 'take action' (state of disavowal) due to lack of contextual information and thirdly, a state of willingness to change as expressed through post screening discussions. The above insights were validated by a survey taken with 200+ responses from varying demographics. Our observations derived a general willingness within the consumers to change their consumption habits but for them the process or the means were unclear. It was also identified that people are in a varying state of awareness or action when it comes to Climate Change. The categories could be described as: the nay sayers/deniers, ignorant, aware, empowered and ideal. It was established that a different strategy of behaviour change was required for each of these states of minds of user. The relevant actions and tasks were designed for people to make a switch from their current state to the next. (E.g.: A person who is currently aware but needs to know how to lead a more carbon neutral lifestyle). A need was realized for a tailor-made contextual program for every individual or a group of similar individuals to help them transition on their journey to a more sustainable behaviour.



[Figure 1]: Old and new system map

## RESPONSES:

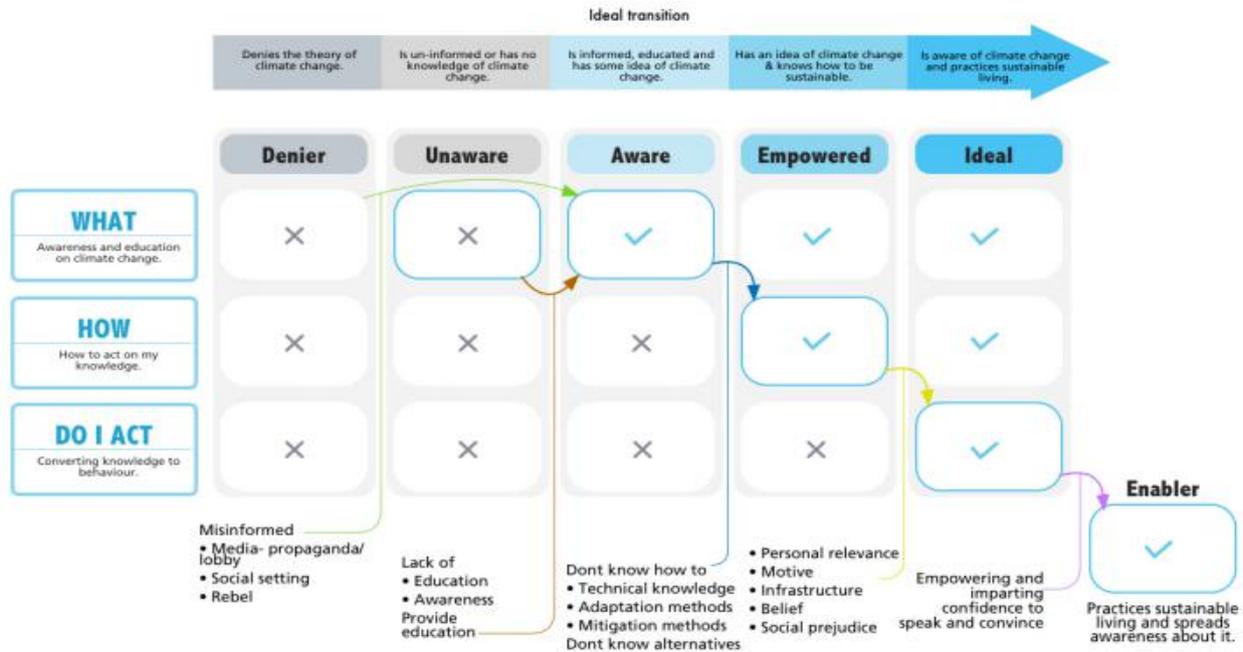
The solutions were developed after understanding and consulting various environment institutions initiatives in India<sup>10</sup> (CEE, AMC, ECS, NEERI, TERI). This gave a clearer idea as to which areas have been explored and which challenges need to be ironed out during execution. Consequently, data from behaviour change theory cast a light on new avenues to dramatically change the approach to tackle the man-made climate problem. In particular, the Fogg's Behaviour Model has inspired the design of a model of behaviour change- the Switchboard (fig.2). The switchboard is a tool for people to contextually interact wherein they can identify themselves based on their current behaviour and plan the transition (switch) to a more sustainable lifestyle. It will be accessed through the climate switch social challenge campaign.

<sup>9</sup> Fordism: Economic crisis and mass production by Micheal Husson at [www.cadtm.org/Economic-crisis-and-global-disorder-An-increasingly-chaotic-globalization](http://www.cadtm.org/Economic-crisis-and-global-disorder-An-increasingly-chaotic-globalization)

<sup>10</sup> Institution for environment education in India, <https://www.india.gov.in/people-groups/community/environmentalists/institutions-environment-education-and-research-india>

For the young generation an interactive board game was designed to simulate the system complexities of the climate change scenario between the major stakeholders; the government, educators, common man (users) and industries. The idea was to educate them on the relations between the various stakeholders and effects they can have on each other, by letting each player taking up a stakeholder type and their journey throughout the game to win, either enhancing or diminishing another player's growth.

A system was designed through the lens of metadesign<sup>11</sup> to enable social movement to take action and promote sustainable consumption. The project compels users at an individual level, to introspect the present state of affair of climate change and speculate for a future which will be governed by conscious consumers, demanding sustainable products and solutions as a response.



[Figure 2] Switchboard tool

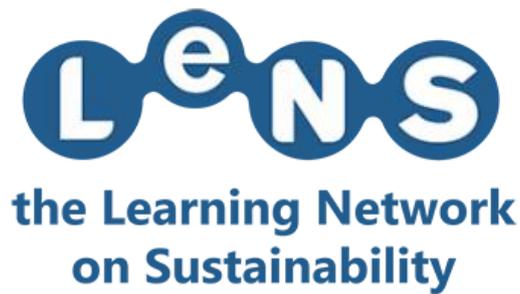
**IMPACTS ON SUSTAINABILITY:**

Our interpretation of sustainability focused on meeting the needs of the present without compromising the ability of future generations to meet their needs. The paper looks at how this can be achieved by empowering them to bring a positive change in the environment they live in. It aims to impact and reverse the cycle of resource consuming and polluting industrial economy driven by consumption from the consumer end. The strength of consumer or market is believed to be the strongest in economics and it is here, where the research proposes the solution. If Climate Switch is to be implemented it will enable many transformations in people's mind and actions, more so it will help newly enabled consumers in developed countries to leapfrog to a sustainable living. This means it aims for a long-term change, not a short term measure or adaptive initiative (as widespread in current industry and government) but a mitigated approach. This is vital as the world population is on a steep rise and only adaptive measures will not suffice to control the climate change effectively.

**CONCLUSION:**

In conclusion, the paper is an attempt for to design alternate policies to the shortcomings of ongoing initiatives. The policy here: 'by the people, for the people', is nothing but a designed social movement which utilizes social norms and nudges the consumer's behaviour to sustainable consumption or climate positive behaviour. It would eventually traverse towards an ideal system of procurement, manufacturing, marketing and sale. This meta-design structure of the solution involves the user in innovative and participative engagement towards a sustainable world and can be applied to other socio-economic issues. This is implied, given the fact that humans are central to most issues. Different institutions across the world all comprise of human beings and they all can be aligned towards the desired change if the behaviour of people driving them can transformed. Thus, the framework which is built around design for behaviour change will ensure the positive change for a sustainable future of the planet and all its ecosystem.

<sup>11</sup> Metadesign thinking as an emergent culture by Elisia Giacardi <https://www.mitpressjournals.org/doi/abs/10.1162/0024094054762098?journalCode=l>



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## **FARM ONTOLOGY: A SYSTEM THINKING APPROACH FOR PLANNING AND MONITORING FARM ACTIVITIES**

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### **ABSTRACT**

Farm Ontology (FO) defines a new and flexible conceptual model used as unique standard in every task of farm modelling. FO considers the farm-system as a whole to achieve its structural and functional aspects in an integrated view. Planning and management tasks are included for a comparative analysis between expected and actual activities. Planning includes simulations of alternative scenarios, whilst management enables practical applications (e.g. operational monitoring, automated controls). FO considers the hierarchical decision levels (strategic, management, operational) and provides information for both ex-ante (comparative behaviour of alternative farming systems) and ex-post evaluations (satisfying traceability and process certification purposes). An efficiency index is computed comparing actual and expected performances, providing an appraisal of different types of Sustainability aspects. FO structure allows to consider, for example, precision agriculture as technological enabler to optimize global farm performance, or the global performance of farming systems in a given region.

Keywords: Farm sustainability, Farm modelling, Precision Agriculture, Decision Making

## BACKGROUND

Despite historical difficulties of ICT acceptance in the agriculture, farmers appear now more available on an opening to these technologies. These the reasons: 1) the revolution of Industry 4.0 is conditioning many approaches of the agricultural sector, in particular as far as the adoption of Precision Farming techniques is concerned; 2) the awareness that digital methods can lead to economic advantages over the medium term, as well as reduce the charge of some bureaucratic tasks (eg certification and traceability); 3) the new entrepreneurial generations are more familiar with ICT and less scared by SSD and MSS digital tools; 4) the need of integrating environmental aspects into many farm decisional processes through tools able to provide the necessary cognitive supports, without the claim of being an expert in the field; 5) the growing interest of local administrative governments in the automated monitoring of farm performances in a territory for policy planning of preventing controls. ICT solutions currently available to farmers for the most part are designed to meet a specific need (e.g. warehouse or livestock management, farm site-specific distribution, etc.) (Pierce and Elliot, 2008). However, they generally preclude the possibility of integration in case the use of more farm management procedures is required. The need to define a more “flexible” conceptual model to be used as unique standard reference in every task of farm modelling is nowadays felt more than ever.

## SCOPE

The paper suggests an approach to share a new “Farm Ontology” (FO) able to define a farm configuration that considers the farm-system as a whole, so one can achieve all its aspects, both structural and functional, in an integrated and holistic view (Mazzetto et al., 2004; Ushold et al. 1998; Martin-Clouaire and Rellier, 2009). In addition, it enables the farmers to include both planning and management aspects (nominal plans vs executed plans), in order to enable a comparative analysis between expected and actual performances within the same computational framework and database. Planning procedures may also simulate scenarios that are alternative to a reference situation, whilst management procedures enables several applications such as the control of the way an operation is performed, the filling of field registers, or the automatic control of some machines (typical of many precision farming applications).

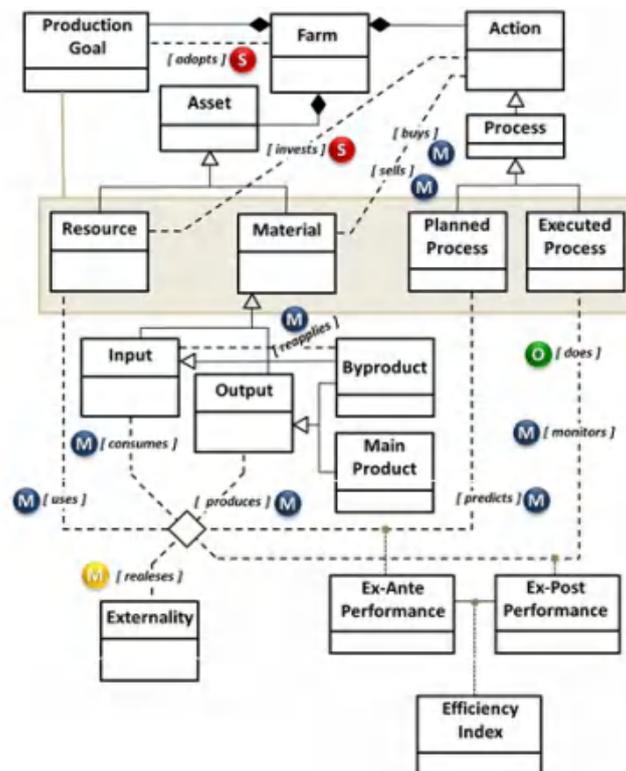
FO is also able to formally express the nature of a decision-making process, distinguishing between the hierarchical decision levels (strategic, management or operational). Each decision type presupposes relationships among different classes of entities. The FO defines the general pattern that binds all the main relationships and entities, regardless of the type of hierarchical decision to be evaluated. FO flexibility lies in the possibility of implementing classes according to increasing levels of detail, according to the hierarchical decision at hand. Major details are typically required by operational decisions (e.g. planning of tractor paths), while taking more nuanced outlines in strategic decisions (investment for a new tractor or adoption of new farming system).

The related farm configurator can be then used to provide information both for ex-ante evaluations to assess the comparative behaviour of alternative farming systems (even supporting the inventory analysis of any LCA application), and for ex-post evaluation for satisfying traceability and process certification purposes.

## APPROACH

The entity Farm can be seen as a collection of Production Goal, Asset, or Action classes, in accordance with the scheme shown by Figure 1 and the definitions given in Tables 1 and 2. The Production Goal generally focuses on the main product targets and the related production protocols, including any possible environmental and/or administrative restriction (e.g. biological apple orchards, grazing system, winery, milk farm etc.). Its definition is the typical result of a strategic decision, but the related implementation requires further details, being a complex interaction among components of the Asset and Action classes. The class Asset defines the Farm Configuration, say the structural composition of any mean used (or produced) at the enterprise.

Assets are then split into **Resource** and **Material** classes, and the latter are in turn divided into **Input** and **Output** classes, depending on the type of relationship an instance of **Material** and/or **Resource** has with an instance of the **Process** class. In addition, **Output** are further divided into **Main Product** and **Byproduct** classes. The formers provide instances destined to the external market, while the latter even includes properties from the **Input** class, thus enabling to consider the recycling of materials within the farm. The class **Action** defines entities and relations resulting from a decision-making process. Some actions regard changes in the availability of new **Resources** and **Materials**. Others focus on the farm behaviour generated by a set of instances of the **Process** class. There are two types of processes: **Planned** and **Executed**, depending whether the task sequence of the process is simply foreseen or has been already actually executed, respectively. Whatever the case, any **Process**'s instance is expected to have one or more relationships with **Asset**'s instances. By definition we can have a **Process** that: a) *[uses]* a **Resource**; b) *[consumes]* or *[produces]* a **Material** (according to its availability status prior and after the process), and c) *[releases]* an **Externality** into the environment, occurring every time a negative impact on the surrounding environment is generated (eg release of harmful or undesirable substances or the creation of noxious effects).



[Figure 1] - General design pattern of the Farm Configuration supported by the FO here proposed. Continuous lines indicate functional or structural relationships. Dashed lines are relationships representing actions (S = strategic; M = management; O = operative) that result from decisions that involve one or more entities. The yellow background of Externality class indicates that the [releases] action can only be partially controlled by the Management, since it cannot be completely eliminated depending also on external factors.

[Table 1] – Main entities provided by the Farm Ontology with related definitions.

ENTITY	DEFINITION
Farm	Geographical and administrative context identifying the farm enterprise
Production Goal	Production orientation defined both by the main target products (what to produce) and by the ways in which production is made (how to produce). It is influenced by climate, environmental and regulatory contexts, sometimes also supported by production regulations and protocols that provide constraints and must guide the subsequent definition of nominal plans.
Action	Any virtual entity, implying a dynamic procedure and determining somebody's or something's behaviour, produced by a decision-making process at the farm.
Process	Action that implements a single treatment (= operation) within the production cycle, aimed at achieving the final product or supporting the farm behavior within predefined environmental or regulatory requirements.
Asset	Any entity with monetary value in charge to the farm administration.
Resource	An asset always available at the farm that can be used by a Process.
Material	An asset that is consumed (Input=factor) or generated (Output=product) by a process. In turn, a product can specialize in a Main Product (when defined as a target by the Production Goal and destined directly to the external market) or in a Byproduct (when it represents an inevitable secondary product not salable - eg crop residues - or an intermediate product to be transformed (reapplies) into a final Main Product - eg milk cheese).
Externality	Chemical or physical event occurring during the execution of a Process generating negative impacts on the environment external to the farm system.
Performance	A numerical index expressing a quantitative evaluation on the behaviour of the farm in relation to a particular domain of interest. It can regard both ex-ante or ex-post behaviours.
Efficiency Index	Dimensionless index quantifying how an ex-post performance meets the prefixed target established by an ex-ante performance.

[Table 2] – Main type of actions defined by the Farm Ontology with related definitions.

ACTION	DEFINITION
Farming System	Strategic action selecting the list of all the possible Production Goals to be realized at the farm.
Nominal Plan	Management ex-ante action selecting the list of all the Process needed to fully achieve a Production Goal. Conceptually, it can be treated as a POS ( <i>partially ordered set</i> ).
Scheduled Process	Management ex-ante action by which the allocation of a pre-defined Process is completed also in terms of responsibility (the executor, a person responsible for the process), space (where it is expected to take place) and time (when it is expected to start).
Scheduled Activity	Part of a Scheduled Process delimited by a specific time range.
Monitored Activity	Activity documented throughout a monitoring procedure, thus always related to an <i>already executed</i> scheduled process. Conceptually the execution can be performed both actually at the real farm or by a simulation model. In the first case, the monitoring procedure can be carried out both manually (direct observations) or by data-logger (automated monitoring).

## INDICES OF PERFORMANCES

The farm behaviour can be finally evaluated throughout some indices of performance (IoP), instances of the classes Ex-Ante\_Performance or Ex-Post\_Performance, according to we are dealing with planned or executed actions, respectively. Different types of IoPs can be taken into account, according to the domain of interest that can affect the various decision-making processes that must be performed at the farm enterprise. A summary of IoPs frequently used (economic, environmental, energy and operational), with related domain of interest and most applied indicators, is provided in Table 3. Ex-Ante Performances are generally estimated through planning tools, able to simulate the dynamic behaviour of the target farm scenario all along the year, once a “desired plan” - rather than a “best practice” - is fixed by the decision-maker as target nominal plan (to be considered also as a reference plan). On the other side, Ex-Post Performances can only be achieved through measuring and detecting (identifying) farm actions, performing a continuous and complete monitoring of parameters and agents that condition the main processes determining the productive behaviour of the farm.

[Table 3] - Performances and related indicators used in the FO. Many indicators can be referred both to the yearly whole business activity - TX(y) - rather than to the i-th productive sector - TX(y,i). (\*) The energy values may be even expressed in relation to the main form of energy supplied (thermal, electric or mechanical)

TYPE OF PERFORMANCE	DOMAIN OF INTEREST	EXAMPLES OF INDICATORS	
		ACRONYM	DEFINITION
ECONOMIC	Farm profitability	TGPI(y); GPI(y, i)	Yearly Gross Production Income at the farm
		TPC(y); PC(y, i)	Yearly Production Costs
ENVIRONMENTAL	Quality of the ecological and physical environment in which the farm acts	TAW-N(y)	Total yearly amount of nitrogen per ha from animal wastes
		TCPhyt(y); CPhyt(y, i)	Total annual consumption of indirect energy related to chemical treatments for phytosanitary measures
		CFP(y,i)	Carbon footprint, calculated every year per each unit of production mass for the i-th productive sector
		WFP(y,i)	Water footprint, calculated every year per each unit of production mass for the i-th productive sector
ENERGY	Quality and efficiency of the energy supply of the productive system (*)	TFE-ST(y); FE-ST(y, i)	Primary energy consumption from fossil sources for stationary user points
		TFE-MB(y); FE-MB(y, i)	Primary energy consumption from fossil sources for mobile user points
		TPRE(y); PRE(y, i)	Percentage of energy needs covered by renewable sources
OPERATIONAL	Quality of the farm management and efficiency of the work organization	Hpeek(y)	Work hours during which the number of workers required is greater than the number of permanent workers available at the farm
		WHP(y,i)	Work hours per unit of product
		MH(y)	Work hours spent in management tasks

A key point of the FO is that ex-ante and ex-post IoPs are determined referring to a farm abstraction model that is represented by the same level of details through common data-structures. The latter are thus able to support both simulation/computing tools working on planned data and inferring/interpreting models treating surveys from monitoring tasks. In Figure 1, the actions typically connected to the simulation and reference tasks are the ones indicated as *[predicts]* and *[monitors]*, both classified as *management* actions. Ex-ante IoPs derived from the simulation of alternative planned scenarios are useful also to support *strategic* decision related to the *[adopts]* and *[invests]* actions (e.g. selection of new production goals or the achievements of new machines).

The main function of IoPs is enabling comparative evaluations in order to get an appraisal of planned and/or executed plans. Comparisons can be firstly done between expected (ex-ante) and actual (ex-post) IoPs, using different computation methods provided by the class **EfficiencyIndex**. Thus, for example, the overall profitability index (PI) for the *y*-th year is then calculated as:  $PI(y) = TGPI(y)_{ex-post} / TGPI(y)_{ex-ante}$ .

In the same way, the overall efficiency index (FEI) in the fuel use to supply all the tractors at the farms all along the year is given by:  $FEI(y) = TFE-MB(y)_{ex-post} / TFE-MB(y)_{ex-ante}$ .

In the case of environmental performances, in addition to the parameters got from the use of the farm assets, the IoPs must also refer to all the undesired effects, which values are provided by the afore mentioned class **Externality**. The related management action *[releases]* can only be partially controlled by the farm decision makers, e.g. through the choice of proper technologies minimizing the negative effects or adopting efficient control systems. Nitrogen leaching, chemical drift or GHG emissions are typical examples of negative impacts.

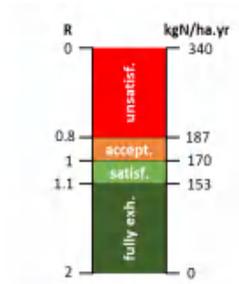
The various IoPs can be put also in relation to a target reference value  $IoP_{goal}$ . Such a value could be set according to: i) external constraints fixed by institutional rules (need to adapt to mandatory regulations or virtuous behaviours); ii) threshold values typically resulting from reference best practices; iii) specific customized goals of the farm management and/or strategic decision makers.

When performing a planning activity, the related  $IoP_{ex-ante}$  should be set in order to fall within a *suitable* range ( $\Delta$ , decimal) around  $IoP_{goal}$ , so that (in case of *benefit index*, say higher IoP better results):

Ratios < 1 indicate a *prudent* planning; ratios > 1 show definitely *optimistic* forecast.

The same approach can be followed also for evaluating the actual performances. According to the values of the ratio  $R = \text{IoP}_{\text{ex-post}} / \text{IoP}_{\text{goal}}$ , the following evaluations in relation to the external goal can be formulated: 1) *Unsatisfactory*, when  $R < 1 - \Delta$ ; 2) *Acceptable*, when  $1 - \Delta \leq R < 1$ ; 3) *Satisfactory*, when  $1 \leq R < 1 + \Delta$ ; 4) *Fully exhaustive*, when  $R \geq 1 + \Delta$ . The on-farm evaluation is finally completed integrating ex-ante and ex-post results.

**SUSTAINABILITY VIEWS**



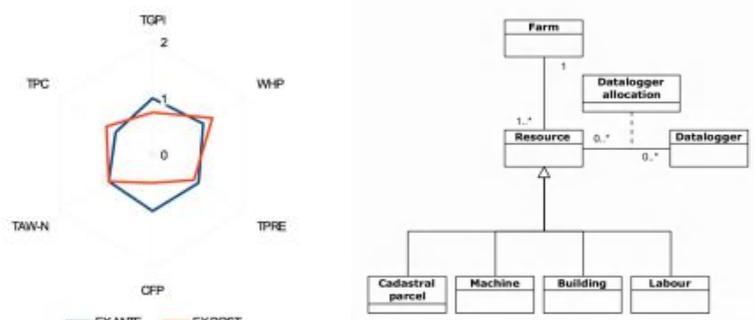
[Figure 2] – Nitrogen load example for IoP sustainability, with the goal of 170 kgN/ha.yr

[Figure 3] – Overview of overall performance

The satisfaction levels established by R can also be assimilated to the more generic concept of **Sustainability**. Depending on the type of domain of interest at hand and its related objectives established by  $\text{IoP}_{\text{goal}}$ , different types of sustainability can be thus defined (*economic, environmental, energy, operational*). As an example, in a livestock farm an aspect of *environmental sustainability* can be expressed by the total nitrogen load distributed every year on lands (**TAW-N** in Table 3, in *kgN/ha.yr*) through organic fertilizations based on animal wastes. The EU Nitrate Directive (91/676/CEE) sets this limit at 340 kgN/ha.yr, which is halved in the case of vulnerable areas. In these last conditions, therefore, it is appropriate to fix  $\text{IoP}_{\text{goal}} = 170 \text{ kgN/ha.yr}$  and - as we are dealing with a *Cost-criterion* - the calculation of R can be expressed as:  $R = 2 - \text{IoP}_{\text{ex-post}} / \text{IoP}_{\text{goal}}$ . If finally we set the value of  $\Delta = 10\%$  of  $\text{IoP}_{\text{goal}}$ , we have the score situation described in Figure 2. Typically, when assessing a farm behaviour all along a period many sustainability aspects can be taken into account simultaneously. The number of aspects is established time-by-time by the farm decision makers and could be even associated to different priorities. Simple aggregation algorithms or multicriteria approaches can be performed with the aim of evaluating an Overall Sustainability Score (OSS) of the farm (the related computation methods are again provided by the class EfficiencyIndex). An example is given in Figure 3.

**FARM INFORMATION SYSTEM**

All of the above can be put into practice only through the creation of an appropriate Farm Information System (FIS) able to process all the information flows through the data structures here described and to support a robust Operational Monitoring System (OMS) designed to collect automatically all the essential details required in the management of the main production processes (Calcante and Mazzetto, 2014). This is the only guarantee to obtain reliable IoPex-post indexes and to get complete and objective reports of the farm’s activities. An OMS requires the use of a data-logger (DL) equipped with proper sensors, positioning and identification systems able to monitor the behaviour of the main farm entities related to the class Resources. Typical farm resources regard lands, building, machinery, plants and labour. In the FO each resource type is modelled through a specific child-class descending from the Resource mother-class and specializing its own properties and methods (Figure 4). Further classes (Datalogger and DataloggerAllocation) and related tables in the Farm-DB enable to manage all the basic information for the resource automatic identification, if any. Machines are the most frequently resources submitted to an automated OMS. In Figure 5 an example of integrated OMS in a dairy farm slurry tanks and slurry spreading is presented (Mazzetto et al., 2009). Merging the information enables an objective evaluation of the N-mass actually distributed on fields all along the year.



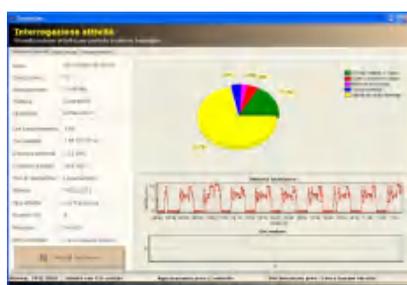
[Figure 4] – Detail of farm model on resources and machine monitoring classes.



**A**

[Figure 5] – FO Example of integrated use of a fully automated monitoring system supporting the slurry waste management in a dairy farm.

A) Continuous monitoring of slurry levels in slurry tanks (detection of filling and unloading operations, with the balance of organic matter masses and related N-contents).



**B**

B) Automated monitoring of slurry spreading operations in the farm fields (with related details on worktimes, operational efficiencies and fuel consumptions).



**C**

C) Yearly slurry spreading register obtained by merging the information in A and B. The columns provides all the details of each field spreading activity. The last two columns (right side) indicate a summary of the kg of N distributed per ha, with a early warning (in yellow) when approaching the threshold limit of 170 kgN/ha.yr. In this case such a limited was sensibly overcome reaching the value of 196 kgN/ha.yr ( R = 0,85 slightly unsatisfactory).

## FINAL REMARKS

The integrated architecture of the FO shows future promising applications in terms of adaptability to many type of farming systems, even including forestry enterprises. Such a flexibility also makes the FO-model, with related data structure, suitable to be considered as proper tool to carry out inventory analyses in agricultural LCA-related issues, as well. In addition, its structure allows applications to be carried out at the level of both single farms and multi-farms organizations.

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## **INCLUSIVE CIRCULAR ECONOMY: AN APPROACH FOR EMERGING ECONOMIES**

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### **ABSTRACT**

Circular Economy-CE is a systemic change that builds resilience in the long term and creates business opportunities and innovative solutions for the economy, providing environmental and social improvements. However, CE guidelines do not include how to deal with the systemic design of 'circular relations' involving the low-income population as promoters and actors of sustainable development, imperative in emerging economies such as Brazil. This article investigates the lack of theoretical and practical structures, in the convergence between CE and design, which may guide the design of circular, systemic relations for socio-ethical development, proposing a bibliographic review of the CE concepts and guidelines, along with a brief evolutionary description of the approaches of Design for sustainability. Finally, present Brazilian case studies to discuss the power of organized vernacular actions for the inclusion and social development of the marginalized members of society, favoring socioeconomic development in an ethical and equitable way of needy communities within CE systems.

Key Words: Circular Economy, Systemic Design, Social Development, Emerging Economies

## 1. FROM LINEAR SYSTEMS TO CIRCULAR ECONOMY

Since the advent of the Industrial Revolution, the world has adopted as a model of progress based on the idea of Linear Economy (LE), where mass produced products follow the logic of ‘make-take--dispose’ (Blomsma & Brennan, 2013). LE is a centralized production system that uses a large amount of resources and energy and is not directly involved with the issues of the territory, culture and identity of the places where its operation takes place (Ellen Mac-Arthur Foundation, 2013).

In general terms, LE is based on a model that does not effectively rationalize the extraction of natural resources, does not predict its efficient use in the industries, or its reuse in consecutive production processes. It also does not aim at the intelligent use of non-polluting energy matrices and from renewable sources and the efficiency of transportation systems in all its stages (Ibidem). Similarly, the outputs of a Linear Economy system are not based on the life cycle analysis, and do not define the end of the useful life of artifacts (Manzini & Vezzoli, 2002).

The results of this practice are the rapid degradation of the environment and its natural systems, the constant tearing of the limits of resilience of nature, and the extinction of non-renewable resources and the accumulation of solid waste, pre and post-use. According to Rifkin (2012), these results are equivalent to the entropy of the planet and its systemic effects have disastrous and irreversible consequences in the short, medium and long term, for nature, economy and society (Lewis & Gertsakis, 2001). However, in recent years, the concept of Circular Economy (CE) emerged as an alternative to the LE. This relatively new paradigm embraces the idea of systemic thinking, and considers the complex relationship between choices and results, offering guidance to make products more effective and efficient in all dimensions of sustainability. According to Blomsma and Brennan (2017, p. 603), CE can be considered an umbrella concept whose roots are in the schools of thought of Regenerative Design, Performance Economics, Cradle to Cradle, Industrial Ecology, Biomimicry and Blue Economy (Ellen Mac-Arthur Foundations, 2013, 2018). These pillars make the CE a model more consistent with the present and future needs of the planet and a strong instrument to reduce its entropy.

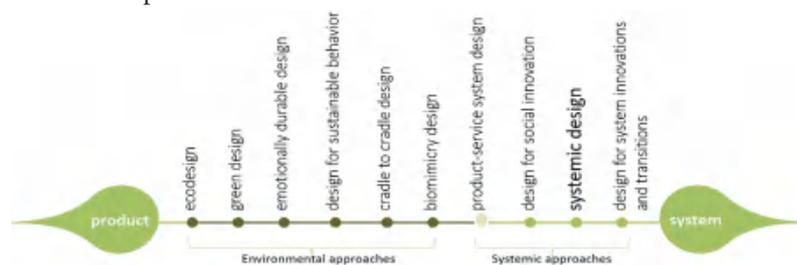
Inspired by the efficiency of the natural systems and considering the interventions of human activities, CE proposes as principles: eliminating waste and pollution; Maintaining products and materials in constant cycles of use; Regenerating natural systems. These principles concentrate, firstly, on dematerializing production whenever possible, mitigating the entropy caused by the intervention of human activities in the natural system, diluting the use of the energy used in the transformations of the raw material and use of products and using materials -natural and artificial- in subsequent cycles (Ellen Mac-Arthur Foundation, 2013, 2018). Circular Economy considers two types of material cycles: biological and technical cycles. The former refers to the reintegration of materials into the biosphere/natural processes, once the products arrive at the end of its life cycle, while technical cycles re-introduce material into other production systems (Bompan, 2017, p. 18).

The emerging new sustainable approaches such as CE, fostered methodological change in design towards a new methodological approach. Instead of focusing on the development of “better” more sustainable products, the design discipline envisioned new forms to attend human needs through the development of less material intensive solutions. In this way, in a short period of time, the design discipline evolved from environmental approaches, focused on product development and eco efficiency, towards a more systemic understanding of human needs, envisioning a more comprehensive, sustainable way to deal with the problems, fostering innovation and less dependency from the linear economy rationale. That evolution is described in the next section.

## 2. FROM ENVIRONMENTAL APPROACHES TO SYSTEMIC APPROACHES IN DESIGN

Faced with complexity and assuming its strategic role in the transition to sustainable ways of life, the design discipline has developed systemic approaches with new theoretical and multidisciplinary contributions in the last 3 decades. Ceschin and Gaziulusoy (2016) elicit some of these design approaches to sustainability, (Figure 1).

As shown in Figure 1, Ceschin and Gaziulusoy (2016) point to a transition to sustainability where, instead of focussing on environmental approaches for product development, there is a shift towards complex systemic approaches in which the use of environmentally friendly materials and processes, clean technologies and sustainable methodologies only make sense for sustainability if designers “pay full attention to the essential relationships and critical connections between systems” (Nelson & Stolerman, 2012, P. 57). According to the authors, designers should be able identify and protect the essential connections found in life, so that systemic thinking can be applied to design projects and the macro systems in which such projects are incorporated.



[Figure 1] Systemic evolution of design approaches (Font: Author)

In their historical review, Ceschin and Gaziulusoy (2016) show that, at first, the methodologies of design for sustainability were essentially concentrated on the environmental requirements of products, developing methodologies, tools and instruments for the design of intrinsically sustainable physical artifacts. This view proved to be insufficient and demanded for a new direction towards the dematerialization of production and consumption in order to reach sustainability. Instead of environmental approaches focused on products, this new vision favored the development of systemic approaches such as Product-Service System-PSS, where the union of product with services associated to it enabled the satisfaction of human needs. (Manzini & Vezzoli & Clark, 2001; UNEP, 2002; Mont, 2002; Manzini & Vezzoli, 2002; Vezzoli, 2010; Ceschin, 2016)

From the moment society shifts towards systemic approaches, it changes the role of users from spectator with the power of choice, to main actors. In this new paradigm, people abdicate from ways of life and consumption with individualistic habits centered in the possession of material things, to collective attitudes centred on being (Manzini, 2003). This approach radically subverts the historical role of design, which passes from designer of products to developer of systemic solutions, paving the way for the emergence of approaches, such as design for social innovation, systemic design and the design of systems for transition and innovation.

It is currently understood that all the choices drawn by design with objectives of promoting sustainable development are only possible with the active participation of all social actors, without exception and in a systemic way. Therefore, basic actions such as the recycling of materials, are only effectively possible if there is a systemic planning that counts on the participation of social actors. For instance, while recyclability is a property of the material and the reuse is a property of the product, circularity is an attribute of the system. When it comes to a physical product, all its sustainable properties and in particular, those related to the end of the life cycle, remain latent until activated by the actors of the system. However, taking as guidance the heuristic and guidelines of the circular economy, there is no allusion in the bibliography to the role (s) exercised by society in the systemic organization required by sustainable scenarios and this is one of the weaknesses of the circular economy. According to the United Nations, “While the Circular Economy takes into account only the environmental and economic pillars of sustainability, it risks leaving out an essential third pillar: inclusion (Social), cutting down the poorest countries of the global supply chains” (UNIDO, 2018, p. 6).

### 3. CIRCULAR ECONOMY IN EMERGING ECONOMY CONTEXTS.

In emerging economies, there are many examples of circular economy programs, especially in the recycling of solid waste. In Brazil, for instance, The National Council of Industries-CNI (2018), e.g., maintains an integrated system of waste stock, which allows the negotiation of these as raw material within the industrial circuit itself.

However, in emerging economies, the concept of a circular economy transcends the industrial perimeter and moves to other layers of society, especially the ones located at the base of the pyramid. Cases of ‘inclusive’ circular economy spontaneously emerge among marginalized population which, finds in the search, selection, and recycling of industrial residues, its main source of income (Figure 2).



[Figure 2]: Scavengers as part of the social cycle of Circular Economy in Brazil. Source: (City of Curitiba (<http://www.cmc.pr.gov.br/>))

Once established, those spontaneous networks of circular economy usually receive support from local governments, through public policy initiatives related to the treatment of industrial waste. One example of this approach is the Green Change Program, conducted by the City of Curitiba (2018). The program encourages the selective collection of solid waste and ensures its reintroduction in the industrial production processes, by connecting, in a virtuous cycle, local consumers, communities of waste pickers, family farmers and recycling industries. Since 1991, the city government exchanges solid waste collected by communities of scavengers with horticultural products purchased from family farmers in the vicinity of Curitiba. Then, waste is marketed to recycling industries, refeeding the cycle. With this action, the municipality reduced the problem of hunger, malnutrition and food quality in 95 points of the city, besides stimulating the selective collection of solid waste and giving flow the production of organic products (Figure 3).

Other forms of implementing circular economy initiatives in emerging economies promote the empowerment of communities. Those initiatives develop training programs for the recycling and manufacturing of new products using discarded and reused materials. For instance, Gatos de Rua is an initiative in the state of Pernambuco, Brazil, that trains members of low-income communities to transform recyclable materials into pieces of art, decorative ob-

jects and utilities, marketed by the brand in various stores in Brazil (Figure 4). The initiative involves more than 500 members from low-income communities, craftsmans and designers, (Gatos de Rua, 2018).



[Figure 3]: Green Change Program exchanges solid waste for organic food in Curitiba, Brazil. Source: (City of Curitiba, 2018, <http://www.cmc.pr.gov.br/>)



[Figure 4]: Gatos de Rua Project, Brazil. Source: (Author & Gatos de Rua, 2018 (<https://loja.gatosderua.com.br/>))

There are also many cases in the Brazil, where circular economy projects are part of corporate social responsibility actions. For instance, 2 furniture companies from Curitiba, Brazil. decided to join forces with a group of social entrepreneurs. The initiative resulted in a partnership where Ronconi, a mattress company donates the residues of fabric from its production process to Associação Zumbi dos Palmares, AEZP, a low-income community located in the outskirts of Curitiba. In this community, the flaps are transformed by the hands of 46 women, into pillows, bedspreads, and covers for armchairs. The products are then bought and marketed by the Paranist Movelaria, another furniture company specialized in corporate furniture (Figure 5). These covers are the result of research in design for sustainability and seek to give an alternative through social responsibility actions, to one of the recurring problems that lead to the premature disposal of chairs in the hospitality and gastronomy sector (LEPRE; VIEIRA, 2015).



[Figure 5]: Products from the Association Zumbi dos Palmares and Movelaria Paranista, Curitiba, Brazil. Source: (Author)

A similar initiative fostering circular economy in the fashion industry takes place in the city of Caruaru, North-east of Brazil. The Mulheres de Argila Project, uses the denim shavers that are left from the production of jeans to the creation of diverse handcrafts (Figure 6). This project has helped, both in the correct disposal of solid waste, and in improving the quality of life of many families in the Northeast region of Brazil.



[Figure 6]: Mulheres de Argila Project. Source: Mulheres de Argila, 2018 (<https://www.facebook.com/MulheresDeArgila/>)

The systemic relations generated in each of the cases involve marginalized populations or in conditions of socio-economic vulnerability. All of them effectively contribute to the cycles of use of pre- and post-consumption inputs, avoiding the premature end of the material life cycle and discarding unduly, resulting in positive impacts for the environment, economy and society, which is more relevant in this article, because the cases demonstrate the transforming power of inclusion of the low-income population in the processes of circular economy. That said, the next section discusses the biases of this power and signals the relevance of the role of design in promoting the Inclusive CE.

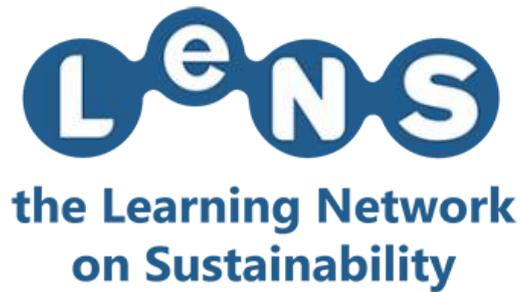
#### 4. CONCLUSION

As it was discussed, according to the principles, guidelines and theoretical matrices, CE can be considered a systemic approach to sustainability. However, when it only focuses on environmental and economic performance it becomes reductionist model difficult to be implemented in low-income contexts. All the examples presented above illustrate that, in order to implement circular economy initiatives in emerging economies, it is imperative to include and define the role of all social actors, considering them as main stakeholders in the design of the system structure. The non-observance of social impacts, when adopting the circular economy initiatives, affects its efficiency. It is known that many pressures of man on the environment are the result of inappropriate conditions linked to the tangible aspects to the satisfaction of basic needs, such as, food and safety. Also, there are needs that are linked to the tangible and intangible hedonistic aspects of life, which supersede the real need for welfare. Therefore, it takes more than looking at the relations between environment and economy to achieve sustainable development. It is essential to integrate human beings in this process, because humans structure those relationships through the understanding of their habits, their beliefs, their culture and their values. Thus, it is concluded that there can be no sustainability without the balance between the three basic pillars and mainly, without social equity (UN, 1987; 1995). Therefore, in order for the CE to be an alternative to the linear economy, it is imperative to fully incorporated human beings, and this obviously results in the increase of the complexity of the system with the involvement of subjective issues inherent to the human species, Requiring complex systemic thoughts and actions. According to Bonpam (2017), the circular economy is a 'newly born process or, at most, in its adolescence', linked to business-related phenomena, the 4.0 industry and the sharing economy, with a long road ahead and its impacts are still to be seen. In this scenario, by bringing the CE as the first principle of systemic design, it integrates to other promising initiatives in the articulation of sustainability. The examples presented in this paper confirm the validity and importance of the inclusion of the social pillar in circular economy systems, especially in emerging economies such as Brazil, where the population has long seen in the residues of industry or consumption waste as raw material for survival. Thus, considering this question as fundamental and observing its absence in the heuristics of CE, it is necessary to adopt measures that bring the social dimension as a fundamental pillar of the systemic and circular design.

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## **PARTICIPATORY AND SUSTAINABLE STRATEGY-MAKING FOR COMMUNITY RENEWAL: THE CASE OF IAO HON IN MACAO**

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### **ABSTRACT**

The recent development of urban Macao calls for renewal or redevelopment of many historical community districts. The Iao Hon community is an old community with more than 40 years in Macao. The poor living conditions in Iao Hon have seriously affected the quality of life of its residents. This research takes on Iao Hon as the study site and conducts surveys of residents on satisfaction with their living conditions and willingness to renew. Descriptive and referential statistical analyses will be performed. The objective of this study is to identify and justify a set of practical and sustainable renewal strategies to revitalise the community. More specifically, the strategies will ensure Iao Hon to be an economically sustainable community with diverse businesses, an environmentally sustainable community with ecological and livable neighbourhoods, and a socially sustainable community with equality and happiness, so that Iao Hon becomes an exemplar community in Macao for other communities to emulate for renewal.

Key Words: Sustainability; Iao Hon; Participatory; Renewal Strategy.

## 1. INTRODUCTION

On October 17, 2016, the Third United Nations Conference on Housing and Urban Sustainable Development (or Habitat III) adopted the New Urban Agenda, which advocates “the city of all people” and emphasizing public participation of multiple stakeholder groups/ public /private and the community in urban planning and city management in the future. This UN agenda serves as a guide to the world on housing and urban sustainable development for the next 20 years (Chen Xiaojian, 2017). This study is also based on this agenda.

Since the return to China, Macao’s economic development has been unprecedentedly transformed. Macao’s per capita income reached \$71,148 in 2017. It is five times higher than that before the reunification. However, not all communities in Macao shared the economic prosperity equally. On the one hand, the newly established gaming area, which fully embodies the international urban planning concept and the world heritage tourist area, which well adopts advanced architectural heritage protection concept of Macao, have developed well. On the other hand, quite many local neighborhoods, have not been fared well with living conditions worse than prior to reunification. A large number of buildings in Macao were built over 40 years ago. In 5 to 10 years, more than 50% of the buildings in Macao will be over 50 years old. Therefore, urban renewal with sustainable community planning is urgently needed for community. “Old District Rebuild” was launched by government in 2004. However, fifteen years have gone by, there have been only a few successful community renewal cases. The development of renewal is very slowly. Therefore, this study will take Iao Hon community as an example, proposes community renewal strategies based on sustainable development by conducting community-wide public participation activities, collecting residents’ opinions and future community renewal expectations.

## 2. THE THEORETICAL BASIS OF SUSTAINABLE COMMUNITY RENEWAL AND PUBLIC PARTICIPATION

### 2.1 Sustainable community renewal

Since the 1990s, sustainable urban research has gradually changed from the urban system scale to community scale. The sustainable urban neighbourhoods and the sustainable 4C model of residential settlements, namely environmental protection, residents’ choice, community and cost, compact development, equal and integral neighbourhoods, were proposed (Rudlin, 1999).

Sustainable communities are compact and eco-friendly suitable for living in the physical environment. At the social level, a fair and inclusive community can provide equal opportunities and good services for all, providing residents with more convenient connection opportunities, communication spaces, and promoting the social cohesion among community members. From the economic perspective, Community sustainability can bring sustained and stable economic growth and provide more employment opportunities for community residents.

Community renewal is to rebuild, refurbish or repair a community that has been declining or dying. It can inject new economic vitality through the renewal of material space and promote community regeneration. After World War II, community renewal began to develop in Europe and the United States. In the early days, material space planning and reconstruction were the mainstays. Later, with the various social problems exposed in development, it was impossible to solve the problem by simply relying on material renewal, community renewal starts comprehensive research and analysis of social, economic, and cultural factors.

In recent years, community-based activities based on community-building occurred in Asia. Japan, Hong Kong and Taiwan have launched activities to mobilise residents to participate in the improvement of the public space environment of the community. Successful cases and formed a certain influence. In China, research and practice on community-renewal are also carried out in community renovation and beautification (Liu Yuelai et al., 2018).

### 2.2 Public participation theory

Perhaps the most seminar work on public participation is done by Sherry R. Arnstein in 1969, who studied the citizen involvement in the planning process in the United States and developed a “ladder of citizen participation” showing high and low participation by scales. Sherry’s eight-rung ladder are 1 Manipulation/ 2 Therapy/ 3 Informing/ 4 Consultation/ 5 Placation/ 6 Partnership/ 7 Delegation/ 8 Citizen Control. Sherry R. divides them into three phases: the first phase of non-participation (no power), the second phase of symbolic participation (degrees of tokenism), and the third phase of substantive participation (degrees of citizen power) (Sherry R. Arnstein 1969). This theory has had an important impact on the subsequent public participation in urban planning research, and is also the basis of this paper’s important theoretical research and practice (citation).

In recent years, some scholars have mainly studied the behavioural characteristics of the subjects from different aspects of the public and different organisational units. Paul D and Yang F testing the social norms and market rules in the initial stage, the role of organisation shall be the unit for thinking participation of citizens, even if there is no monetary compensation, they are willing to participate in the project decision-making. Wang A et al. improved the previous public decision-making model (GDM), established a two-stage PLS model for urban reconstruction and constructed a hierarchical linear public participation method, and proved its feasibility and creativity with case studies (Ma Hui, Huang Mengjiao& Wang Suzhen , 2018). Active public participation can effectively promote the exchange of information between stakeholders and reduce the occurrence of conflicts of interest. It is also the main

factor affecting the quality of decision-making and implementation of community renewal (Andrew Tallon, 2013). Therefore, the effective implementation of public participation plays an important role in promoting community renewal.

### 3. THE STATUS OF MACAO PUBLIC PARTICIPATION IN COMMUNITY RENEWAL

#### 3.1 Macao's public participation and public policy advisory system

Before the return of Macao to China in 1999, due to language barriers, Chinese residents mainly expressed public opinion to the government through various associations and had little experience in participating in public affairs. After the reunification, the implementation of the "Macao people governing Macao and a high degree of autonomy" as set out in the Basic Law, the government actively explored channels for direct communication with the public to enable public participation to develop. On August 15, 2011, the No. 224/2011 Chief Executive's instructions were published, promulgating the Macao Special Administrative Region's "Guidelines for Regulations on Public Policy Advice" (referred to as the "Guidelines"). Relevant issues such as the subject, conditions, principles, processes, implementation, feedback summary and protection of personal data for public consultation have been clearly defined, and the government has established normative standards for public policy consultation, and public participation in administrative management. Legal protection is provided. Since then, the Macao government has carried out a large number of public consultation activities in policy formulation, and has received active participation and feedback from the public, with remarkable results.

#### 3.2 Public participation in community renewal in Macao

With the improvement of the education level of local residents, the rapid development of the economy, and the enhancement of social identity, the residents' participation in their own demands has also been rising. The government has carried out a series of forms of public participation activities related to urban planning and historical urban protection and renewal after the "Urban Planning Law" promulgated in 2014, including public consultation, public lectures, popular science promotion, media promotion, questionnaire research, community workshops, etc., among which public consultation activities are the most frequent.

According to the information items published in the 2018 annual summary report published on the government website, there are a total of 8 projects, and a total of 41 public consultation activities were carried out, which were planned and implemented by eight relevant government agencies, and a total of 17,166 feedbacks were collected. As shown in Appendix, items 1 to 4 are related to urban planning and construction in Macao. A total of 19 public consultation activities have been carried out, which is close to 50% of the number of consulting activities throughout the year; four government agencies are involved. As shown in Table 3, a total of 13,998 opinions were collected, accounting for 81.5% of the total feedback in the annual public consultation, which is 4.4 times the total number of feedbacks from other projects.

[Table3] Public consultation activities on urban planning and development conducted by the Macao government in 2018

Public Consultation	Number of projects	Number of consultations	Opinions collected
Urban planning and development public consultation activities	4	19	13998
Total public consultation projects throughout the year	8	41	17166
Urban planning and development account for the annual project ratio	50%	47.5%	81.5%

(source Author)

As can be seen from Table 3, Macao's public consultation activities on urban planning and development direction are frequent, and the public's attention to and participation in this subject matter is high. It can be demonstrated that Macao has a good public participation base and platform. It provides a broad space and favourable conditions for the future of participatory community renewal.

In recent years, influenced by the community creation in Japan, Taiwan and Hong Kong, Macao has spontaneously generated a civil society organisation, "My City Community Planning Cooperative" (Lin Yijie, 2014), mainly for Macao's old community to carry out the "bottom-up" community building, there are several successful cases, but due to the smaller, has not yet formed certain social influence. However, there are few researches on the community renewal of public participation in Macao.

### 4. THE PARTICIPATORY COMMUNITY RENEWAL PRACTICE: THE CASE OF IAO HON COMMUNITY

#### 4.1 Overview of Iao Hon Community

Iao Hon community (formerly Iao Hon new estate) is the first large-scale residential house in Macao with a total of 46 buildings and more than 2,000 units. But up to now the buildings have been more than 40 years without any renewal, and have seriously affected the safety of residents and living environment (see Figure 1). Besides due to the increasing population density, the outdoor public space and facilities are also beyond the capacity. In response to the current situation of the Iao Hon community, many social groups have repeatedly called the government to use the Iao Hon community as a pilot to promote community renewal as soon as possible and to improve the living envi-

ronment of residents. However, due to various reasons, the owners have not been able to meet the 100% consent to the legal requirements for building redevelopment, and the renewal plan has not been implemented yet.

**4.2 Participatory Community Renewal in Iao Hon Community**

This research explores and examines the effects of public participation and sustainability on community renewal in Iao Hon Community. First of all, using the method of urban impression research, we randomly select residents to ask their impressions of the regional boundaries and landmarks in the outdoor public places, and sketch on the maps to understand the residents' perceptions of the community (see Figure 1). It is found that the impression of most residents on the geographical boundaries of the community is not clear, indicating that the community has more frequent interactions with the external space and most people have labeled Iao Hon Market for their awareness of landmarks.

Then through field questionnaire surveys, resident interviews, the survey was conducted on residents' impressions of the district, residential satisfaction and vision of future community renewal. The research samples selected in this study are all residents of Iao Hon Community. The research sites are Iao Hon Market, Iao Hon Park and nearby commercial spaces. They have the most realistic and representative of the actual situation of the community.



[Figure 1] The current situation and Impression Survey of Iao Hon Community Picture : by Author

**4.3 Survey statistics and analysis**

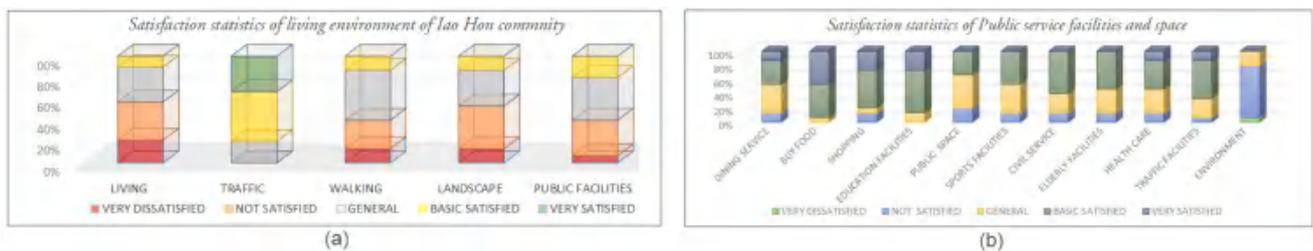
A total of 100 questionnaires were distributed in this survey, 89 questionnaires were collected, and 82 valid questionnaires were collected. In this survey, women accounted for 36.67%, males accounted for 63.33%; most of them were between 45-60 years old; among them, there were more retirees; the proportion of self-owned housing was 93.33%, and their opinions reflected the self-occupied population. Improvements in the community environment. Those who have lived in the community for more than 20 years account for 53.33%, they are more comprehensive about the situation and advantages and disadvantages of all aspects of the community.

(1) Satisfaction Analysis of Living Environment of Iao Hon Community.

According to the survey statistics (see Figure 2(a)), residents are more satisfied with the current situation of traffic in the area. They can get to most places conveniently, and can walk to the Border Gate. However, the satisfaction with the walking environment and living conditions is poor, indicating that most of the buildings in the community are dilapidated and very dangerous. Residents have the lowest satisfaction with the landscape environment and leisure facilities. Respondents said that there is very limited space to interact with each other. Often, only the seats facing the motorway are available for rest, and then they can only talk with the traffic, breathing the exhaust fumes.

(2) Public service facilities and space satisfaction analysis

According to Figure 2(b) survey statistics, community residents are generally satisfied with grocery shopping, educational facilities and the environment, thanks to the later construction of Iao Hon Market, where the general needs of residents can be met and reachable with high accessibility. Most of the life-like public service facilities and space are basically satisfied. However, the satisfaction of public activity space and green environment is low. Many respondents indicated that there is only one small area of Iao Hon Park in this area, which can't meet the needs of residents' outdoor leisure activities. I hope to have more spacious public space and a more beautiful landscape.



[Figure 2] Satisfaction statistics of living environment (a) and Public service facilities (b) of Iao Hon community (Picture : by Author)



[Figure 3] Statistics of the intention of Iao Hon community renewal Picture: (by Author)

## (3) Survey and statistics on the intention of Iao Hon community renewal

This study designed a series of ideal community visions for the respondents to choose. According to the survey statistics in Figure 3, the community residents' attention to the future community renewal vision lies in outdoor public space and roof garden. This shows that after the living needs are met, the residents hope to have more spacious public space and a better ecological landscape environment, and can play chess and chat in a beautiful environment. The demand for public service facilities such as commercial and cultural centers is not high, which is also related to the age of the respondents.

## 5. PARTICIPATORY COMMUNITY RENEWAL STRATEGIES BASED ON SUSTAINABLE DEVELOPMENT

Based on the above survey and the successful experience of sustainable urban and community construction in Sweden, this paper proposes a series of sustainable renewal strategies from the perspectives of environmental ecology, social interaction and economic development, as follows:

## (1) Deeper participatory in community renewal

In the whole process of community renewal, it is important to make full use of the power of the widely distributed community associations in Macao, and plan together with planning experts to carry out various kinds of public participation activities. We will establish a reward system for people's participation, fully mobilise their enthusiasm, and participate in the reconstruction of their homes.

## (2) More compact communities with a large service complex

The Iao Hon community is mostly a six-storey residential building of over forty years old, and they have been seriously damaged. It is recommended to rebuild the old buildings into a super-high building of about 40 floors with setting commercial spaces on the street, enrich the type of apartment, improve space utilization rate. Although the people in this area are basically satisfied with the current situation of community service, the new community will attract a more diversified population structure and the population density will increase, and then the existing community services facilities will not be load. Therefore, a large community service complex need to be built, as can be shown in Figure 4, that were originally abandoned will be connected to the current Iao Hon Market and Park plots across the street, to provide residents with a culture, life, leisure, entertainment, business and other services. In order to attract more young people to live in the area to enhance the economic vitality of the area. At the same time, this building will became a landmark building of the Iao Hon community.

## (3) Maintain existing street layout

According to the survey, residents are generally satisfied with the traffic and travel in this area, with high accessibility. Therefore, the community renewal will maintain the existing road texture and maintain the residents' sense of social identity as the left in Figure 4.

## (4) More pleasant public open spaces and connections

According to the survey, residents are less satisfied with the existing public communication space and environment. Therefore, it is proposed to increase green areas, including ground greening, three-dimensional gardens and roof gardens, to enhance the public greening environment in the area. Connect the roof between each building, use the landscape of the roof garden and planting activities to create more space and opportunities for residents to interact.

The roof landscape of the community service complex provides residents with a roof park that simulates "hills" (see Figure 4), building large artificial landscapes, and greatly improving the quality of outdoor public space.



[Figure 4] Renewal planning of Iao Hon community (Picture : by Author)

## (5) More sustainable energy use and recycling systems

To build green buildings and enhance the ability of wind protection and disaster prevention to cope with the annual typhoon season. Heat energy is stored on the building surface to provide public space and residential use within the community. As can be shown in Figure 5, the kitchen waste processor is installed in each unit, which is connected to the automatic garbage recovery and treatment system established under the community to deal with the organic waste in daily life and turn it into fertilizer for planting in the roof garden. The generated gas can be used as part of the gas energy in the community.



[Figure 5] Schematic diagram of energy utilisation and garbage disposal system(Picture : by Author)

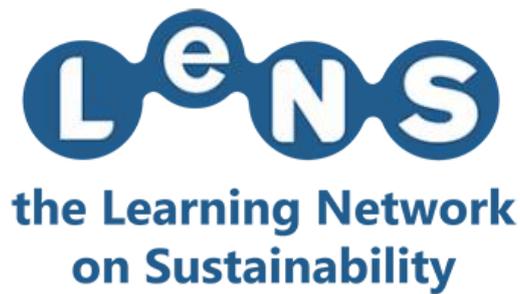
## 6. CONCLUSION

Macao, as a special zone under “One country, two systems”, has a unique social and cultural background that makes the community renewal issue to involve more stakeholders and more complicated relationships. In this regard, the author believes that public participation activities should be carried out to the greatest extent at each stage of community renewal. Make full use of good public participation in Macao, to promote the community renewal smoothly. Taking the Iao Hon community as an example, we conducted a practice survey of participatory community renewal, and proposed five strategies for community renewals based on sustainable: more in-depth participatory/ more compact communities/ more pleasant public spaces and connections/ more sustainable energy use and recycling systems. To make the area an eco-friendly, livable and equally friendly sustainable community, to provide reference for community renewal in other areas of Macao.

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## **5. DESIGN FOR SOCIAL EQUITY, INCLUSION AND COHESION**



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## **TRANSDISCIPLINARY AND INTERCULTURAL FIELD STUDY AS A NEW APPROACH TO ADDRESS CLIMATE CHANGE DESIGNERLY**

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### **ABSTRACT**

Climate change is not only an issue relating to the environment but also the structure of our society. This paper is to discuss a new model of field study to support design to address climate change. The article uses a field study performed in China by an European design school as an example to explain the new model in more detail. This model has three main characteristics: this field study is an explorative process for design with a flexible frame; this field study is a transdisciplinary approach, and the process is an intercultural process. The transdisciplinary approach could provide a holistic solution to form the 'new' living. The team members from different cultures could make the process easier to sense the alternative living model and nurture a collective global vision of sustainable development. To conclude, the paper explore how an explorative, transdisciplinary and intercultural field study could be a robust approach to address climate change.

Key Words: Transdisciplinary/Intercultural/Field Study/Climate Change

## 1. CALL FOR A NEW DESIGN FIELD STUDY

### 1.1 Climate Change and Design

Climate change requires us to question the effect and the aims of free market ideology in relation to the limits of natural resources (Klein, 2015). In this context, designers are embracing new tangible spaces to address problems that climate crisis brings forward. Since the carrying capacity of the planet is distinctly limited, less developed countries are constrained to the extent which they can follow the old industrialization route developed countries adopted before so as to achieve what is known as the “standard life” (Dietz and O’Neill, 2013). At the same time, it seems hard to justify directing developed countries to consume less and to restrain consumption, given the consumption-driven economic model (Hickel, 2017) unless the terms of the debate are changed. It is time for designers to rethink what standard life should look like and whether the standard life means a quality life. Thus, we need a intercultural way to understand the quality of life.

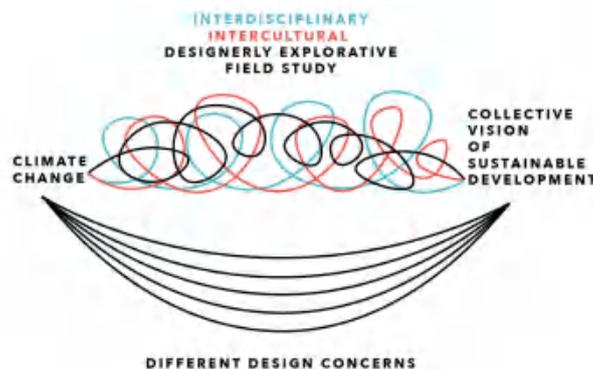
Ehrenfeld (2013) wrote that the current collective model that the world operates under, and our understanding of human behavior, drives an unsustainable, unsatisfying, and unjust social and economic machine that dominates our lives. In general, existing approaches to deal with climate change aim to raise public awareness and to call for individuals to reduce, reuse and recycle (McDonough and Braungart, 2002). The normal design process to handle these approaches is more or less problem-oriented. But in this way, design itself as a problem-solving activity loses the ability to deal with wicked problems (Rittel and Webber, 1973) like climate change. A paradox comes out then. The clear aim to design for solving a concrete problem makes the design process efficient indeed. And mostly, high efficiency is very much the goal in the ‘business as usual’ society, but the pursuit of high efficiency might result in a loss of focus on the broader context. This requires the transdisciplinary design and inquiry.

Climate change as a wicked problem is a structural problem rooted deeply in modern social production and consumption patterns (McDonough and Braungart, 2002). Since design is more than the simple activity of solving problems, giving an ‘ideal’ to the world (Harold G. Nelson, 2012), design processes, through their negotiative role, can handle wicked problems. At the same time, there is a need for transition to solve the root of problems by changing social-technical systems. Fry (2008) argues that design can redirect development for a transformation to change social-technical systems. He proposes that sustainable design could be a ‘redirective practice’ which is able to direct society away from deepening the disaster of unsustainability and towards the integrative character of sustainability. Transformative design as a ‘redirective practice’ facilitates or enable radical transformations e.g. by inspirational products, visions and scenarios that make our ultimate goals “thinkable”(Wood, 2016).

### 1.2 An Interdisciplinary, Intercultural and Designerly Explorative Field Study

In accordance with the goal of climate change and transformative design, we also develop the idea from matters of fact to fact of concerns according to Bruno Latour’s Actor-Network-Theory (Latour, 2005), which helps to understand that the sperate domain or material no longer contributes to the progress of social science and that it is necessary to reassemble the knowledge beyond its border. When it comes back to climate change, what needs to draw attention is not only the facts, but also the concern widely-spread through human society. At the meantime, the concern might present in various patterns but each would converge into the same topic behind.

To support transformative design, we adopt the smile model (see figure 1) to extend a field study that aims to inspire different designs. All designs from the filed study doesn’t start with facts but share positive attitude towards future. All designs go through sophisticated creative process with the start of different specific concerns, to compose a big vision how we address climate change. We will describe how the filed study is organised and what conclusions we get.



[Figure 1] Smile Model

### 1.3 Field Study of designBRICS Courses

designBRICS is a project aims to bridge the north and the south (focusing on BRICS countries) in the context of climate change. The project is profoundly occupied with what we, as designers, can do in order to: address and mitigate the global process of Climate Change and build long term sustainability and build a platform that facilitate a discussion based on sharing ideas and promote a fair global development. In 2018’s October, a group of five students from different cultures joined a field study in China with the clear purpose to collect inspiration for alternative future of climate change.

China might be the most diversified area now all over the world, which makes it to be the best place to test our field study model. Our field study was delicately planned and covered the most representative locations with symbolic characters, including the most and the least developed places. Being intercultural is the first point we emphasized in the field study and the other the transdisciplinary. We brought students to visit School of Environment, Tsinghua University. The environmental scientists shared the advanced technologies and workshopped with our designers. What makes our field study distinguish with the traditional ones is that our field study is not just to focus the inspiration collection but to explore the collective vision of climate change. And all processes put an emphasis on the intercultural and the transdisciplinary. Both emerging social and technical approaches are then of interest. The task to the students is given by our project “designBRICS” and our expected outcome is an exhibition that convey the climate challenge in a way that is different in ways that “make a difference that potentially could make a positive difference” in relation to our ‘goals’ in both Scandinavia and globally.

## 2. TRANSDISCIPLINARY DESIGN AND FIELD STUDY

Our students went to China with the clear purpose and they were arranged to meet the locals with different disciplinary backgrounds and different practice experiences. They went to Tsinghua as mentioned above to meet the environmental scientists from whom they learnt the progress of the advanced technologies, discussed difficulties to fulfil some seemingly wild ideas with and work on how to collaborate to achieve the same goal together with. They went to Chongming Island where they had chances to visit the on-site agricultural waste water treatment facilities and to exchange opinions with the practice operators. This brought students with very direct feeling on the technology in a real environment.

The easy possibilities to communicate with people from different disciplines but sharing the same goal is the first step to carry on transdisciplinary design, but the language is very important to guarantee the communication efficient and effective. The language is more about the tech language, via which designers without tech training could grasp the points. So the preparation is essential. Designers don't really need to know all the technology details and what they really need to know is the basic function and how it is different from other technologies. This requires that designers review related technologies before the transdisciplinary practice happens and make the demand specific and clear.



[Figure 2] ACO2 designed by Jonas Carlsen Kolstad

One student interviewed a scholar from Shanghai Jiaotong University and discussed his project of element flow in the electronic device industry. He did tech review before the trip in Norway and brought his specific questions to attend the discussion. He achieved the most from this transdisciplinary activities and his project is a good proof for the transdisciplinary design. His final design is called ACO2. ACO2 is the air conditioner of our time, being implemented as a means to encounter the excessive demands for energy to cool and heat residential buildings in a steadily warmed Europe. By carefully balancing a self-sufficient cooling system with carbon capture and sequestering ACO2 has created an advanced era of how residential housing gives back to the environment. In the interdisciplinary research, the outcome of this exploration is not only a new application of science and technology but also shows the unique interdisciplinary perspective for both disciplines (Dykes, Rodgers and Smyth, 2009). ACO2 is an artifact to explore the relationship between indoor and urban environments. This shows science and design to work in a specific area and produce new knowledge in both disciplines.

## 3. INTERCULTURAL DESIGN AND FIELD STUDY

IFS (Intercultural field study) is designed to understand the plural everyday livings with a global perspective. Culture study has become a process of studying cultural heritage, customs and traditions around the world in many cases. For instance, many design field studies are usually looking for some traditional crafts or some form of the past. The new concept of culture study from cultural neuroscience and cultural psychology that culture is not only these symbols but more as a force to influence people's thoughts and actions (Shaules, 2015). IFS can give designers chances to understand how different people in different places to choose the way they live as future design contexts. During designBRICS's field study, we went to Azheke village in a very poor area in Yunnan Province, China. As an intercultural

tural team, we have different understandings of the local people's way of living, from the respect the relationship between the people's life and nature to the anxiety of the primitive living in poverty. These intercultural interpretations are in-depth cultural learnings through cultural misunderstanding which provoke changes in our perception and worldview. Also, these intercultural interpretations are the resources for imagining the alternative livings, instead of some design elements from special architectures and craft products.

The imagining alternative livings through IFS could bring a new realism in our business as usual society in the context of climate change. We live in an era which is strongly influenced by digital media and pop cultures, and what we see is something very superficial and usually the same (Miller, 1992). We see the same things that IKEA sells all around the world, but we don't sense those different meanings of IKEA in different countries. There is a lot of criticism on IKEA about the product quality and consumerism in Nordic countries, while IKEA has become a pioneer branding for sustainable products in China. We need intercultural dialogues to think how to deal with some misunderstanding of cultures.

PETeasy™ (See figure 3) is one of the students' works after the field study with a vast cultural challenge. PETeasiness™ is a public plastic waste recycling tool which will become part of every household in Europe in 2050. It could turn plastic waste into food using two microbial food cultures. The implementation of PETeasiness™ across Europe in both private and public sector has been a megaproject radically changing the poisonous plastic waste management system on a global level. In the age of globalization and digitalization, there is a strong consensus on a particular cultural phenomenon, sometimes with prejudice. Plastics, as a material with strong chemical symbols, have an inedible image all around the world. During the field study, we went to eat insect food in Yunnan. Intercultural dialogue and experience of insect food make us understand this particular food culture in this unique environment, give some inspiration for further implementation of PETeasiness™ in the future and change the cultural identity of plastics. Climate change requires us to imagine things outside of our current culture, and Intercultural dialogue is a space for these things. Like self-sufficient village- Azheke, it could be the beginning of imagining the quality of life which is different from the current mainstream life.



[Figure 3] PETeasiness™ designed by Zane Cerpina

#### 4. DESIGN EXPLORATION AND FIELD STUDY

The designerly explorative field study is a narrative co-prototyping process. Prototyping in speculative design could be a way of knowing, exploring, projecting, and activating the relationship between users, objects, and the systems that they exist in. Co-prototyping becomes a commonplace form of communication and interaction for co-prototyping and becomes prevalent as a new medium in many areas of daily life (Kimpel, 2016).

The result in the co-prototyping provide descriptive and visual information for a technical realization. The designer takes on the role of a storyteller and author where fictional scenarios are developed to position the object, but also where the imagined or rhetorical interaction with the object itself works to make the fictional scenarios believable. Narrative traditions are not only for remembering but also are a form of knowledge management. They can express elementary and tacit knowledge in tangible and emotional images in order to pass down this knowledge in a sustainable way (Zerwas 2013). During the field study, some co-prototyping workshop could facilitate a process to turn the insights from field study into multiple-levels solutions. The solutions are tangible results of the field study which are possibilities for future design practices.

We have a co-prototyping workshop to explore the future and embrace uncertainty (Akama, Pink and Sumartojo, 2018) during the field study of P8 Planet. P8 Planet is a sustainable park including an empty 838-meter-high skyscraper called SkyCity which is built in just 90 days, Pyramid-liked conference center, co-working space, an, and factories. These things make the whole park full of uncertainty. The topic of the workshop is the sustainable development of the park in the future. After a detailed investigation of the entire park, we conducted a workshop in the co-working space. There are 5 groups (consisting of 5 to 6 participants) and three steps in the workshop. The steps are: 1) Each group draw the most impressive thing (only one) in each location. 2) Every participant imagines how to redefine these things in the future through design. 3) Every participant shows the most promising idea or scenario (only one).

The workshop was conducted immediately after the field study of P8, and the uncertainty of the environment was felt effective and sensorial which made the workshop more than cognitive level. The second step is a selection process. The discussion in this process can help the participants in the group have a better collective goal for the future addressing climate change. In the third step, every student gives the same thing different future design imaginations. These different imaginations could be transformed into plural possibilities for future design practices. The whole workshop was full of improvisation, not only with imagination as well as experience and action. The interactions between participants, design imaginations and the environment provoke future action and intervention.



[Figure 4] Co-prototyping Workshop in P8 Planet

## 5.CONCLUSIONS

Climate change requires us to transform design approaches to facilitate the future transformation of our society. In this situation, the design approach has to be more systematic and future-oriented. This transformation of design approach requires us to change the problem-oriented approach to interdisciplinary, inter-cultural and designerly explorative way to do a field study.

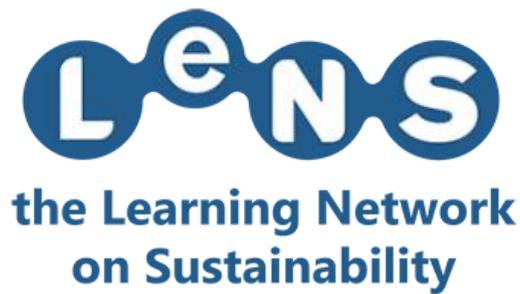
Climate change as matters of concern is the basis of the transdisciplinary. Transdisciplinary breaks the boundaries of design and other disciplines and provides an opportunity for other disciplines to produce new knowledge through design. We can understand the plural cultures of everyday living profoundly through intercultural inquiry. These plural understandings is a new vision of global cultural design. The co-prototyping workshop in a field study can make insights of the field study more visible and active. The workshop during the investigation embraces more uncertainty and sensorial experience. In this way, the workshop itself could be action and intervention, not only the imagination.

People from different disciplines have different language systems to make communication ineffective, and design needs to create a common language through such as visualization in the future. Intercultural contact cannot automatically produce mutual understanding, and design needs to be an in-depth exploration tool to get a good reflection. The future is uncertain and has many challenges, and I hope this paper will shed some inspiration on some of the projects that are currently being designed to highlight wicked problem like climate change.

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## **CERNE PROJECT AND REMEXE COLLECTION: ACTIONS IN SOCIAL DESIGN IN SEARCH OF SOCIAL INNOVATIONS OF SYSTEMIC CHARACTER**

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### **ABSTRACT**

This article presents the experience of a coordinated action between three institutions - FUMEC University, Lá da Favelinha Cultural Center and SEBRAE / MG - developed from a systemic perspective, with the intention of integrating the community of the villages of Aglomerado da Serra with the neighborhoods in its surroundings, where the FUMEC is located, stimulating a collaborative network of flows of clothing, accessories and shoes used for a process of creative reinvention through the logic of upcycling. This work was based on the concepts of Social Design and awareness of the need for sustainable integration with the natural environment, rethinking the limits of its ability to provide raw materials and absorb the impacts of our society's waste.

Keywords: Social Design. Systemic Design. Sustainability.

## 1. INTRODUCTION

This article discusses the co-creative relationship between the university extension program Cerne: Design, Architecture, Artisanry and Art, of the FUMEC University, the Lá da Favelinha association, composed by creative idealizer Kdu dos Anjos and by seamstresses of Aglomerado da Serra (urban periphery of Belo Horizonte), and SEBRAE-MG. This combination of forces has been made due to the proposition of the collection Remexe 2, produced from the action of upcycling in fashion, performed with donated clothes and accessories created with solid waste. The Cerne program operates in a logic of integrated extension projects, composing a network of action in function of objectives and beneficiaries in common. In this way, the diagnosis and the systemic vision of the problems to be faced in the beneficiary community/institution is led by the Cerne Design and Systems Project; the specific actions of Fashion Design products, accessories and furniture for events and retail points are carried out by the Cerne Products and Services Project; and the contents and educational materials in sustainability, which result in a printed booklet on the theme, are under the responsibility of the Cerne Education for Sustainability Project. The proposal of the Program is that the activities of all the projects that comprise its structure are complementary and joint, so that the results have a broader scope and with prospects of permanence for a longer time in the benefited community. Therefore, the projects that make up the program offer a diversity of thoughts and resources precisely to support an interdisciplinary action in the solutions and challenges of the work. In this logic, the projects do not act in isolation, but in an articulated way in function of common problem-situations, discussed and solved collectively.

Among the main goals of the program, we can highlight: to promote joint and systemic actions, based on the concept of sustainability and interdisciplinary logic, in support of the demands of the beneficiary community; to seek the articulation between partners and supporters that can integrate the mapped systemic network of projects, products and services; to investigate the role of the Brazilian university in the consolidation of Social Design as an area of academic and professional activity, capable of promoting social innovations through systemic thinking and the connection between products and services; to provide Design graduates of the University FUMEC with the experience of integrated practices with related areas, of elaboration of projects in teams and of works of interdisciplinary nature; as a consequence, to promote the formation of Design professionals engaged with the concept of sustainability through the socio-environmental path; to collaborate in response to the contemporary needs of environmental awareness and social return of companies, organizations and institutions; to awaken in partners and beneficiaries a greater awareness of their responsibility for the socio-environmental conditions of their environment; and, finally, to increase the diversity of social sectors that can partner up with the university in actions of a socio-environmental and sustainable character, increasing the dialogue between the university and society.

It is perceived the need to intensify and deepen the ties between areas related to Design in the construction of the project actions, systematizing the interdisciplinarity between the knowledge of all these fields. However, Design remains as the core of the actions that unite all these areas and the starting point to conceptualize and generate shareable social technologies. The Cerne Program constitutes itself as a project of social-environmental innovation and integration between creative methodologies and productive techniques, aiming at the social, environmental, cultural and economic benefit of the groups involved and the social counterpart of University, accomplished through the sharing of the knowledge produced in the academia with the community and, in a double way, by an incorporation of the practices and popular knowledge in the discussions and solutions thought in the academic field. Given the urgency of a broad reeducation for sustainable consumption, the challenge in the project described was to understand the expansion of the theoretical field of design towards the social.

## 2. THEORETICAL BACKGROUND

This project is based on the systemic thinking applied to Social Design, that is, on a project logic that thinks a productive chain and service delivery, in which projects, products and actions are planned at the same time as the mapping of raw materials sources, input suppliers, users/consumers and environmentally friendly disposal processes. The concept of Social Design used was developed by Pazmino (2007), who considers that social design implies working in areas where there is no performance of the designer, nor the interest of the industry with solutions that result in improved quality of life, income and social inclusion. Other concepts used are: service design; sustainable design; social and environmental design; social innovation; collaborative design; social business; social technology; participatory immersion; co-creation; systemic design and complexity. The theoretical reference came from the following authors: Carlo Vezzoli, Ezio Manzini, Luiz Lagares Izidio, Carla Cipolla, Bibiana Serpa, Rita Afonso, Paul Singer and Rafael Cardoso. Concepts linked to the SPSS/Sustainable Product Service System logic are fundamental for understanding the conceptual and methodological strategies shared by the group.

In the researches in specialized bibliographies of the area, especially in the annals of the 12th Brazilian Congress of Research and Development in Design, which happened in 2016, we found around 90 results of articles on Social Design, and we highlight the article Design for social innovation between university and the broader society: the mutual learning process, (Design para a inovação social entre a universidade e a sociedade em geral: um processo de aprendizagem mútua) by authors Carla Cipolla (UFRJ), Bibiana Serpa and Rita Afonso. This article reinforces the potential of universities to promote innovative actions because of their character as a territory of experimen-

tation and reflection. In the article, the LASIN network/ Latin American Network of Social Innovation is cited as one of the ones dedicated to the topic, with the development of SISU/ Social Innovation Support Units, installed in Latin American universities with the purpose of intensifying the relationship between university and community towards social innovation through extension actions, research, development of methodologies and sharing of positive results in cases carried out by universities connected to the network. The article also cites the international network DESIS/ Design for Social Innovation Network as another important pole of production and dissemination of knowledge, methods and experiences in the connection between Social Design and Social Innovation through the actions of universities. It was also observed a strong presence of the university, mainly through extension programs, in the range of projects identified as typical initiatives in Social Design. It is important to note that a design aimed at minimizing the low quality of life indexes of the most deprived regions is a trend in the second decade of the 21st century, given the vastness of the field that opens up in terms of unexplained demands, so that the design goes beyond its classic and established ambit in relation to the assisted public. In the hypothesis that, for not starting from demands that form from the market and for not involving the most characteristic social actors of the design modus operandi, traditionally focused on market trends, and that Social Design become dependent on the thought of social institutions that extrapolate the market, it is to be expected that the university participates so intensely in this process. It is necessary to consider the need to understand that the participation in this so emergencial tendency, which is the proposal of social design aimed at urban and rural communities that are formed with much lack of services and products.

Around themes such as social innovation, participatory immersion, co-creation and social technologies, it is observed that the methodologies for entrepreneurship in the field of social design seem to have passed, necessarily, by reflections and projects, if not initiated, almost always adopted and developed by institutions that rely on academic production.

### 3. RESEARCH METHOD

Qualitative techniques of systematic bibliographic review and data collection were used, with an exploratory and descriptive character, about the performances in social design carried out by the universities. The qualitative analysis was based on immersion of ethnographic nature and of non-participant character; sensorial and photographic mapping; knowledge of the previous collection, Remexe 1, and contemporary consumer philosophy; use of a fashionable sustainable production method, the upcycling.

In addition to the training of beneficiaries, other work fronts were offered, such as short workshops, to make available the social knowledge and technologies generated in the project to the general public; and the development of concept products, resulting from innovation research and inventiveness of the project students themselves, to serve as a source of inspiration for all the Cerne Program's work fronts. In this way, volunteer and scholarship FUMEC University students working on the project had the opportunity to conduct guided research of references and techniques in several areas; to exercise the construction of creative methodologies for training beneficiaries; to work in workshops and training; to design projects and model-products with the technical and conceptual support of the team; to develop the creative autonomy associated with a perception of project reality, contextualizing their professional actions based on the real conditions of the beneficiaries; and to add to their training a humanistic and social view of the profession, enabling their future professional actions to be more committed to collective responsibilities and inclusive solutions.

The workshops related to the Remexe 2 collection started in may 2018, with themes such as "collection concept" and "storytelling technique", and intensified from a visit with SEBRAE-MG to the association Lá da Favelinha in order to diagnose the problems characteristic of the community. The students photographed important details and interviewed the residents, constituting a critical perspective of that reality. Then, from the Fashion Design's own methodology, the group began the concept generation phase for the new collection of the project. To do so, the research resulting from this diagnostic visit was presented, as well as a brainstorm done in a meeting. Consequently, there were defined the products lines and the color chart. Through a donations campaign, enough clothing parts were received to work in the upcoming workshops with the process of upcycling of clothes, which were then separated following the color palette. The upcycling phase included the following training workshops for the seamstresses associated with Lá da Favelinha: customization, from the dismantling of the cloth pieces to the sewing of new clothes made from the derived components; silkscreen, from the preparation and making of silkscreen-printing matrices to the printing process itself; tie-dye, from the ink preparation, tying and dyeing of parts; hand made embroidery, from the basic stitches to the finishing of the sewing in writing and drawing format on the clothes; and production and finishing of clothing and accessories. At the end of the technical training phase for the seamstresses, the consultancy given by the stylists hired by SEBRAE-MG and the experimental modeling of the Remexe 2 concept pieces began. A photographic essay was also made for the editorial, with the concept pieces already finished. The community's own residents and association organizers modeled for the photoshoot and fashion show. The first fashion show of the Remexe 2 collection was simple, made together with the fashion design project nuclei own fashion shows, in the hall of FUMEC university, in December of 2018. However, it was very intimate, with dance performances and the visit of the families of the involved participants. In summary, the complete methodology took

place from the insertion of the Lá da Favelinha brand in the fashion market through the creation of a contact network between the participants and professionals of this market, to the fashion show of the new collection.

#### 4. RESULTS AND ANALYSIS

The results in products and collection for the fashion show and launching directed to the market were pieces of clothing, conceptualized from the scenes and images of the Aglomerado da Serra's community, seen by the design graduate students and lived by the beneficiaries in their daily routines. The lyrics of a rap song created by a community artist, helped to build the name of the collection - *É Curva*, which also represents the curves of the streets, alleys, nature and architecture of this so particular place. The clothes were designed in an upcycling process and also received individualized typographic prints done in silkscreen and hand made embroidery. The accessories were created by the beneficiaries and students of the university, in collective workshops and co-creative processes. All of these products were portrayed in a photographic essay presented in a printed graphic catalog (FIG 1 and 2) and in enlarged posters of each look.



[Figure 1] Frontpage of the printed graphic catalog created by Designer Marja Marques and team, directed by SEBRAE-MG's consultant Rodrigo Cesário, in partnership with students and teachers of FUMEC university.



[Figure 2] Back cover of the printed graphic catalog created by Designer Marja Marques and team, directed by SEBRAE-MG's consultant Rodrigo Cesário, in partnership with students and teachers of FUMEC university.

In addition to product results, the Cerne Program as a university extensionist activity has brought several results in knowledge gains, and experiences such as: systemic solutions for each project situation and communities, designed and executed from the specific methodologies proposed and interactions with partner projects; beneficiaries with creative autonomy and qualified to work professionally in a network of partners or to solve problems of their daily life; conceptual and educational products about the training methodology that will be made available to the community through print, exhibitions, internet and presentations organized in public spaces; integrated projects in Graphic Design, Product Design, Fashion Design, Interior Design and Architecture; formation of teams of teachers and university students trained for the extensionist and professional action of interdisciplinary, systemic and socio-environmental character; papers written by students and teachers for the dissemination of methodological process reflections and results; approximation between companies, institutions, society and the university.

#### 5. IMPACTS ON SUSTAINABILITY

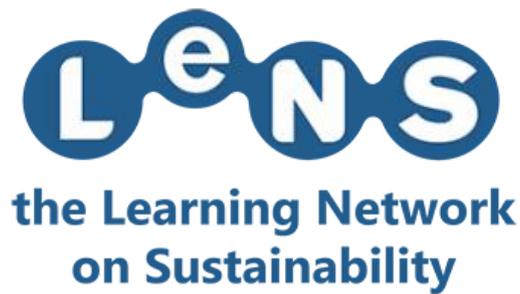
The Cerne Program resulted in positive social and environmental impacts of sustainability since it contributed to the construction of a new logic of fashion production, based on reuse of clothes and the transformation of donated clothing pieces with the objective of local commercialization, fomenting a new cycle of life for the products used and for the generation of income for the Lá da Favelinha association. The clothing pieces produced and made feasible by

the program have boosted the original energy spent in its manufacture, resuming a new phase of reuse that extended its useful life. In addition, the process of generating products based on collective creations create a co-responsibility for the results obtained, both in terms of the quality of the clothing pieces and in relation to their commercialization. The social character of collective responsible management of the processes and the results, fed the relationship between the participants, generating a common awareness among them of authorship, development, finalization and commercialization of the products, strengthening the relationship between social actors, a very important aspect for the success of a collaborative action. The resulting income, reverted to the financing of the association own project actions and its participants, was a fundamental factor for the initiative to have continuity in time, incorporating new ideas and new actions and guaranteeing the economic sustainability of the initiative and allowing other versions of the project with the same partners, or with new participants. So the Cerne Program used the concept developed by Manzini, which maintains that moving towards sustainability is going against conservatism, in other words, preserving and seeking the regeneration of our environmental and social capital means breaking with the dominant tendencies in terms of lifestyle, production and consumption, opening up to new possibilities. (MANZINI, 2008 p.15)

In this sense, the Cerne Program at FUMEC University achieved the expected social and environmental objectives, fulfilling its social function in the community, reusing products in new production processes, avoiding premature discarding, collaborative co-creation and the involvement of partners, students and teachers in a continuous manner and committed to processes and results. In addition, the dissemination of the processes and results was recorded in a publication of the Cerne Education for Sustainability booklet, which steps up to the place of the academic reflection on the actions and disseminates the experiences lived by the team and partners of the Program, contributing to the generation of an awareness on various aspects of socio-environmental sustainability.

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## **TOWARDS INCLUSIVITY: EXPLORING THE IMPLICATIONS OF MULTI-SENSORY AND PARTICIPATORY DESIGN APPROACHES IN A SOUTH AFRICAN CONTEXT**

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### **ABSTRACT**

Against the backdrop of existing ocularcentrism in the field of design, this paper reflects on how design can function more inclusively within the specific context of visual impairment at a South African institution of higher education.

Following a practice-based research approach, the research engaged in multi-sensory and participatory design processes with three visually impaired individuals in the specific campus community. The aim was to use design for social innovation to work towards a stronger, more inclusive campus community. This paper provides an example of how ocularcentrism in design was challenged in order to expand the boundaries of traditional design strategies. It shows how, through collaborative, multisensory design practice, social spaces that foster inclusivity, mutual insight, accessibility, and independence can be created within a specific community. Such an approach to design could hold value in similar contexts of disability and warrants further research.

Key Words: Ocularcentrism, Inclusivity, Disability, Multisensory Design

## 1. INTRODUCTION

Currently sight disability accounts for 32% of all disabilities in Southern Africa. Of this 32%, 97% of visually impaired persons remain unemployed due to misconceptions, prejudices, a lack of independence and lowered productivity incurred as a result of inaccessibility<sup>1</sup> (Sacharowitz, 2005). These statistics highlight the importance of exploring strategies that work towards a more inclusive society in our local South African context.

The research this paper reflects on stems from the illogical premise that design can function under the term Inclusive Design – “an intentional project that sets out to include significant sectors of society that are all too frequently ignored or overlooked” (Coleman cited in Luck, 2018, p.97) – when the majority of its practitioners operate ocularcentrically. Inclusive design practices were consequently explored within the specific context of visual impairment at a particular institution of higher education in South Africa. The aim was to follow a bottom-up approach and work with visually impaired individuals (Manzini, 2014) in order to challenge the ocularcentric nature of dominant communication design practices.

The paper starts by contextualising the research theoretically. Specific concepts touched on include ocularcentrism as dominant ideology, disability and design. The next section discusses the specific case study in depth. This is followed by a concluding section where specific insights regarding inclusive design practice in the context of visual impairment is shared.

## 2. PROVIDING CONTEXT

### - Ocularcentrism as dominant ideology

In *Rethinking Disability. Bodies, Senses and Things* (2010), Michael Schillmeier discusses the way in which the Enlightenment bred the belief that sight is the noblest sense due to its comprehensive simultaneity, variability and permanent nature. Sight was seen as the strongest sense; biologically surpassing its counterparts in intricacy and capabilities. It was viewed as the most disconnected from subjective bodily experiences, thus offering the most truthful account of the world. Sight was regarded as making us truly human. Little room was hence left for discourse that allowed for the possibility of visual impairment as being something we could learn from and use as a catalyst for the development of a more inclusive society and social sustainability. Through the formation of these rationalistic ideologies rooted in dialectic reason, modern society developed a fixation rooted in classification. The value of individuals became based on (and, we would argue, largely remains based on) hierarchic classification.

The problem with favouring sight is that it has introduced the tendency to forget about the “lived body” (Keat, 1982, p.3). This has resulted in a disembodied understanding of reality from which to draw creative reference. Maurice Merleau-Ponty has argued that “more than anything we are carnal beings who move around, smell, touch and hear, so that every visual contact with the world becomes a lived-out, not a thought-out experience of it” (cited in Belova, 2006, p.97). By shifting our attention to the experiences beyond sight, we can possibly overcome one of the many issues of ocularcentrism; i.e. that it denies us a certain amount of expression. Merleau-Ponty argues that only embodied beings are capable of expression (Workman, 2016). To subscribe to a visually slanted discourse sustains disembodiment and ensures a disconnect from creation.

It could be argued that if we are embodied due to the synthesis of our senses, a visually impaired person, who lacks a sense, would be disembodied. It could, however, similarly be put forth that even a person with full access to a sighted experience cannot see everything in the world (Workman, 2016). This does by no means disconnect such an individual from what he/she cannot see, nor does it suggest that objects in the world do not exist because they are not immediately seen. It can thus be argued that a person’s lack of sight does not reduce their world, nor their ability to live in it. Visual impairment also does not lessen visually impaired individuals’ phenomenological experience (Workman, 2016). Merleau-Ponty argues, in terms of disability, that “this person’s body is still the center of the world around which all objects flow. It seems that this person is no less integrated with the world. To perceive is to have a body, and to have a body is to inhabit the world” (cited in Workman, 2016, p.70). This suggests that the absence of a sense does not sustain disembodiment. It is rather the choice we make to delegate one sense as superior and to mute the others that fosters disembodiment. It could similarly be held that visually impaired persons make use of their senses in a more interconnected manner to fill in the phenomenological gaps created by the absence of sight, and this could suggest that a visually impaired person is more embodied than ocular dependent persons. If this proves true, great knowledge can be drawn from visually absent experiences.

### - Disability studies

Visual impairment disrupts the binary logic of ocularcentrism and thus ignites a need to consider a reformation of communication design, particularly when one observes “vision as [an] incising, objectifying, and ordering activity aimed to seize and appropriate the other” (Belova, 2006, p.93). Emmanuel Levinas has rightly stated that “I am not constituted of myself as an individual, but rather ‘I’ am entangled with and inextricably connected to ‘the other’ and grounded in a demand to fulfil my responsibilities to him or her” (cited in Workman, 2016, p.3). If we do not ques-

<sup>1</sup>Inaccessibility herein, not only refers to physical boundaries, but also takes into account restriction from information (WHO, 2001).

tion ocular favouritism, then we risk disregarding our very nature as Beings. “Existence is the inclusion of the Other, it is this double process of relating that defines the being of existence” (Schillmeier, 2010, p.13). By disregarding the embodied nature of being, we support the notion of disability as a limiting construct that serves to divide us. In order to start considering disability in more inclusive terms, it is necessary to consider disability studies within the South African context. In order to affect any kind of sustainable future change, one should consider change at a local level first (Braidotti, 2011).

“The social and economic destiny of disabled people tends to be understood as the logical – and politically sanitised – consequence of impairment of the body,” says Leslie Swartz and Brian Watermeyer in *Disability and Social Change: A South African Agenda* (2006, p.2). This understanding tends to eliminate any questioning into the treatment of those with disabilities. Through the lens of the Social Model of Disability<sup>2</sup> (Goodley et al, 2012), such an individualistic perspective of disability is, however, seen as oppressive. Critical Disability Studies (CDS) is a theoretical framework that calls for the political and societal emancipation of disability from disablist beliefs that insult human rights and dignity (Watermeyer et al, 2006). Whilst this has global importance, this could not be more necessary in South Africa where human rights are such an integrated part of our history. CDS within South Africa is about understanding how oppression came about, investigating the social relations and barriers that prevent disabled persons’ participation, equality and integration in society, and formulating strategies that challenge and resist disablist oppression in the hope of effecting positive social change (Watermeyer et al, 2006). We do acknowledge, however, that dealing with research on disability and impairment remains sensitive terrain and must be handled with care. The aim of this research was thus not to pity disability or position impairments in a negative light, but rather to explore and navigate dominant ideologies from a designer’s perspective and investigate whether alternative ideas and practices might not have a more productive impact on future societal transformation.

#### - Design for sustainable social change: Activist, inclusive, multisensory and participatory

Much like researchers need to consider the implications of CDS on the subjects they enquire about, it is of importance that designers continually reflect on the nature of design and the real world implications of their designs. “Design is a key agency in materialising, and designing, our lives. For, as many observers have noted, what is already designed exerts a huge influence over the design of our lives, and what comes next” (Faud-Luke, 2009, p.xix). Design is a suggestive force that has the ability to guide perceptions. It has the explicit power to drive society as it is, or alter it.

With this power comes the responsibility of designers to focus their energy on positive social change; thus, to merge the practice of design with the academic discipline of CDS is a powerful and dynamic duo when sustainable social change is the aim. This research thus acts as a form of sustainable design activism – a “discipline capable of effecting intensive resistances to the present – resistances that present ways to think and do otherwise” (Hroch, 2015, p.238) – and urges designers to consider themselves as change-agents with social responsibility. Design activism takes a step away from traditional design motivations, namely monetary compensation and status, and considers first and foremost the ethical nature of their work. thus By adopting activist roles, designers can, in the words of Petra Hroch, “enact an affirmative politics – a politics that engages the made world in order to re-make it in ways that promote the flourishing of future heterogeneous connections” (2015, p.239). In this way, dominant ideologies regarding disability can be challenged and design can act as a catalyst for radically affirmative social transformation and innovation.

As an existing field of design, inclusive design generally aims to “bring about change, to redress through design the many situations in everyday life that do not accommodate the diverse capabilities of people with (dis)abilities” (Luck, 2018). In this light, the fact that the visual nature of communication design remains dominant, deserves critical attention and negotiation. There is a sad irony in a practice dedicated to inclusivity that omits those that struggle visually. As Rachael Luck has said, “[i]t is precisely this critical attention that the inclusive design movement aims to provoke, that is, to shed a light on what design should routinely address but currently does not do well” (2018, p.96).

Designing inclusively aligns with contemporary political thought and, as suggested by Schillmeier (2010), there is great power in not being confined to the experience of sight. It proves liberating and can allow for greater authentic ideation. By seeing blindness as an inferiority or loss, designers have limited themselves from engaging with realms that transgress what we know as visual beings. The blind know more of what it means to be sighted than we know of what it means to be blind. To attempt to subvert those power relations and dominant ideologies and operate within a world void of the visual is thus a worthwhile challenge for communication designers.

Due to visual thinking being at the core of most communication design practice it becomes important to consider how we are designing if we are not designing with sight, nor with the intention of design being understood through sight. If one understands humans as embodied beings with a plethora of sensory faculties at their disposal, designers who aim to contest dominant ocularcentric ideologies should engage with a host of senses in an integrated manner rather than with singular ones. This can be achieved through applying a multi-sensory approach to design. Multisensory design entails the consideration of incorporating two or more sense into a design and is concerned

<sup>2</sup>The Social Model of Disability sees an impairment as something that a person has, but is not disabled by. It makes a claim for society being the disabling factor in a person’s life (Goodley et al., 2012).

with the overall experiences that design creates (Truckenbrod, 1992; Schifferstein, 2011). The benefit of multi-sensory design to a person with a visual impairment is that through the engagement of the sensory faculties they do possess, a mental image of the experience, space and/or design can start forming. By providing more sensory information to visually impaired persons, a richer and more in-depth sense of space and the world can be formed, thus facilitating the destabilisation of barriers that perpetuate exclusion.

Contemporary designer, Trevor Conrad has tackled the issue of exclusivity in his dissertation *Beyond Braille: Graphic Design for the Visually Impaired* (2012). Conrad aims “to show how inclusive design can create effective communication for both the non-visual and visual” (2012, p.1). He does so by developing a prototype of an app that guides visually impaired persons through grocery stores. His app contains voice-over assistance, colour co-ordination and considers optimising screen real estate to incorporate larger text-sizes for partially sighted and blind users. It does, however, still contain traditional functional aesthetics that make it appealing to sighted users. Conrad understands design inclusivity as referring to the access and usability of a design solution by as many people as reasonably possible (2012). His work and writing are both effective in highlighting that design solutions should consider all end-users and must not adopt an inclusion via exclusion approach; the functionality of a design solution to an end-user is more important than the visual aesthetics that define it. In working towards inclusive design practice, it is thus important for designers to understand that they are not designing for but designing with; a crucially important characteristic of the bottom-up approach to design for social innovation as described by Ezio Manzini (2014). According to Manzini, design for social innovation entails “initiat[ing] a constellation of design initiatives geared toward making social [change] more probable, effective, long-lasting, and apt to spread” (Manzini, 2014, p.65). He argues that design for social innovation and participatory design (Ehn, 2010) thus share a similar foundation. Both are “highly dynamic ... complex ... and often contradictory processes” (Manzini, 2014, p.65). Both are also “creative and proactive activities” where the designer acts as “mediator” and “facilitator (Manzini, 2014, p.65).

In this light, participatory design (or co-design) stems from the realisation that creative potential lies in the non-designers that designers design with. From a socialist and humanist approach, user participation in design becomes necessary for collective security and individual autonomy (Asaro, 2000). It is precisely this individual autonomy that we set out to cultivate when conceptualising this research. By using a participatory design approach, a designer has the ability to “emancipate people by making them active contributors rather than passive recipients. It is therefore a form of design humanism aimed at reducing domination” (Faud-Luke, 2000, p.147). This invites the question as to what role the designer occupies in this context. Even though the role of expert is intermingled with that of non-expert, designers still have a learnt set of expertise. Thus, one should not be scared to embrace such skill in the fear of an obsolete role. It is still the primary role of designer to guide and provide the scaffolding to participants. One needs to have patience with the process as it can take time for participants to embrace that they too have creative potential.

Designers have the task of developing methods to cultivate a sense of ease among co-creators that is conducive to creation without stifling or subliminally influencing results. The next section of this paper discusses how activist, inclusive, multi-sensory and participatory design strategies were employed to work towards sustainable social change in the context of visual impairment at a specific institution of higher education in South Africa.

### 3. FOR ALL EYES: A CASE STUDY

As mentioned earlier, this research was situated within a specific institution of higher education in South Africa. Codesigners were purposefully obtained through the university’s Braille Centre. The process started with meeting various visually impaired persons in informal settings as we wanted to convey that we were genuinely interested in who these persons were disassociated from their impairments. During these meetings we discussed what the research process would entail and the specific sample group was lessened to three visually impaired individuals who were most available and willing to participate. All participants provided informed consent to participate in the research. In hindsight, a smaller sample group enhanced the research as it allowed for more in-depth exploration which aligned with the central aims of the research. The next step consisted of informal interviews with each respective co-designer. The following questions were asked:

- What do you think is the dominant mode of communication?
- Does the aforementioned mode of communication feel restricting?
- Do you feel that there are misconceptions around visual impairment?
- Do you ever feel ‘othered’ or excluded because of your disability?

The aim of these interviews was to gain insight into the experience of the participants as impaired persons in the campus community. We wanted to gain insight into their points of view so as to be able to translate these into design experiences that could bring to realisation the implications of exclusivist design approaches. It was a conscious decision to not draw a common thread between participants, but to rather treat each in a unique manner driven by the special needs of their individual impairments. Although we did not seek out commonalities, a recurring theme could be seen:

The physical barriers of low-vision were inferior to the struggle that sighted persons introduced into the

participants' lives by believing in perpetuated misconceptions. Our approach was thus simultaneously aimed at debunking misconceptions of the sighted, whilst pushing the boundaries of inclusive design. It was decided to engage in a participatory poster<sup>3</sup> design process with each of the participants<sup>4</sup>. In order to highlight the individuality of individual's each impairment, a single poster was designed with each individual participant and contained the message that the respective participants wanted a sighted person to understand about visual impairment. The individual posters subsequently functioned as a series of three, seen in Figure 1.



[Figure 1] Poster Series. Poster one (left), Poster two (middle), Poster three (right).

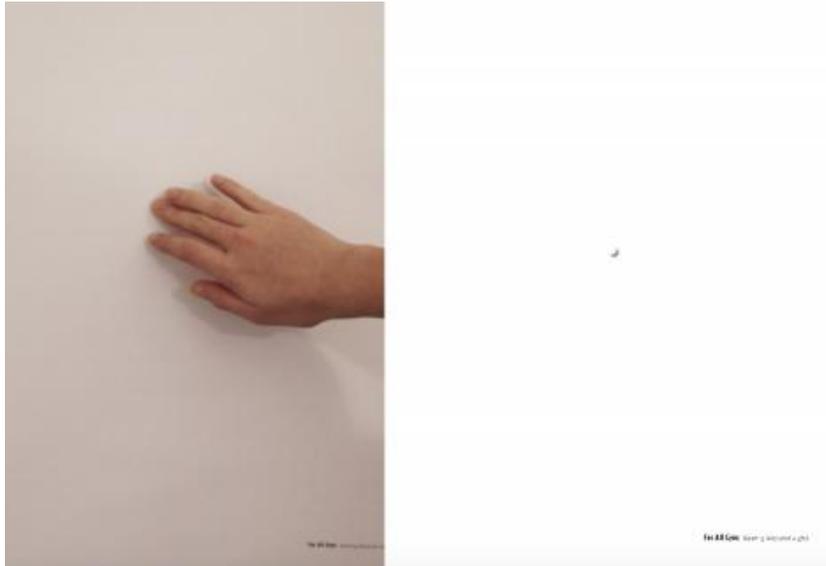
The use of a poster format originates from the highly politicised history of posters as means of propaganda and sociopolitical critique. Important to conceptualising inclusive design solutions, is that one does not necessarily have to reinvent the practice of design, but can also make use of existing structures in a reformative way. We were able to use the inherent power of poster design in a new context to convey the alternative approaches designers can take and the inclusive implications thereof. Posters are traditionally used to convey information in a visual way. We, however, redesigned the form to be multi-sensory and thus were able to redefine its original function.

The poster for participant three was the easiest to conceptualise. As she is legally blind, no visual imagery could be used which eradicated the use of traditional design aesthetics and allowed room for creative expansion. The media used was adopted from her dominant method of study; i.e. a mix between braille and audio. She preferred learning and communicating through audio, thus directing the design of a predominantly audio poster. The choice of medium not only contested the misconception that all visually impaired persons rely solely on braille, but also ensured that the communication design was also accessible to a sighted audience who could not understand braille. A sound device with audio clip was embedded within a thick paper box. The audio clip relayed the message participant three wanted to convey to sighted people – that often people don't know how to treat or communicate with impaired individuals, so they would rather avoid interaction altogether. This can, however, easily make the impaired persons feel as if they don't exist. The poster was kept white so that the device blended into it. This colour choice further highlighted the notion of not existing. It also invited touch and closer inspection as one could not initially see the sound device. This added another sensory dimension to the design. An effective technique employed throughout the poster series was to place sighted persons into the experience of the visually impaired and vice versa so as to make their experience equal to one another and diminish barriers.

<sup>3</sup> All posters were A2 in size. The size was chosen because it is big enough for the participants to engage with, yet still allowed for ease and affordability of printing. Cost considerations were made due to the South African disability context and the budget that would be available for campaigning in the specific community we worked in.

<sup>4</sup> Participant one has Stargardt's Disease, and is categorised as Partially Sighted. She has 10-15% vision and makes use of a guide dog. Participant two has Optic Atrophy and is also considered Partially Sighted. Her vision is the best of the three participants. Participant three has Lebers Congenital Amourosis and is legally blind. She makes use of a guide dog. All participants were registered students at the institution at the time of the research.

The final poster can be seen in Figure 2.



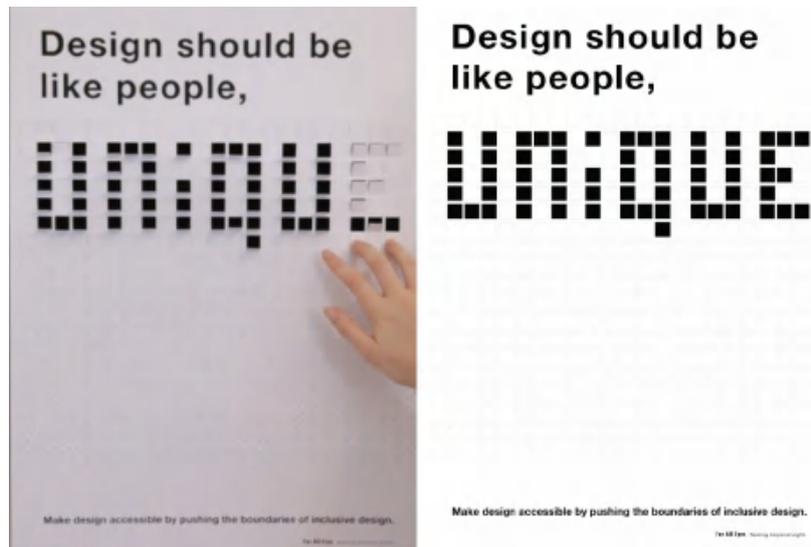
[Figure 2] Poster Three. Embedded sound device being pressed to play recorded audio clip.

Poster two is the best example of the application of this relational technique. With participant two, who has the most sight of the three, we conceptualised a poster that made use of high-contrasting colours, big and bold type, and a logical, non-distracting flow of information. In the experience of participant two, sighted individuals often treat visually impaired persons as though they also have a cognitive impairment and lacked intellectual capabilities. We thus wanted to convey that a visual impairment is only visual. To create an equal experience, we drew inspiration from the prototype sessions we had with smaller scale posters. Participant two would have to move the posters back and forth to see at what distance the text became clear. We decided to use this experience of movement in order to gain effective focus and vision to enhance the message that just because something is unclear visually, it does not make you mentally challenged. The larger A2 poster was hence accompanied by a smaller A5 replica. The text on the smaller version was, however, cut out so that viewers would have to stand at a distance and try and match it up with the text of the larger poster in order to be able to read the message clearly. This poster can be seen in Figure 3.



[Figure 3] Poster Two. Example of how smaller replica with cut out letters can be aligned to the larger poster behind.

Designing Poster one involved the most challenging process since the participant's sight lies somewhere in-between the other two participants'. This implied that the poster could incorporate text, but not as overtly as poster two did. The message the participant wanted to convey was that each person with a visual impairment is unique. One cannot assume every impaired individual's experience to be similar. The poster contained the following message in words: 'Design should be like people, unique'. The word 'unique' was, however, made tactile by introducing little flaps of paper that could be lifted and lowered to reveal the black background underneath the white poster. This tactility bolstered the intended message, because the flaps could be re-arranged to spell out another word, making the poster continually unique. The multi-sensory aspect allowed for participant one to feel the new words with the existing knowledge of what the poster says. She consequently did not feel excluded even if the message changed. This final poster can be seen in Figure 4.



[Figure 4] Poster One. Paper flaps allow interaction as new words can be made.

#### 4. CONCLUSION

The research this paper reflects on was situated within a critical paradigm and followed a practice-based, participatory approach to design. It was found that if one opens up to the idea that design can be understood without sight through practice and collaboration, a whole new world of design solutions presents itself. Through participatory processes, the research illustrated how design can operate more inclusively and overcome the ocularcentric tendencies it largely perpetuates. The following critical insights were gained from the experience:

- In order to foster respect and inclusion, designers should take the time to build personal relationships with design participants. An emotional connection based on authentic interest and genuine concern can make contributors more willing to participate and can nurture greater freedom of expression.
- When applying a participatory design approach, designers must remember that every co-creator is an individual. By embracing the diversity of participants, the design goes through many iterations that can add depth to the final solution.
- Allowing time for material exploration is important. Material exploration teaches designers to open up the process of design and not have full control over the aesthetics of end products. With this approach the narrative behind the work can come to transcend its visual nature.
- Using the power inherent in existing media holds value. By using existing techniques in new contexts, this research has not just commented on an important social issue, but allowed for the embodiment of critique. The implication of this was that the intended message could be felt and witnessed in an embodied manner and was thus more easily received by respective audiences.

This paper provides an example of how ocularcentrism in design was challenged in order to expand the boundaries of traditional design strategies. It showed how, through collaborative, multisensory design practice, social spaces that foster inclusivity, mutual insight, accessibility, and independence were created within a specific community. Such an approach to design could hold value in similar contexts of disability elsewhere and warrants further research.

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## **THE OPPORTUNITIES OF SUSTAINABLE HOUSING TO PROMOTE GENDER EQUALITY**

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### **ABSTRACT**

Between 2014 and 2016, a pilot project was executed to promote energy efficiency through the NAMA housing retrofit. This project was carried out between the Mexican government and the German Cooperation for Sustainable Development (GIZ) in Mexico. The exercise served to propose specific approaches for certain groups of the population, by using energy efficiency to improve the conditions of Mexican families and showed the co-benefits that can be obtained from monitoring awareness and communication activities on climate change and saving energy and water. The results of this pilot have served to verify that gender inequality in housing can be reduced by proposing affirmative actions to vulnerable groups by providing access to information and technical assistance for the improvement of their homes through energy efficiency.

Key words: sustainable housing, gender's perspective, climate change, social impact

This document talks about the lessons learned during the implementation of a pilot project planned to test energy efficiency for social housing in Mexico. It was evident during its execution, the necessity to get close to the population to achieve the goals of the project and the potential of these types of actions to reduce social inequality.

According to data from the National Council for the Evaluation of Social Development Policy (CONEVAL), the reconfiguration of Mexican households and the role of women reflects gradual changes for certain stereotypes, for example, in 2014, for every hundred households whose heads of family were men, 35 were headed by a woman, a situation that is growing and is relevant since it is directly related to women's participation in labour market and the difficulties they face in order to provide their households with material and human resources and to guarantee the subsistence of their families. It is important to notice that these households are more vulnerable, they have a greater number of members, greater needs, a greater number of dependent members and greater poverty conditions (Coneval, 2014).

The National Survey of Occupation and Employment (ENOE) said in 2016, 20.8 million women aged 15 years old and over were part of the economically active population. Of the employed women, 23.3% are self-employed, 2.3% are employers, 7.5% do not receive remuneration for their work, and 33.8% do not have work benefits (Coneval, 2012). Related to housing, 25% of Mexican households are headed by women, they receive a salary up to 30% lower than men and do not own their household papers, only 42% are owners; In addition, due to the conditions of access to economic activities and labour benefits, more than 50% of the houses are the result of their effort, built with their own resources, auto-constructed and without legal titles (María Elena Barrera, 2016). It is worth mentioning that of the 31.6 million households in the country, 8.9 million are in housing arrears (Conavi, 2016); These households have more difficulties obtaining adequate conditions such as energy and water. Currently, the residential sector is responsible for 16.2% of the country's energy consumption and the production of 4.9% of all CO<sub>2</sub> emissions (Fundación IDEA, 2013).

The Housing Law establishes in article 3:

"The provision of the Law must be applied under the principles of equity, social inclusion, so that any person, regardless of ethnic origin, age, gender, disability or economic and social condition, physical condition, religion, opinion or preferences can practice his constitutional right to acquire a home".

It is the State's obligation to provide the population with an affordable and dignified place where they can carry out their day-to-day activities (DOF, 2015). In addition, the National Development Plan 2012-2018 established gender's perspective as a transversal axis, so all government programs and institutions should promote equality between men and women (Inmujeres, 2013).

In order to comply with this mandate, the Government carried out actions related to reduce gender inequality by supporting women's formal access to land or providing access to loans for the construction or expansion of housing areas. These projects had the purpose to reduce home violence, for example the program "One more room" whose objectives were to offer spaces free of violence to girls and adolescents, to reduce urban gaps by improving the quality of life within cities and to contribute to the reduction of deprivation caused by the quality of housing space (Sedatu, 2016); However, policies should not only promote the reduction of overcrowding, but to consider cross-cutting actions that promote the possibility for women (particularly heads of households) to make decisions related to the condition of their homes and not available subjects for credits, to give them the opportunity to have access to programs to purchase and to improve their houses, so that they cannot only upgrade their lives in terms of space, but also to make them more comfortable and allow them to save money for other activities and thus reduce their poverty conditions.

In 2014 and until 2016, the German Cooperation for Sustainable Development (GIZ) in Mexico supported the National Housing Commission (Conavi) to develop the existing housing NAMA and to carry out a pilot project in the city of Mérida, Yucatán. The NAMAs are the National Appropriate Mitigation Actions and are voluntary activities whose purpose is to reduce greenhouse gas (GHG) emissions in developing countries. Mexico is the first country to carry out an action like this and this NAMA is the most developed in the world and received support from the German government for its design and implementation.

The objectives of the NAMA housing retrofit are to promote scalable energy efficiency standards, to support the government to create programs for the population to promote economic, social and environmental development through social housing (Passivhaus Institut, Izn Friedrichsdorf Gopa, 2014) and promote the energy rehabilitation of the existing housing stock.

The objectives of this pilot in general were:

- To propose cost-efficient measures for housing rehabilitation including energy efficiency
- To know the challenges of dealing with inhabited homes
- To establish communication processes with final users
- To evaluate the cost and benefit ratio of the proposed measures
- To provide practical information to the Mexican government

CONAVI, the National Institute for Housing for Workers (Infonavit), GIZ and the Trust for Energy Saving (FIDE), decided to execute it in the area called Polígono 108 in Merida, because it is a formal social housing development and there is a close relationship between the local Infonavit and the population.



Image 1: Anahí RamírezOrtíz, GIZ First meeting with inhabitants of Polígono 108

To establish contact with the population of the neighbourhood, two workshops were planned for the inhabitants of the area, in addition to making house-to-house technical visits. These visits consisted of giving away information about the project, to invite the population to participate in the workshops in order to learn about climate change, what is energy efficiency and, to talk about the programs of the Mexican Government to promote housing. They also received specific information of the pilot project and the process used to choose the participants (Conavi, 2014).

There was not much information about the inhabitants or a clear idea of how their population should be approached, with the aim of achieving the goals of the project. The only certainty was the need to contact the people in a specific way, by using a simple and clear language so that the interests of the related institutions could be transmitted, and the objectives fulfilled.

It became evident the importance of being supported by the leaders of the neighbourhood to establish contact with its inhabitants; here, women are the leaders and through them the working team was able to bond with the others. Once the team (consisting of almost exclusively women) began to interact and to communicate with the population, it was possible to arouse the interest of the settlers and to count on their participation.



Image 2: Anahí Ramírez Ortíz, GIZ Working team during the first visit of the pilot Project for the NAMA housing retrofit  
The fact that the leaders accompanied the working team at all time was part of the success because they influ-



Image 3: Anahí Ramírez Ortíz, GIZ First workshop for inhabitants of Polígono 108

enced in a positive way and improved the relations in the neighbourhood. The housewives felt confident, they were interested in learning about energy efficiency and a bond was established between all the inhabitants; A series of parallel activities to the awareness-raising workshops were carried out, for example, surveys were conducted to choose the dwellings to be intervened. The parameters considered to be part of the project were: houses with high energy consumption, without significant modifications to the original architecture, with a high number of inhabitants, who had the papers of their houses and have actively participated in the two workshops.

Once the contact with the people was established, the working team reformulated the role of the women, in order to encourage them to participate actively in all phases of the pilot; they attended most of the meetings, they sent information about their homes, they knew its conditions, their consumption of electricity, gas and water, they transmitted the information about the project to other members of their families and began to modify their habits inside their homes so they could save water and energy.

This contact was key to know how the population relates, and to consider the roles of men and women for the implementation of the project, for example, the schedules of the workshops and work visits were adapted to the climate and activities of the region, the information was elaborated considering their socioeconomic level and especially assured women did not have extra work from this project: It also emphasized their role to obtain benefits in their daily basis.



Image 4: Anahí Ramírez Ortiz Initiation of remodeling activities Visit to the site, Polígono

During the workshops, the population had basic information about the risks of natural disasters, the consequences of our way of consuming, and how to modify habits to consume fewer resources. They learnt how to improve the comfort of their homes. They were taught how to make a basic energy balance and solutions were shown to reduce their electricity consumption.

Students from Anáhuac Mayab University helped to carry out the physical and appliance surveys of the households interested in the pilot. This activity served them to practice how to make improvement proposals by using environmentally friendly technologies and materials. The students were impacted by the conditions of many of the houses and were sensitized on the role of construction professionals to improve the quality of life and to help people to reduce their vulnerability to change climate. After a year of the workshops, visits were made and the families commented the economic and comfort benefits they had, some commented their electricity bills decreased up to 50% during the summer.

The technical design of the NAMA housing retrofit proposes a “step by step” rehabilitation until reaching the optimum energy and environmental performance. This design proposes a baseline that consists of carrying out basic maintenance actions and once the houses are in good conditions, it proposes three steps to reduce energy consumption and to improve comfort; this to reduce the costs of rehabilitation and for users to immediately see the benefits and economic savings (Conavi 2014). The steps include the change of household appliances and modifications such as the installation of thermal insulation, high quality windows, cross ventilation and finally the use of renewable energy.



Image 7: GIZ Rehabilitation step by step refurbishment to achieve optimal energy and environmental performance,

Six improvement packages were proposed for the different types of housing including the steps of the NAMA. Due to time and budget, only two of them were used. The measures included the change of windows, the installation of shading and insulation for walls and ceilings, change of water saving equipment, and use of reflective paint.

Only nine houses were chosen to be modified. The families were asked to keep the electricity, water and gas bills in order to be used as a reference to know the behaviour of their homes. There was a specific follow-up for each participating family during the rehabilitation process and the first savings were the result of simple changes in habits inside their homes.



Image 5: Anahí Ramírez Ortíz NAMA Housing Retrofit Project, site visit, Polígono 108

The reform of the houses lasted almost six months and it was necessary for GIZ to accompany the inhabitants and the local construction workers in order to avoid misunderstandings between the masons and the users, to give confidence, to explain the constructive process and to eliminate any concern during the construction.



Image 6: Anahí Ramírez Ortíz Construction of ventilation for houses in Polígono 108

Although it was not possible to have specialized teams to monitor the impacts of the project, the population independently carried out measurements inside their homes and sent information to the GIZ; among the changes were that the temperature inside during the hottest seasons hovered around 8-12 degrees, which caused a decrease in the use of air conditioning (when they had it) and being able to change the destinations of their incomes. Once the work was completed, the GIZ team gave new training to the families about the use and maintenance of the homes, so that the interventions have an adequate duration.



Image 9: Marco Casado Pilot Project, Polígono 108

In addition to the accompaniment, the pilot served to exemplify how training families helped to transform the way in which they interacted; members changed their consumption habits and changed their perception about climate change and the impact on their daily lives. Although each family had a different leadership, the participation of the women increased during the pilot. They felt more secure to give their opinion to other family members, to ask for advice from the working team about the type of interventions they could do in their homes and how to guide others to save energy. It was interesting to see how they taught their husbands, their children and grandchildren about energy efficiency and how to take care of the environment. They also changed the destinations of their savings, making energy efficiency a priority.

Many of the beneficiary population is self-employed and once they learned the benefits of rehabilitating their homes, they asked what other actions were feasible. Some of them used part of the money not spent on electricity

and water to expand some areas of their homes and even transmitted the information to others. The biggest impact of the project was that through the dissemination of knowledge, mainly from mouth to mouth, a greater number of people in the neighbourhood and in the region rethought their ways of consuming and living. They learned that taking care of the environment it is something that benefits them, that not everything “green” is expensive, that having access to information is key when making decisions. Women mainly changed their role once they had the tools to educate their families differently and how giving their opinion made their homes more inclusive and equitable.

The experience of this pilot was key to elaborate technical and testimonial information in order to design communication procedures and information on the benefits of energy efficiency. For international cooperation programs, it helped to know from facts the importance to ensure the inclusion of gender’s perspective as a transversal axis, especially for housing and rehabilitation programs in Mexico; In addition, another lesson learned was to understand that international financing must help to transform the population and that projects must fight to have among its objectives the empowerment of vulnerable groups, not only from the reduction of overcrowding and violence, but through education and training, recognizing that this type of projects are also an opportunity to comply with the Sustainable Development Goals (SDG) and other international commitments.

The activities of the project were used to develop awareness material for the Mexican government, it can be found on the portal [www.micasaemimundo.com](http://www.micasaemimundo.com). A Strategy was developed to raise awareness on energy rehabilitation of housing with gender’s perspective and GIZ will carry out a new project for the existing housing for the year 2019.

This exercise whose purpose initially was only energy efficiency, showed how sustainable development is a means of social transformation, because it positively influenced not only economic growth and protection of the environment, but also helped to eliminate social inequality. If the government aims to become sustainable, they must assure the participation of the population. Many urban problems can be reduced if the population is encouraged to change its habits. The role of Mexican households is key to transform the country and to trigger the social and economic changes necessary to achieve a more equal and more inclusive country.

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## **DESIGN FOR ALL TO SUSTAINABILITY FOR ALL SOCIETY**

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### **ABSTRACT**

In the context of the evolution of Design sustainability for All, Design for All is the specific and coherent approach of design culture for human diversity, social inclusion and equality.

This contribution presents the progress of a study conducted by the Design Research Unit at the University of Chieti-Pescara, on the possible relationships, intersections and synergies of Cross-fertilization between Design for All and Design sustainability for All, and developed on the basis of some research questions: What is the role of Design for All in the transition to Sustainability for All society? What is the required update with respect to its current theoretical, methodological and applicative tools?

It is the natural evolution of a debate promoted by IEA/Sub-Technical Committee “Ergonomics and Design for sustainability”, whose first results were discussed at the IEA (International Ergonomics Association) conferences.

Key Words: Design for All, Design for sustainability, Transdisciplinary Approach, Social inclusion

## 1. INTRODUCTION

In the transition towards sustainable society it is essential, also for ethical reasons, to broaden the debate on the role of design in relation to the dimension of social sustainability that refers to the distributive equity of available resources and access to resources, goods and services.

In this perspective, on the one hand the design for sustainability, through the numerous activities, projects and conferences promoted by the LeNS network, enhances its field of investigation in the ethical and inclusive dimension of sustainability<sup>1</sup>. On the other hand, among the different disciplines of the project, ergonomics is also involved in a process of redefining strategies and topics of ergonomic design for sustainability. In particular, within the various Design for Inclusion approaches, Design for All proposes a holistic, inclusive and participatory approach to the design of environments, products, services and systems.

In this sense, Design sustainability for all, as a new and possible expression of design for sustainability, and Design for All, seem to converge towards a common strategy that could favor the application of the principle of equity for all individuals and social groups, according to the concept of human diversity as an inclusive factor, but which requires the development of topics, methodologies, tools and new practices of “Sustainability for All”.

## 2. ERGONOMIC DESIGN AND SUSTAINABLE WELLNESS STRATEGIES, ARGUMENTS AND TOOLS

As part of the project, sustainable development requires new forms of well-being less linked to the acquisition and use of artefacts, and more able to recognize and enhance the qualities of the physical and social environment in which we live, through the identification of sustainable solutions, ie systems of products, services and knowledge that facilitate the individual-actor in achieving a goal (Manzini, Jégou, 2003). In its disciplinary guidelines, ergonomics already pursues “human well-being” through the design of “comfortable” material and immaterial goods: objects, equipment, tasks, operating procedures, services, environments and organizational systems of life and work. Using specific methodologies and advanced research tools, ergonomics provides a contribution to product innovation in the field of design (industrial design, architecture, urban planning and organizational structures and processes in general), through the study of risk and safety factors, adaptability, usability and pleasantness of use. Thus, ergonomics, being already addressed to well-being, is culturally predisposed to imagine and extend its own criteria of reasoning even to the parameters of sustainability.

What is missing, however, is the start of a evolutionary process of the theoretical-procedural apparatus, belonging to the discipline, towards the search for design solutions, certainly “comfortable” (basic performance qualities that should belong to all artifacts and not only those so-called “ergonomic”), but, above all, in harmony with the new idea of sustainable well-being increasingly widespread in the scientific communities of many design, social and economic disciplines.

With reference to this problematic framework, for some years now the IEA / Sub-Technical Committee “Ergonomics and Design for Sustainability” promoted a debate on the basis of a specific study, divided into two successive studies on ergonomic design for sustainability (Di Bucchianico, Marano, Rossi, 2011), whose first results were discussed in the IEA (International Ergonomics Association) Conferences. These researches have substantially highlighted how “classical” ergonomics is no longer able to respond in a sufficiently organic and coordinated way to the complexity and novelty of the issues posed by sustainability. The classic ergonomics, in fact, which wanted to guarantee first the safety and then the well-being of man, has always been interested in the average individual, “normal”, healthy and intact, whose biological, psychological and behavioral characteristics are common to the generality of individuals, males or females depending on the roles codified by society and therefore easily generalizable and parameterizable.

### 2.1 Strategies and themes of ergonomic design for sustainability

The general objective of the first research work on “Strategies and themes of ergonomic design for sustainability” concerns the identification and the setting of a research methodology for the definition of ergonomic design criteria for sustainability.

The research has achieved some initial results concerning the identification and description of possible and significant ergonomic design strategies for sustainability, which corresponds to the indication of specific sustainable topics. In particular, the strategies identified, which respond to specific issues, are:

Optimizing the ergonomic life of products, services and work environments.

Question: how to make objects, services, living and work environments more “comfortable”, while at the same time safeguarding their ergonomic “durability”?

Design topics: postural design for “ergonomic durability”; environments and places of work; from “User-centered design” to “Social-centered design”; the ergonomic quality of products and equipment in the evolution of the physical and socio-cultural factors of the users.

The facilitation of the sharing and socialization of products, services and work and management activities.

Question: how to develop an ergonomic approach to the project that is able to pursue the well-being of the individual through sharing and socialization, reducing the use of personal and collective tools and “prostheses”?

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<sup>1</sup> Sustainable energy for all LeNSes conferences 2016, Designing sustainability for all 2019

Design topics: the management of human resources in the new socio-occupational perspective; evaluations of “sharing” and of the “socializing” capacity of products and services; the redefinition of a “working group” in new work and self-production activities; “participatory planning” in the “shared use” of products and services.

The choice of intelligent systems for learning and developing technical skills and creative skills.

Question: how to favor the ability of technical systems to learn from experience by developing error-friendly solutions and increasing the number of network nodes with listening and action skills?

Ergonomic design topics: from user friendly to error friendly; the evolution of decision-making processes from the development of “how to” skills to the awareness of the “why do” objectives; the role of imagination in the development of technical skills; the mental workloads and stress in creative activities.

Valorisation of contemplative time in targeted actions.

Question: how to generate systems characterized by different temporalities, reducing the average speed of movements and consumption of resources?

Ergonomic design topics: design of working time in the recovery of the value of reflection and care of things; the “slow” usability of products and systems; postural assessment in new forms of creative work; reevaluation of the “physical and intelligent” relationship with artifacts and systems.

Cultural, psychological and economic-productive regeneration of everyday life contexts.

Question: how to respond to the “creative” requests of “know how” linked to the renewed and innate human desire to pursue one’s personal satisfaction from the search for good work done with art, intelligence, and manual knowledge and wisdom?

Ergonomic design topics: organization and management of work in a sustainable home environment; health and safety in home self-production activities; the architectural evolution of the productive and sustainable domestic environment; self-learning through deliberately “not perfect” products and systems; the art of “soft power” (the search for minimum strength) for the improvement of manual skills; the use, transmission and dissemination of knowledge and practical experience.

From the critical reading of the results achieved it was possible to identify a first logical-interpretative filter for the construction of a thematic table of ergonomics for sustainability. This is the idea that, if the same evaluation and comparison model were extended to all Domains of specialization and related Themes of ergonomics, an organic framework could be obtained of the new thematic structure of ergonomics for sustainability.

## 2.2 Towards the transdisciplinary approach of ergonomics for sustainability

The second research work, “Toward a transdisciplinary approach of ergonomic design for sustainability”, has dealt with the “multidisciplinary” and “interdisciplinary” dimension of “classical” ergonomics, which makes use of the contribution of several disciplines, even distant among them, such as psychology, physiology, occupational medicine, sociology, engineering, architecture, and so on, and at the same time favors the interchange of approaches, methods and tools between them. In fact, although it is a constructive and coordinated “comparison” between disciplines, the ergonomic approach to design deriving from it, however, does not seem able to respond in a sufficiently organic and coordinated way to the complexity and novelty of the questions posed by the sustainability.

Ergonomics, on the other hand, needs to act in a “transversal” way, or rather “transdisciplinary”, with respect to the amplitude of the issues related to sustainability, putting into play the single “disciplinary identities”, based on consolidated theoretical and methodological systems, in order to identify new “concepts” of well-being.

Based on these assumptions, the research has moved from a critical comparison with some ergonomic design strategies for sustainability with respect to which the current theoretical and instrumental apparatus of ergonomic design can no longer be used without a “sustainable” evolution.

In particular, research has evaluated:

- the level of inadequacy of the current interdisciplinarity of ergonomic design and of the apparatus of the disciplines attributable to the main areas of specialization of ergonomics with respect to the questions posed by sustainability;
- if and how the current theoretical, methodological and instrumental apparatus of ergonomic design can be transformed into a sustainable key.

This last point, in particular, has been applied, for example, to the definitions of usability of products (declined compared to the concepts of effectiveness, efficiency and satisfaction) which, with respect to the new paradigms of “sustainable wellbeing”, have developed into:

“Extended” effectiveness : also referred to the objectives of socialization and sharing ;

“Relative” efficiency : with the introduction of the concepts of relative or “educational” error (error-friendly) and relative time, extended to include also the time for reflection and learning (“slow” usability);

“Extended” satisfaction: with well-being also referred to the gratification and fulfillment of the task and the appreciation of the value of things.

## 3. WELLBEING FOR ALL, DESIGN FOR ALL

In recent decades society has undergone substantial changes, both on the demographic and on the social and cultural levels. Aging of the population, migratory phenomena and development of networks: three phenomena that have

amplified the comparisons and highlighted the differences between generations, cultures, and different habits.

Since the last decades of the last century, however, we began to think of human diversity not as a discriminating factor, but as a systemic characteristic of the generality of individuals, and in many cases as a resource, useful for encouraging project innovation.

1993 was a pivotal year in this sense. In New York in that year, in fact, at the United Nations, with the “Standard rules on equal opportunities for people with disabilities” a long ideological itinerary is completed based on the concept of “society for all”, which has its roots on the functionalism of the ‘50s and the Scandinavian politics of welfare, and at the same time a new path begins that will end in the “International Convention on the Rights of Persons with Disabilities” (CRPD), approved by the United Nations on December 13, 2006.

In the same year 1993, in Dublin, the EIDD (European Institute for Design and Disability) was established: the association was chaired by Paul Hogan who, starting from his hiring “Good design enables, bad design disables”, outlined the goal of “improving the quality of life through the Design for All” for the largest possible number of individuals.

Design for All, therefore, is a relatively recent design approach, which falls within the framework of the “Design for Inclusion” approaches, but which differs from the others essentially to concentrate primarily on the design process. This must take into account the principles of sustainable development and the participatory involvement of all project stakeholders, from end users to decision makers (public administrators, politicians, business executives), in order to activate virtuous awareness processes.

The 2004 Stockholm Declaration briefly defines Design for All as the “design for human diversity, social inclusion and equality”, with the aim of facilitating equal opportunities for participation in all aspects of society for all. In this perspective, human diversity is considered a resource and not a limitation for the project; equality is understood as equal opportunity for all individuals to make use of products, environments, services and systems in an autonomous and comfortable manner; social inclusion is the principle on which Design for All is based, seeing in the needs, desires and aspirations “of all” especially the socio-political implications, as an indispensable step to change reality: if an artifact is really for all, it will probably be suitable for adults and children, fat and thin, distracted and illiterate, Europeans and Orientals ... (Bandini Buti, 2008).

#### **4. SUSTAINABILITY FOR ALL: A NEW RESEARCH PARADIGM?**

The holistic, inclusive and participatory approach of Design for All to the design of environments, products, services and systems, based on the enhancement of human diversity, can offer new paradigms to the possibility of amplifying the diffusion in the world of Design for sustainability, aiming to a “Sustainability for All”.

An attempt to find points of contact and integration between Design for All and Design for Sustainability, and in particular, between the complex dimension of social inclusion and that of environmental sustainability is being tested in a research project, under development.

The research, conducted in the context of an industrial Doctorate in progress at the University of Chieti-Pescara (Italy) and financed by the PON - National Operational Program for Research and Innovation 2014-2020, involves the College of Engineering Design and Physical Sciences of Brunel University London and the company Aran cucine. The research intends to jointly and comprehensively investigate the complex dimension of social inclusion and eco-sustainability in industrial production, with particular attention to the Kitchen furniture sector, which requires studies and product innovations to respond with scientific data and tangible solutions. to the new needs related to human diversity, through the integrated and coherent approach between Design for all (DfA) and Ecodesign according to the strategies of Life Cycle Design (LCD) and the Life Cycle Assessment (LCA) methodology.

It is a research model in which multiple branches with different specializations (university research centers and companies) can interact each other, aiming at the study, development and testing of technological, functional and morphological product solutions, through the use of methods and tools of the discipline of industrial design applied to the issues of social inclusion and eco-sustainability.

In particular, in order to reach the design solutions, the research involves the following phases:

metaprojective analysis, aimed at orienting research and isolating design problems (problem finding), structuring knowledge and organizing information (problem setting), identifying technological constraints and opportunities for product innovation (vision design and innovation scenarios).

Product brief, aimed at describing the expected results and identifying the list of environmental requirements (Ecodesign) and the requirements of physicality, perception and sensoriality, understanding (DfA) for the development and subsequent evaluation of the product innovation process in the considered industrial sector.

Concept and development of the product concept, aimed at displaying one or more original concepts of components and product subsystems that best meet the strategic objectives of environmental sustainability and inclusive usability, and the development and design of the concepts necessary for the integrated implementation of solutions.

Anthropometric, analogical and digital checks (two-dimensional and three-dimensional), and environmental checks conducted on the concepts, to attribute the definitive measures and characteristics to the parts of the product that physically interface with the human body, and to measure the potential ecological footprint of the proposed solutions.

First prototypes and experimental laboratory tests on prototypes and physical simulations of components and

product subsystems, for further comparisons and evaluations with the results of virtual verifications carried out in the laboratory, and possible re-design of parts and components.

Definition of the design innovation model related to the integrated solutions of Design for All and Ecodesign for product innovation in the kitchen furniture sector and communication of the final results of the research.

## 5. CONCLUSIONS

In order to facilitate the transition towards a sustainable society, it is necessary to amplify the diffusion in the world of Design for sustainability, aiming in fact at a "Sustainability for All".

Design for All, considered as a holistic evolution of ergonomic design, already has in its "genetic heritage" the concepts of aware participation of the greatest number of individuals to the design processes, in the diversity that characterize them, aimed at social inclusion and well-being based on autonomous and comfortable access to goods and services.

The attempt to find points of contact and integration between Design for All and Design for Sustainability, and in particular, between the complex dimensions of social inclusion and environmental sustainability, also through unprecedented research paths that involve and facilitate dialogue between actors different, could make it possible to achieve the desirable goals of global dissemination of the principles, processes and models of design for sustainability more quickly and more effectively.

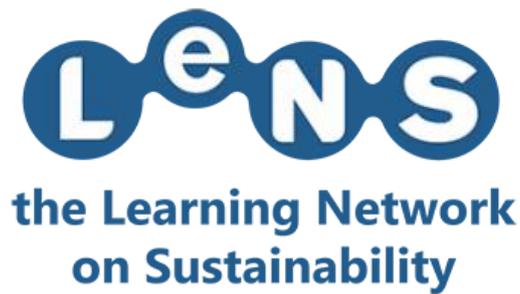
## 6. CREDITS

This contribution is the result of a research activity conducted in recent years in the Design Research Unit at the Department of Architecture, University of Chieti-Pescara (Italy)

In particular, Antonio Marano is the author of paragraphs 1 and 2, and Giuseppe Di Bucchianico is the author of paragraphs 3,4 and 5.

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## **INTILANGA: THE HUMAN-CENTRED DESIGN OF AN OFF-GRID FOOD PROCESSING SYSTEM FOR MICRO-ENTERPRISES WITHIN JOHANNESBURG**

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### **ABSTRACT**

Around 20% of South African households do not have access to sufficient food to meet their dietary needs. Food processing and preservation can however allow food to be made available during dry seasons and decrease post-harvest crop losses. This study involved the development of an off-grid food-processing system reliant on solar energy for micro-food processors in Johannesburg. The solutions were developed with the users playing a central role in the design process, which consisted of various stages from problem identification, field observations, product development and user testing. Through following a Human Centered Design process, it allowed for the product development to lead meaningful solutions according to what was learnt through end-user participation. This paper presents the methodology and data gathering tools utilized to understand the participant's behavior towards energy within the micro-scale setting, offering the opportunity for its use in other energy-related projects. Through better understanding user behaviours and requirements in their own setting, designers can develop products able to be used effectively and accepted by them. This project explored the possibilities of implementing the use of renewable energy in users' daily-life activities and attempted to reorient the design of energy-related projects with user needs as core to sustainable technological advancement.

Key Words: Human-centred-design, Sustainability, off-grid-food-processing, renewable-energy,

## 1. INTRODUCTION

An estimated 20% of South African house hold shave in adequate or severely in adequate food access to meet their daily dietary requirements (Statistics South Africa, 2010, p. 6). To address this situation, the South African government as well as Non-Government Organisations, have encouraged the cultivation of crops for small scale farmers in order to reduce food insecurity in the country (Department of Agriculture, Forestry and Fisheries 2011, p. 72; World Wide Fund for Nature 2017, p. 9). Along with the cultivation of crops to increase food security, processing and preservation of raw food is used, preventing it from spoiling and making it available during off seasons when the food is scarce or unavailable (Sethi 2007, p. 7). The availability and cost of the energy is one of the major considerations when selecting a method to process food, while the energy required can vary depending on the cooking methods and machines used (Bastin 2011, p. 1).

For its part, the advancement of renewable energies has seen growth for the past four decades resulting in more energy that is clean, sustainable and constantly becoming more economical through technological improvements (Farmer & Lafond 2016, p. 648). However, the use of renewable energy requires a change of paradigm in how people utilise the energy since its use is dependent on geographical location and availability (Ruiz-Mercado, Masera, Zamora, & Smith 2011, p. 7559).

This study was planned and organized in four phases (Figure 1), with the first phase consisted of the problem identification, where a thorough understanding of the energy usage and requirements of food processing equipment was sought from the literature. During the second phase, field observations were conducted with three users, in order to gain a thorough understanding of their energy needs and requirements. The third phase consisted on the design and development of the off-grid food processing system through the utilisation of sketches, mock-ups, and prototypes, allowing for their evaluation within a laboratory setting. Finally, the fourth phase was the field testing of the prototypes with the participants processing their raw ingredients into final products using the newly developed system. This paper describes and discuss the methodology and tools used during the second phase, where field observations were conducted.

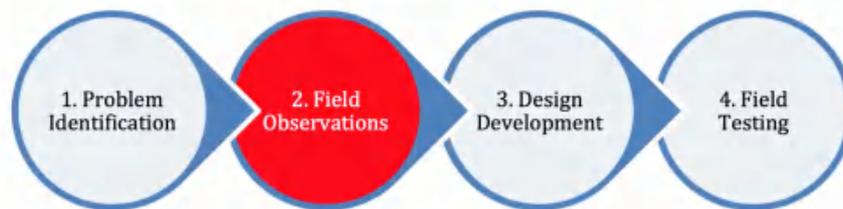


Figure 1: Project planning, highlighting the Field Observation phase, described in this paper (Diagram by the author).

The goal of this project was to understand the energy needs of different micro-scale food-processing business, and the behavior of the participants related to their energy use during the practice, as a means to propose an off-grid food processing system.

## 2. METHODS OF ENGAGEMENT WITH PARTICIPANTS

The project was approached through a constructivist paradigm, also known as interpretivism. This paradigm is based on the holistic understanding of the participants of the study and the importance of the context to interpret findings (Shkedi 2005, p. 13). In order to align with such an experiential approach, the Human-Centred Design (HCD) methodology was utilized throughout the project to include relevant participants throughout the design process. HCD is a methodology where the design-researcher learns from potential users about the product that is to be developed, in order to best understand the users' practices, needs and preferences (Steen 2011, p. 1). This allowed the product development to explore meaningful solutions according to intended end-user's needs. The role of the design-researcher was to engage with the participants to develop such appropriate design solutions, with the objective of facilitating the tasks of the users to ensure that the product was able to be used as intended (Abrams, Maloney-Krichmar & Preece 2004, p.2).

Participatory observations were performed during the visits to the place where the participants execute their activities. Three participants were included in the study, visiting their own space where they conduct their food-processing, having the opportunity to gain a deep understanding of the ongoings within these spaces. The observations provided insights into the activities of the process, the energy needs, the tools and machinery used and the participant's personal perspective (Patton 2002, p. 262; Krippendorff 2006, p. 225). To conduct the observations, four data gathering tools were used. First an understanding of the participant activities was required. To undertake this a Process Flow Sheet was created which maps the sequence of operations users undertoo. Additionally video documentation of these process flows were undertaken (Marín A, 2017) (Marín B, 2017) (Marín C, 2017). This was used to identify the machinery and tools utilized during the production (Wang 2008,

p.49).Second, an Energy Audit was conducted to track the energy consumption and associated costs throughout the process, in order to determine how and where energy is used. This allowed for the identification of opportunities to reduce energy usage and to estimate the cost of the production (Wang 2008, p. 45). Following with the Process Flow analysis, an analysis of the workplace was undertaken which included the creation of a diagram documenting the room layout., This included dimensions of the facilities and the locations and types of the machines and tools used, registering the participants’ displacements and paths during the activity. Finally, a semi-structured interview allowed the researcher to enter into the participant’s personal perspective, exploring issues that could not be observed during the process(Patton2002,p.262).With this data was possible to identify the energy requirements to design a system for food-processing powered with renewable energy.

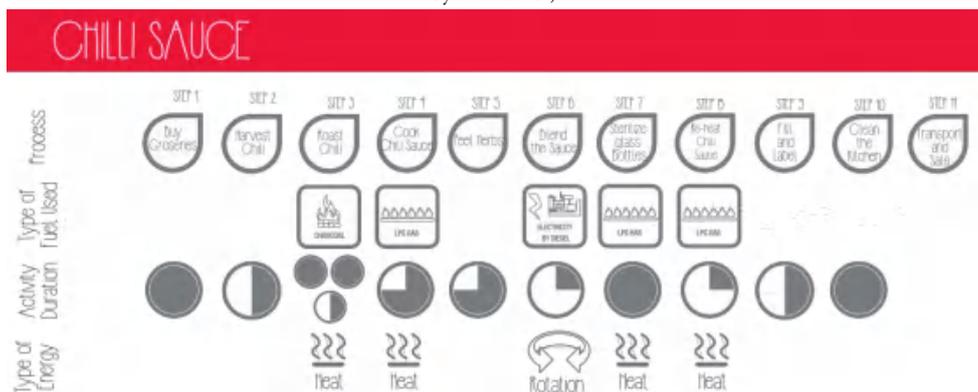
**3. FIELD OBSERVATIONS**

The study aimed to involve participants with different processing and energy requirements, in order to allow for the development of a product which is able to be used in various settings, and process various types of foods. After visiting various food markets around Johannesburg, three entrepreneurs agreed to participate in the study. These included chili sauce, skin soap, and ginger beer producers. Although skin soap is not a food stuff, the tools and operations are similar that the ones needed for food processing.

**3.1. Chilli Sauce**

During the visit to the chili sauce producer, the step by step sequence of the process was observed and video documented (Marín A, 2017). A tabulated version is shown in Table 1 which illustrates the 11 steps left-to-right. It was identified that the utilization of thermal energy was required for the sterilisation of bottles during step 3 (by means of charcoal) and step 4, 7 and 8 (LPG gas). Furthermore, in step 6 the use of rotational energy is identified by means of electricity from a diesel generator, to power a blender. It was also required that hot water needed to be available at a temperature between 70°C to 90°C for various activities during the whole process.

Table 1: Process Flow Sheet of the process to prepare chilli sauce, the type of fuel used, the duration of the activity and the type of energy utilised (Table by the author).



The chili sauce production’s workplace is performed in a room of 6 X 6 meters. Figure 2 presents a diagram of the zones: Cold Storage, water supply, a cooking zone, tools storage, and a surface-working-area. The zones are located in the perimeter of the workplace, leaving the centre empty for displacements.

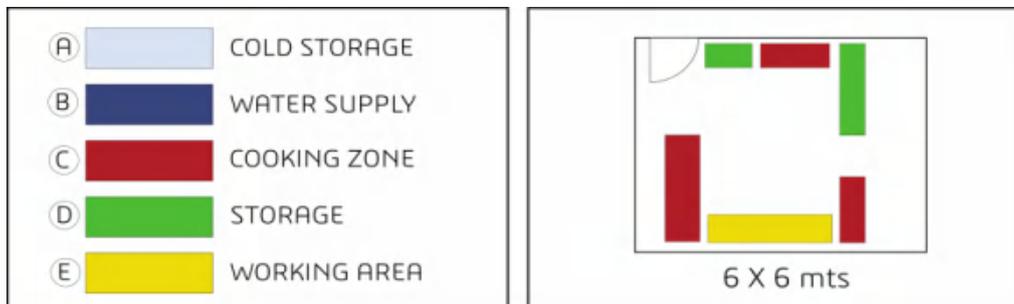


Figure 2: Chilli sauce production workplace (Diagram by the author).

**3.2. Skin Soap**

The second participant approached was the skin soap’s producer. As with the first participant, a video documentation of the Process Flow Sequence was undertaken (Marín B, 2017) and the step by step process was summarized as is shown in Table 2. Thermal energy was used, from an electric stove in steps 2, 6, and in step 8. In steps 5 and 7 the use of rotational energy was used to power a blender. Finally, the availability of hot water was needed during the whole process.

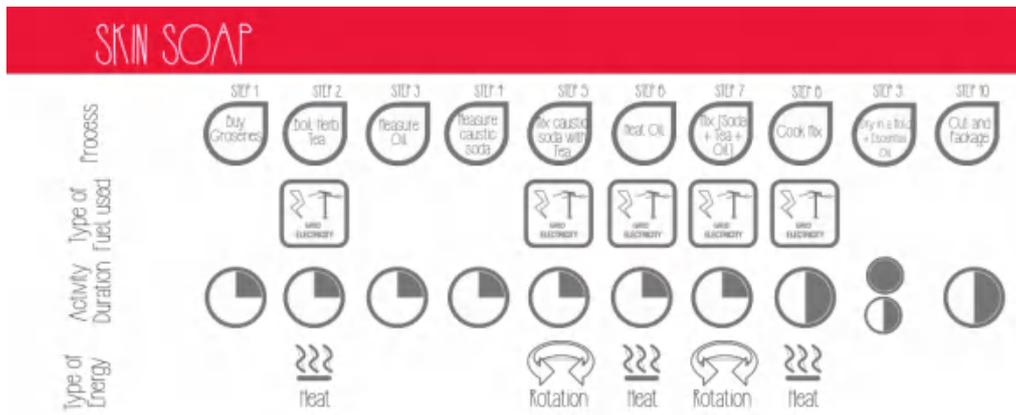


Table 2: Process Flow Sheet of the process to prepare soap, the type of fuel used, the duration of the activity and the type of energy utilised (Table by the author).

The workplace to prepare body soap was a room of 5 X 3 metres, as is shown in Figure 3. The diagram presents the zones located on the perimeter: Cold Storage, water supply, cooking zone, tools storage, and a surface- working-area



Figure 3: Diagram of the zones identified in the workplace to prepare skin soap (Diagram by the author).

**3.3. GingerBeer**

Finally, the workplace of the ginger beer producer’s was visited and the process documented (Marín C, 2017) and summarized in Table 3. Was identified the use of thermal energy by means of LPG gas in the steps 1 and 2, and the need to have hot water available during the whole process.

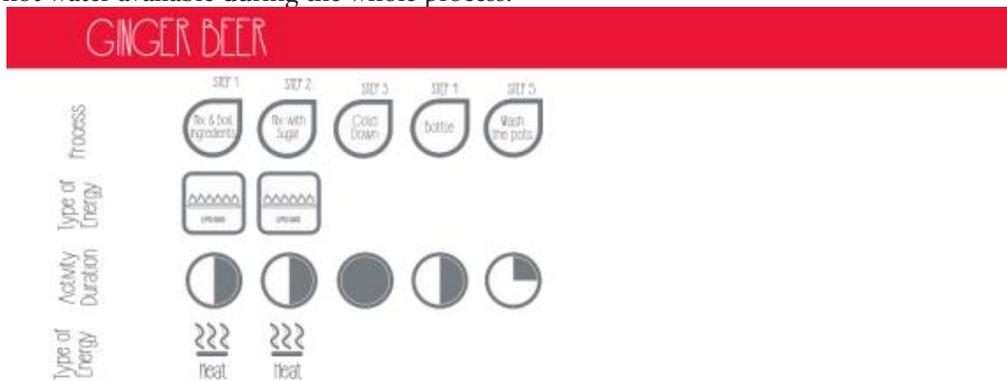


Table 3: Process Flow Sheet of the process to prepare ginger beer, the type of fuel used, the duration of the activity and the type of energy utilised (Table by the author).

To prepare ginger beer the activities are performed in different zones, also located on the perimeter of the workplace(4), leaving the centre empty for displacements. The size of the workplace is a room of 5X10 metres. Figure 4 present a diagram of the zones: Cold Storage, water supply, cooking zone, tools storage, and a surface- working-area.

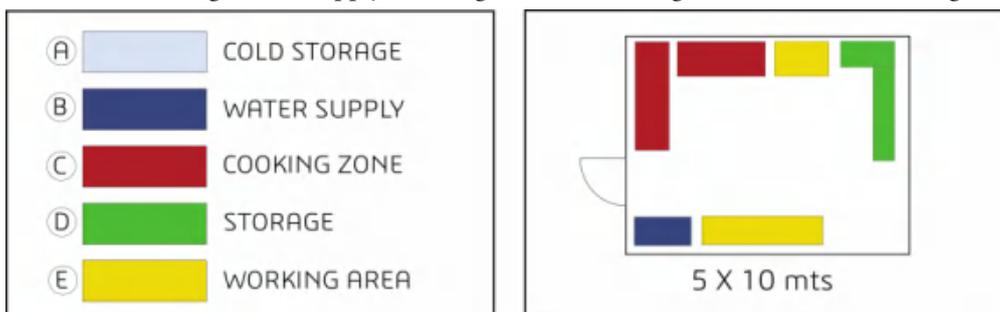


Figure 3: Diagram of the zones identified in the workplace to prepare ginger beer (Diagram by the author).

It is noticed that the types of energy and operations that all three producers required was high heat for cooking, hot water on demand, and rotational energy for blending processes. The machines required by the micro-scale food-processors were a stove, a water heater, and a blender, powered by means of diesel, LPG gas, electricity or biomass fuel. Additionally, was necessary to provide a working surface, a place to store the ingredients and tools. These formed the basis of the product requirements for developing suitable solutions.

#### 4. OUTCOMES

With the machines required identified, a general design concept was proposed “Solar-energy-harvest outdoor appliances, for food processing”. This concept guided the building of the off-grid food-processing system, with the developing of a “Heliotropic Parabolic Stove”, a “Thermosiphon Solar Water Heater”, and a “Photovoltaic food-process workstation” (Figure 5), answering the requirements of the food-processors for a stove, a water heater, and a blender respectively.



Figure 5: A) Off-grid food-processing system prototypes. B) and C) Participants of the study testing the prototypes. (Photos by the author).

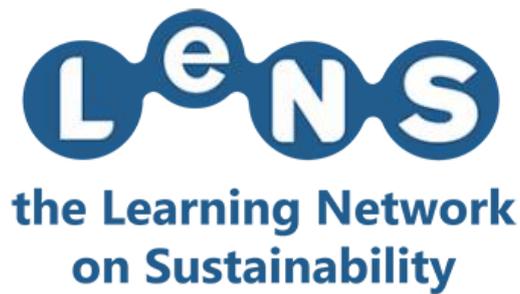
#### 5. CONCLUSION & DISCUSSION

This project explored the possibilities of implementing the use of renewable energy in users’ daily-life activities, and attempted to reorient the design of energy-related projects with user needs as core to sustainable technological advancement. The exploration of real-world situations, related to energy needs in micro-scale food-processing business allowed for the development of an off-grid appliance system based on the user’s input as a means to reduce their dependency on fossil fuels. The methodology used to engage with the participants in this project, offers the opportunity for its use in other energy-related projects by incorporating the users within the whole design process, in order to allow for the development of meaningful energy solutions for a wide range of user needs. When designing, the context determines the functional aspects, economic restrictions, characteristics of the materials and other decisions. This project sought to relate the context in terms of the natural resources available in the territory with the practice of food processing, determining the object’s function and energy requirements by the sun’s energy.

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## **SOCIAL SUSTAINABILITY AND VIRTUAL REALITY HEAD-MOUNTED DISPLAYS: A REVIEW OF THE USE OF IMMERSIVE SYSTEMS IN THE AID OF WELL-BEING**

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### **ABSTRACT**

This review seeks to update our knowledge about the positive effects in the use of VR head-mounted displays (HMDs) for immersive systems in the aid of human well-being and quality of life. Through a systematic Literature review which includes all peer-reviewed research documents that are relevant to the objective to ensure a comprehensive search. Four research databases were identified: (I) web of Science, (II) IEEEExplore, (III) ScienceDirect and (IV) PubMed. Only primary empirical studies on the use of HMDs were included. The review identified a number of situations where HMDs are useful for aid and improvements of the human well-being, rehabilitation, and improvement in the quality of life, thus, contributing in the field of sustainability study. Although there are several studies, more research is needed on the use of this technology within settings to ensure recommendations that can implement the improvement of use for social sustainability and sustainable development.

Key Words: Virtual reality, sustainability, sustainable development, well-being

## 1. INTRODUCTION

Technological advancement brought enormous possibilities, mainly in the field of design, for the development of new techniques and devices that are linked to the potential of visuality, interaction, human factors, perception, cognition and user experience. This progress brought about profound consequences in the many fields of the sciences, be it on the intellectual field or the practical. Consequently, with the advent of globalization, concerning technological globalization, new technologies with developments in computing, communication and transports were highlighted, in detriment to social inequalities. Questions involving innovation and sustainability have brought new challenges to the new business models, incorporating not only the technological factor, but also strategies to achieve sustainable development, which, through technology, promote new possibilities to create user experience for human well-being and quality of life. In the theoretical referential of Positive Psychology, Seligman; Csikszentmihalyi (2000) approach the idea that Positive Technology provides the increase of emotional, psychological and social well-being. As such, positive technologies can influence individual experiences by promoting positive emotions, engagement, social integration and connectivity.

Sustainable development has been walking in parallel with the technological innovations that provide new devices, techniques and processes. The term “sustainable development” has been widely discussed and has many definitions. The ideology was discussed in the report entitled “Our Common Future”. Sustainable development is that which “answers the needs of the present without compromising the capacity of future generations of satisfying their own needs” (Brundtland, 1987; Olakitan, 2018).

With technological development, design supports itself more and more on strategic tools to give support in the many fields of knowledge, in search, analysis and representation of information. Because of this great amount of information, visualization techniques have a fundamental role in the achievement of this task. Until recently, this information was provided through written word and visual screens, which are now replaced by computerized devices that include from daily objects, such as radios, watches and smartphones, to controls in a nuclear power plant where an inadequate project can have disastrous consequences. Among the sensorial organs, vision has stood out as the main organ for the reception of this new human-machine relationship, followed by hearing – which, generally, is used in a complementary way to visual information in some specific situations (IIDA, 2016).

On the other hand, virtual environments amplify the user’s capacity in their evaluation with the use of multimodal interactions, with the aid of 3D software technology that allow photorealistic images that complicate the distinction between real and digital. Many products, such as: smartphones and social media websites that need the user’s interaction were projected having mainly the user in mind. Others were not projected taking the user experience into consideration, being conceived as systems that execute defined functions. Even though they work efficiently, this changes when we analyze these processes of interaction in the real world. This way, new forms of projecting interfaces, together with the technological convergence, are pointing toward the new generation of computation systems based on immersive VR for use in many areas: from entertainment, such as games, to collective scientific experiments, collaborative environments, medical applications and architectural and product design, constituting true research laboratories.

## 2. RESEARCH METHODS

### 2.1. Systematic Literature Review

The Systematic Literature Review (SLR) seeks to establish a rigorous procedure to bring about a revision of literature, to identify the available literature and analyze data so as to obtain evidence of a certain phenomenon with a rigorous process in identification, evaluation, interpretation and relevance conducted in revision. It will be made according to the simplified model proposed by Conforto et al. (2011), which can be described in 15 steps and divided in 3 phases: Entry, Processing and Exit.

Research Question (RQ) 1 – How can VR technology contribute to help human well-being?

VR immersion has been studied in many domains, but its correlation with well-being has not yet generated explicitly addressed interventions. Examining the case studies to identify the possible relation between VR technology and sustainable development.

Research Question (RQ) 2 – To which aspects of VR were attributed questions related to the contribution to sustainable development?

New ways of interactivity and development in the fields of: social and economic and environmental associated to VR, taking into consideration triple bottom line (TBL). These are the research questions that will be addressed by this revision through the following steps.

### 2.2. Method and Tools

Also, to definition inclusion and exclusion criteria was used to search string definition was defined using the terminology identified for PICOC framework (table 2) – which stands for population, intervention, comparison, outcomes, and context can be useful to ensure that one decides on all key components prior to starting the review. During the planning phase, we used Parsifal tool to document the whole process, keywords and synonyms, and selecting the sources.

- Search databases: IEEE Xplore, ScienceDirect, Web of Science, PlubMed
- Search string: (“virtual reality”) AND (“head-mounted display” OR “immersive systems” OR “virtual environment”) AND (“economic” OR “environmental” OR “social”) AND (“quality of life” OR “social well-being” OR “sustainability” OR “sustainable development” OR “well-being”)

### 2.3. Eligibility Criteria

- Inclusion Criteria: IC 1: primary study that presents evidence of the use of VR systems for sustainable development; IC 2: primary study that presents evidence of the contributions of VR for the well-being. IC 3: primary study that presents evidence of the use the VR technology to enhance the quality of life.
- Exclusion Criteria: EC 1: Papers not written in English; EC 2: Papers that were published before 2014; EC 3: Papers that are duplicated within the search documents; EC4: Study that is not full paper EC5: Papers that do not meet any of the inclusion criteria EC6: Papers that are not primary research. EC7: Primary study that not use HMDs for VR.

[Table 1] SLR search: search string delivery results classified by database.

Database	Search string	Total	Included	Results
IEEE Xplore	(“virtual reality”) AND (“well-being” OR “sustainability” OR “sustainable development”)	81	32	3
ScienceDirect	(“virtual reality”) AND (“head-mounted display” OR “immersive systems” OR “virtual environment”) AND (“economic” OR “environmental” OR “social”) AND (“quality of life” OR “social well-being” OR “sustainability” OR “sustainable development”)	318	154	3
Web of Science	((“virtual reality”) AND (“well-being” OR “social well-being” OR “sustainability” OR “sustainable development”))	171	93	5
PlubMed	(“virtual reality”) AND (“head-mounted display” OR “immersive systems” OR “virtual environment”) AND (“economic” OR “environmental” OR “social”) AND (“quality of life” OR “social well-being” OR “sustainability” OR “sustainable development” OR “well-being”)	405	310	5

[Table 2] Research scope: obtained through the application of the PICOC framework to the SLR. (Font: FERNÁNDEZ DEL AMO et al., 2018)

Concept	Definition	SLR application
Population	The problem or situation the research is dealing with.	Virtual Reality for maintenance applications research: well-being, social well-being, welfare
Intervention	Existing techniques utilised to address the problem identified.	Methods, tools and techniques for VR technology: head-mounted display, immersive systems, virtual environment
Comparison	Techniques to contrast the intervention against.	Contrast between intervention techniques.
Outcome(s)	The measure to assess the effect of the techniques in the population.	Sustainability, sustainable development, social well-being, well-being, quality of life
Context	The particular settings or areas of the population.	Maintenance of medium-long life complex assets. triple bottom line – social, economic, environment.

### 3. DISCUSSION AND RESULTS

The aim of this paper is to discuss the challenges immersive VR technologies posit to human well-being. Through of the search string definition with the aid the PICOC framework our search strategies retrieved a set of 975 papers out of which 16 were selected as primary studies after qualitative assessment criteria. techniques; and Improve safety.

[Table 3] Empirical papers relating to the use of VR-HMDs.

Reference	Benefits found	Target group   Context
Meneses et al. (2017)	Social impacts; well-being	Senior citizens in an adult day care centre

Tashjian et al. (2017)	Reduces pain; well-being; therapy for pain	Hospitalized patients with pain
Suhaimi et al. (2015)	Rehabilitation of the arm movement	Stroke patient
Crespo et al. (2016)	Entertainment, physical activity; quality of life	VR based on drones for older people
Quesnel et al. (2018)	Transformative experience, well-being	VR to elicit feelings of awe and wonder
Román-Ibáñez et al. (2018)	Sustainability; e-learning;	Students in robotics technology courses
Battisto et al. (2018)	Therapeutic; promoting health; quality of life	Increase nature contact for older adult
Salisbury et al. (2016)	Neurorehabilitation	Spinal cord injury; brain injury
Wiederhold et al. (2014)	Distraction techniques; treat chronic pain	Chronic Pain Patients
Didehbanani et al. (2016)	Social skills; promoting social-cognitive	Children with Autism (ASD)
Fralish et al. (2018)	Improved Physiology; psychosocial well-Being	Individuals with Physical Disabilities
Shi et al. (2016)	Sustainable development; communication	Building sustainability; (BIM)
Tang et al. (2016)	Health; well-being; quality of life	Busy working people
Yoo et al. (2016)	Health; well-being; quality of life	Promoting health through exercise
Yu et al. (2018)	Access nature environments for restoration	Positive impacts on psychological health
Käthner et al. (2015)	Visual stimuli; effectiveness of HMDs	A person in the locked (LIS)

With recent advances, the use of immersive virtual reality devices is becoming more and more popular. According to Schmidt et al. (2018), they present the results of a subjective experiment carried out with the aim to compare different kinds of virtual environments with each other, such as HMDs<sup>1</sup> and CAVE<sup>2</sup>, the present results were demonstrated that the majority of participants showed a superior feeling of presence with using the HMDs. Therefore, the non-use of HMDs were not included in this study. These devices vary by their relationship to the user's eyes, the field of view, illumination, resolution, color, stereopsis, effect on head motion and user interface (Ehrlich et al., 2017).

### 3.1 Designing for Social Sustainability and Human Well-being

In this line of thought in which design walks towards a model of sustainable development in the environmental, social and economical fields, the traditional methodology of industrial design production has been giving space to the production of a new paradigm, based on the sustainable development that seeks the human well-being, which, through environmentally harmonic solutions, seeks the satisfaction of human needs and desires, bringing a strategic and systemic approach of innovation applied to the emergent product-service systems of this new social context to reach solutions that are harmonic with the limits of the environment, through a long and healthy life (Vezzoli et al., 2018). According to Bolier et al. (2013) "It is possible to define 'subjective well-being' as the cognitive and/or affective appraisal of one's own life as a whole, while the term 'psychological well-being' refers to the optimal functioning of the individual and includes concepts such as flow, hope, and resilience". Additionally, World Health Organization, "Mental Health" is defined as "a state of well-being in which the individual realizes her or his own abilities, can cope with the normal stresses of life, can work productively, and is able to make a contribution to his or her community."

Design is oriented towards the resolution of problems, which go from simple daily cases to complex questions, such as: the use of immersive systems that aid in the neurorehabilitation of patients through VR systems – providing a significant improvement to the quality of life and well-being of the patients after the use of these devices, which were made based on user experience, as well as an improvement in the assistance of medical procedures, entertainment and even simulations for military training. According to Battisto (2018) scientists generally, recognize five factors or determinants of health. (I) Genes and biological factors such as sex and age; (II) Health behaviors such as physical activity, eating habits, smoking, and alcohol use; (III) Social environment or social characteristics such as income, gender, and family composition, which influence an individual's health; (IV) Total ecology or physical environments that an individual inhabits, such as where a person lives and works, community characteristics and natural resources; (V) access to medical care and quality healthcare services.

With the paths that may be addressed by the designer and the diversity of use scenarios, considering users that utilize immersive computing systems, design requires a new way of thinking. Interaction and environmental devices

<sup>1</sup> A Head Mounted Display (HMDS) is a display system worn on the head that presents views to one or both eyes. In immersive virtual reality this is both eyes, often using stereoscopic displays to create the illusion of depth through the use of parallax. Font: Brooks, A. L., Brahnam, S., & Jain, L. C. (Eds.). (2014).

<sup>2</sup> The Cave Automatic Virtual Environment (CAVE) projects computer images onto the walls of a room and the participant wears tracked shutter glasses to view the scene three-dimensionally. Font: (CRUZ-NEIRA et al., 1993).

lead to the necessity of flexible systems that can adequate themselves to different requirements of interaction, collaborating for the inclusion and social well-being.

### 3.2 VR Technology for Sustainable Development

VR technology can provide tools that aid in creating a more profound comprehension of the addressed subjects on the educational field – through training and simulations that diminish the risk of accidents in medical procedures or the training of pilots, for instance. Currently, the dimensions of sustainability have been highlighted around the world in eight aspects: economic, social, environmental, cultural, ecologic, territorial, national politics and international politics, as listed by Ignacy Sachs, one of the foremost scientists to contribute to the subject. In the 90s, we were presented with the triple bottom line (TLB), which highlights three dimensions and was originated by the observation of the social and economic dimensions of the agenda proposed by the Brundtland Report, 1987 (Elkington, 2004; Vellozi, 2018; Sanchs, 1997; Wced, 1987).

Aside from inspiring users, virtual reality systems can improve empathy through the impact generated by immersive systems, as reported by the United Nations Virtual Reality (UNVR) – (visit: <http://unvr.sdgactioncampaign.org/>).– which seeks to use immersive narrative to raise awareness of various global issues, by means of Agenda 2030, adopted by all member-states of the United Nations in 2015 that aim for the 17 Sustainable Development Goals (SDGs) (UNVR, 2019).



[Figure 1] Sustainable Development Goals (Font: United Nations)

According to Makarova et al. (2019), technologies become inherent to human beings and, in 5 to 10 years, will change the world. These technologies are incorporated to this new generation of people in the use of cellphones, computers and internet, and the most promising ones are linked to the fourth industrial revolution (industry 4.0). Known as smart technologies, they aim to provide better life conditions, generating social well-being through sustainable development. The author highlights that, to increase the quality of the projected systems and products, a new approach to education is necessary, one that guarantees ways to improve the education process through virtual reality simulators in the automotive area. Questions about the sustainable development and minimization of environmental impacts must be taken into consideration as well, if we are to have an intelligent education.

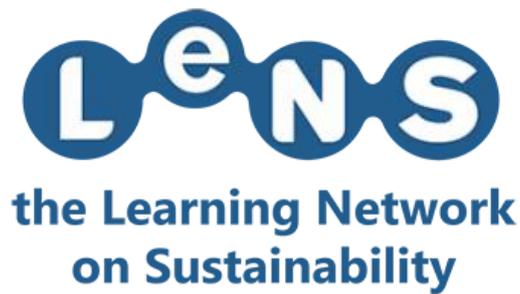
## 4. CONCLUSION

In this revision, we evaluated the current state of the 5 last years of research in VR-HMDs on what concerns sustainability, sustainable development, and human well-being. The research found that immersive virtual reality systems can bring benefits through the technological potential in rehabilitation, intervention in quality of life, psychological evaluation, education and promotion of health and well-being. Therefore, researchers must keep up with technological advancement so as to develop new methods and devices that amplify the limits and potential for more effective interventions through user-centered design (UCD). This study approach how the VR technology can provide the improvement in health and wellness as well as showcasing a wide range of the results in contexts that aim social and life skills, training in safe, controllable virtual environments.

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## **RESEARCH ON DESIGN EMPOWERMENT OPPORTUNITIES FOR THE ELDERLY IN COMMUNITY**

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### **ABSTRACT**

From the perspective of “active aging” to transform the pressure of aging on social development into a driving force for sustainable development, more and more scholars begin to study how to promote the continuous social participation of the elderly. However, most of the current studies on the elderly empowerment opportunities focus on the macro level, such as the significance and policy conditions, and lack of specific strategies and methods of research and application. This article shares insights on how design empowers the elderly, based on the research practice of designers. The purpose of the study is to promote the elderly to play their subjective initiative and become the solution of community problems through design, so as to promote the sustainable development of society.

Key Words: The elderly, Empowerment opportunities, Empathic design, Participatory design

## 1. INTRODUCTION

It is of great significance to give full play to the initiative of the elderly today. In order to cope with the aging society, the active aging advocates to return the right of social participation to the elderly, and the empowered elderly can change from the maker of social problems to the solver of them. In this context, “active” is defined as the continuous participation of the elderly in social, economic, cultural, spiritual and public affairs, rather than merely physical health or limited to labor participation.<sup>1</sup>

However, some studies have shown that community services for the elderly lack effective response to the real needs of the elderly population, and the elderly become passive “objects” to receive services. This makes the effectiveness and professionalism of community services, especially community pension services, more prominent, which is not conducive to the sustainable development of society. (HouBing, 2018)

In order to change this passive situation, this paper, from the perspective of design, considers how to promote the elderly to give play to their own subjective initiative, studies the possibility of design to empower the elderly and provides methods and paths, and explores how to promote the elderly to become problem solvers. By means of the research method of empathic design, community service participation of the elderly was observed. And through a participatory design case to explore whether design can empower the elderly, and analyze how design can empower the elderly.

## 2. RESEARCH METHODS

Due to the particularity of the elderly population, it is difficult to obtain accurate and effective feedback by conventional survey methods. By applying the research method of empathetic design, designers can intuitively understand the actual situation of elderly community service participation from the micro level. This can help designers intuitively recognize the thoughts and feelings of others -- their motivations, emotional, and mental models, values, priorities, preferences, and inner conflicts.” (Fulton, 2003)<sup>2</sup> to understand what affects the elderly’s motivation to participate in community service.

According to Ilpo Koskinen’s suggestion on the selection of subjects in the Empathic Design Methodology, the primary group in this study is mainly the elderly who are active in the activity center of the elderly in the community. And the secondary group is the elderly who live in the community. In these two groups, the author pays more attention to the “special users”, such as empty nest elderly and the elderly who move in from other places.

In the first stage of the study, the author uses the following research methods of empathic design to study the situation of elderly community service participation:

- Observation method: Designers write diaries to record the participation of the elderly in community services and draw the social situation of the elderly in the community.
- Empathic probing This part mainly uses visual recording tools and question cards. Senior citizens are invited to take pictures of their daily routines and show the scope of their main activities with the help of smartphones.
- Interview method: The designer carries out personal interviews with the elderly, so as to strengthen the further understanding of the collected data and verify the results of the probing and observation.

In the second stage of the study, the designer observes whether design can empower the elderly when they participate in design activities, and how design can play an enabling role through the design activities.

In this part of the participatory design project, three generative tools are used, including community impression map board, service intention board and community service vision board. These tools guide residents to express their opinions on the past, present and future experience of community service respectively. In the process of participatory design, the designer is mainly responsible for guiding and observing the self-expression of the elderly as participants.

## 3. RESEARCH RESULT

### 3.1 The Status of the Elderly Participating in Community Service

Since June 2018, the author has used the above research tools to study the elderly in Wuxi and Shanghai communities, and the following three typical elderly community service participation type were finally summarized:

- Active participation type: The 73-year-old takes part in monthly volunteer activities and choir rehearsals. He firmly believes that “old people are old but not weak”. Although most of the volunteer services involved were simple tasks such as distributing bottled water or disease prevention propaganda materials and performing performances, he was very satisfying and fulfilling with his volunteer activities. He said Problems in the community service can only be solved by the government, because “it is difficult for people to act as organizers”.

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<sup>1</sup>Quotations from World Health Organization (2002). Active ageing: a policy framework. *The Aging Male*, 5(1), 37.

<sup>2</sup>Quoted in Thomas, J. , & Mcdonagh, D. . (2013). Empathic design: research strategies. *Australasian Medical Journal*, 6(1), 1.

- Lack of participation type: The 65-year-old followed her son halfway across China to settle in new home. She does most of the housework at home, so she only comes out at 3 or 4 p.m. She hasn't been involved in the community since she moved here. For one thing, she didn't want to be seen as "a Lazy people with no sense of family responsibility." For another thing, she admitted that she was unable to communicate because she cannot understand dialect. And she added: "but there is no need to understand." Figure 2 records her social dynamics in the square when she basks in the sun for an hour. When the crowd gathers, she showed an air of curiosity about the conversation of others.



[Figure 1] On the right side were new immigrants and on the left four were local elderly people.

- Common participation type: The 65-year-old retired worker, is an empty-nester. His daily schedule is usually: from the opening of the elderly activity center (usually 6 a.m.), he will stay in the mahjong room until the afternoon activity center closes (usually 3 p.m.). He describes the activity center, "The computer in the e-reading room is always down, and I can't surf the Internet. One or two people were sitting in the dark, smoky TV room.

It's much more lively in the mahjong room. By the way, it's good to have lunch here." As for the problems in the community, "it is useless to care about them. The most important thing is to take care of yourself." But he has no plans for his future.

Through the above three typical case descriptions, by comparing what they say, do and think, we can conclude that the positive factor affecting the elderly's participation in community service is that community service can meet the needs of self-realization, respect and social interaction of the elderly. Negative factors are:

- Lack both systematic and organizational support and solutions to complex problems in the community. The elderly had to wait passively for the government to act.
- Lack of identity hinders the establishment of social relationships and makes it difficult to integrate into the local elderly community. She gives up the right to participate in community service passively.
- The individual-centered ideology, which takes enjoyment as the premise to participate in community service, is not willing to assume more responsibilities and obligations.

In the later part of the discussion, the author will propose the design of enabling opportunities for the elderly according to these three factors.

### 3.2. Participatory Design Practice

Participatory design activity in the community<sup>3</sup> take the form of open workshops. Designers use design tools to gather comments from residents and stakeholders on community services (software) and utilities (hardware). In the design activities, the designer as the guide helps the elderly to participate in the design activities, and people can immediately communicate the solutions and get relevant feedback.

The workshop located in the garden of the community centre and attracts the participation of many elderly people, not only old residents, but also new immigrants. Residents will lead designers to every corner of the community, so that designers can feel the specific situation and inspire a lot of inspiration, which could not be achieved by the conference-style. [Figure 2] With the help of design tools, the elderly not only put forward opinions and requests for existing services, but also look forward to future community services.

From the perspective of the elderly themselves, the demand for services mainly focuses on self-realization and social interaction. Specific wishes include regular reading and tea parties, community professional training courses.

<sup>3</sup> This participatory design activity is part of the micro-renewal design project of Hongxian community by Shanghai DAYU Community Building Development Centre. The author participated in this activity as a guide and observer. The essence of the project is community design.

In view of the fact, that the existing public space is mainly used by the male elderly, the female elderly emphasize that they need an independent space for social and leisure entertainment.

In addition to their own needs as the elderly group, they will pay attention to the needs of their grandchildren, other relatives, especially the disabled relatives. For example, the design of space and services (parent-child reading clubs, etc.), barrier-free gardens, Blind road and lane traffic problems, etc. Others think from the young people's point of view that the community's public space can be used in different periods of time and become a place for young people to read and work at night. Some pet owners want to borrow their pets to socialize and change the uncivilized behavior of other pet owners.



[Figure 2] Collect the opinions and vision of the elderly on community service

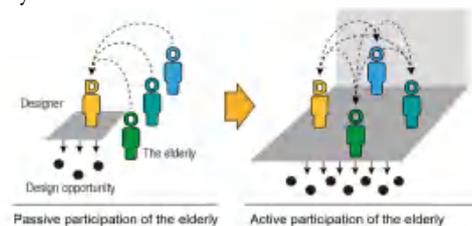
## 4. DISCUSSION

### 4.1 Providing Solutions to Problems

Participatory design practice has proved that the use of generative tools in the design can help the elderly to better self-expression. Compared with the design research activities carried out by the above designer as observer, the role of the elderly is passive, the transmission of information is one-way, and new values can only be generated through the re-processing of the designer. In the stage of participatory design, not only the designers and the elderly exchange information, but also the exchange of knowledge can occur among multiple stakeholders, which is more likely to produce creative solutions or design opportunities. [Figure 3] Therefore, the elderly may become active problem solvers.

From the perspective of design, this is mainly due to the following three points:

- The role of the elderly in the design tool has changed from passive to active;
- The elderly has mastered the method of finding problems and obtained the way to solve them by means of the design tool;
- Based on the real life environment, multi-role participation enriches the exchangeable information. And based on empathy with others, it is possible to obtain design opportunities that are in the common interest to create sustainable community services.



[Figure 3] The role of the elderly changed from passive to active in this study

### 4.2 Create Opportunities to Build Relationships

In his book *Return to the Community: Volunteer Morality and Community Care*, C. Heginbotham put forward the goal ideal of community service.<sup>4</sup> One of the ways to realize the ideal is to rebuild the new citizen consciousness, that is, residents' voluntary participation in the community, and establish the relationship of mutual assistance and love in the community. "Relationships" are also described by Manzini as one of the important components in the framework of sustainable quality, and it is believed that creative solutions can be produced in "deep relationships".

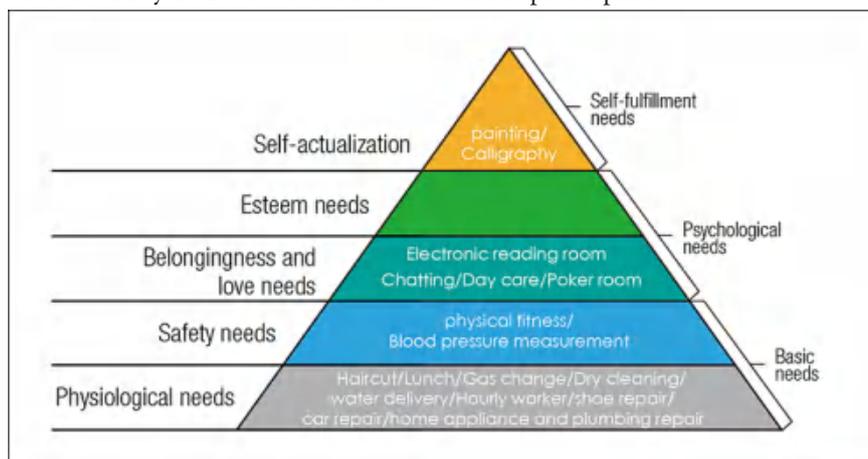
As far as community service is concerned, it lacks the shaping of new citizenship consciousness and the establishment and guidance of in-depth relationship. To some extent, the interaction of Participatory design activity can also be regarded as an important community participation, which enables the elderly in the community to sympa-

<sup>4</sup> Quoted in Dai Ming, & Yuan Shasha. (2010). Research review of urban community service at home and abroad. *Urban issues* (11), 25-33.

thize with the elderly from different backgrounds and provides opportunities for the creation of “relationship”. It has changed some old people’s indifferent attitude towards community service participation, especially those new immigrants. In the process of participation, they acquire a sense of satisfaction and identity, which to some extent improves their sense of community participation, which may become a positive force to promote the development of community services in the future.

### 4.3 More Active Community Service

As mentioned above, community service is in many people’s minds is almost equivalent to providing entertainment and dining for the elderly. To some extent, this implies to the elderly that “you only need to wait for services”, but it limits and weakens their ability to participate actively. Comparing with Maslow’s demand theory (as shown in Figure 4), most of the services are focused on meeting physiological needs and low-level security needs, which limits the ability development of the elderly and their enthusiasm for social participation.



[Figure 4] Distribution of community services for the elderly based on Maslow’s Hierarchy of Needs

When Manzini talks about “active participation”, he thinks that each subject’s ability depends on the characteristics of his environment (his or her enabling ecosystem) and his or her personal resources. From this point of view, the designer’s task should be to expand the elderly’s personal resources including knowledge, organizational skills, entrepreneurial skills and design capabilities through design. In the design of the content and form of community service, designers can guide the higher-level needs, change the negative ideas of the elderly on their own values, eliminate the confrontation of identity and break the shackles of their roles, and help them acquire the corresponding knowledge and tools through various ways.

Through the design, the chat in the community square is not just chat, and the debate in the reading room is not just debate, exploring and enhancing the value of dialogue among the elderly, providing the possibility of defining and practicing different lifestyles for the elderly. Then we can expect that in the future, more and more community service objects - the elderly to the role of community service designers and providers, thus creating a more positive community service.

## 5. CONCLUSION

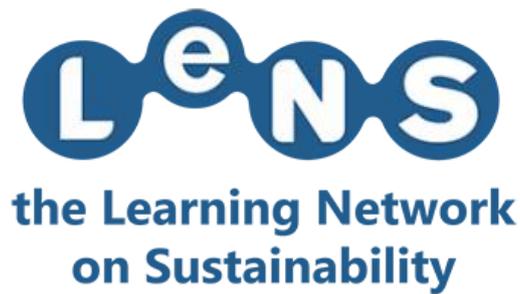
From the perspective of design, this paper studies how design intervenes in the empowerment problem of the elderly. With the research method of empathy design, this paper studies the present situation of elderly people’s participation in community service. It also analyses the positive and negative factors that affect elderly people’s participation. Design can provide the elderly with solutions to problems, ways to build relationships, and more active community services to empower the elderly, so as to promote the participation of the elderly in community services.

In this paper, the elderly is regarded as “problem solver” to actively explore the problem of elderly empowerment. At the strategic and methodological level, it provides practical reference for the design of research and application of intervention in elderly empowerment.

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## **FRAMEWORK OF ANALYTICAL DIMENSIONS AND DESIGN APPROACHES FOR SOCIAL INNOVATION**

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### **ABSTRACT**

Considering the complexity and uniqueness of social innovations and their contribution to society in learning sustainability, this article, result of a brief summary of a master's dissertation, aims to propose a framework to facilitate the analysis of cases of social innovation, unifying analysis dimensions and design approaches. This study uses the process of designing a framework proposed by Jabareen (2009) as a guide for the research stages. As a result, the framework contains six dimensions of analysis (Emergence Conditions, Nature, Field and Actors, Resources and Dynamics, Evolution and Results), as well as Design Approaches. The framework presents itself as an advance in the research of social innovation in the field of design, apt to be applied to analyze real cases, as a strategic diagnostic tool and systemic understanding of how design can contribute to social innovations and to the issue of sustainability.

Key Words: Social Innovation; Design; Sustainability; Framework.

## 1. INTRODUCTION

The seriousness of the socio-environmental problems currently faced is due to the imbalance between consumption and production, which is common to the industrial standards maintained by the rich countries and which proved to be unsustainable (Manzini, 2008). In this sense, Manzini (2008) understands that social innovations are presented as promising cases of social learning towards sustainability and will become increasingly common, since they tend to happen more intensely in the face of urgent problems. Unlike other types of innovation, social innovations do not have as main objective the creation of new products or artifacts (Cajaiba-Santana, 2013), but rather the formation of social relations, promoting a qualitative social change (André & Abreu, 2006), from the necessary interactions of cooperation and collaboration (Cajaiba-Santana, 2013), seeking to generate well-being to individuals and communities (Cloutier, 2003).

The social innovation, although discussed long ago, is understood in different ways, presenting a multidisciplinary concept (Moulaert et al., 2005, Pol & Ville, 2009, Murray, Caulier-Grice & Mulgan, 2010). For this study, it is understood that social innovation is a social phenomenon that presupposes interactions of collaboration and cooperation that happens, mainly, from bottom-up initiatives (including creative communities), and can be manifested in the form of a social movement or, in a more structured way, an organization. These initiatives seek the quality of life and well-being of its members, creating new social relationships and promoting new lifestyles, often with solutions that reduce consumption, indicating more sustainable futures, triggering social, environmental and economic changes qualitative.

Considering that social innovations and the solutions generated from them are intrinsically complex and have unique motivations, qualities and results (Manzini, 2017), it is understood that a model is needed that offers the systematization of the dimensions of analysis and the design approaches in order to facilitate their understanding. Thus, the research problem is presented: “How to establish a framework based on the systematization of analysis dimensions and design approaches for social innovation in order to analyze cases of social innovation?”

This article presents a brief summary of a master’s dissertation (of the same title as this article), elaborated in the Design Program at Federal University of Paraná (UFPR) in the year 2018, by Camila Ferrari Krassuski and guided by the teacher Liliane Iten Chaves. The present study aims to connect two themes in a unified way: social innovation in the sense of understanding its dimensions of analysis (evaluation of the most important attributes); and design for social innovation (practical understanding of how the design for social innovation happens), contributing to the evaluation of real cases of social innovation and recognition of opportunities.

Several authors acknowledge that most innovation research is not focused on social innovations. It is understood that are lacking efforts to systematize social innovations regarding their processes, practical approaches and methodologies. Cajaiba-Santana (2013, p. 48) states that “there are no methodological structures capable of covering the procedural evolution of the different elements that interact in the construction of social innovations”. In the context of evaluating a social innovation, Svensson et al. (2018) says that it is a poorly explored research front. With regard to the meeting of the social innovation and design themes for social innovation, through bibliographical surveys, no framework was found that contemplated both. From this, we can see a gap in the literature that this study aims to fill.

As for the method, this article uses the process of designing the framework proposed by Jabareen (2009) in the study “Building a Conceptual Framework: Philosophy, Definitions and Procedure”, as a guide to the research steps.

Considering social innovations as ways of learning society towards more sustainable futures and considering the complex nature of a social innovation, from a gap in the literature, this study proposes a framework where there are unified dimensions of analysis and approaches of design for social innovation. In order to analyze cases of social innovation, the framework is proposed, presenting itself as an advance in the research of social innovation in the field of design and sustainability, helping to initiate dialogues on the subject, apt to evolve and be applied in the analysis of a real social innovation.

## 2. METHOD

This article uses the process of designing a framework proposed by Jabareen (2009) in the study “Building a Conceptual Framework: Philosophy, Definitions and Procedure”, as a guide to research steps. For the author, a framework is a construct where each concept incorporates an integral role, interconnecting with the other concepts, which in turn are articulated in relation to the phenomena and that its construction is based on a process of theorising the existing multidisciplinary literature.

For the construction of the framework, Jabareen (2009) defines eight steps: 1) Map literature; 2) Read and categorize data; 3) Identify concepts; 4) Deconstructing and categorizing concepts; 5) Integrate concepts; 6) Synthesize, and build meaning. ; 7) Validate the framework; 8) Rethink and revise the framework. This study uses until step 6, which will culminate in the proposal of the framework. In order to map the literature, an assistematic bibliographic review is used, with the intention of selecting authors to base the systematization of analysis dimensions and design approaches for social innovation.

For the analysis technique, the author proposes a conceptual analysis of the framework that aims to generate, identify and trace the major concepts of the phenomenon, as well as to develop concepts with their own attributes,

characteristics, limitations and different perspectives. As a final product, the framework can present different styles and representations: “Usually they are designed in the form of graphs and diagrams, and are accompanied by exploratory texts. In addition, these instruments can have several levels organized to facilitate their visualization and understanding.” (Shehabudeen et al., 1999 apud Delgado, 2016).

Thus, concerning to its nature, this research is considered applied. The applied researches aim to produce knowledge for practical application, directed to solutions of specific problems, involving local truths and interests (Prodanov & Freitas, 2013). Considering the objectives, the research can be classified as exploratory, because according to Prodanov and Freitas (2013), it has the purpose of providing more information about the subject being investigated, allowing its definition and its delineation, and possible discoveries about a new type focus on the subject. As a technical procedure, we use the bibliographic research that, according to Prodanov and Freitas (2013), p. 54: “It aims to put the researcher in direct contact with all the material already written on the subject of the research.”

### 3. RESULTS

With the mapping of the literature, eight studies were selected: André and Abreu (2006): *Dimensões e Espaços da Inovação Social*; Chaves (2017): *Design for Social Innovation: Distributed Economy, Collaborative Network and Creative Communities*; Cipolla e Moura (2012): *Social innovation in Brazil Through Design Strategy*; Cloutier (2003): *Qu'est-ce Que L'Innovation Sociale?*; Manzini (2017) *Design: When Everyone Does Design - An Introduction to Design for Social Innovation*; Meroni (2007): *Creative Communities - People Inventing Sustainable Ways of Living*; Murray, Caulier-Grice and Mulgan (2010): *The Open Book of Social Innovation*; Tardif and Harrisson (2005): *Complémentarité, Convergence et Transversalité: La Conceptualisation de L'Innovation Sociale au CRISES*. The selected materials compose the bibliography of this work and guide the creation of the framework from the concepts they present.

André and Abreu (2006), Cloutier (2003), Murray, Caulier-Grice and Mulgan (2010) and Tardif and Harrisson (2005) contribute to the construction of the framework through concepts of analysis dimensions of social innovations. Chaves (2017), Cipolla and Moura (2012) and Meroni (2007), contribute with the design approaches. Manzini (2017) contributes with both. The selected materials are separated, systematized and organized into convergent aspects and complementary concepts. From this, the concepts are deconstructed and categorized into seven aspects: 1) Emergence Conditions; 2) Nature, 3) Field and Actors; 4) Resources and Dynamics; 5) Evolution; 6) Results and 7) Design Approaches.

For the Emergence Conditions, three levels were identified for the emergence of social innovations: macro context, motivations and a favorable environment. The macro context refers to broader global external factors, related to critical socio-environmental issues, connected environments (technology use) that end up impacting everyone, triggering in some way, a movement in relation to change. At the motivation level, incentives have been identified that influence people in their choices at the individual level, such as local challenges and opportunities, cultural factors, and the desire to change lifestyles. The favorable environment represents the immaterial environments in which social innovations develop; such médium are creative, endowed with factors that stimulate social innovations such as tolerance, democraticity, social cohesion and the Social Economy.

As for Nature, from the authors, it is understood that it is linked to three items: object, objective and tangibility. The object item refers to the definitions and characteristics of each social innovation, its essences and particularities. With regard to the objective, it is understood that the achievement of the identified objectives common to social innovations (well-being, more sustainable lifestyles and new social relations), as well as specific objectives related to the achievements and contributions which social innovation itself proposes. Another item to be considered in the Nature of a social innovation is tangibility, that is, in what way it can be perceived: in this context, definitions of new ideas, products, services, processes are contained.

In the approach of Fields and Actors of social innovations, it is understood that the field of action of social innovations is diverse, since social innovations happen in several sectors of society, but they occurs mainly from the creative communities. Actors are the mediators, the individuals who produce the social innovations, and, like the field, are diverse: they can be the promoters, the agents, the participants and even the design professionals. At the actuation level, it is perceived that a social innovation is active, promoting the change that it wants, not passive, waiting for other organs or people to do or solve their questions for them. They act locally, however, their scope has no boundaries, due to its action in networks, accessing global connections.

The Resources and Dynamics of social innovations are related to the processes of social innovations, dependent on the resources to be realized (goods, knowledge, time, networks and flows and mainly people). The dynamics comprise interactions carried out internally or externally between resources. The internal dynamics of a social innovation represent the way in which social innovations are organized and can be configured in collaborative organizations or social movements, and depend necessarily on relations of collaboration and cooperation, equipped with mechanism of negotiation of conflicts, collective learning and flexibility, where the relations between the participants denote their specificity. The external dynamics refer to the partnerships and collaborations that social innovations can establish between peers or with other institutions or even the State, in processes of cross-pollination: multiple and diverse relationships that contribute to its increase.

The dimension of analysis Evolution refers to the development of the social phenomenon in relation to its maturation. Social innovations, when they do not end or “exhaust”, if they are not absorbed by other institutions, or remain independent, evolve to mature and implemented solutions, towards systemic changes.

The Results of social innovations are subjective and complex. It is understood that general results (related to achieving the intrinsic objectives common to social innovations such as well-being, sustainability and new social relations) and specific results (relative to the fulfillment of the objectives established on a case-by-case basis) can be considered.

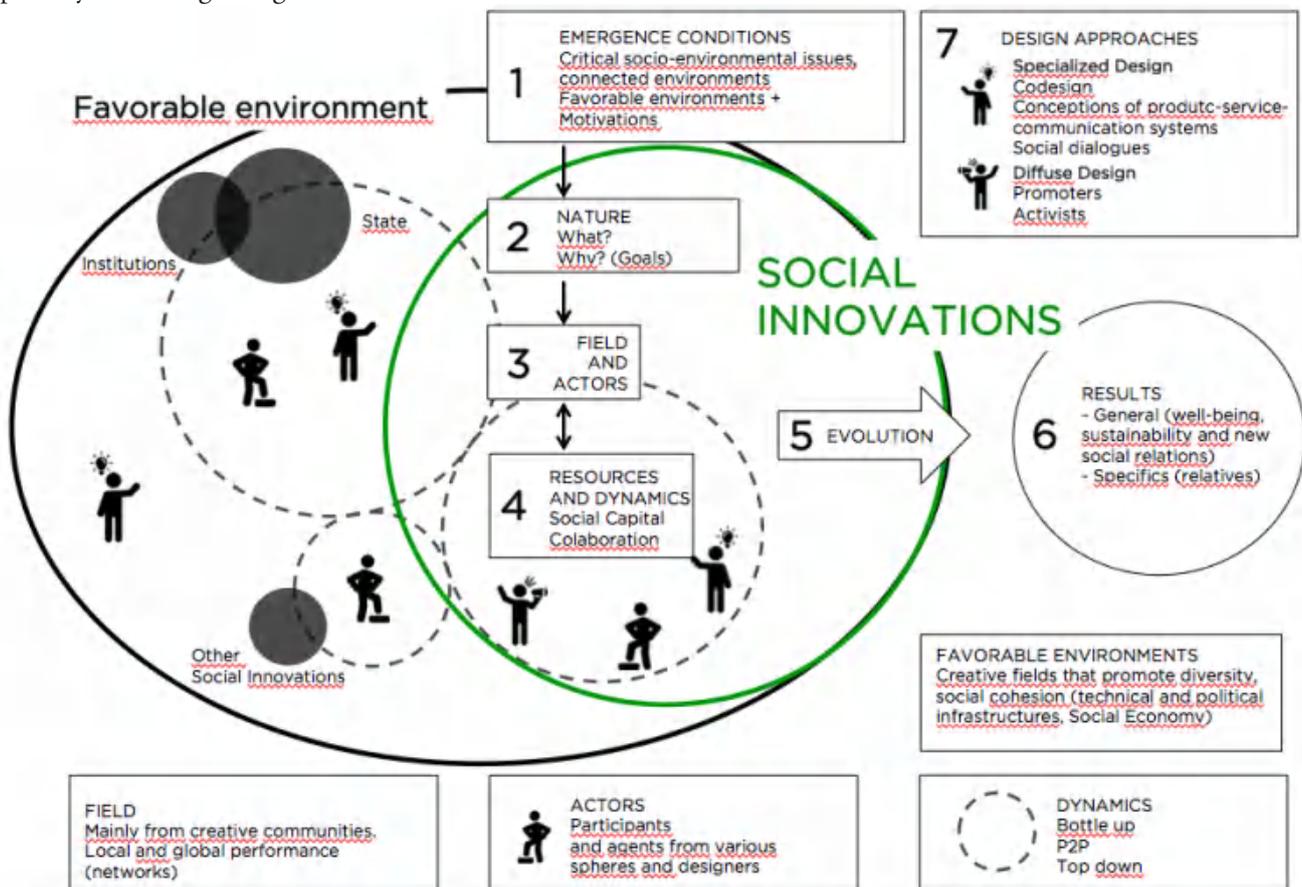
Regarding the Design Approaches to social innovation, it is understood that they can be branched out into the modalities of specialized design and diffuse design. The specialized design is the modality of design practiced by design professionals, whose objective is to support and guide processes of social innovation. In this modality, the designer can operate in three spheres: within social innovations, between social innovations and other spheres or in society, acting at two levels: operational or strategic.

In the specialized design modality acting within the social innovations, it can be seen that the agency can happen at the operational level (designing product, service and communication systems), or at strategic level, in the diagnosis of the condition of social innovations, and in the elaboration of possible futures, working with collaborative and participatory design, supporting diffuse design skills.

In the form of specialized design working between social innovations and other spheres, it is understood that the design acts only at strategic level, in a process of codesign, articulating between different actors, organizations and institutions, organizing coalitions and promoting social dialogues. In the modality of specialized design acting in the society, the action of the design is restricted to the strategic level, monitoring and learning with the existent solutions, or identifying contexts that need of the social innovations; moreover, design can act in the form of activism, proposing and triggering social innovations.

Diffuse design is the modality of design practiced by non-specialists, which holds a natural ability for design and creativity. Also called “social heroes”, they are responsible for triggering social innovations. Diffuse design can be practiced in two spheres: unleashing collaborative organizations that, according to Manzini (2017), are products, services, models or new ideas that aim to deal with local problems that generate new relationships or social collaborations; or local activism, which is the conception of spaces where opportunities for exchanging experiences and promoting debates are created (Manzini, 2017).

At the end, there is the synthesis and construction of meaning with the framework proposition, presented graphically, according to Figure 1.



[Figure 1] Framework of Analytical Dimensions and Design Approaches for Social Innovation (Font: Krassuski, 2018, p. 122)

Because social innovations are social phenomena (Cajaiba-Santana, 2013), the framework emphasizes social relations, since, according to Cloutier (2003) and Cajaiba-Santana (2013) as important as the results, are the pro-

cesses of cooperation between the various actors. Through the framework, referring to the legends, it is possible to perceive the performance of specialized design within social innovation, in the internal dynamics acting as a social actor (Meroni, 2007), as well as in other social relations and between social innovations and other spheres, acting in codesign processes. The designer is also seen in the favorable environment, acting as an activist, triggering social innovations.

#### 4. DISCUSSION

Recognizing the importance of social innovations as promising cases of learning towards sustainability and considering the complexity and uniqueness of social innovations, the objective of this work was to propose, through a framework, the systematization of the dimensions of analysis and design approaches for social innovation, with the purpose of analyzing cases of social innovation.

This study used the steps of designing a framework proposed by Jabareen (2009), to establish a construct that unifies the themes of social innovation and design for social innovation. From the eight selected studies coming from a bibliographical review, as a result, the framework composed of seven items was proposed. From the six dimensions of analysis defined, it is possible to make a better understanding of a case of social innovation on its most important aspects. Considering the importance of the contribution of design as a creative, systemic and cultural activity, focused on problem solving (Mozota, 2011), it is possible to systematize design approaches in modalities, spheres and performance levels, making it easier to understanding of the possible actions to be taken in the field of strategic design that aim to support and strengthen social innovations.

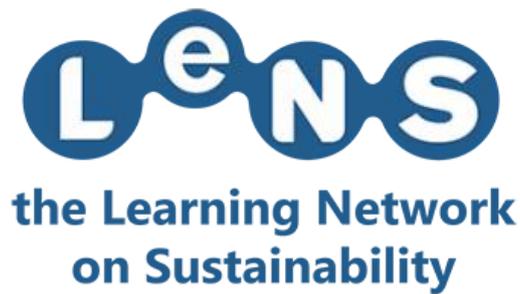
It is concluded, therefore, that the framework presents itself as an advance in the research of social innovation in the field of design, collaborating with the support and strengthening of social innovations and their sustainable practices in the generation of well-being dissociated from material consumption, acting in the design for sustainability and triggering dialogues on the subject. The presented construct is apt to be adapted and directed to the new scenarios and other topics that are important to facilitate the understanding of possible design actions to be developed in support of social innovations.

Finally, it is believed that the framework can be applied to study existing cases of social innovation, as a strategic tool for diagnosis and systemic understanding of how design can contribute to social innovations and to the issue of sustainability.

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## **COLLECTIVIZATION OF DESIGN AND DIGITAL MANUFACTURING: SOCIAL LABORATORIES**

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### **ABSTRACT**

With the growing popularization of digital manufacturing, a sector of society has generated many expectations on how this can contribute to the development of social welfare. These expectations are reflected in a series of initiatives from the public sector, which seek, through the implementation of spaces dedicated to these technologies, to benefit the community. Taking as a starting point the analysis of the objectives of some of these projects, this research reviews the proposals of some authors that provide tools for understanding how a digital manufacturing space can become a public service for the benefit of communities. The research reveals that, although there are many possibilities opened by digital manufacturing, it is necessary to first problematize some ideas that are taken for granted when thinking about these new technologies as a contribution to the quality of people's life.

## COLLECTIVIZATION OF DESIGN AND DIGITAL MANUFACTURING: SOCIAL LABORATORIES

I'd like to start out by showing a presentation on my previous work to help chronicle how I landed on this particular subject of research. My background is that of a sound engineer, and, after working in various different areas within the field, my research started to gear itself towards the construction of electronic musical instruments.

Through this research, I started to give workshops on electronics geared towards musical projects. As a result of these workshops I was able to travel throughout Chile and South America, teaching at a variety of spaces that were both institutional and independent. During these trips I also had the opportunity to get to know a group of like-minded individuals working on similar projects within various multidisciplinary fields such as: visual arts, music, engineering and programming. All of these individuals work under an Open Source philosophy and share their artistic production as well as pedagogic activities in art and technology.

Following this experience, the motivation arises to begin a research project regarding the question "how is it possible to generate a long lasting impact through these spaces that goes beyond simple workshops? by doing so, how do we generate critical thinking with regards to the subject matter dealing specifically with technology?"

Additionally, one might ask:

Through these subjects of interest, how does one go about fomenting the democratization of technological knowledge? It is with this intention that I enrolled in the Industrial Design masters program at UNAM.

During the first stage of my bibliographic survey, I realized that these technologies for digital manufacturing have gained increasing interest worldwide, especially in latin america, generating a growth in their use as well as in the spaces in which they are developed and presented.

There are even initiatives from public institutions for the implementations of communal spaces for digital manufacturing, as a form of citizenship empowerment and the generation of social innovation. This is a similar phenomenon to the implementation of spaces with public access to the internet a few years back. Everything points to the this phenomenon, which we can see clearly illustrated by the projects: Ateneus de Fabricación in Barcelona and FabLab Libre in Sao Paulo. These projects will henceforth begin to be replicated in an array of places around the world.

Alongside these spaces, a great opportunity arises, now with the expansion of these design spaces along with the rapid growth and diversification of their members, rather than limit mobility for designers, they expand a wide field of work for the creation of structures that propagate, catalyze, and speed up these processes of technological appropriation by the public.

It is by identifying this phenomenon that I reformulate my research questions and decide to focus on the opportunities that arise.

Questions:

- How does one make a space for digital manufacturing an integral element of a social infrastructure?
- How do we turn these spaces into centers for social innovation that respond to local needs?
- The objective of this presentation is to analyze if tools for digital fabrication promote processes of fabrication and design that are more democratic, if so, how do we foment them? what role do public spaces of digital fabrication play in this context?"
- Do new tools in digital fabrication allow for new ways of socialization and democratization in the processes of design and production? If so, how do we foment this potential?
- What role can public spaces for digital manufacturing play in this context?

In order to understand these phenomena, one must first learn about the contexts that brought them into being, both in the realm of ideas as well as in technological development.

Through this analysis, it can be inferred that, although there are many ways that these new modes of fabrication allow for new possibilities, another way of looking at them is seeing how they join the advantages of automated modes of artisanal production at a small scale.

When one brings together the process of prefabrication and execution; there is a potential to break through the separation between design and production that industrialization has imposed on artisanal processes. Thought this process, and after two centuries of separation, the conception and execution of these daily objects can once again return to the same hands.

The other pillar on which this investigation is based is openness as a value in the design process as well as the participation of using in this process.

The point of departure of this investigation is the incipient interest of public institutions to make available tools for digital manufacturing as a way of citizenship empowerment. (Smith, n.d.)

Although there aren't many referents of this type, nor in-depth studies, the idea has emerged that these technologies by themselves are able to better quality of life.

This is related to innovation that has installed itself as a paradigm of the new century, planting itself as an ideal in all areas of human action. One can simply take out a random magazine to find proposals such as "five way to innovate within marriage" or "business innovation", however, in the same way that this has become popularized, the idea has become equally vapid.

Despite the lack of concrete references of this kind, if we examine the objectives of many of these initiatives, we can see that they're pretty ambitious and cover a wide range of themes. The following table shows the objectives exposed by

two spaces, public laboratories of digital manufacturing that are currently operating in Barcelona (Proyecto Ateneus) and in Sao Paulo (FabLab Livre) and a third that is being implemented in Cuernavaca, México. What technologies?

If the socialization and democratization of technological knowledge is to be established, first it's necessary to realize certain definitions and position them within the subject.

Now I want to reflect about a few of the aspect to keep in mind when thinking about how the socialization of digital manufacturing can turn become valuable for society.

Technologies are not neutral, they respond to ideologies and worldviews, this is why we must begin to ask ourselves "what are desired technologies and how can they help resolve current problems while simultaneously evading the charm of futuristic scenarios seen in science fiction and fomented by the entertainment industry and are tech companies. These scenarios are found everywhere, from communications to medicine.

These visions make it so that technological development is more preoccupied with generating devices that, for example, allow quick communication between our home appliances than generating a response to concrete problems such as hunger, environmental degradation, or bettering the quality of life for millions of people that, although there is talk of economic dematerialization, must make their living realizing works that could be hazardous for their health and that could be subject to automation, like, for example, transportation of heavy loads, mining, or work in trash dumps.

Here we add Ivan Illich's idea of Conviviality

In his work, beyond realizing a critique towards the monopolization of technological knowledge by way of industry and specialists, which we can see in the medical and transportation industry, plants that technology and scientific progress have to serve towards building a postindustrial society in which a person's creative exercise won't impose labor, understanding, or forced consumption upon anyone else.

Human beings are in need of a tool with which to work, not instruments that work in their place. They need a technology that takes out the best parts of personal energy and imagination, not a technology that subdues and programs. The tool is convivial in that each one can utilize it without difficulty, as frequently or rarely as they desire, and for the ends that they determine. The use that anyone makes of the tool does not intrude on another's freedom to do the same.

For this investigation, tools are not the technologies of fabrication, rather, we see the space for digital manufacturing as a tool for conviviality.

This is why if the democratization of the tools of digital manufacturing are to be established, it is necessary to go beyond the idea that "everyone can do anything" and think about how these technologies add to the democratization and means of production. The potential of this paradigm-shift in fabrication is to return to different communities, the possibility of managing their own necessities and in this way adding to their autonomy and self-determination.

These aspects have to be taken in mind during the design and implementation of this type of space, above all in the articulation with the different organizations of the society of which it is to be a part of. Due to this, the challenge is not to assemble the greatest quantity of individuals specialized in these themes, or to generate a new group of specialists, but rather it means finding ways for these technologies to be at the reach of the community and at the resolution of their needs. What is more interesting than an army of people capable of operating a 3d printer is a group of people with these understandings integrated in communal networks of knowledge, that dialogue with the rest of the community in search for integral answers with regard to the social problems within the territories, respecting other ways of doing things that might not be so efficient within contemporary parameters, but that have other sorts of values and characteristics that make them important for the community.

In order to carry out in practice these ideas, it's proposed that these spaces open on three levels.

### **Pedagogies**

The relationship between pedagogy and technology is also a theme about which a lot has been said and in which we find many different postures. For the purposes of this investigation many of the ideas that Gilbert developed through his work with Pacey will be used. Through this model, Gilbert takes to education, proposing three approximations:

Teaching for technology, that centers itself around technical aspects and is oftentimes the most common perspective, while also being the most restrained; (2) teaching about technology, which is more oriented towards socio-technological questions, meaning, towards those related with the organizational aspects and ideology/culture. and (3) Teaching within technology, which takes into consideration all the aspects of the model. Gilbert (1992) underlines that adopting this last point leads towards a comprehensive and holistic teaching of technology as well as a more balanced technological education.

The educational program of a public center for digital manufacturing should act within those three levels. Understanding where the technology that surrounds us comes from is a prerequisite for generating our own responses, that contain and express the values of the communities that generate them.

### **Communitary**

The second level in which a space of this type should foment the strengthening of networks and community groups. In order for this to happen, a participatory design is proposed, similar to a tool as it has been proposed since the beginning of the process. In order to determine the characteristics of the space, both physically as well as operationally, only with the information that the users themselves have over their own context, one could aspire to accomplish the ambitious proposals. On the other hand, the process in itself will be a form of empowerment for the participants

and will permit the exchange of learning between those who propose and those who will be the beneficiaries of this new infrastructure.

### **Economic**

This is the aspect that could turn these systems of production into the 4th industrial revolution that's been promised time and time again. The previous two points can be achieved among other ways, through other methods and technologies that get taken from practice into reality.

Only by effectively replacing systems of industrial production with these new systems will the expectations be met with regard to solving the problems associated with mass production fomenting sustainable economies with regard to their economic and social aspects. Direct digital manufacturing as an addition to industrial production only sharpens and intensifies the problems that the latter has generated.

The way in which the systems of direct digital manufacturing have been inserting themselves in the economy and have been generating a model based on distribution through platforms like kickstarter in which an individual, for example in Spain, designs a product, offers it on a global platform and through that method, they raise money for their production which could be realized in China or in another country. Then the products travel to the country of their design, to then be distributed globally.

## **CONCLUSIONS**

From this research it can be seen that the challenges and possibilities that the socialization of design opens for designers are many. The distribution of means of production poses a total paradigm shift for the discipline. This change goes beyond the "materiality" on which designers work: the design of experiences or that of services pose a change in this sense, but although the problems they face require skills different from those of designing products, their goals are still linked to economic systems that respond to industrial production modes, ie the service industry and the experience industry. Overcome the paradigm of industrial manufacturing with cleaner, more democratic, transparent and fair production systems it requires a total reconfiguration of the discipline of design, in its means, but above all in its aims.

Many of the social and environmental problems today are more related to the scale at which things occur than to the techniques used. This is why although economic parameters are extremely difficult to overcome the advantages of mass production, designers must seek new ways of relating to society more direct and low logics that give as much or more value than economic to social, environmental and cultural aspects.

The origin of Design as a discipline is inseparably linked with the industrial development of societies, so collecting the ideas of small, local, open and connected that Manzini poses, requires a change of mentality of design professionals in search of ways more sustainable, fair and democratic to manage the needs of society.

In a world where the ability to configure and produce objects is democratizes and expands, that is, everyone can design, the question is what is the role of the professional designer, that is, those people who not only want to design, everyone can do it, but also want their main activity and contribution to society be design.

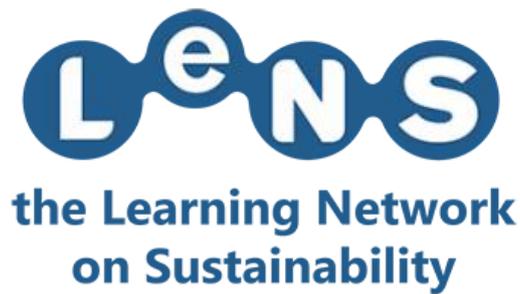
In this sense short and long term challenges can be glimpsed. In the stage in which this evolution is currently the panorama that opens up for professional designers is quite broad if you know how to comprehend the situation in an integral way. That the field of design expands to more people opens many possibilities in the generation of infrastructures that are required to enable non-professionals to make their own designs. On the other hand, there will still be areas of design that, due to their complexity, should remain in the hands of experts in the field.

If you think long-term, Krippendorff with his speech design proposal can shed some light on the role of the designer when they all design. The designer can become an articulator of values and ideas in the configuration of the artificial world and social organization. Designing speeches does not mean imposing, such not even propose ideas, but be able to collect the concerns and values of a community and crystallize them into proposals that go beyond just the material configuration of objects and space.

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## **FOSTERING SOCIAL INNOVATION THROUGH SOCIAL INCUBATORS AND CORPORATE SOCIAL INCUBATORS: EVIDENCE FROM ITALY**

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### **ABSTRACT**

Recently, some incubators are focusing on supporting social startups. This type of incubators can be named Social Incubators. The same specialization is also involving some Corporate Incubators, which can be named Corporate Social Incubators (CSIs). Even if the literature has analyzed several types of incubators, the studies investigating Social Incubators is limited. Moreover, to our best knowledge, no one has analyzed CSIs. This study aims at filling these gaps analyzing the incubators of these typologies in Italy. In 2018, we identified 31 Social Incubators and we sent them a survey, obtaining a representative response rate of 41,9%. In addition, we performed three exploratory case studies on the three CSIs that we have identified. Our results show that Social Incubators are mostly private-held; offer services on CSR and impact investing; and 30,8% of them invest in their tenants. Regarding CSIs, our results suggest that they integrate strategies of Open Innovation and CSR.

Key words – Incubator, accelerator, corporate incubation, social startup.

## 1. INTRODUCTION

In the last decade, the number of incubators<sup>1</sup> is increasing all around the world (Messeghem et al., 2018). Since their origin, incubators aimed to support the growth of startups by providing a variety of services (Aernoudt, 2004): space, know-how, legal and entrepreneurship, human capital (through network and ecosystem), education, access to capital, and, more recently, social impact measurement. Incubators and their incubation programs have evolved (Bruneel et al., 2012) and continue to evolve (Pauwels et al., 2016), adapting their business model to the needs of the startups and economic trends. In fact, as a consequence of the global effort to promote social entrepreneurship (e.g., European Commission, 2012), some incubators decided to specialize in supporting social startups. Moreover, the literature shows that specialized incubators have a competitive advantage over other incubators (Aerts et al., 2007; Cohen and Hochberg, 2014). Indeed, incubators which are specialized in incubation of a particular type of startups can focus on specific competences and can offer specific assets to their tenants. In addition to this, the number of social startups is increasing (Arena et al., 2018) and, therefore, the demand for incubation by this type of startups is increasing. Corporations are creating their own incubators (Kohler, 2016) or their own incubation programs in order to apply a strategy of open innovation and improve their competitiveness (Becker & Gassmann, 2006). Indeed, several international corporations operating across various sectors, such as insurance (Allianz), telecommunication (Orange), healthcare (Bayer), consumer packaged goods (Coca-Cola), social media (Facebook) and data-driven technologies (Google) are creating their Corporate Incubation program (Kohler, 2016; Colombo et al., 2018). Also, some Corporate Incubators are focusing on supporting social startups. We call this type of Corporate Incubators Corporate Social Incubators (CSIs). Even if there is increasing attention to the support of social startups and several works studied incubators (Mian et al., 2016), only a few studies have analyzed incubators specialized in social startups (Sonne, 2012; Nicolopoulou et al., 2017).

Moreover, there is not a clear definition of Social Incubator and, in addition, it is not clear what are the characteristics (e.g. aims, competences, services) of Social Incubators. Finally, to our best knowledge, no studies have analysed CSIs. This work aims at filling these gaps by analysing Italian Social Incubators and CSIs. To carry out this study, in 2018 we identified and analyzed thirteen Social Incubators and three CSIs in Italy. The data of the thirteen Social Incubators came from a survey, while the data of the CSIs came from the analysis of their web site and social media. More information about the data and methods are reported in detail in Section 3. Thanks to the answers of these thirteen Social Incubators, we have been able to gather a lot of information that allows us to explain the characteristics of Social Incubators. In more detail, we have data regarding their diffusion, maturity in term of years of operation, numbers of employees, number of incubation requests, number of startups and entrepreneurial teams<sup>2</sup> supported, services, funding received from the startups and entrepreneurial teams supported, incubation time, costs and sales. Moreover, thanks to the analysis of three Italian CSIs, we have obtained information about the reasons for the creation of the CSIs and about the benefits of this type of Corporate Incubators for the corporations promoting them. We find that CSIs integrate strategies of Corporate Social Responsibility (CSR) and Open Innovation. All these findings are reported in detail in Section 4. In conclusion, our research aims to make a theoretical contribution to identifying the characteristics of Social Incubators and introducing a new type of incubator named CSI. Moreover, our findings can make policymakers aware of this instrument for the purpose of supporting and fostering social entrepreneurship. Lastly, our research suggests to corporates interested in CSR policy and Open Innovation strategy how a CSI can be useful for developing these strategies.

## 2. LITERATURE REVIEW

Incubating organizations are part of a wide range of initiatives aimed at stimulating and supporting entrepreneurship (Mian, 1996). Indeed, incubator is a “word umbrella covering a heterogeneous reality” (Aernoudt, 2004). Therefore, there are different types of incubators. In order to carry out our literature review and our subsequent analysis, we developed a simple model to classify the different types of incubators and to introduce Social Incubators and CSIs. The model is represented in Table 1 and includes: Business Incubator, Corporate Incubator, Social Incubator and Corporate Social Incubator (CSI).

[Table 1] Types of incubators

	Independent	Corporate
Business	Business Incubator	Corporate Incubator
Social	Social Incubator	Corporate Social Incubator (CSI)

To generate this table, we use two variables, the first is related to the presence or absence of a relationship with a corporation (Independent vs Corporate incubators) and the second to the presence or absence of a focus on social innovation and social entrepreneurship (Business vs Social incubators).

<sup>1</sup> Some authors consider incubator and accelerator equivalent, while others prefer to difference these two organizations (Cohen and Hochberg, 2014; Pauwels et al., 2016; Pandey et al., 2017). However, since the difference between incubators and accelerators is not clear and they offer the same services and they have the same object, this study uses the term incubator also for the accelerators.

<sup>2</sup> Entrepreneurial teams have not formally established their company yet.

### A. Business Incubator

Business incubators are incubators which are not focused on supporting startups which aim to introduce a positive social impact. These incubators have their own business, independent of any corporate entity, but may be linked to universities or research centers. This is the typical and most diffused form of incubators. Indeed, many studies have analyzed only this type of incubators and the role of these incubators for entrepreneurship (Colombo and Delmastro, 2002; Mian et al., 2016; Pauwels et al., 2016; Messeghem et al., 2018). In fact, although the number of incubators in the world is increasing (Pauwels et al., 2016; Messeghem et al., 2018), as the types of incubators, Business Incubators remain to this day, one of the most widespread categories of incubators.

### B. Corporate Incubator

Large corporates have developed and are developing Corporate Incubators. This type of incubator is an example of Open Innovation (Chesbrough et al., 2006), which can be defined as the use of external knowledge to accelerate internal innovation and expand the markets for external use of innovation (Huizingh, 2011). Indeed, Corporate Incubators aim to support incubation teams in order to come up with innovative ideas which fit existing business capabilities and business models of their sponsoring corporate. This type of innovation can be more easily transferred from the incubation teams to the sponsoring corporate. And then this corporate can use its existing structures and large resources to rapidly exploit the new business opportunities at scale. Today this type of incubators is rapidly developing, changing its characteristics and becoming a strategic tool for many large corporates (Kohler, 2016). However, already Smilor (1987) in the late eighties mentioned the existence of Corporate Incubators. It is also interesting to indicate another type of Corporate Incubation: the Corporate Incubation with partnership (Kohler, 2016). This type of Corporate Incubation program is the result of collaboration between a corporate and a public (Allen and McCluskey, 1991) or private organization (e.g. an incubator).

### C. Social Incubator

Today the attention to the environment and social problem is increasingly important both for entrepreneurs and customers (Dangelico and Pujari, 2010). Indeed, the number of social startups is increasing (Arena et al., 2018). For these reasons, incubators have the opportunity to specialize their activity on supporting startups or entrepreneurial teams which aim to do business on the social innovation field. Indeed, through this specialization strategy, incubators obtain an important competitive advantage (Aerts et al., 2007; Cohen and Hochberg, 2014). In the literature, there are different definitions of Social Incubators. For instance, Aernoudt (2004), according also with Eitzkowitz et al. (2005), stated that Social Incubator is a tool “to bridge the social gap by increasing employment possibilities for people with low employment capacities such as disabled people, minimum guaranteed income beneficiaries, low-skilled workers, long-term unemployed, immigrants, political refugees, etc.” (Aernoudt, 2004 p. 129). However, we think that this definition considers only a part of the activity of a Social Incubator. Indeed, according to Sonne (2012), Nicolopoulou et al. (2017), and Arena et al. (2018), we consider Social Incubator an organization which supports startups which aim to introduce a positive social impact on Society. The sustainability of the union of economic and social needs is not a utopia. Indeed, Bank and Klofsten (2017) show that Social Incubators, which they call Sustainable Incubators, can have a reasonable inflow of tenants, even if these incubators support only social startups.

### D. Corporate Social Incubator (CSI)

Our hypothesis is that there could be Corporate Incubators which are specialized in supporting social startups or entrepreneurial teams that want to develop their business in the social innovation field. To our best knowledge, there is no literature about Corporate Social Incubator (CSI). Indeed, even though vast literature devoted to incubation programs (Mian et al., 2016), few studies have dealt with the theme of Social Incubation and no one with that of the CSIs. Therefore, this study aims at filling this literature gap analysing the Italian incubator ecosystem.

## 3. DATA AND METHODS

To reduce the impact of different national policies and to understand the relevance of the phenomenon at the national level, this study focused on one specific developed country: Italy. To identify Social Incubators in the Italian incubator ecosystem, in the first part of 2018 we analysed the web sites and the social media of all the Italian incubators, which were 171, and, considering startups or entrepreneurial teams supported and the sectors of specialization (e.g., cleantech, circular economy, clean energy, development of smart industry, support to smart city, security, and many others), we identified a population composed by 31 Social Incubators. It is interesting to note that some incubators analysed already explicitly qualify themselves as Social Incubators. Afterward, we created an online survey on SurveyMonkey, based on the literature (e.g., Colombo and Delmastro, 2002; Aerts et al., 2007; Bruneel et al., 2012). The questionnaire asks several questions such as the perceived importance of their services, if they have invested in their tenants, the number of supported startups, and the business sector in which their tenants operate<sup>3</sup>. In the spring of 2018, we submitted the survey to the population of Italian Social Incubators. Out of 31 Social Incubators in Italy, we received 13 valid answers, obtaining, therefore, a representative response rate of 41,9%. Additionally,

<sup>3</sup> We also collected information regarding the incubators such as their foundation years, number of employees, services offered, incubators funding and investment, their costs and revenues, number of tenants in 2017.

to obtain more information about them, we used the database AIDA by Bureau van Dijk, which contains comprehensive information on corporates in Italy, with up to ten years of history. In addition to this, we also analysed the Italian Corporate Incubation ecosystem. Out a population of 15 Italian Corporate Incubators, we discover 3 CSIs. To identify this type of Corporate Incubators, we analysed web sites, social media, and official description of Corporate Incubation programs. Similar to the analysis of Social Incubators, we considered startups or entrepreneurial teams supported and the sectors of specialization. These CSIs will be described in Section 4.2.

## 4. RESULTS

### 4.1. Italian Social Incubators

This study found that out of 171 Italian incubators 18,1% (31 incubators) are Social Incubators. In 2018, 13 of these Social Incubators (41,9%) responded to our survey. Table 2 shows our sample of Social Incubators<sup>4</sup> in chronological order. This table also shows the location, the year of foundation, and the legal form of the Italian Social Incubators of our sample.

[Table 2] Italian Social Incubators

N.	SOCIAL INCUBATOR	LOCATION	YEAR OF FOUNDATION	LEGAL FORM
1	Social Incubator A	Lazio	2006	Public-private incubator
2.	Social Incubator B	Lombardia	2008	Public-private incubator
3	Social Incubator C	Lombardia	2009	Private incubator
4	Social Incubator D	Emilia-Romagna	2012	Private incubator
5	Social Incubator E	Piemonte	2013	Private incubator
6	Social Incubator F	Lombardia	2013	Private incubator
7	Social Incubator G	Puglia	2013	Private incubator
8	Social Incubator H	Puglia	2013	Private incubator
9	Social Incubator I	Campania	2014	Private incubator
10	Social Incubator L	Trentino-Alto Adige	2014	Private incubator
11	Social Incubator M	Sardegna	2014	Public incubator
12	Social Incubator N	Liguria	2015	Private incubator
13	Social Incubator O	Puglia	2016	Private incubator

Table 2 shows that about 60% of analyzed Italian Social Incubators are in the north of the Country. Moreover, Table 2 shows that 79,9% of the sample is constituted by private incubators (15,4% is constituted by public-private incubators and 7,7% is constituted by public incubators). This is in accordance with abovementioned literature (Dangelico and Pujari, 2010), which showed that there is growing attention to social problems from private institutions. Further confirmation of this growing attention can be found in the fact that, as shown in Table 2, there is a growing trend in the number of Italian Social Incubators in recent years. Indeed, the 13 Social Incubators were recently founded. In more detail, the “2013” was the year with the highest number of Social Incubators established. These results may be an effect of the “Decreto crescita 2.0” of 2012 (Italian Government, 2012), through which the Italian Government has encouraged the creation of startups and related services such as incubation support. Our analyses, furthermore, show that most of the Italian Social Incubators are small organizations. Indeed, the mean of Italian Social Incubators’ employees in 2017 was 4,2 and the median was 2. In addition, the mean of incubation requests received on our sample in 2017 was 66,1, while the median is 12. This considerable difference between mean and median is due to the fact that 8 Social Incubators received less than 25 requests, while only 1 Social Incubators received more than 250 requests. It is also interesting to observe that the mean of tenants supported in 2017 for our sample was 14,4 and the median was 7.

In more details, 10 Social Incubators of our sample supported less than 15 startups in 2017, while only 1 Social Incubator supported more than 50 startups. All these results confirm abovementioned consideration about the small size of Italian Social Incubators. Looking at the services offered by these incubators, we can observe that 94,8% of our sample considers networking fundamental. Other proof of the relevance of this service and of the important role of relationships for Italian Social Incubators is the fact that 84,6% of these have made specific efforts to create a strong community. In addition to networking, the results show that management support is another important service for this type of incubators. Indeed, 76,8% of our sample pays much attention to this. Moreover, it is interesting to evidence that 69% of Italian Social incubators consider that access to finance is an important tool for their tenants. In addition to these services, most of these incubators offer services on CSR and impact investing. However, we found that, surprisingly, not all the Social Incubators analysed use metrics for social impact assessment of their tenants. Moreover, we discovered that the majority of tenants incubated in 2017 by our sample of incubators belonged to the manufacturing sector. This result indicates that there is growing attention to social impact from

<sup>4</sup> For reasons of privacy, the names of the incubators are not shown.

the startups operating in this sector and from incubators specialized in this sector. Finally, we found that the mean incubation time of our sample is 15,5 months and then or during this time part of the social startups can receive financing from Social Incubators. Indeed, 30,8% of these incubators invest in their tenants.

#### 4.2. Italian Corporate Social Incubators (CSIs)

Analysing the Corporate Incubators in Italy in 2018, we discovered that out of 15 Italian Corporate Incubators 3 (20%) were CSIs<sup>5</sup>.

[Table 3] Italian CSIs

N.	CORPORATE	YEAR OF CREATION	SECTOR	LEGAL FORM
1	Corporate Social Incubator A	2016	Energy, cleantech	Private incubator
2.	Corporate Social Incubator B	2018	Food, Agri-tech	Private incubator
3	Corporate Social Incubator C	2018	ICT	Private incubator

Table 3 shows the year of creation, the sector of specialization, and the legal form of the three Italian CSIs. On the base of Table 3, we can state that CSIs are a very recent phenomenon in Italy. In addition, considering turnovers of the corporation which have developed these CSIs, we found that this type of Corporate Incubator involves only large corporates. This result is in accordance with the existent literature about Corporate Incubators (Bollingtoft and Ulhoi, 2005). Moreover, we found that there is not a specific sector in which CSIs are more diffuse. Indeed, we can suggest that Corporate Social Incubation is a transversal phenomenon, which can involve corporate operating in every type of business sector. In addition to this and based on our analysis, this study suggests that CSIs can integrate strategies of Open Innovation and CSR. Indeed, analysing Italian CSIs, we found that this type of Corporate Incubators enables corporates to use external knowledge deriving from supported startup to accelerate their internal innovation, also reducing time and costs of R&D. According to abovementioned literature (Chesbrough et al., 2006), these benefits can be qualified as results of an Open Innovation strategy. In addition, the CSIs allow corporates to carry out CSR activities. In fact, thanks to CSIs, corporates support social startups, having an indirect positive impact on Society themselves. Moreover, through social startups supported by CSIs, corporates can easily develop new products and services with a social impact. For instance, the owner corporate of CSI A uses this

incubator to support social startups or business ideas, including from employees, which develop new solutions to produce clean energy efficiently. In this way, this corporate has through a single management strategy both a positive impact on the Society and a significant contribution to innovate its business. Finally, we found that 2 of the analysed CSIs were developed with a partnership. In more details, the CSI B was developed with the partnership of corporates operating in the food business, and the CSI C was developed with the partnership of a community which creates and sustains projects for social innovation and supports social entrepreneurs.

## 5. CONCLUSION

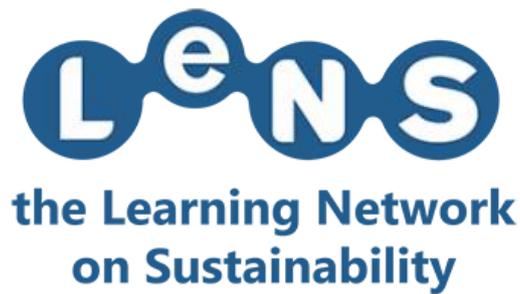
Social Incubators and CSIs are incubators which are specialized in startups which aim to introduce a positive impact on Society. This study analyses these recent types of incubators in the Italian ecosystem. Thanks to this research, we found that most of Italian Social Incubators are private small organizations, while CSIs involve only large corporates. Moreover, we found that Italian Social Incubators offer services on CSR and impact investing, but not all of them use metrics for social impact assessment. In addition to these, this study discovered that CSIs can be an important instrument of strategic management. Indeed, thanks to CSIs, corporates can integrate strategies of CSR and Open Innovation. Finally, we show also that is possible to develop a CSI with a strategic partner. However, our research is not exempt from limitations. One of the limits of this work is represented by the focus on Italian incubators ecosystem. Indeed, it would be interesting to analyse the differences between the Italian Social Incubators and CSIs and Social Incubators and CSIs of other Countries.

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<sup>5</sup> For reasons of privacy, the names of the incubators are not shown

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## **UN-NUANCES OF CO-DESIGNING AND CO-CREATING: A DESIGN THINKING APPROACH WITHIN A ‘ZONGO’ COMMUNITY IN GHANA**

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### **ABSTRACT**

The paper reports on a study exploring co-designing and co-creation (collaboratively) with the main stakeholders – residents, landlords and designers– in prototyping a design system for tackling sanitation and environmental issues within a section of a deprived community in Kumasi, Ghana. The aim was to explore the benefits of including stakeholder voices in decision-making in sanitation planning; as well as analysing the contributions of stakeholders (landlords, tenants, and residents) in improving their environment through sanitation and sustainable environmental practices. Interviews, focus group discussions and ethnographic activities were employed in collecting data for the study. Even though the results indicated stakeholders (co-designers) in such collaborative (design intervention) approach will want their voices be heard in decision-making in sanitation planning and environment that will boost the self-efficacy of their sanitation. But more importantly, the study unpredictably tended to restore peace and befitting relationships, as unhealthy factions and differences between two ruling classes in the community created un-savoury attitude to insanitary conditions.

Key Words: Co-creation, participatory design, ethnography, design intervention.

## 1. INTRODUCTION

That the world is filled with countless social difficulties that cry out for solution, including improvement in sanitation (Cipolla & Moura, 2012) is no exception in Ghana. Efforts by governments, local Government, non-governmental organizations and others to implement interventions to persuade and engage citizens to adapt to environmental cleanliness, have not yielded desired results (Crook & Ayee, 2006). The task, however, seems to be confronted with reoccurring difficulties and hence, appear to be ineffective especially in some underserved areas and communities in Ghana.

These campaigns mostly resort to the print and electronic media for public sensitization, knowing that these are unconcealed means of effective communication which have the capacity to influence how people think, act and also evaluate their responsibility to promote sustainable development (United Nations 2014) Assumption by planners that when people are well informed, they avoid unsanitary practices and embrace hygienic living is not always true (Van Wijk, Murre, and Esrey 1995). Studies reveal that in Ghana, the media have all it takes to help change attitudes to the environment but they often focus on issues of little value to national development (Asante 2012).

Other interventions employed by the government of Ghana to correct the unhealthy sanitation practices over the years include programmes such as: Ecological Sanitation (ECOSAN): an approach, which promotes a practicable, closed-loop system, where human excreta are treated as a resource, rather than waste (Musa, 2015); Water, Sanitation and Hygiene Project (WASH): designed for change of conduct and maintenance (Dreibelbis et al. 2013), and Community-led Total Sanitation (CLTS). These are also participatory in nature and facilitates communities to take a decisive role in safeguarding that each and every member internalises the implication of poor sanitation, such as open excretion (Sah, 2008). Such efforts have achieved some level of success in some communities in the country but not to the level of satisfaction.

Attitudes and behaviour of people in these unsanitary areas validate finding from a study that states that “poor sanitation is significantly noticed in poor neighbourhoods” (Owusu 2010). One of the main reasons for this seemingly challenging situation stems from the attitude of the citizens, whose behaviour and tendencies seem to be difficult to change. This study sought to test a social innovation intervention with the inhabitants of Moshie Zongo, a less deprived community in Kumasi - the second largest city in Ghana - through a design approach, which in turn could be replicated in other deprived communities in Ghana. The overall aim was to explore how a design approach can stimulate and support sustainable environmental sanitation by changing the attitude of inhabitants—through the ambit of design thinking. This paper reports on one of the nuances that characterized the design approach of co-creation and co-design, and how its solution helped to impart positively on a social innovation intervention for sustainable environmental sanitation programme.

The research however focused on the following questions as a guide for investigation:

- How do stakeholders perceive the conditions of their environment using participatory design-thinking approach?
- What are the benefits and contributions of including stakeholder voices in decision-making to enhance the environment as far as sanitation and environmental sustainability is concerned?

## 2. LITERATURE FOCUS

The plan for the study was hinged on the following cardinal factors:

- Scheduling a series of participatory events involving residents, experts, cooperation partners, networks, employees of related agencies relating to waste management, and other interested parties. These events resulted in the articulation of seven core values to be explored as part of the development process and ultimately to be incorporated into the project. These were:

- The residents as Key Factor;
- Lifelong Learning and Community;
- Diversity, Cooperation, and Network;
- Culture and Experiences;
- Bridging Citizens, Technology, and Knowledge;
- Flexible and Community but Professional Organization; and
- Sustainable Icon for the community (Dalsgaard, 2012).

Identification and exploration of the factors influencing residents in understanding the sanitation challenges, and the problems concerning providing adequate and appropriate tools for the maintenance of sustainable environmental sanitation. Design for social innovation is really interaction design in the broadest sense; it is interaction between people that take responsibility for positive, systemic impact” (Unreasonable Group, 2015). For instance, the approach in Design for Social Innovation which basically deals with collaborating with the stakeholders to plan, develop and execute a protocol that seeks to be human-centered, technologically feasible, and economically viable (Sain, 2014).

### 2.1. Co-design

Co-design is a creative system that supports and facilitates the democratic involvement of people in addressing social challenges (Szebeko & Tan, 2010). It can be a powerful change management tool, encouraging the collaboration of people within organisations and among local communities. The key principle in its approach is to view all stakeholders of an issue as valued partners in the development and decision-making process, rather than being passive recipients of products or services. "When working with individuals and families, it is important first to establish a positive, proactive, and personalized relationship: with communities, it is important to promote community empowerment, which is achieved through participatory decision-making and planning from the bottom up and is culturally sensitive" (Keller & Lehmann, 2008).

### 2.2. Design push for behaviour change

Behavioural change is central to attaining sustainable growth as far as environmental sanitation is concerned (NESS-AP, 2010). A school of thought is also of the view that people mostly have subjective stand on situations; they have predictable mental biases that affect how they perceive situations and make decisions (Weinreich, 2011). Smith-Asante (2011) in agreement with other researchers, is certain that attitudinal change towards the environment is one of the main solutions to sanitation problems in the country.

Colfelt (2010) believes that designers are in a position to firmly nurture behaviour in the direction of sustainable practices. "They are in a position to purposefully shape behaviour towards more sustainable practices" (Colfelt, 2010). It is therefore understood that notional design has been tested to be relatively more appropriate for solving issues on environmental cleanliness and therefore conceptual design solutions to a given problem is suitable for addressing complications that pertain to environmental sanitation (Blessing & Chakrabarti, 2009)..

### 2.3. Theoretical model Fonts

Using the framework by Lee (2014), designers and co-designers (communication, architectural, urban and stakeholders) shared expertise and experiences in their related fields during the pre-design phase. They will then construct and justify initial concepts and ideas during the schematic design phase, as prescribed in the theory. Next, they then developed a concrete proposal for a particular site or street during the design development phase; and finally, they would disseminate the new knowledge during the documentation and presentation phase. According to Nonaka and Toyama (2003), such new knowledge will then have to be internalised in the practice and will then become new routines for achieving a sustainable sanitary environment.

Another instrumental subject with regard to the study worth a review is design for social innovation. This is significant to the study in a sense that it fosters the ability to create what this new study is revolved around, based on a shared responsibility among all stakeholders (including end users). Co-design seeks to involve and integrate diverse expertise and is a keen requirement for this study. This is because Participatory Design is a guiding, principled approach for development aimed at achieving implementable recommendations within a schedule articulated by human need.

### 2.4. Design intervention

Activities were formulated for the implementation of the objectives to attain possible maintainable solutions to the sanitary issue. At the design-thinking stage, the main objective was to create the appropriate collaborative environment for establishing a framework for cleaning and maintaining a sustainable clean environment through the integrated process of a repeated pattern of research or analysis and team workshops in each phase of the project (Lee, 2014). Using Lee's (2014) framework, designers shared expertise from various individuals in the related fields during the pre-design phase; constructed and justified initial concepts and ideas during the design development phase; and disseminated the new knowledge during the documentation and presentation phase. Such new knowledge was adopted for future practice, and became new custom for achieving a sustainable clean environment.

The intervention code-named "5-Star Street Project" drew on the motivation of awarding each street with a "Star", which would be tagged to the Street's name after street residents fulfilled basic sanitation and environmental instructions. This is in line with United Nations Development Programme (UNDP) belief that such targets can only be attained through equipping individuals, households, and communities to take charge of their own development (Conant, 2005). A 3-Star Street would imply such a street where residents and all users on that street – were more environmental and sanitation conscious than a 1-Star Street. It also meant a 3-Star Street is much superior in terms of all that would happen on the street to 1-Star or no-star street. A 5-Star Street would seem to be above all standards, and hence, possess the ultimate superiority tag. Residents in this case would therefore have to consistently make conscious effort to maintain the status of their streets since there is a probability of a 5-Star Street being downgraded or elevated. A sustainable design required environmental solutions with a sustainable future, environmental solutions sought within a complete and profound perspective on the relationship between dwellers and the environment beyond mere technical solutions (Lee, 2014).

## 3. MATERIALS AND METHODS

The study employed an ethnographic approach to the study on the field; a qualitative research orientation used to study other cultures (Hunn, Fox, and Hunn 1998). Brewer (2000) describes ethnography as "the study of people in

naturally occurring settings or fields by means of methods which capture their social meanings and ordinary happenings, involving the researcher partaking directly in the setting, if not also the activities, in order to collect data in a systematic manner but without meaning being imposed on them externally". By this method, we were able to deeply understand the residents who happened to be the end-users of the design solution. It also helped us to remain committed to getting connected to residents consistently, thanks to their receptive nature; contrary to a misconception in the public domain. This healthy relationship inspired the researchers throughout the study.

### 3.1. Focus group discussions

Through Focus Group, the participants had significant impact on each other through their answers to the ideas and contributions for the duration of the dialogue (Jenkins, 1998). The Focus Group Discussion (FGD) sessions conducted for the respondents as part of the study was allied with its objectives. Meetings were held on two occasions for the residents who made time to be part of the programme from both streets. The first author, who doubled as the moderator, created a warm and friendly environment for participants before hand. The introductory stage of the discussion was treated cautiously because it is believed that, "the first few minutes in focus group discussion is always critical" (Krueger, 2002). "In a brief time the moderator must create a thoughtful, accommodating atmosphere, provide ground rules, and set the tone of the discussion; since much of the success of group interviewing can be attributed to the development of this open environment" (Krueger 2002).

## 4. DISCOVERIES AND DISCUSSIONS

### 4.1 Sensitization programme

Attaining maintainable behavioural change towards environmental sanitation among residents of the two streets remained the ultimate goal throughout this study. The need for creating awareness was therefore deemed an integral step in this study. Researchers are of the view that people mostly adopt a subjective stand in situations they have predictable mental biases that affect how they perceive situations and make decisions (Weinreich 2011). It was hence necessary to correct a few misconceptions about sanitation that were the obstacle to improved sanitation among residents. The sensitisation programme was the initial cooperative dialogue for the study. It involved residents of the target community, resource persons and technocrats. This dialogue was conducted for clearer and profound understanding of the study to foster involvement among the stakeholders. The goal for the meeting was attained in that, residents demonstrated the willingness to cooperate with other researchers and thus became "co-researchers". Such meetings also afforded the opportunity for residents, as stakeholders, to ask questions that baffled their minds about the study in particular, and about sustainable environmental sanitation in general.

### 4.2. Ethnographic activities

As part of the ethnographic approach to the study, the researcher took a couple of days off to observe the community in question. This necessitated a deeper understanding of the cultural and social settings among the residents. This period was not without in-depth study to ascertain from existing literatures, pertaining to the generic issues on environmental sanitation at the Zongo societies.

In his work; "Sanitation: A human rights imperative" Alexander, (2008) asserts that, environmental sanitation is not only about hygiene and disease; but also about dignity; and everyone in the world has the right to have it (Alexander, 2008). Arguably, one does not take long to notice the extreme deprivation of the right to clean environment after touring the length and breadth of the community. The situation of most part of the community was noticed to be a true reflection of the finding of a research by Williamson (2014) which reveals that 'severe cases to that effect are noted among underprivileged nations in the world such as Ghana, where reckless disposal of solid waste into gutters and water bodies by some citizens consequently impede drainage system and trigger flood cases which destroy human life in diverse ways'.

Engagement with the inhabitants over a year moreover, deepened the belief of the researcher to remain circumspect with people who appear to be deviant in a society and that rather than delighting in ruthless criticism, getting to the root of issue tends to render full and clearer picture for their related corrective line of attack. This is because; the residents had genuine issues that cry out for immediate attention. This notwithstanding, it was evidently clear that, almost all respondents were generally noted to be fully aware of the indiscriminate attitudes to certain daily activities that mostly give birth to insanitary condition within their neighbourhood in general and on their streets in particular. They hence acknowledged the need to team up for improving the existent condition.

Residents demonstrated high level of commitment to what they deem to be a worthy course by opening up to the researchers; suggesting pre-emptive measures to curtail insanitary practice; sharing insightful opinions for improving sanitation in the neighbourhood; buying into the concept behind the design intervention; giving the researcher the best of reception on cell phone or in person; and attending meetings in line with the study for discussions.

The study that is geared towards testing a social innovation phenomenon through a design thinking approach at the research area is in turn envisioned to be repeated in other deprived communities in Ghana for a sustainable environmental sanitation. Per the long-term visit to the community as an ethnographer, it was observed that the purpose has already started paying dividends; in that, the study has stimulated an atmosphere of team building for attaining worthy course.

## 5. CONCLUSION

It is established that, issues on energy, sanitation and transportation are the three foremost and noticeably global challenges that cry for immediate paradigm shift. Engaging in peculiar substandard activities recurrently however, can hardly result in an improved condition. The starting point of the way forward was therefore to pull resources together by way of sharing ideas in line with design-thinking or human-centred approach; this would help to attain innovative solutions bearing in mind that, the use of technology is essential, yet must be understandable and useful to the end-user. Hence, there was the motivation to involve residents on the streets vis-à-vis selected judges from the community in the context of this study, for intervention that improved sanitation.

Though the study is yet to attain its conclusive section, it has very nearly all the answers to the research questions.

### 1. Hopeful design intervention

The stakeholders or co-designers have firmly embraced the "5-star street" concept (design-thinking approach) with zeal to get entirely involved in execution of such a design intervention to address the environmental sanitation in the community, regardless of the fact that the design intervention is yet to be tested on the two selected streets with the stakeholders.

### 2. Voice of end-users

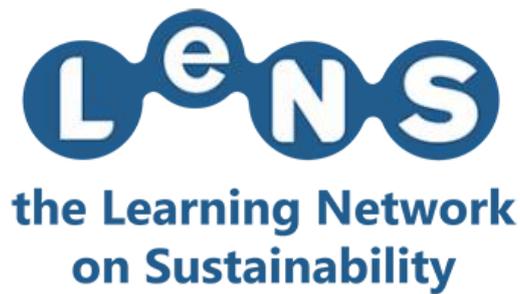
The inclusion of the stakeholders' voices in decision-making as far as sanitation planning on the streets is concerned has practically boosted the self-efficacy of the residents; in the identify themselves as keen figures to ensure the furtherance of proper sanitary conditions on the streets and beyond. Besides, in both the focus group discussions and interviews, residents pinpoint certain insanitary practices as they acknowledge the need to improve their attitude to environmental sanitation.

### 3. Intrinsic motivation by residents to cooperate

There have been encouraging contributions by the stakeholders – landlords, tenants, and residents to enhance the environment as far as the issue of sanitation and environmental sustainability are concerned. The residents have wilfully demonstrated plans to team up in other to have practical impact on collective effort to address the insanitary practice.

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## **THE DESIGN OF BANYANKOLE TRADITIONAL HOUSE: POWER DIMENSIONS, HOSPITALITY AND BEDROOM DYNAMICS**

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### **ABSTRACT**

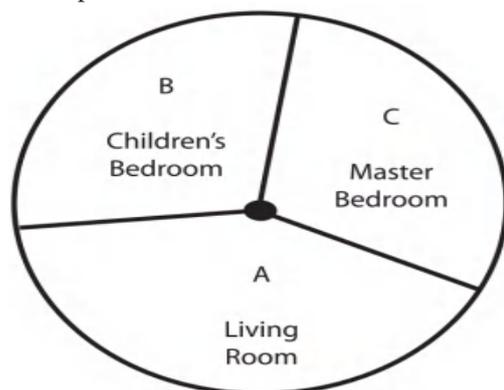
This paper analyses the design layout of a traditional Kinyankole house in which the design was meant to promote and strengthen family power dimensions, bedroom dynamics and hospitality. In many societies, culture is a social function embodies values, beliefs and customs that bring out the society's identity, solidarity and how traditions and shared values are communicated among members and also preserved. Basing on tacit knowledge, I interviewed five elders about the social connotation and meaning of the Banyankole house design using in-depth informal interviews. First, I argue that the house design epitomized the power structure in which families and the entire community were governed. Second, the design showed how welcoming and organized the families were. Third, the layout of the bedrooms represented respect and strategy of the bedroom dynamics. I conclude by observing that some aspects of indigenous designs need to be adopted into contemporary designs because of their design values.

Keywords; bedroom dynamics, family hospitality, family power dimensions, Kinyankole house

## 1. INTRODUCTION

Culture plays an important role in achieving originality and aesthetic value considerations in the design and creativity field (Weggeman, Lammers, & Akkermans, 2007; European Commission, 2009). In fact, the European Commission (2009) argues that culture is the expression of humanity's creativity that brings out meaning, knowledge, talents, civilization and values of individual groups. As the world becomes one block under globalization, I argue that cross cultural designs will be a required design characteristic before any product penetrates the global market and sustain its visibility there. The fact that production machinery and technology has globally been standardized, cultural uniqueness will be the most identifying character for any successful product. In addition, the emergence of several design approaches that have been recently developed to manipulate various design challenges, continue to narrow down the variety of design concepts on the market. Although contemporary designs are appealing to the user, users do not have any embedded attachment to the designs. Unlike the traditional designs which were based on well-studied frameworks and were part of the community values, contemporary designs are simply accepted on their face value. The case of Banyankole house design is one of such designs that were embedded with a lot of well-studied frameworks that highlighted community values and demonstrated a well-organized society. The Banyankole are a Bantu speaking group of people living in Western Uganda. They have two main social sub-groups of Bairu (crop growers) and Bahima (cattle keepers). Apart from being referred to as occupants of the Ankole Kingdom in Western Uganda which was a creation of British rule at the beginning of the 20<sup>th</sup> Century, the Banyankole are believed to have lived in the areas which were favorable for their occupations for example Rwanda, Tanzania, Democratic Republic of Congo and other districts of Uganda (See Karugire 1971; Morris, 1962; Kirindi 2008 & Kamuhangire 1992)

The Banyankole house design represented the power dimensions, hospitality in the family set up and bedroom dynamics. The Banyankole material culture items clearly spelt out each member's responsibility and roles. The houses were temporary built with organic materials, especially flexible trees and thatched with grass. The house designs were round and were divided into three main spaces (Figure 1). The spaces included the living room, the sleeping room for the head of the family and his wife and the sleeping room for the children and some times where visitors would sleep.



[Figure 1] Kinyankole house exterior (courtesy of Uganda Museum) and layout

The first space "A" served as the living room. It was a sitting room, dining and kitchen and sometimes as a pen for newly born calves. Space "B" served as Children's room and sometimes for visitors. Space "C" served as a Master bedroom only used for the husband and wife. Each space was carefully designed to serve its purpose.

## 2. METHOD

Principally, the study followed a deductive approach, where narratives of five elders in Kanoni and Engari-sya sub-counties in Kazo county Kiruhura district were used to share their tacit knowledge about traditional house design.

Young people were not included in the study because the youth have been influenced by modern living styles, religious influence and educational systems which could generate biased data. I allowed free expression because according to Alvesson (2002) cited in Canale (2011) knowledge is becoming an asset and as such it has to be protected and treated carefully because tacit knowledge has an important perspective of development. The data was collected through in-depth interviews and phone calls to five elderly senior members of the community who were purposefully selected. As Saunders et al. (2007) observe that the tools for semi-structured interviews do not necessarily have to follow a particular order, Respondents were allowed to freely narrate their stories with minimum interruptions (Saunders et al., 2007; Zaltman & Moorman, 1988).

## 3. RESULTS

The tacit knowledge collected from the five respondents illuminated several considerations that informed Banyankole house designs. Data from respondents revealed that Kinyankole house designs were based on a framework

derived from the activities and roles of each member of the family as well as the entire community. Respondents further revealed that whenever one was constructing a house, several members of the community would participate.

### **Space A: Living Room**

The living room was designed in such a way to allow different activities to take place in a home. Traditionally, a house did not have fixed doors because the house was considered as part of the kraal. The main gates of the houses were secured with a mihiigo (assorted dry tree branches that were used to close the main entrance of the kraal). The cattle stayed near the house, especially cows that had calves. It was also believed that as cattle rested, their breath was a pre-cursor for sound sleep for their owners. To avoid the cattle from damaging the grass thatched houses, a wooden retainer was usually erected in front of the house. The living room space was divided into the following work stations; Orugyeegye (Milk pot platform), Akarugu (one side of the entrance), and Amahega (the other side of the entrance).

#### **Orugyeegye (Milk pot platform)**

The spacious design and material culture used in Banyankole houses were not meant to only serve the day-to-day activities in a home, but also helped in identifying distinct characteristics of various community members and to segregate roles in homes. Families perceived indigenous house designs and materials as a means to assign responsibilities, determine maturity, and instill respect in a way a household or community was run. The study respondents informed the researcher that some areas in a house such as orugyeegye (milk pot stand) were significantly important in managing the affairs of the family. This was observed from the position of the orugyeegye and in the manner in which milk pots were exhibited on it. Orugyeegye was located in a central position in a house. The milkpots were also arranged according to their sizes and who used them. The entire arrangement showed the pride of the community, the power dimensions and hospitality of households.

Orugyeegye is traditionally located astride the emwomyoyakanono (centre pole of the house). One of the respondents who was found seated next to orugyeegye attending to her milk pots explained that orugyeegye is a center of power and a reflection of roles and obligations of each homestead member in traditional Banyankole culture. She recounted that the orugyeegye was located in the middle of a house astride the enyomoyakanono because it was the main food store where everybody had to be served. Ekyanzikya'nyineeka (the milk pot in which the head of the family was served) was placed next to enyomoyakanono because nyineeka was a central figure and the head of the family. The other milk pots were then arranged on either side of ekyanzikya'nyineeka following their importance. The milk pot such as one for the wife, children, visitors, and for making ghee and those milk pots without a specific user were displayed on either side the milk pot for the head of the family. The aim was to show the hierarchy of power at home. Respondents observed that the woman's special place in the home was next to the orugyeegye because that is where she could serve the milk to her family. This was very important because through it, women were able to participate in family matters. On the other hand, orugyeegye was also a place from which women traditionally drew their respect and contributed to the affairs of their family. In the first place, women were able to know how much milk was collected each day, which cow had more milk and which cow had the best milk for making ghee or serving to visitors. It was next to orugyeegye where women spent most of their time and effectively administer to their families. If one was not appreciated by the woman in the home, one would fail to get milk to drink because only women were allowed to handle all activities surrounding the orugyeegye.

#### **Amahega (Fire place)**

On one side of the entrance, there was amahega (the cooking place). This is the place where food was prepared or roasted and where water for washing hands was boiled. The fire place was installed with traditional adjustable cooking stones which were adjustable so as to accommodate different sizes of cooking pots unlike the modern cooking stoves that instead have different sizes of plates or burners. Above the fireplace there was orutara or obugamba (a drying rack) which was designed for preservation and preparation of food items. Orutara was made out of pieces of wood which were joined using fibres from tree barks. Several items such as millet, cassava, meat, grasshoppers were dried on the orutara. More so, bananas were put on orutara to ripen. The space that remained between the fireplace and the house wall was used for keeping the pots especially for mingling millet meal and boiling meat.

#### **Akarugu (one side of the entrance)**

This was one side of the entrance of the house which was reserved for newly born calves. Whenever the cows produced, the calf was kept inside the house opposite the fireplace. It was done so to avoid the calves from being eaten by wild animals, but also to provide warmth for them. The calf would later be transferred to the calf-pen after two or three days. In families of crop cultivators, akarugu was a place where goats and hens used to stay at night. Although this practice was later discouraged as unhealthy, the initial design for keeping animals safe from wild animals cannot be underestimated. In homes where the goats were kept in akarugu, several poles were erected and each goat had its pole. The rest of the space was a living room for the family members. The design did not encourage the use of chairs. Actually traditionally, the house had two wooden stools. One of the stools was for the head of the family (ekitebekyanyineka) and the other for special visitors. However, the living room was neatly covered with grass (eyojwa) which was collected by women and young girls from the hills. Various skins would then be placed on top of the grass. It is on this neatly done and colorful arrangement (remember the skins had different spots of color) that formed the general design of a Banyankole front space of the house.

**Space B: Ekitabokyanyineka(The Master Bedroom)**

Unlike the modern bedrooms where there is a closet for clothes, the traditional bedroom was almost all occupied by the bed. The difference between the children's room and the master bedroom was the position of the entrance. While the children's room entrance was in the middle, the entrance to the master bedroom was at the side, leaving a small free space. The beds were made of sticks woven together and placed on erected poles. In some cases, the woven sticks were placed on empikye (black soil ant hills). The beds were then covered with a pile of grass well cleaned and sorted. This grass was collected by women, sorted and creatively arranged to create a comfortable bed. Unlike today where men boast of having purchased a good bed or mattress, in the old days, this was a woman's duty and hence, some level of control. On top of the grass, very soft well treated skins were laid and served as bed sheets.

**Space C: Ekitabokyaabaana (Children's Bedroom)**

The children's bed covered up the entire room, leaving out any free space. From the living room, children would directly step on their bed. It was also made out of woven sticks erected on poles or empikye, piled grass and several skins placed on top. The room was shared by all children up to the age of fifteen or sixteen. In situations when a family received visitors, the children shifted to living room while the visitors occupied their room. When children reached the age of 12-13, girls would get married and boys at the age of 16-17 years would build their houses and also get married.

**4. DISCUSSION****On promotion of family power dimensions**

The Banyankole house was designed with specific spaces and material culture items that demonstrated roles and responsibilities of every member such as the father's stool, the milk pot platform - Orugyeegye, and position of the spears.

All milk pots were arranged on the Orugyeegye designed at the center of the house. The milk pot for the head of the family ekyanzi kyanyineka was placed against the center pole which supported the house like the father did. The house was made of several ridges – embazi and each ridge was important in achieving the dome shape of the house. In a similar way, the milk pot of the father was placed centrally on the Orugyeegye and other milk pots were placed either side of it because the father was the head of the family and was supposed to give the strategic leadership, defend the family members and make decisions that would make his family prosper. On the other hand, the position of the milk pot for the head of the family was as inspiration to young men as they themselves prepare to be heads of their own families.

The traditional house design promoted the role of a mother in a home. The mother's position in the house was an administrative and its position at orugyeegye demonstrated this. Women exercised their authority because each member of the family knew that women (mothers) were the custodian of the family welfare. Whenever milk was brought into the house from ishaazi (milking space) the woman would inquire; as follows; Nageeha? The one bringing it would reply as follows nagagaajuya Mugendi, meaning, whose milk is this? it is for gaaju (that was given to the family by Mugendi). This practice enabled women to take stock of the family herd and especially the production capacity. Having received all the milk and kept it in various milk pots, women were responsible for serving it because no one in the family could, because no one knew which milk was kept for which use. This gave women authority in a home unlike the current practice of selling milk that has denied women to take part in the family socio-economic roles. In addition, the stool of the father was an important item in a home. It was so sacred because other than sitting on it, the stool was used to bless or curse. Whenever a daughter or son was getting married, the father would sit on the stool to give blessings to his children as they start a new family or he would sit on the stool to receive a daughter-in-law and give her blessings. At the same time if the father was annoyed, he would use the same stool to curse whoever annoyed him. This made the stool a significant material culture item in the Banyankole house design. The design of the house provided a space in the master bedroom for keeping important items such as spears, sticks and other sacred items. This can be compared with the bedside drawers of the contemporary bed where in some cases people keep their security equipment.

**On the hospitality**

The Banyankole home design was a hospitality venue where families entertained visitors. Male visitors especially the elderly had a special stool and the rest of the house was covered with eyojwa (soft grass) with well-trimmed animal skins laid on top on which young people and women would sit. The common practice among Banyankole homes was okuterama (vigil) where young men and women would gather at the home of one of the families, tell stories and share happy moments and this activity compelled families to construct large houses. In some situations, some families would allow their cows to deliver from the house. This meant that houses had to be well designed to allow such an activity to take place. It also showed how much a Banyankole treasured his cattle. In the Kinyankole tradition, cows are exchanged as gifts between two friends. Many times, friends would mention their intentions to exchange cows during a drinking party at the neighbor's home - entereko, the recipient would officially visit the home of the one giving a cow to be introduced to the family members. This practice of family visiting each other to exchange

gifts promoted house designs and increased hospitality in a home.

### On Bedroom Dynamics

The Banyankole house design was generally simple, had no ceiling yet well designed to take care of bedroom dynamics. The arrangement of the bedroom was determined by the entrance. The children's bedroom was designed in such a way that it had no privacy as its door was in the middle while the one for the parents the door was towards the outer wall. The occupants of the beds put their legs towards the centre pole. This was intentional because the children's head was towards the outer wall of the house and away from the master bedroom. This was helpful because when the parents were making love during the night, it was believed that the children could not hear. Okuhindukaahakitabo (turning on the bed) is a term used when a man engages his wife in sex. The sleeping design in the children's room was therefore meant to reduce the possibility of the children hearing the parent's conversation during the night. It was believed that sex was good, satisfying, and enjoyable during the early hours of the day -omwitumbi and that such sex encounter would result into pregnancy. Omwitumbi is the time between 2:30 am and 4:30 am. This was the time recommended for the man to turn on the bed. I posit that this was advocated for because at such a time, children were fast asleep. Unfortunately, in the contemporary societies, men can turn on bed at any time, even during day time, which makes sex less sacred.



Figure 2 Kinyankole house lay out showing the bedrooms, platform for milk containers, fire place and place for newly born calves (illustration by Banga Simon)

This was not an accident because the children's head was towards the outer wall of the house and away from the master bedroom. This was helpful because when the parents were making love during the night, it was believed that the children could not hear. Okuhindukaahakitabo (turning on the bed) is a term used when a man engages his wife in sex. The sleeping design in the children's room was therefore meant to reduce the possibility of the children hearing the parent's conversation during the night. It was believed that sex was good, satisfying, and enjoyable during the early hours of the day -omwitumbi and that such sex encounter would result into pregnancy. Omwitumbi is the time between 2:30 am and 4:30 am. This was the time recommended for the man to turn on the bed. I posit that this was advocated for because at such a time, children were fast asleep. Unfortunately, in the contemporary societies, men can turn on bed at any time, even during day time, which makes sex less sacred.

The master bedroom was also designed in such a way that it allowed the man engage his wife in an uninterrupted manner. The entrance to the master bedroom was towards the outer wall of the house. Unlike the children's bed, which covered the entire space in the room, the master bedroom had a small space where a man kept his spears, sticks and other important artifacts in the home. The bed design extended to the center pole and it was actually the center pole that marked the man's position. The science in the design was that it facilitated effective love making because the man used the pole as a support. The Banyankole have a saying that omucugimubi atiekyahikyaterera (a man who is poor at making love complains that the bed is slippery). In fact, the dynamics of making love were that the man used the center pole for stability and maintaining the target (Figure 3). This was a secret for adults and young boys could not manage turning on the bed because the skins were indeed slippery and one needed to have mastered the science of making love to be able to maneuver without a center pole. Even when the couple changed the style of turning on the bed from what is now called the missionary style to the akacabari (western jazz), not the western world but probably western Uganda, the man used the center pole where he rested one leg to be able to apply the western jazz. All in all, the bedroom was well designed to facilitate bedroom dynamics and was a masterly design of the Banyankole house.

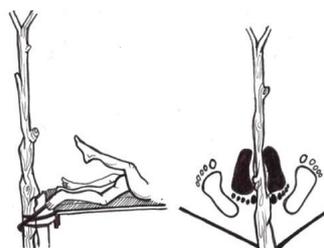


Figure. 3 Using the center pole for bedroom dynamics (illustration by Banga Simon)

## 5. CONCLUSION

The Banyankole home design was not only built for accommodation but also as an interaction space. The design promoted family values, respect among society members and a place for co-creation. The success of the family was gauged on the type of a home one had. The design actually did not stop on the house itself but the entire set up of homestead. The design encompassed the space for cows, the pen of calves, the house for the head of the family and other houses in case the family had grown up sons. The narrative of the Banyankole home design gives us a chance to understand the importance of adapting some aspects of indigenous designs into contemporary designs. This practice further, shows that the house design helped in creating a society with high values in terms of behavior respect, productivity and co-creation which should be a guide for contemporary design.

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## **CHALLENGE BASED INNOVATION FOR HUMANITARIAN PURPOSES: DESIGNING A WEB-APP TO FIGHT OBESITY. RESULTS OF THEPORT\_2018 PIER 32**

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### **ABSTRACT**

exploration space<sup>1</sup> @ ACDH-AAS against unite innovators, impact future, act today invited for the first time people with knowledge in the Humanities to join CERN THEPort-Humanitarian Hackathon.

It aimed at prototype a modular structure enhancing the analysis and understanding of knowledge systems, connecting food and its different cultures with the SDGs<sup>2</sup>.

During THEPort2018, an interdisciplinary team addressed the Humanitarian challenge of obesity to fill a knowledge gap. Better knowledge about eating behaviour is core to acting properly, supporting behavioural changes. In addition, cultural knowledge and experience may allow to support better decision making processes.

The paper showcases the hackathon result: a design study of the OrBEat application, aiming to increase the knowledge about individuals' eating behaviour and support behavioural change in a sustainable way, against the background of nutritionists' knowledge, facilitated by neuroscientific insights (EEG).

It demonstrated how fundamental science can provide tech-enabled responses to urging Humanitarian issues, simultaneously triggering innovation.

Key Words: Citizen Innovation, Sustainable Social Innovation, Process design, Humanity centred Innovation

<sup>1</sup> [Eveline Wandl-Vogt]: exploration space @ ACDH [accessed: 12.10.2018]

<sup>2</sup> <https://sustainabledevelopment.un.org/?menu=1300> [accessed 03.03.2019]

## 1. INTRODUCTION AND BACKGROUND

### 1.1 ThePort

A hackathon can be defined as “as a problem-focused computer programming event (Topi & Tucker, 2014), as well as a contest to pitch, program, and present instances of prototype digital innovation (e.g. a prototype mobile application) (Leckart, 2012)” (Brisco & Mulligan, 2014, p.1). In recent years, however, hackathons have more generally become popular events across different disciplines and areas as design and development events. On the one hand they have emerged as “effective approaches to encouraging innovation with digital technologies in a large number of different spaces (music, open data, fashion, academia and more)” (Brisco & Mulligan, 2014). On the other hand, hackathons have also served to bringing together ad hoc groups of people from various fields with the aim to prototype ideas addressing specific global and local issues. Thus, issue-oriented hackathons, for example, are one such sub-group which “bring together ad hoc groups under the auspices of conceiving and prototyping technologies to address social conditions and concerns.” (Lodato, & DiSalvo, 2016).

In the context of ThePort, a hackathon is more specifically described as “[...] problem-solving workshops started for intensive collaborative work between software developers – more general, as in our case, it is often seen as limited time innovation focused collaborative effort.”<sup>3</sup> ThePort as a special format of hackathon is thus based on the principles of unite innovators, impact future, act today. “Organised by ThePort Association, hosted by CERN IdeaSquare and with partners from other non-governmental organisations, a three-day problem solving workshop hackathon devoted to humanitarian, social and public interest challenges. Interdisciplinary teams of hand selected participants working together in the fields of: communication – transport – health – science – education – work – culture – data.”<sup>4</sup> Together with coaches and experts-on-call, teams work on a particular challenge for 6 weeks to prepare for the 60 hour final. At the final event taking place at CERN, teams present their prototypes to the broader public. The main aim of this initiative is to prepare conceptual innovative ideas, that can be driven forward and put into practice after the event.

### 1.2 The Challenge: Humanities and innovating for the Good

exploration space, a virtual and physical space for experimentation and innovation at the Austrian Academy of Sciences, Austrian Centre for Digital Humanities, was founded in 2017.<sup>11</sup> by Eveline Wandl-Vogt. Against a background of Humanities, the space aims to apply Open Innovation methods and practices in science to facilitate, design, develop and analyse knowledge partnerships and innovation networks for the purpose of the good. The research question for the described experiment was how Humanities and knowledge of Humanities could stimulate and contribute to a Humanitarian challenge.

Sustainable Development Goals (SDG) are a collection of 17 global goals set by the United Nations for addressing urgent issues like poverty, education, gender equality, energy, environment or social justice, among others (Griggs et al., 2013). Among them, one of the core goals (number 3) is to ensure healthy lives and promote well-being for all at all ages.

The Digital Humanities projects related to this challenge are exploreAT! 5 (exploring austria’s culture through the language glass) funded by the National Endowment via the Austrian Academy of Sciences under the funding scheme Digitales kulturelles Erbe No DH2014/22 and ProvideDH (progressive visual decision making in digital humanities) funded by the Austrian Science Fund (FWF).

The challenge submitted was framed as the following:

“Summary

Food, its cultivation, preparation and consumption as well as the connected service, products and emotions are a cultural heritage. A variety of databases capture the importance and the different “flavors” of food but do not map the associated emotions. We aim at bridging this gap using augmented reality, embedded technologies and other digital means.

Goals

Co-design and co-develop a participatory knowledge experience by offering creative opportunities of knowledge exchange throughout society and independent of organisational boundaries. Prototype a modular structure that enhances the analysis and understanding of knowledge systems, connecting food and its different cultures with experience that is accessible for the broader public and thus contributing to the SD Knowledge Platform and SDG17.

Resources

Access to certain data bases, Expertise of Mentors working in the field, Life cooking and dining experience”.

Based on this description, 12 people of 9 countries accepted the challenge, namely: Sophie Ashcroft, Pierre-Alexandre Fonta, Carmen Margiotta, Anna Matuszynska, Joseph-Paul Manda, Giuseppe Reale, Norwin Schnyder, Duygu Saykan. As mentor and contributor acted Amelie Dorn; as sponsor, mentor and contributor Eveline Wandl-Vogt; Josefina Espinosa and James Jennings served as Coaches.

The collaboration started during August 2018, 6 weeks before the face-to-face interaction in Geneva. The team met virtually, organised by the two coaches in weekly meetings and discussed how to address the challenge.

<sup>3</sup> <http://theport.ch/#about> (Frequently Asked Questions: Hackathon? Never heard) [accessed: 03.03.2019]

<sup>4</sup> <http://theport.ch/#about> (Hackathon Event) [accessed: 03.03.2019]

<sup>5</sup> exploreAT! [accessed: 01.03.2019]

In October 2018, 8-10th the team met face to face in CERN IdeaSquare.

### 1.3 Collaborative Knowledge Production and Citizen Innovation

exploration space aims to apply Open Innovation<sup>6</sup> (OI) methods and practices in Science. One of the reasons for applying OI in research methods and practices like the ones described here is based on the shared importance of both the fields of transdisciplinary collaboration and co-design for social innovation and the collaborative construction of knowledge (Yañez-Figueroa et al., 2016). This approach to research, where communities are involved as full partners in proposing and designing solutions along with researchers, represents a challenge in modalities of interaction and as a relationship-building process (Halseth et al., 2016). With its roots in the action-research tradition of social sciences (Brydon-Miller et al., 2003), OI has recently integrated design thinking, with co-design as its more collaborative dimension (Manzini, 2015). This way, collaborative creativity can combine visual and conversational modalities for the definition and solving of problems based on design (Cross, 2011), generating different types and forms of cross-organizational knowledge and of “design knowledge” (Thoring & Müller, 2011). Co-design offers a variety of materials, procedures and techniques for collaboratively define new projects and solutions, as well as the simultaneous exploration of possibilities and the integration of diverse points of view (Blizzard & Klotz, 2012). Authors like Manzini & Coad (2015), in this respect, consider co-design an open-ended culture with the main characteristic of involving all actors in a productive and reflexive context, which for other authors consists in a process of “constructivist enquiry” (Kimbell, 2011).

In this sense, relating OI and participatory observation, ThePort2018\_Pier32 was conducted as a co-design experiment.

### 1.4. Human centred and Humanity centred approach

From a systemic perspective, human-centred co-design can represent a variety of visual methods, procedures and techniques for collaboratively defining new projects in complex circumstances, as well as the simultaneous exploration of scenarios, user-centred and participatory approaches and the integration of many possible points of view and perspectives to a given situation (Blizzard & Klotz, 2012). This way, a discussable, transferrable, and accumulable knowledge was dynamically generated in the session around the concept of a web-app to fight obesity, taking into account the notions of human-centred co-design, in detailed stages and techniques like the described by Naranjo-Bock (2012):

- Self-reflection of research methods, focusing on research goals and questions, who the audience is and what tools they can use, and the stage of the project;
- Running co-design activities onsite, with techniques and “placements” like collages, context mapping, storyboards, inspiration cards, modelling, paper prototyping or games; and finally,
- Pilot testing and results, where the data obtained is generally visual and tangible, accompanied by the important debrief of the results of each co-design step or process.

In a wider context of knowledge management (KM), developing and strengthening knowledge ecosystems, and connecting to different knowledge communities is a major goal of global but also local societies. The acquisition, transmission and fostering of knowledge is at the heart of humans’ advancement and also directly connected to the UN’s Sustainable Development Goals (SDGs) and related Knowledge Development Goals (Brandner & Cummings, 2018). In this and our given context of the ThePort Humanitarian Hackathon, multidisciplinary and cross-organizational collaborations (SDG 17) are key in enabling persons across various actor groups to put their shared visions into practice and co-create together for a better society.

In relation to these goals and initiatives, exploration space seeks to draw on human centred approaches for the benefit of moving towards humanity centred approaches and design, focusing to further society via technology in order to enable a better life.

## 2. THE RESULT OF PIER<sub>32</sub>: ORBEAT

### 2.1. The Humanitarian Challenge: Obesity

Obesity is a humanitarian challenge and it has become a systemic problem for our society increasing by 600% over the past 40 years and reaching a total number of 650 million people. Key facts according to the WHO<sup>7</sup> are the following: (i) worldwide obesity has nearly tripled since 1975; (ii) in 2016, more than 1.9 billion adults, 18 years and older, were overweight; (iii) out of these, over 650 million were obese; (iv) 39% of adults aged 18 years and over were overweight in 2016, and 13% were obese; (v) most of the world’s population live in countries where overweight and obesity kills more people than underweight; (vi) 41 million children under the age of 5 were overweight or obese in 2016; (vii) over 340 million children and adolescents aged 5-19 were overweight or obese in 2016; (viii) obesity is preventable.

### 2.2 Humanities and the added value of Cultural knowledge to fight obesity

<sup>6</sup> [http://openinnovation.gv.at/wp-content/uploads/2015/08/OI\\_Barrierefrei\\_Englisch.pdf](http://openinnovation.gv.at/wp-content/uploads/2015/08/OI_Barrierefrei_Englisch.pdf) [accessed: 03.03.2019]

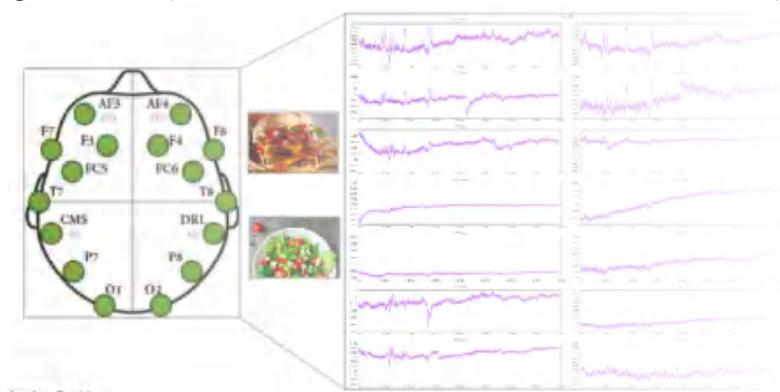
<sup>7</sup> <https://www.who.int/en/news-room/fact-sheets/detail/obesity-and-overweight> [accessed 03.03.2019]

Culture is a fundamental aspect of our lives that shapes and impacts on the way we live together. The word itself has a complex history and diverse range of meanings. In the literature of cultural studies, the culture as we understand it today can be understood as a way of life, arts and artistic activity or a process of development (cf. Longhurst et al., 2008). In the context of ThePort2018 Humanitarian Hackathon and the OrbEat app, we understand food as a tangible and intangible cultural heritage, as a framework of individual behaviour and societal norms. It is product, service and emotion. Food is thus different across various regions on earth and has a significant environmental impact. In this light cultural knowledge is key in tackling obesity, also to reconcile society with their cultural food heritage, return to local, seasonal foods and their consumption, and raise awareness about personal food behaviours.

### 2.3 The Human centred approach: A Web-App for Selen. Tools and results

The result<sup>8</sup> of our interaction as the Pier32 group at ThePort32 Humanitarian Hackathon was presented on Sunday 7 October 2018 at the Globe CERN, Geneva, Switzerland.

The concrete result and was a paper prototype for a web app (see Figure 1) developed following a human centred approach. The app prototype aimed to provide the following functions: working with the concept of personas. During the Hackathon the group chose the persona of Selen, a female adult, single, living in the UK with Turkish roots, who was actively looking to lose weight. Based on this profile a journey map through the app was developed. The OrbEat app starts with a short questionnaires, determining the user's personal eating habit. Based on the results, the app suggests recipes, lists ingredients of recipes and the option to buy them online at the nearest supermarkets. Users can then provide feedback on the recipes suggested. Finally, the user has the option to gain scientific insights on their individual eating behaviour by means of an OrbEat EEG scan at a local community group.



During the hackathon, the Pier32 group tested the use of EEG in relation to food responses and whether relevant results could be obtained. A total of 8 persons were tested using an Emotiv EPOC EEG headset<sup>9</sup>.

[Figure 1] EEG measurements of unhealthy vs healthy images CC-BY 4.0 Giuseppe Reale et al.

As a first step, the resting state of each individual person was captured. Then, subjects were exposed to pictures of unhealthy food, a neutral picture, and finally a picture of healthy food. Results showed differences in activities (power spectra), however, more data and further measurements are needed for reliable interpretation of results.

By integrating EEG measurements in the OrbEat app, a more personalised understanding of eating behaviours is to be obtained. Ultimately, OrbEat aims to be a platform that helps users build a better image of their behaviour with food by raising awareness about food healthy behaviours and enabling them to switch their food patterns to be more healthy. It aims to support the cultural goal of improving our understanding of the food emotional relationship on the one hand, and personal goal of getting a better individual picture of one's relationship with food and guide along the nutritional journey.

### 3. CONCLUSIONS: WHAT MAKES ORBEAT UNIQUE?

Concluding, the developed OrbEat app is unique in that it combines both EEG scientific measurements as well as societal, cultural knowledge in tackling obesity, against a background of nutritional knowledge, something that has not been addressed at the same time before. In addition, our approach also directly connects to the UN's Sustainable Development Goals for improving a sustainable development on a social and ecological basis. As a follow up of the initiative described in this paper, the endeavour is continued as case-studies in the context of projects such as LODES (Global working group on Linked Open Data Repositories in the framework of OECD), ProvideDH (Progressive Visual Decision Making in Digital Humanities) and a non-research prototype development.

exploration space serves as a non-profit interaction platform for connecting actors and foster fighting obesity.

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## **USER EXPERIENCE IN DESIGN TARGETING POVERTY ALLEVIATION: A CASE STUDY OF “SHANJU RENOVATION” ACTIVITY IN MAGANG VILLAGE**

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### **ABSTRACT**

This paper aims to explore the methods of user experience for reducing poverty. Proposing the design of life's "Hedonics quality" is the value of introducing user experience in Targeting poverty alleviation. Through the user-centered design process, the design method and process of user experience in Targeting poverty alleviation are constructed. Take the poor households B in Magang Village, Shunde County, Guangdong Province as an example. Considering the design method and process of user experience in Targeting poverty alleviation, from the three aspects of space, product and service, it proposes a systematic solution covering multiple levels of needs such as physiology, safety and social, and cooperated with the B family, and carried out feasibility verification of some solutions, completed the space renovation and product design work. The results show that the intervention user experience design can bring new ideas and methods to the poverty alleviation work.

Keywords: Targeting poverty alleviation, User experience, Design poverty alleviation, Shanju renovation, Magang Village

## 1. INTRODUCTION

The eradication of poverty is the common goal of the international community and the inevitable choice for maintaining social equity and harmony. Currently, there are still 783 million people living below the international poverty line of \$1.90 a day, and they are working hard to meet their most basic living conditions. However, poverty is not only manifested by the lack of income that makes it difficult to sustain a livelihood, but also includes hunger and malnutrition, inadequate access to education and other basic public services for the poor, they suffer from the discrimination and exclusion, and the inability to participate in social decision-making related to it. As one of the countries where the number of poor people in the world is relatively concentrated, China has helped 800 million people to get rid of poverty in the past 40 years, and the contribution rate of global poverty reduction has exceeded 70% (“National Bureau of,” 2018). However, due to China’s large population, according to the National Bureau of Statistics’ National Monitoring Report on Rural Poverty, as of the end of 2018 (“The number of rural poor “ 2019), there are still 16.6 million poor people in China.

## 2. TARGETING POVERTY ALLEVIATION AND USER EXPERIENCE DESIGN

### 2.1. Targeting poverty alleviation

In 2013, General Secretary Xi Jinping first proposed Targeting poverty alleviation when investigating in Xiangxi, Hunan (“Xi Jinping went to Xiangxi,” 2013). In March 2014, Xi Jinping emphasized that in the deliberation of the two delegations, it is necessary to implement Targeting poverty alleviation, aim at poverty alleviation targets, and carry out key policies. Further explanation of the concept of Targeting poverty alleviation (“Xi Jinping’s new theory of poverty alleviation,” 2014). In 2015, General Secretary Xi Jinping delivered a keynote speech at the High-Level Forum on Poverty Reduction and Development, proposing “six precisions”(Xi Jinping, 2015). At the Central Poverty Alleviation and Development Work Conference, General Secretary Xi Jinping elaborated on “Five types of poverty as a group of simultaneous assistance” and further improved the basic strategy of Targeting poverty alleviation (“Xi Jinping Implementing,” 2016). Since 2016, General Secretary Xi Jinping has proposed in the New Year message to examine Chongqing and Jiangxi, Ningxia, Hebei, Shanxi and other places, and made a series of in-depth explanations on the major issues of Targeting poverty alleviation and Targeting poverty alleviation Targeting poverty alleviation Explain the development of people-centered thinking(Cao Li, 2018). Since 2017, with the deepening of the fight against poverty, General Secretary Xi Jinping further pointed out that whoever supports, who will help, how to help, how to retreat, the whole process must be precise, and some need the next “embroidery (Long-term and meticulous)” work(Sheng Yulei, 2017). At the 19th National Congress of the Communist Party of China, General Secretary Xi Jinping further clarified that we must persist in ensuring poverty alleviation and let the poor and poverty-stricken areas join the country in entering a comprehensive well-off society. By 2020, we will ensure that the rural poor under the current standards will all achieve poverty alleviation and solve problems(Xi Jinping, 2017). Under this macro background, all walks of life have intervened in this attack in their own way. As a problem-oriented design, they also showed a positive attitude. However, in the process of poverty alleviation, poverty is only a phenomenon. Accurate poverty alleviation is not only material, life, but also emotional. One of the main tasks of the user experience is to design the “Hedonics quality” of life, which is also the value of introducing “user experience” in Targeting poverty alleviation.

### 2.2. User Experience Design

User Experience Design (UXD) is a multidisciplinary concept that first appeared in the field of human-computer interaction. It was proposed and widely promoted by Don Norman at the CHI conference in 1995. Its main body is interactive design, but in 2010, as Garrett mentioned, in the past ten years, the user experience has not been limited to “network products”, not even limited to “Product based on screen interaction”, it seems to be everywhere(Kuniavsky,2013).

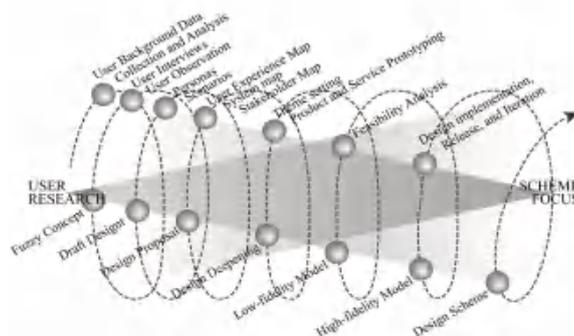
The user experience has evolved from tool to emotion since its usability. Early human-computer interaction researchers focused their attention on the achievement of behavioral goals in job settings. The realization of instrumental value has become the main goal in this field (Hassenzahl, 2013). In the 1990s, aesthetic quality was mentioned in the evaluation of experience quality (Alben, 1996). Hassenzahl (2001) proposes Ergonomic quality and Hedonics quality that make up the product’s appeal. Later, the needs, emotions and experiences of hedonics were further used as key qualities of interactive products. Sascha Mahlke (2005) analyzes the non-instrumental qualities of enjoyment, aesthetics, and pleasure, as well as emotions and experiences, and proposes a basic user experience process model. Hassenzahl and Tractinsky (Hu Fei, Jiang Mingyu,2018) divide the user experience into three dimensions: beyond the instrumental, emotion and affect, and the experiential.All the above discussions confirm the role of user experience in turning to “Hedonics quality” of design life.

In recent years, with the sociological turn of the design discipline, the content of user experience has continued to expand, and related methods have continued to update. At the same time, the development of design methods in emerging practices such as interaction design, service design, and experience design has also brought new enlightenment to user experience. In 2010, ISO 9241-210 defined user experience as: “The perception and reaction

of a person’s use or intended use of a product, system or service.” This definition clearly defines the object of the user experience as “product, service or system.” Law et al. (2009) also suggested limiting the term user experience to products, systems, services, and objects that a person interacts with through a user interface. That is, as long as the human interface is involved in the interaction, whether the interface is a product, an application or a service, it belongs to the scope of the user experience. However, what is not equal is that the discussion of the design subject “humanity” is still insufficient. Stefan Hellweger et al. (2015) counted 173 blog posts from 4 blog entries for the period from January 2012 to October 2013. It is found that in the research dimension, the industry mainly focuses on the user experience research on the interaction dimension and product dimension. The attention to the user dimension is obviously insufficient, mainly focusing on the “interface” rather than the “interact”. Some scholars have extended it to product.

### 3. DESIGN METHOD AND PROCESS OF USER EXPERIENCE IN TARGETING IN TARGETING POVERTY ALLEVIATION

The author (Hu Fei & Dong Xianzhi, 2011) proposed a “double funnel” model for user research in industrial design industry. In this paper, the model and method mentioned above are introduced into the design of Targeting poverty alleviation, providing a path reference for solving poverty or broader social problems. The user experience in Targeting poverty alleviation is in line with the user-centered design process. This includes background data collection and analysis → user field survey → Personas and scenarios → user experience map, system map and stakeholder map → theme establishment → product and service prototype design → feasibility analysis → design implementation → operation and iteration (Figure 1). The steps loop until the project is completed. The entire project creates a series of design steps to ensure the rationality of the task structure and organization. The iterative design is analyzed and evaluated using a similar process until all functions are integrated into the overall architecture.



[Figure 1] Design process model of user experience in Targeting poverty alleviation

- **Background data collection and analysis:** The field theory of sociology and the environmental determinism of psychology all indicate that the environment in which humans live has an impact on their behavior and decision-making. In the process of poverty alleviation, if there is a lack of understanding of background information and Scenarios, it is easy to have an arbitrary and condescending aid posture. Background information sources: including literature (such as newspapers, books, magazines, letters, diaries, memoirs, etc.), audiovisual media (such as television, radio, movies, etc.), new media (websites, blogs, mobile phones, etc.) and other channels; Analytical method: classify by content analysis, card classification, qualitative analysis, link analysis, etc., extract keywords and discover the possibility of design.
- **Field surveys of users:** Field surveys include two paths: observation and interview. Researchers track the daily behavior of the users through non-participatory observations, indirect observations, and invisible observations, and identify key points that can be improved in the user’s life; For situations in which researchers without the possibilities participating in the observations, a record package can be practice to help users record their lives through image logs or video stories; At the same time, combined with telephone interviews, household interviews, in-depth interviews, stakeholder interviews, the focus groups, etc., from the language approach to understand the user’s daily life trajectory.
- **Personas and Scenarios:** Personas defines the social status, lifestyle, values, behavioral habits, and user expectations of the target family; Scenarios is a scenario that maps users and their activities, and is a key activity that reflects the core characteristics and concepts of users. Personas points to user behavior, and Scenarios points to the user’s environment.
- **User experience map, system map, and stakeholder map.** The above three no longer treat the user as a single individual, but rather as a core element of a service or system, for exploring its interactions with other elements.
- **Theme setting:** The design team can organize brainstorming of multiple professionals and propose subject settings based on the shared vision of each stakeholder. These topics are based on background data collection and analysis, user field surveys and visual charts, in the form of focus groups or brainstorming, community workers, governments, NGOs or charities, universities, designers, users, etc. all related groups can participate in this process. Establishing clear themes can create a unified goal awareness for the team and reduce

communication costs.

- **Product and Service Prototyping:** Prototype design is widely used in design and engineering to test product appearance and functionality by building models prior to mass production. The prototype can intuitively reflect the advantages and defects of the product, which can help the designer to correct the design in time and reduce the development cost.
- **Feasibility analysis,** Feasibility analysis is to evaluate the practicability of the project or system to be implemented. The influencing factors of feasibility evaluation can be divided into three aspects: context, content and users (Rosenfeld & Morville). Situations refer to the current situation of politics, economy, culture, technology, commerce, capital and resources that need to be considered when designing the existence and specific environment and organization. The content is the main body of design, which needs to consider whether they meet the needs of users. The users refer to whether the user's behavior will be blocked or the experience will be generated when they use it.
- **Design implementation, release, and iteration:** The causes of poverty are often complex and difficult to solve in a single way. Therefore, it often involves various design forms such as space design, product design, and service design, and finally forms a systematic solution covering products, space, and services.

#### 4. TYPICAL CASE

“Reliable Living and Shanju Public Welfare Project” (referred to as “Shanju renovation”) is supported by the Shunde Civil Affairs Department and the Rongshutou Village Residential Conservation Public Welfare Foundation; A continuous design charity event jointly sponsored by the Guangdong Industrial Design Association and the Interior Design Branch of the China Architecture Society-Foshan Committee.

In 2018, the “Shanju renovation” was targeted at three poor families living in Magang Village, Ronggui Street, Shunde District, Guangdong Province. Among them, the status of family B is more typical: the head of the household (grandmother) is the only labor force of the family; her husband (grandfather) suffered from a stroke 8 years ago and can only stay in bed for a long time, and the whole day is taken care of by her grandmother; Her son suffered a first-degree disability of the limb since a car accident and was completely incapacitated. Her daughter-in-law and her grandson left home; Her daughter has been married. Therefore, the following is a description of the key steps and steps of the user experience process and method in the Targeting poverty alleviation.

##### 4.1 Background data collection and analysis

At the beginning of the “Shanju Renovation” project, formed a research team led by Professor Hu Fei and the graduate students and undergraduates from the School of Art and Design of Guangdong University of Technology. Conduct the extensive and in-depth resource surveys were conducted on the geographical context and social context of Magang. The research team uses the material culture layer (including geographical location, natural environment, human environment, basic services, etc.) through literature, journals, web pages and other channels; For their behavioral culture (including population, historical events, diet, social activities, customs, traditional art); The three dimensions of conceptual culture (including population, historical events, diet, social activities, customs, traditional arts, etc.) The characteristic points of Magang regime in various dimensions are proposed. According to the feature points, clustering and relationship construction are carried out, and five strategic goals of Magang regional culture are proposed, namely: project respect for cultural beliefs and habits, the homeland of Taohuayuan (Shangri La), Lingnan style architecture, folk heritage, and healthy family.

##### 4.2 Field investigation for the users

The research team in the project carried out user field investigations from user interviews and user observations. (1) Before the face-to-face interview, the research team conducted in-depth interviews with relevant groups such as community workers, family neighbors, relatives and friends who are closely related to poor families through a combination of telephone interviews and field visits. (2) In the process of entering the family interview, the research team adopted two methods: one-day life tracking and space structure research.

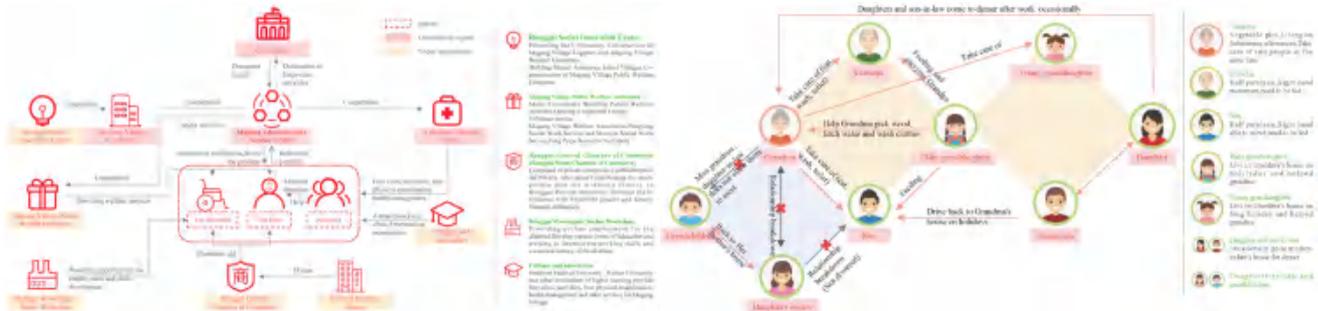
##### 4.3 Personas and Scenarios

Through many in-depth interviews and behavioral observations of the household, the research team basically grasped the daily living conditions of the B households. On this basis, it depicts the Personas and user situations of the B-family grandmother and the grandfather, son, and granddaughter that enable the research team to have a clear understanding of the basic information, life attitudes, and daily life of the members of the target family.

##### 4.4 The User experience map, system map and the stakeholder map of family B

Meanwhile, the researchers completed the User experience map, system map and the system diagram of family B. The application of the above research tools makes the interaction between family members and the surrounding environment and the internal environment of the family more obvious. (1) User experience map. The life trajectory of the B-family grandmother is divided into two situations. One is that when their son is not at home (the working day son is in the welfare home); The other scenario is weekends, she needs to take care of the two men. At this time, her workload will double in time. (2) System map. the main activity of this family is done by grandma. Grandma has

to go to the bank every month to receive a government-issued minimum pension; she needs to go to the pharmacy once a week to get medicine, take care of her relatives every day, and occasionally purchase items such as necessities (Figure 2). (3) Stakeholder map. Including external and internal stakeholder map. There are three groups of family relationships related to B households. Including grandmother's family, daughter's family and son's home. Among them, the grandmother is the key person of the family, and the main members are grandmother and grandfather; their oldest granddaughter who is attending school and lived with her grandparents; She is the contact link between her mother's family and her grandmother's family. For the old persons of the B family, their daughter-in-law took her grandson back to her own parents' home and was in a state of rupture of her marriage.



[Figure 2] External and Internal stakeholder map of family B

#### 4.5 Establish the theme of problem solving

Based on analysis of background data collection and analysis, user field surveys, and personas, the design team proposed five different design themes for the B households. Including program of the safe and secure life guidance, planning storage space, home rehabilitation, family reunion time, holding a family “meeting”. These theme conception have a mapping relationship between native characteristics, user concepts and demand elements in the early stage (Figure 3).



[Figure 3] The mapping relation between theme conception and local characteristics, user ideas and demands

#### 4.6 Prototype design and feasibility analysis

Based on the theme orientation, the design team proposed a variety of design solutions for the helping B families from different levels, including three aspects. (1) Space design. Consolidate the space that sons and grandfather that need to care for, add the grandchildren's study space, (add photo walls, storage boxes and storage pendants), toilets and add the barrier-free facilities. (2) Product design. Add nursing bed and bath bed, add a call bell, pressure pump decanter and so on. (The grandfather often needs to use water to clean the bed due to his stool and urine.) (3) Service design. Social workers intervened to repair the marriage relationship of their son and their daughter-in-law; and organized daily activities to help the grandmother take care of the grandfather's. Mobilize the neighborhood to help buy food, pick vegetables, buy medicines, etc., to make time for the grandmother to participate in community-organized activities (food exhibitions, watching opera, etc.) to meet the emotional needs of the grandmother.

#### 4.7 Design implementation and release

At present, the renovation and product addition work for the three poor families has been completed. As a bottom-up, spontaneous design action, the influence and appeal of “Shanju renovation” is limited. Therefore, the design team also released the poverty alleviation proposal and participated in the Guangdong Design Week exhibition in order to attract more designers, social groups, people to pay attention and participate, build new scenarios and blueprints and explore new possibilities for helping the poor families. For the more complex problems of poor family emotions and other levels, the university researchers are also studying further, and hope to help users further improve the quality of life of poor families through follow-up intervention.

## 5. CONCLUSION

This paper proposes the process and method for user experience design in Targeting poverty alleviation, and takes the research process of “Shanju renovation” as an example. However, Targeting poverty alleviation is a complex issue of “humanization”, showing network and dynamics structure, and the related user experience is also dynamic. Therefore, it is difficult for us to simply use the “analytical-integrated-assessment” linear method to solve. We often encounter the possibility of “ill-structure”, which also challenges researchers. The designers need to dynamically

adjust based on continuous feedback. In addition, people’s choices in difficult circumstances are purposeful. To make substantial progress in our work, we must truly understand their lives, including the complexity and diversity. Designers use their own expertise to practice the ideal of “design for people”; at the same time, how to solve the problem of family relations caused by poverty and their lack of dignity in low social status, how to truly let the poor people escape from Dan Pisa Moyo’s The Potential Poverty Trap mentioned in his book “Dead Aid” allows the poor to live in a more independent and confident manner, which is still a topic that we need to think further.

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## **DESIGNING SUSTAINABLE MOBILITY FOR PEOPLE AT RISK OF SOCIAL ISOLATION – TWO CULTURAL PERSPECTIVES FROM SINGAPORE AND FRANCE**

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### **ABSTRACT**

In both Singapore and France, the proliferation of technology in mobility services induces a risk for non-tech savvy users to be left behind. This may create barriers to mobility and contribute to social isolation. This paper proposes to use a mix of design methods considering specific user problems.

In Singapore, after shadowing and interviews with people with reduced mobilities, a persona was drafted, and two key needs for travelling were highlighted: the role of time and the reliance on other people. In France, personas were defined for non-tech savvy users during a design workshop. A new mobility service was created to answer their needs. Further work will be on (i) feeding design workshops with the identification of personas, based on interviews with persons with reduced mobility and (ii) comparing personas in Singapore and France and investigating how design actions can be conducted and evaluated in two different socio-cultural contexts.

Keywords: Human-Centred Design, Sustainable Mobility, Social Isolation, Technologies in Mobility Services

## 1. INTRODUCTION

People with Reduced Mobility (PRM; Zajac, 2016) encounter a number of challenges when travelling out of the home into their neighbourhoods, and beyond. In this paper, this group encompasses older people and people with disabilities, as rates of disability are higher among older adults, with more than 46% of persons aged 60 years or over living with disabilities (UN, n.d.). These challenges restrict mobility and limit people's exposure to the social aspects of everyday life (Webber, Porter & Menec, 2010), which in turn contributes to a higher risk of social isolation characterised by a lack of interaction with other people. As a risk factor for depression, cognitive decline and mortality (Courtin & Knapp, 2017), tackling social isolation has been identified as a public health priority in many parts of the world, including Singapore (MOH, 2016) and France (CESE, 2017; Auxilia, 2014).

In parallel, both countries are supporting the development of technology in mobility services involving the use of smartphones for booking rides (e.g. Grab services in Singapore) and autonomous vehicles (in Singapore conducted under the Smart Nation initiative (Smart Nation, 2019), and in France, e.g. in Rouen, (Transdev, 2018)). At first glance, these technologies may have a positive impact on people at risk of social isolation. For example, door-to-door services would match the needs of seniors in reducing transfers between transport modes, therefore providing them with a more convenient and comfortable travel experience. But what would be the impact on older people who are not familiar with or unwilling to use new technologies?

Considering this specific user group (older adults or people with reduced mobilities who are 'non-tech savvy') is at risk of being 'left behind' with the rash development of technologies embedded in mobility services, the authors suggest moving towards a new approach for designing urban mobility. This new approach is i) inclusive, since the design methods used are human-centred and grounded in Universal Design principles<sup>1</sup>; and ii) fosters sustainability, since the developed solutions are meant to encourage public transport use and improve quality of life in cities.

## 2. STATE OF THE ART

### 2.1 Ageing populations in Singapore and in France

In 2015, 17.9% of Singapore's population was aged 60 or over, rising to 30.7% by 2030 and 40.4% by 2050, and in France, 24.1% of the population was aged 60 or over in 2015, with this figure increasing to 29.9% by 2030 and 31.8% by 2050 (UN, 2015). In Singapore, population ageing is occurring more rapidly than in France (UN, 2015). As such, Singapore will need to quickly adapt its transportation infrastructure and services to fit the needs of an increasingly aged population. In France, the majority of older people live alone or with a spouse only; 88.3% of older females and 85.7% of older males did so in 2017 (UN, 2017), whilst in Singapore, in 2011, only 9% of adults aged 65 plus live alone (Linton, Gabhaju, & Chan, 2018). 27% of people over 75 are considered isolated, especially amongst women. A risk of isolation arises when the needs for daily life are not fulfilled with available means (Auxilia, 2014).

Whilst older adults have much to gain from technologies that enable mobility, they may be less likely to adopt new technologies (WHO, 2016). For today's older generations, history-graded factors play a role as digital technologies were not in existence when they were at school or in the workforce. Thus, the pace of innovation and proliferation of technology may operate as a barrier to being mobile.

In Singapore, in accordance with the Enabling Masterplan (MSF, 2016), measures have been taken to promote a more inclusive public transport system, with fare concessions for senior citizens and more accessible infrastructure (e.g. wheelchair-accessible ramps). However, some challenges remain for example with accessing information about bus arrival times and routes (Ongel et al., 2018), booking taxis for travel to medical or other appointments, and navigating Mass Rapid Transit (MRT) stations.

In France, 75-85-year-old people (representing 4.5 million people) are potentially losing their autonomy (Keolis, 2016), because of health issues and functional limitations (Auxilia, 2014). Regarding technology, 40% of French adults do not own a smartphone. Similar to people with lower levels of education and lower incomes, elderly citizens may be excluded from the usage of technologies.

In France and in general in Europe, public transport becomes an attractive alternative for seniors to maintain an active and independent life, as they are faced with financial issues or difficulties driving due to ageing, health conditions or reluctance to drive in an increased traffic (Auxilia, 2014). Public transport plays an important role in older people's quality of life because it enables mobility and facilitates opportunities for social participation (WHO, 2016).

### 2.2 Design methodologies and a need for a new approach

It appears that the mobility of older people in the city requires specific attention because of their specific conditions and the consequences for their health in case of social isolation.

In Singapore, several agencies are already thinking of mobility for specific users and moving towards the use of

<sup>1</sup> As defined by the Center of Universal Design (1997)

qualitative data to understand user groups (PTC, 2018). In August 2018, the Land Transport Authority (LTA) started public engagement in the form of online surveys with the goal of ensuring a convenient, inclusive and safe land transport system (LTA, 2019). However, methods requiring potential participants to register online may inadvertently exclude subjects – in some cases, seniors – who do not have access to the Internet. New methods are needed that are more inclusive.

A possible method for greater consideration and characterisation of the needs of vulnerable groups is the use of personas. They are used to help designers focus on the major needs of a few specific user archetypes to better fulfil those needs (TandemSeven, 2019; van Boeijen, Daalhuizen, Zijlstra, & van der Schoor, 2013). Gonzalez, Justel, Iriarte & Lasa (2017) developed personas through interviews with elderly people in the French Basque country. The three types of ‘elderpersonas’ were described with attributes such as profile (successful, normal, pathological), age, capabilities and habits, and the products important in their lives. They stressed the importance of distinguishing ages: biological but also psychological, subjective, functional, and social. In another study, nine ‘elderpersonas’ were developed based on a large-scale survey of people aged 55 and over, conducted by the French cluster Silver Valley (2018). For the construction of the personas, two main dimensions were intersected: generation (consumerism 55-65; individual 65-75; collective 75-85) and lifestyle (pleasure; sharing; decline).

Additionally, once the specific needs of vulnerable groups are identified, design solutions can be created during design workshops conducted with designers, or participatory design workshops with the targeted user group. We can report several studies where elderly people are involved in co-design activities. For instance, Wallisch et al. (2018) co-designed a tricycle with ten elderly people and four students, and Wikberg-Nilsson, Normark, Björklund, & Wiklund Axelsson (2018) co-developed prototypes of digital services with seniors.

Designing for sustainable mobility which is inclusive for non-tech-savvy people requires specific methods that are grounded in the socio-cultural context of the investigations, in our case: Singapore and France.

### 3. METHODS

#### 3.1 Diagnosis of mobility situations and development of a persona: Investigations in Singapore

As part of the diagnosis of the situation, we adopted a mixed methods data collection approach involving semi-structured interviews and shadowing as data collection strategies to understand the issues faced by users on public transport today. During the interviews, questions were asked about different elements of participants’ mobility experiences. For example, “Why do you prefer to travel during off-peak hours?” and “How would you compare your journey on a train to a bus?”. The interviews, which typically lasted 15-30 minutes, were audio-recorded and transcribed for thematic analysis (Nowell, Norris, White, & Moules, 2017). In the shadowing study, a researcher accompanied subjects from origin to destination on their usual routes to observe their experiences. Mixed methods were used to obtain conscious and unconscious insights. The latter refers to thought processes or behaviours which the user may be unaware of him/herself. The insights were gleaned from a third party’s observations of repeated and/or atypical behaviours. Based on the results, key attributes, such as pain points or travel preferences, were identified and combined with contextual information such as demographics to build personas. One such persona is presented in this paper.

#### 3.2 Design workshops based on personas: Investigations in France

As part of the design of sustainable solutions, we report an excerpt of a 3-hour “Design of Mobility Experience” workshop organized by five post-graduate students training in innovation in CentraleSupélec in Paris in 2017. The workshop was attended by 15 people of various backgrounds and expertise (students, professionals and researchers in the mobility domain, industrial designers). It was hypothesised that shared mobility could counter social isolation, as well as solve mobility issues. The brief was written as follows: “How to design desirable solutions for shared mobility while restoring social links in everyday life?” The objective was to uncover ideas for situations where people would be eager to share their mobile life with others to further inspire new solutions. Based on the persona approach, four phases were developed in groups of two to three persons:

- Choice of one persona among predefined categories namely ‘Shares’; ‘Does not share’; ‘Shares without awareness’
- Creation of the persona profile, and description of his/her “Journey Map” from morning to evening, while detailing what he/she does, feels or thinks, and if he/she feels like sharing throughout the day.
- Detail the moments of sharing mobility and activities depending on the family and social situation of the persona (single, with children, couple, with friends, with his/her grandmother).
- Focus on the sharing moments as creative prompts to design new mobility solutions to alleviate social isolation.

### 4. RESULTS

#### 4.2 Investigations in Singapore

The sample (n=16) comprised public transport users from vulnerable populations – older people and people with physical or sensory (i.e. visual or hearing) impairments. The interviews provided practical insights into the details important

to these users. The problems that hinder PRM from travelling are not confined to the mobility system (e.g. lifts leading to the train station). For instance, when the lifts at MRT stations break down, a physically-impaired subject could not travel as they were unable to even access the train platform. One visually-impaired participant (male, guide dog owner) agreed to the shadowing procedure. The subject was able to find an available seat easily with the aid of his guide dog. However, the researcher noticed that he needed more time than the average person to sit down as he had to rely on haptic feedback, i.e. feeling around the seat, to orient his body. In another instance, the guide dog successfully led the participant to the escalators upon receiving an instruction. However, the dog had guided the participant to an escalator going in the wrong direction, so the participant had to rely on a fellow passenger to show him the way.

These investigations enable us to define the main attributes of a persona that could be considered later for design actions (i.e. design conception and evaluation). The persona is Peter Tan, a 72-year-old who moves with support aids, such as a walking stick or handrails, within the home. He stays at home most of the week, and when he does go out, his travels are restricted to his immediate neighbourhood because he relies on a wheelchair to travel longer distances, which can be a hassle. The travel experience with public transport is unpredictable for several reasons: crowds can greatly impede movement, particularly when boarding or alighting vehicles; facilities enabling access to the mobility service are sometimes unavailable (e.g. lift breakdowns), and there is a reliance on other passengers to give way or provide information about the route when going to an unfamiliar destination. This unpredictability makes Peter anxious, as he can never be sure whether the journey will be smooth and comfortable. Although his family gave him a smart-phone, he rarely uses it, except to make and receive phone calls, as he does not really know how to use it.

### 4.3 Investigations in France

During the “Design of Mobility Experience” workshop, the groups created intertwined life and mobility experiences for five personas who mainly belong to non-sharing profiles (Table 4.1).

[Table 4.1] Personas created for the Design of Mobility Experience workshop

Name	Age	Category
Pierrette	64	Does not share; Impaired mobility and arthrosis of inferior limbs
Clara	68	Does not share; Non-tech savvy
Romane	Non-defined	Unconsciously share; Single young women
G�rard	Non-defined	Does not share; Independent; Single father
Jean-Pierre	50	Does not share; Reluctant

In the sample of non-sharers, we were interested in Pierrette, who represents a person with reduced mobility, and Clara, who is non-tech savvy. For Pierrette, the group imagined all sorts of moments where she may feel pain and isolation while leading her daily mobile life with family and friends. For instance, an experience imagined for Pierrette is at 8 pm, when she goes to the theatre with some friends: “I enjoy theatre plays very much. But moving to the theatre is such a nightmare that it makes me nervous and I do it only from time to time”.

The outcomes of the workshop were translated into design actions as follows. The story of Pierrette was taken as a new innovation design brief by a group of students, who implemented a need-seeker method called Radical Innovation Design (Yannou, 2015; Lam , Yannou, & Cluzel, 2017). Crossed with insights on the difficulty for seniors to live a satisfactory life, especially in suburban areas, and with the benchmark of existing solutions on the French territory, they designed and service-blueprinted a ride-sharing concept dedicated to elderly people called Mooment – a single word for Moment, Move and Mood. It aims at connecting two types of user profiles: elderly people, like Pierrette, who are supposed to be non-sharers; and sharers in their neighbourhood, who are ready to help. This service works with an easy-to-use device to counter the reluctance towards technology. It consists of a simple support in the form of a connected button allowing the elderly person A to send: (1) a request of ridesharing to all the people owning a matching phone application in a defined area, (2) a request for a particular service, shopping groceries for instance. If the person B acknowledges the request, a phone call is established without having to share one’s phone number. If no one answers the request, Mooment suggests an alternative transportation service and deals with the booking procedure for the elderly person.

## 5. DISCUSSION AND CONCLUSION

These investigations in France and Singapore confirmed the necessity of using mixed methods in designing towards sustainable mobility. Both sets of methods – in Singapore and in France – complemented each other, revealing different aspects of designing for older people, including those with disabilities. In Singapore, empirically-based qualitative research enabled a detailed diagnosis of the public transport experiences of people with restricted mobility, who may be at risk of social isolation. One insight was about their need for time. Although participants did not always formulate this explicitly, observations and interviews showed that this user group requires more time, e.g. to board and settle into their seats. Mobility design guidelines can include considerations for time that the passenger needs to complete each segment of the trip; further work will be done on how this affects other operational functions, e.g. vehicle dwell times and on a larger scale, the service schedule. Additionally, the investigations in Singapore identified a new key need: ‘reliance on other persons while travelling’, which has so far not been identified by

transport authorities, such as in the standard EN 13816 defining service quality for public transport (CEN, 2002). This key need should be considered in designing future mobility systems, for example autonomous buses (i.e. driverless): The issue of not having a driver on board – whom people with reduced mobility currently rely on heavily for information and vehicle access – could be tackled thanks to a Virtual Companion that answers their questions and requests. In France, the involvement of experts and the use of hypothetical scenarios during the “Design of Mobility Experience” workshop enabled the creation of a new mobility service adapted to the needs of non-tech savvy older persons. This should be consolidated with observations and interviews with older people. A design workshop could be conducted with a panel of seniors in a participatory approach, as in Wallisch et al. (2018) and Wikberg-Nilsson et al. (2018). Moreover, the diagnosis of mobility situations and the design workshops could be chained thanks to the construction of personas.

The investigations focussed on specific user groups who are non-tech savvy and less mobile. Beyond that, in a mindset aligned with the Universal Design principles, any actions benefiting people with reduced mobility would likely benefit other user groups, e.g. both a wheelchair-bound user and a parent pushing a baby stroller will need barrier-free access to transportation. Sze & Christensen (2017) conducted a review of Universal Design guidelines for the US, UK and Hong Kong, noting the target group for each specification. The proposed groups can be enhanced for design action. Firstly, by identifying distinct sub-groups, e.g. different abilities and needs between young-old and old-old users. And secondly, by prioritising design tasks through the clustering and identification of similar needs across personas. In this way, design considerations for one group, e.g. PRM, can also ease travel for other vulnerable groups, such as pregnant women or people with injuries. For future mobility, e.g. driverless buses, how can people with disabilities signal to the vehicle that they simply need a little more time, especially in the case of a visually-impaired passenger who may be unaware that the vehicle is departing?

With the use of design methods grounded in the local socio-cultural context, social isolation can be countered by enabling better access to and acceptability of mobility services. This extends to the creation of greater comfort and a more predictable experience on public transport. Such action would foster increased usage of public transport, including shared mobility services, which in turn would better facilitate people with opportunities for social interaction. The enhancement of these interactions combined with a reduction of private motorized mobility is aligned with sustainability goals for a better quality of life through improved mental and physical health in less polluted environments.

Further work will be on strengthening research collaborations between Singapore and France by (i) feeding design workshops with the identification of personas, based on interviews of persons with reduced mobility, (ii) comparing personas in both countries and investigating how design actions can be conducted in two different socio-cultural contexts, and (iii) conducting usability tests with users from Singapore and France with the developed solutions (e.g. the ride sharing service Mooment or a Virtual Companion for autonomous buses) and comparing the results.

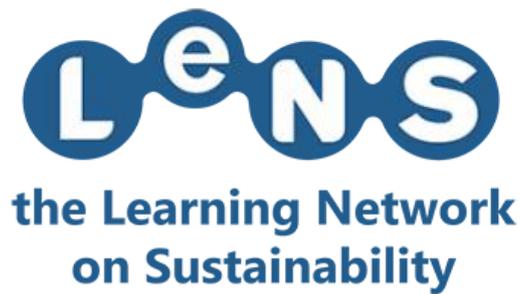
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## RESEARCH ON THE DESIGN OF SUSTAINABLE BATH EQUIPMENT IN POOR RURAL AREAS OF HEBEI

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### ABSTRACT

The purpose of the research is to meliorate the situation of the rural residents who have difficulties in bathing and poor personal hygiene in the poverty-stricken areas of Hebei Province, improve the living standard of rural residents and reduce the environment pollution. We select the rural residents in a typical poverty-stricken village of Taihang Mountain Area in Hebei province as research objects. Through field investigation, questionnaires and detailed interviews, we learned the actual needs of the residents for bathing and finds that the main difficulty in bathing is that the residents cannot afford the independent bathing facilities because of poverty. After investigation, comparison and reference of the bathing methods and the various sustainable energy, we select the solar energy and biogas as a combined energy supply. Moreover, we bring out the design of a reasonable, sustainable and convenient service system. It can improve the sanitary condition of rural residents and provide a new solution to improve the quality of life of rural residents and reduce rural environmental pollution.

Key Words: sustainable, bathing, rural areas, low cost.

## 1. THE SIGNIFICANCE OF RURAL SHARED BATHING FACILITIES CONSTRUCTION

### 1.1. Bathing is important for people in China

Bath is an important way for human beings to keep clean, and it has become an important part of daily life for urban residents in China. However, in the rural areas of China, especially the Taihang in Mountain Area of Hebei Province, in the reasons of poverty, energy supply difficulties and other causes, urban residents have low bathing frequency, causing poor quality of life and other healthy and mental issues.

Bathing has a long history in China. As early as the Shang Dynasty, the words “mu” and “yu”, which means bathing appeared in the oracle bones. “Confucius bathed and swayed.” In the feudal society, regular bathing has always been the social etiquette and norms of behavior the upper ruling class. However, as the development of the agricultural society, bathing has rarely treated as necessities to the farmers, especially in winter season.

### 1.2. The problem of lack of bathroom is widespread in rural China

Agriculture is the foundation industry of the country. More than half of China's population lives in rural areas. According to the sixth census, in 2011, the population in China's rural areas was 67.415 million, accounting for 50.32% of the national population. The general peasants usually have poor living conditions. Compared with urban residents, the frequency of bathing is extremely low, and the sanitary conditions are poor all year round. In poor rural areas, more than 95% of villages do not have public baths, and more than 99% of households do not have bathrooms. The root cause is that economic costs are the most important problem. In some areas where extreme poverty is extreme, some residents have a few baths in their lifetime. Rural energy structure is unreasonable, relying heavily on coal to boil water. Each household has a slightly better economic condition to install the boiler. The poor one can only use the coal stove for heating, and there is no condition for intensive heating renovation in the short term. Causes serious air pollution in winter.

### 1.3. Construction of bathing facilities contributes to the construction of new countryside

The China government attaches importance to the development of the countryside. The Fifth Plenary Session of the 16th CPC Central Committee proposed to promote the construction of a new socialist countryside in accordance with the requirements of “production development, affluent life, rural civilization, clean villages, and democratic management.” The Central Rural Work Conference proposed to actively and steadily promote the construction of new countryside, speed up the improvement of the living environment, improve the quality of farmers, and promote the construction of “new rural areas” and “new rural areas”. To improve the living conditions of farmers, the vast rural areas need low-cost and easy-to-use bathing facilities to enhance the living environment.

## 2. DEMAND AND BACKGROUND RESEARCH ON SHARED BATHING FACILITIES IN RURAL CONSTRUCTION IN HEBEI

### 2.1. Choosing and introduce the research object

Select a village in one poverty-stricken county of Hebei Province as the research object. This county is the old revolutionary base areas, was identified as national key poverty-stricken counties in 2012, and is located in the south west of Hebei Province, northern of Shijiazhuang, on the edge of the North China Plain, the Taihang Mountains foothill light the mountainous area covers an area of 966 square kilometers. The terrain slopes from the northwest to the southeast. It administers 15 townships and 330 administrative villages with a population of 460,000.

The village is located 7 kilometers west of the county town, with a registered population of more than 1,300. In the whole village, about 90% of single-storey cottage housing construction. Most of the above do not have family bathing facilities, and less than 20% of the households use electric water heaters, solar water heaters and household bathing facilities. The bathroom is so simple that it cannot meet the requirements of the annual bath.

### 2.2. The demand of bathing for people in the village

In some areas, summer bathing can be done by the river or outdoors. At present, the water quality in Hebei cannot meet such requirements. Some rural residents have opened bathing rooms in their own homes, but they are often very simple. The picture shows poor farmers who are bathing in large pots, unable to use showers or go to the bathhouse. Children in the rural bathroom. However, even the bathrooms with such simple conditions are not distributed in every village. Most of the bathrooms are only distributed in the more affluent villages where the township government is located. The coal is burned every day, the cost is high and the profit is difficult, and the pollution is serious.

Through visiting villagers and old village cadres, we can understand the bathing conditions and energy use of residents. In the past 40 years, the village stoves have been demolished in large numbers; quite a few residents with better economic conditions have begun to use coal-fired boilers; the number of residents using new energy sources such as solar energy is small.

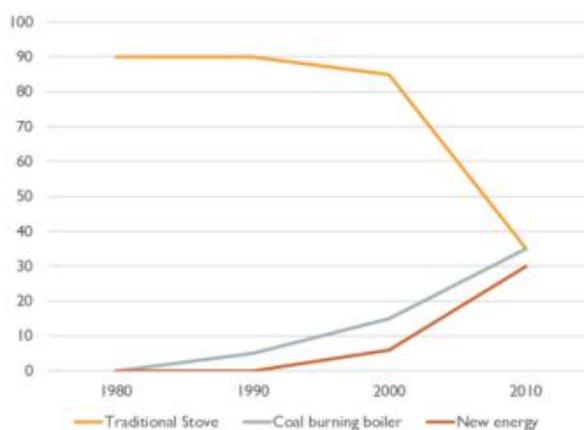
Most of the villagers with better economic conditions moved to the buildings in the county, and the problem

of bathing in poor families in winter still has not been solved. Residents need to go to the bathhouse in the town to bathe; families using solar energy or water heaters have obvious frequency of bathing in winter.



[Figure 1]The village and one of the self-built bathroom

The village is in the future for a long period, the family does not have the amenities of rural residential houses will remain the majority. How to solve the problem of bathing for the majority of farmers has become the most pressing issue in the future. It is necessary to build a public bath in the village by using economical solar energy, ground source heat pump, building insulation, waste heat recovery and bathing wastewater treatment technology.



[Figure 2] Changes of the amount of different ways to heating the water

### 3. THE EXISTING RURAL BATHING FACILITIES SURVEY

Needle current situation in rural areas lack the amenities, from the current solutions, in 2007 Shandong Guoqiang Group proposed “convenience solar bath room” design; this “Environmental protection, energy-saving convenience bath room”, covers an area of over 50 square meters male and female rooms each one. 2 m<sup>3</sup> tank capacity, which can accommodate 8--10 personal bath while continuously bathing 100. Renewable clean solar energy source is the main heat source, supplemented by biogas source. The cost of the program is about 80,000 yuan. It uses a combination of new energy sources, adopts the hardware facilities provided by the bank loan, and the mode of contracting the villagers to reduce the price and propose a better solution for the utilization of rural bathing facilities.

Ming Solar Co., Ltd. is located in Zhangjiakou City, Hebei Province, which in 2010 launched the product, “Yuan Hao brand overall bath room” with 15 solar tubes, bucket capacity of 140 liters of water daily for 10 people to take a bath. The wall of the bath room is made of thermal insulation board; the part that absorbs light energy adopts hollow sunlight lighting board: high heat absorption efficiency, slow heat dissipation, good light transmission effect, and equipped with Yuba. It has many functions such as start clock display, water temperature, water level prompt, water shortage prompt, automatic water supply and so on. Stainless steel floor, the overall bath life can reach 15-20 years. Equipped with hair dryer, thermometer, ventilation fan, clothes box, beauty mirror and other facilities, it is convenient to use.

In the rural areas, in the cold and cold regions, in the winter, the heating will be done by burning and burning the stove throughout the day. After the fuel is fully burned, most of the residual heat is discharged outside the flue gas, causing waste of energy. The packaging device applied to the fire wall designed in this paper incorporates a phase change thermal storage material. According to the phase change of the phase change thermal storage material at a specific temperature and accompanied by energy storage and energy release, the

smoke can be absorbed and stored in the daytime. Gas residual heat. After the indoor heating is stopped at night, the packaging device can release the energy stored in the phase change material to ensure the comfort of the indoor environment at night.

#### 4. SUSTAINABLE SHARING LOW-COST BATHING DESIGN

##### 4.1. Service mode and management mode design

The government, the village committee, highlights the service model and the villagers assist in maintenance; the county government and the village committee evaluate and evaluate the scale of the village bathroom, and purchase, entrust the company to produce and install the bathing facilities. Poor villagers can use it free of charge, and other villagers pay for it. The county government identifies the poor villagers. The village committee is responsible for the supervision, maintenance and repair of the bathing facilities. The company is responsible for the commissioning and overhaul of the bathing facilities.

In the rural areas where the bathing in the poverty-stricken counties is difficult, the village government and the village committee set up the village public bath. The scale of the bathroom is determined according to the size of the resident population and the sex ratio, and the company is entrusted by the national poverty alleviation fund. in production. After the bathing facilities are manufactured, the company is responsible for installation and commissioning. After the county government and the village committee accept the inspection, the card issuance work is initiated. For poor villagers who meet the state regulations, they cause the social security card to swipe their cards. Other villagers can use the pre-existing amount in the social security card for paid use.

The village committee is responsible for managing the daily opening hours of the bathroom to maintain the daily cleaning of the bathroom. For the faults and use problems, the village committee will report to the company for repairs. The company is responsible for timely maintenance and regular maintenance. The county government pays the relevant fees.



[Figure 3]Service and management mode

##### 4.2. Design of product composition and energy supply mode

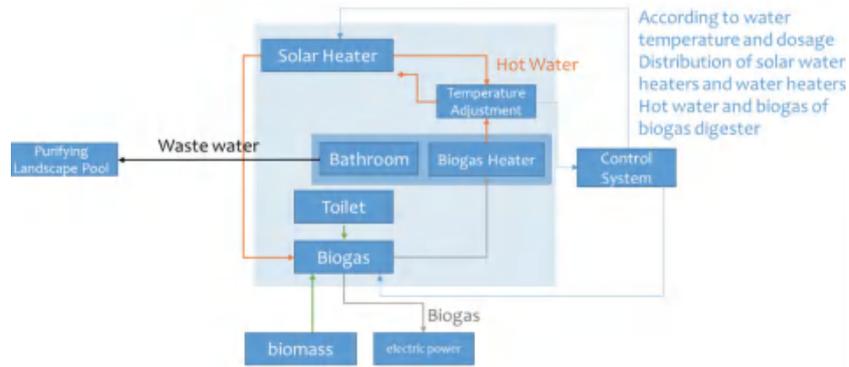
The bathing facility consists of a power supply part, a bathing part and a sewage treatment part.

The bathing part is a plurality of independent bathing rooms, and the number of opening can be adjusted according to the number of bathing persons to avoid waste of large bathhouse formation.

The energy supply method is mainly based on solar energy heating, supplemented by biogas heating. The normal temperature water passes through the control system and adjusts the distribution of the control water according to the water temperature and room temperature information fed back by the sensor. The hot water generated by solar energy during the winter can be used to replenish the biogas. The biogas produced in the summer can be used to generate electricity, supplementing the shortage of electricity generated by the summer electricity peak.

The sewage enters the purification landscape pool and is purified by multi-layer sedimentation, so that the discharged sewage is purified through layers and flows into the farmland of the village for irrigation.

4 square meters solar-based solar hot water bath system under daylight conditions county, 40 may be supplied per day 5 tons of hot water . The system may be employed a temperature cycle heating mode, to ensure all-weather use. Using a temperature sensor for water temperature automatic intelligent control, without staff on duty. Constant temperature water to prevent the elderly and children from scalding due to misuse. Compared with gas water heaters and electric water heaters, solar water heaters have an investment recovery time of 2-4 years, but the service life is greater than 15-20. Years, not only energy security, and easy to use non-polluting, is an ideal green energy product.



[Figure 4]Energy supply mode of the bath

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## **MAKING A COMIC ABOUT WESTBURY'S ANTI-APARTHEID ACTIVIST, FLORRIE DANIELS**

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### **ABSTRACT**

This study investigates how a comic about the anti-apartheid activist, Florrie Daniels, may be used to de-marginalise the Westbury community. Further, I propose the possible extension of this method to other communities and argue that marginalisation can be addressed with the distribution of a community's positive heritage. Comics are the most accessible medium for the propagation of education; by exploiting their innate ability to convey narratives across multiple physical and intellectual barriers, sustainable community resilience and upliftment may be achieved.

## 1. INTRODUCTION - WESTBURY'S MARGINALISATION INCONTEXT

Westbury neighbours the historically significant Sophiatown, in Johannesburg, South Africa. Its name changed from "Western Native Township," to "Western Coloured Township" in 1962 after apartheid's race-based evictions between 1955 and 1960 demarcated the areas for coloureds<sup>1</sup> (Brindley, 1976). It was renamed "Westbury" in the 1980s (Payne, 1987).

Like most non-white communities<sup>2</sup> during apartheid, Westbury suffered municipal neglect and political oppression. From the 1970s the area faced severe overcrowding due to a housing backlog; which had been building up since the 1960 forced removal. A series of expansion restricting by-laws exacerbated this. The apartheid government made cursory attempts to tackle these issues but did too little too late for any lasting impact (Dannhauser, 2018; Payne, 1987; Westbury community knowledge holders, 2018).

In reaction to the area's poor municipal development, a number of Westbury's residents organised themselves into the "Westbury Residents Action Committee" (WRAC) in 1981. This civic body was led by a beloved community 'grandmother', Florrie Daniels. WRAC with Daniels at its helm initially dealt with social problems and gave a voice to the community in municipal dealings. The government, however, paid little heed to the movement which was becoming increasingly aware of apartheid's unequal treatment of them. As a result, Westbury's community and WRAC became political<sup>3</sup> and allied to the "United Democratic Front" (UDF) and "African National Congress" (ANC) in 1983. In coalition with the UDF, WRAC assisted with the establishment and organisation of civics throughout the western areas of Johannesburg, and parts of Soweto. This led to the founding of the western areas umbrella civic called the "Community Residents Action Committee" (CRAC) (Mudney Halim, 2018; Jansen, Fritz, Mohamed, & Kavin, 2017; Penniken, 2017; Westbury community knowledge holders, 2018; Westbury Residents Action Committee, 1985). The UDF later recognised the area as a source of South Africa's better organised pro-UDF civics (Switzer & Adhikari, 2000).

Throughout the 1980s WRAC with Daniels organised numerous socially uplifting projects and spearheaded local distributions of UDF and ANC media and strategies. This was achieved despite constant and violent harassment by apartheid police and military (Jansen et al., 2017; Penniken, 2017; Westbury community knowledge holders, 2018). To date, Westbury's contribution to the struggle against the apartheid has not been formally documented or recognised. Instead, the contemporary view of Westbury is highly derogatory (Dannhauser, 2018; M Halim, 2017). It is of vital importance for Westbury's community that their instrumental contributions to democracy in South Africa be recognised and their true narrative distributed.

Today's marginalisation of coloured areas, like Westbury, is insidiously political. The reasons for this relegation are based on post-apartheid bias deriving from the political propagation of misinterpreted apartheid rhetoric and policies. During apartheid coloureds never carried passbooks and could participate in elections<sup>4</sup> from 1983. These same freedoms were only extended to Abantu blacks in 1994. The dominant language amongst coloureds is Afrikaans, which is perceived by many South Africans as the language of oppression. Apartheid stemmed from white Afrikaans nationalism, and thus any Afrikaans speaking peoples are inherently tainted by this heritage (Essop, 2016). That coloured communities suffered a mixed heritage of conquest, slavery, indoctrination, received farm wages in alcohol, and experienced forced removals is often overlooked by political attitudes which still believe that coloureds benefited under apartheid and colonisation (Adhikari, 2005; Dannhauser, 2018; Khoza, 2018; Madia, 2018; Penniken, 2017; Van Driel, 2017).

These attitudes resulted in the heritage of areas like Westbury being overlooked in national development plans. The dismissal of Westbury's trauma during apartheid has resulted in their dehumanisation by outside communities that do not believe the area is deserving of priority development (Dannhauser, 2018; Madia, 2018; Van Driel, 2017). This is alarming as Westbury was socially and economically impoverished by apartheid policy and, with continued neglect from the government, has retained a reputation for violent gangs and substance abuse (Dannhauser, 2018; Jansen et al., 2017; Van Driel, 2017). This is sadly a regular occurrence throughout South Africa's still impoverished regions but combined with a lack of recognition for Westbury's contributions, has devastated the community's overall self-efficacy (Dissel, 1997).

Self-efficacy is an individual's belief in their ability to problem solve and persevere through challenges in order to achieve goals. It is determined by how often and how well that individual, their family, community, and role

<sup>1</sup> Contemporary coloured culture descends from homogenised Khoi and Griqua nomads. Malaysian slaves and children from mixed race relationships. Under apartheid, coloureds were racially amalgamated as a group apart from the historically populous Abantu, or black, cultures (Adhikari, 2005; Brindley, 1976; Dannhauser, 2018; Penniken, 2017).

<sup>2</sup> Community roughly defines people according to a particular region, belief system, culture, or activity. For Westbury this refers those who live or once lived in the township (Flinn, 2007).

<sup>3</sup> Many civics from the Vaal Triangle region of today's Gauteng province experienced a similar phenomenon. Apartheid policy limited municipal development in all except white areas. This caused an increase in service delivery protests which turned political due to a combination of the UDF's media campaigns and unnecessary police brutality (Switzer & Adhikari, 2000).

<sup>4</sup> Then president PW Botha's Tricameral parliament gave coloureds and Indians limited voting rights, but did not allow any anti-apartheid parties to participate in elections (Adhikari, 2005; "Against Botha's Deal," 2018; Switzer & Adhikari, 2000).

models have succeeded according to the opinions of both that individual and society (Bandura, 1977; Hook et al., 2016). If the only widely accessible information about a community is that of poverty, crime and substance abuse; the cultural resources available to them for the development of self-efficacy are severely limited (Bushnell & Wild, 2017; Dissel, 1997). External involvement and infrastructural development can alleviate poverty and its associated problems, but, it cannot be sustained without community driven problem solving and participation (Switzer & Adhikari, 2000; Tosh & Lang, 2006; Zeilig, 2014). In order to sustainably improve Westbury, its self-efficacy must be raised to facilitate local problem-solving (Estrella & Forinash, 2007; M Halim, 2017; Knowles & Cole, 2008; Ryan, 2017). I argue that this can be accomplished by distributing a highly accessible narrative about Westbury's heritage both to the community and broader society.

## 2. THE ACCESSIBILITY OF COMICS

Comics use sequential graphics and text to tell a story (Levay, 2013; McCloud, 2006). The medium, which was once seen as trivial<sup>5</sup>, has become increasingly popular for serious historical narratives (Blades, 2017; Brister, 2014; Schack, 2014; Thomas, 2011; Worcester, 2017).

Comics have a relatively low production cost and can be viewed across numerous platforms. These include digital web-comics, newspaper and magazine sections, pamphlets, graphic novels, and exhibited posters. Unlike fine art, comics are not as restrictive to high socio-economic background through elitest gallery markets, and unlike film, their viewing does not require a designated time and location, or expensive electronic devices (Carter, 2011; Cope & Kalantzis, 2000; Meskin & Cook, 2012).

The beauty of comics is their accessible multi-modal communication; separating comics from purely textual mediums. Both the explicit and implicit communication of text and images are used in unison to disperse a message. This increases how much information can be interpreted by an individual, and allows different intellectual levels to interpret and enjoy the medium at whatever speed and analytical intensity necessitated (Christensen, 2006; Meskin & Cook, 2012; Mitchell, W, J, 1994; Sundberg, 2017).

Visual art as a narrative is also advantageous for establishing empathetic connections. One typically remembers lived experiences as emotional narratives to make sense of cause and effect scenarios and empathetically insert oneself into a story character's experiences. Thus, stories can distribute otherwise boring facts and opinions in an entertaining style which encourages empathy for others (Carano & Clabough, 2016; Chaney, 2013; Keen, 2006; "The Power of Storytelling: The Annual International Conference, Bucharest," n.d.). Image-based stories further this by visually recreating real communities for the viewer to recognise and feel empathy towards (Harvey, 2015; Maughan, 2016; Thomas, 2011).

These advantages mean that comics are also suited for educational purposes. The medium encourages development in literacy and visual communication skills. Comics also make their subject matter interesting for students, which when combined with their diverse communication format allows students to both learn more and hunger to learn more (Bakis, 2011; Christensen, 2006; Kan, 2010). Ultimately, producing a comic about Westbury was perceived to be the most accessible and informative art with which to educate the local community and outside society about Westbury's heritage.

## 3. COMMUNITY ENGAGEMENT WITH THE STUDY

For this study to succeed it depended upon the involvement of Westbury's community through narrative inquiry. This method gathers information by asking community members to tell stories about their own experiences, thereby allowing the community to determine what direction the research takes (Boje, 2001; Clandinin & Huber, 2010; Estrella & Forinash, 2007). In order to develop a relationship with the community, there were two interview stages. The initial interviews revealed unpublished information about Westbury's heritage and suggested alternative records. Florrie Daniels' personal archive, which was kept by her descendants, and several books and articles which referenced Westbury were also utilized to produce the comic's first drafts (Baines, 2005; Flinn, 2010; Mudney Halim, 2018; Tymon, 2006).

The second stage included focus groups or the original interviewees and took place after the comic's first draft had been assembled. Community members were encouraged to critique the draft and give suggestions which would make it more representational of their heritage (Flinn & Sexton, 2013; Nieftagodien, 2010). This increased the narrative's depth and imbued an enthusiasm for the research when the community realised that they had the power to determine the narrative's direction (Westbury community knowledge holders, 2018). The comic became an artwork for the community, as opposed to about them.

The community members involved started to recognise that their personal stories had a place in South Africa's history. There was a palpable difference in the pride for their heritage and enthusiasm for the comic's completion.

<sup>5</sup> The development of Anglophonic and Western comics was stigmatised after Wertham published his 1954 study, *Seduction of the innocent*. It stated that comics were addictive, and could dangerously influence young readers through explicit and implicit messaging.

Members of this study's associates from the Centre for Education Rights and Transformation (CERT) were increasingly invited to events organised by Westbury's increasingly involved community. It was a pleasant surprise as the study did not expect any change in the self-efficacy of these community members until the comic was officially distributed. This situation requires further contextual analysis.

The study only started because members from Westbury's community with academic connections explained that there was such a need (M Halim, 2017; Sithole, 2017). This unveiled a budding awareness among community members about their heritage's importance and their own marginalisation. Once the study started, a bitterness about this marginalisation was uncovered and prevalent amongst all interviewed individuals, even if the majority were at first only mildly surprised about the significance of their heritage. It is important to note though, that these individuals were chosen based on their knowledge of Westbury's heritage, and not for proportional representation of their community's opinions. Thus it was a biased sample pool. However, at the end of 2018 Westbury erupted into organised protests for the first time since 1994 (Marinovich & Silva, 2000). These were in reaction to police apathy and the area's marginalisation (Evans, 2018; Khoza, 2018). Other than the area's 2018 riots, they also participated in public talks and conferences, such as the annual Neville Alexander Conferences. Since 2018 Westbury also organised annual Heritage Day celebrations, and organisations like the Together Action Group and the Westbury Youth Centre became increasingly active.

The community's self-efficacy seems to be on the rise based on their desire to encourage academic studies, like this one, and Westbury's gradual renaissance of old organisational strategies. WRAC has previously used universities to further their needs, such as when they organised a mass health screening and vaccination in 1984 (Westbury Residents Action Committee, 1985). This study and comic whose goal it is to enhance Westbury's self-efficacy for social change appears to be the result of initially growing self-efficacy causing grassroots level social change in their desire to be heard.

## 5. CONCLUSION

This study intended to determine if a comic could address Westbury's marginalisation by providing its community and broader society with a narrative about their positive heritage. This was done to counter disproportionately negative reputation which had crippled Westbury's self-efficacy and ability to sustainably self-improve. Central to this process was a consistent determination of the comic's content based on what the community reasoned was best. This allowed for a more interesting and representational narrative.

Although, the primary goal of this study was not to measure how much the comic developed Westbury's self-efficacy, or what effect that increased self-efficacy might have on the community, it certainly revealed a change. Throughout the comic's production, Westbury became increasingly involved in social action, which demonstrated that its self-efficacy was increasing. These developments can barely be attributed to the comic, as it is still in production. However, the comic and its goal to develop the area's self-efficacy can instead be attributed to a willingness in Westbury's community to self-improve, which the comic is sustainably encouraging.

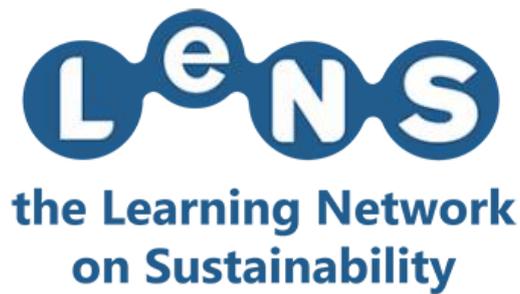
Upon the comic's completion, a future study should be done in order to record what aspects of the comic contributed to the Westbury's de-marginalisation according to Westbury's community and outside society. Future results could be used to determine how sustainable projects like this one are, and if they can be improved upon in future attempts to further encourage community-based self-upliftment.

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## FROM ROBOTS TO HUMANS: PROSTHETICS FOR ALL

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### ABSTRACT

SoftHand is a novel robotic hand combining the principles of soft robotics and postural human synergies to achieve a simple and effective implementation of the human functional and structural anthropomorphism in prosthetics aids. Originally developed for the industry by the Italian Institute of Technology and the “E. Piaggio” Research Center of University of Pisa, the SoftHand is becoming a prosthesis thanks to SoftPro, a H2020 research project. Thirty prosthetic users are currently testing it in 4 academic and rehabilitation centres around the world, to improve design, dexterity, and fitness to myoelectric prosthetic users. The latest design of the hand is smaller and lighter while keeping its merits: simplicity, due to the presence of one only motor; compliance, strength and robustness, thanks to its intrinsic softness and its human-like (19 degrees of freedom) architecture. The team involves a designer - who is also a tester - to improve design by considering also its social and aesthetic impact. Sustainability is a core issue of this research to present the market a robotic prosthetic hand with an affordable price; this goal has important socio-economical aspects. The paper will analyse market scenarios and competitors. The integration of contaminations coming from the Design and Humanities in the research flow is fundamental to explore the relationship between prosthetic appearance and social sustainability, which already achieve novel and unique self-interaction capabilities.

Key Words: soft robotics; prosthetics; myoelectric hands; social sustainability.

## 1. INTRODUCTION

Originally developed for the industry by the Italian Institute of Technology and the “E. Piaggio” Research Center of University of Pisa, the Pisa/IIT SoftHand is a simple, robust and effective robot hand, which combines the modern technology of soft robotics with a bio-inspired joint design and the neuromorphic principle of sensory motor synergies, and is able to achieve an adaptable and gentle grasp, together with advanced manipulation capabilities. The simplicity of its mechanical structure is ascribed to the use of only one motor, which nonetheless, is able to activate the whole hand. This is possible thanks to a distributed transmission system – namely a tendon - that runs through all the fingers and that is wrapped around and winded up by the motor. Often, robotic hands with many degrees of freedom (DoF) are controlled by diverse motors, the Pisa/IIT SoftHand has 19 degrees of freedom (as the human hand), but the use of only one motor keeps the hand very light and robust. Moreover, its tendon-based transmission system lets the fingers to adapt to different shapes while creating an interdependency between the phalanxes, in line with the concept of human hand synergies. The hand system designed is very robust and its biomorphic joint design allows perfect recovery after large deformations and even disarticulation. In ultimate analysis that studies in human synergies led to a design which simplifies the handling of 19 degrees of freedom and guarantees, at the same time, an affordable technology. As mentioned before, the idea at the core of the Pisa/IIT SoftHand, i.e. soft synergies, comes from a theory in natural motor control which interprets part of the complexity of the motions of the human hand as the result of two opposing principles: on one side the coordinated (i.e. synergetic) motions that our nervous system command to the hand, and on the other its physical and elastic (i.e. soft) interaction with the environment. The application of these principles in a robot system makes the SoftHand capable of grasp a great variety of objects despite its single degree of actuation.



[Figure 1] The SoftHand adaptable and gentle grasp. In the middle, its self-interactions feature exploited.

Simplicity, robustness, lightness and effectiveness make the Pisa/IIT SoftHand ideal for both humanoid robotics and industrial application<sup>1</sup>. Moreover, a commercial version of the hand, the qbsofthand, is produced by a spinoff of University of Pisa and IIT. Literature is available on this topic (Catalano et al. 2016), devoted mainly to engineers' research community. The original Pisa/IIT SoftHand is released as an open hardware project under the umbrella of the Natural Machine Motion Initiative (Della Santina, 2017). Despite the apparent distance that separates prosthetics from industrial automation, the same characteristics that make the SoftHand innovative and versatile in factories, render it potentially disruptive in prosthetic application. So, thanks to the European Commission H2020 project named “SoftPro”, currently the hand is designed smaller and lighter and integrated with convectional controllers for prosthesis (surface electromyographic sensors - sEMG). Usually, active prosthetic hands are controlled by one or two sEMG sensors: a solution that perfectly fit the Pisa/IIT SoftHand system with its two input requirements: the opening and the closing commands. A novel prosthetic hand borns: the SoftHand Pro (Godfrey 2018).

## 2. MARKET SCENARIO

One of the key issues in developing a prosthetic hand is related to its possible position on the market. Concerning this aspect, one of the emerging strengths of SoftHand Pro is its economic sustainability due to the relative electro mechanical simplicity of its architecture. To complete this analysis, it is necessary to define a preliminary market state of the art. Few robotic hand prostheses are available worldwide and are owned mostly by few leader companies (van der Riet et al. 2013); the most important are Michelangelo, BeBionic and MYO hand owned by Otto Bock; iLimb owned by Touch Bionics (now a part of Ossur). Few other hands occupy a very little percentage of the market, Taska hand (from Australia) is an example. Each hand has its own market, defined by specific user's needs that are reflected in imaginaries described trough specific marketing activities. Otto Bock's most advanced robotic myoelectric hand is Michelangelo. It has two motors: the thumb, index and middle fingers are actively driven, while other fingers follow passively. Michelangelo has three position modes, offering 7 grip types. Michelangelo comes with a clear glove or a natural pale rose (human-like) silicone glove<sup>2</sup>. In Otto Bock's website real-life stories videos refer to

<sup>1</sup> A proof of this is that the University of Pisa team was finalist at the Amazon Picking Challenge.

<sup>2</sup> Information from official website: <https://www.ottobockus.com/prosthetics/upper-limb-prosthetics/solutionoverview/michelangelo-prosthetic-hand/> (accessed 30/01/2019). The motto is: “Fascinated with Michelangelo. Perfect use of precision technology”.

keywords such as new normal, positive attitude, do things people love to do, life grateful, passionate. BeBionic hand (Otto Bock) has individual motors in each finger that allow to move the hand and grip in a natural, coordinated way. It has up to 14 programmable grip patterns and proportional speed control for each finger that gives precision control over delicate tasks<sup>3</sup>. BeBionic is, most of the times, portrayed without a glove, even if cosmetic gloves are available in black, white or in flesh tones. Emerging keywords are: this is every day for me, bebionic is part of me, allow me to be the person I want to be, embrace the everyday. MYO Hand (Otto Bock) is the oldest hand in the Otto Bock fleet (originally designed in the Sixties); it has a tridigital grasp actively controlled by EMG sensors, covered with a human-like glove. It is simple and strong, can be opened with a quick real time reaction; it has one motor and six control<sup>4</sup>. Other keywords related to this hand are: quick reflexes, secure hold, grasping objects, different sizes, flexible in application. iLimb (Ossur) is a robotic hand with five motors, two degrees of freedom per finger and four controls modes, with up to 36 different(customizable) grips available. It has different finishing, such as black, transparent and flesh tones gloves. Emerging keywords are: inspiring, things I love to do double handed, simple controlled, total control via app<sup>5</sup>. Taska hand has 10 joints, it is waterproof without the need of a covering glove, is black and finished using a combination of different materials. It's presented in a very forceful and assertive way. Key features are: robust, waterproof, flexible and dexterous. The users also can also use controls placed on the back of the hand<sup>6</sup>.

[Table 2.1] Myoelectric robotic hands comparison.

	Size	Motors	DoF	Weight	Cost*
Otto Bock Michelangelo	Male (7 3/4)	2	6	420 g	Approx. 25.000 €
Otto Bock BeBionic 3	Medium (length 195 mm)	5	11	500-570 g	Approx. 15.000 €
Otto Bock MYO Hand	7 3/4	1	2	460 g	Approx. 8.000 €
Ossur iLimb	Small (length 180 mm)	5	11	450-615 g	from 12.000€ to 33.000€
Taska hand	8 1/4 (length 181 mm)	n.a.	10	616 g	n.a.
SoftHand Pro	Length 180 mm	1	19	290g+70g (wrist)	8.000 € estimated

\* Estimated costs referred to the hand (no glove, wrist, etc) for the Italian market, excluded tax.

Table 2.1 summarizes the main features of the previous described hands (extrapolated also from Belter et al., 2013) comparing them to the SoftHand Pro. In this scenario, SoftHand Pro stands up for its lightness, and accessible market costs. This could generate a market positioning that is not covered by any other product at the moment: **a new idea of affordable high technology hand prosthesis**. In terms of economic accessibility, SoftHand Pro could be compared only with the MYO Hand - that has the majority of the market in Italy – but that is not comparable in terms of intrinsic technology. Moreover, SoftHand Pro features traits that, at the moment, are not present on the market, such as robustness (Catalano et al. 2016) and soft and deformable fingers, that make the hand unique in terms of self-interaction and grasp possibilities.

### 3. DESIGN OF UPPER LIMB PROSTHESES: A FRAMEWORK

In anthropology and sociology, disability is often perceived as a concrete form of otherness. The disabled person perceives himself as “something else”, mutilated in relation to a normal standard (Saradjian et al. 2008). Traditionally, the Stereotype Content Model about disabled people’s group elicits disrespect for a perceived lack of competence (Fiske et al., 2002). Moreover, this approach targets a paternalistic prejudice and lets pity emerge (Fiske et al., 2002). Murphy (2017) states that disabled people remain blocked in a sort of liminality phase: they are not healthy but, at the same time, are not ill. As a consequence, they are not excluded from society but not perfectly integrated either.

Disability can be understood as a cultural issue, able to guarantee social inclusion or favour the raising a stigma, as described by Goffman (1963). This makes upper limb robotic prosthetic design a complex issue that invest technical and technological aspects with critical subtended social consequences. To enhance design, dexterity, and fitness to myoelectric prosthetic use, the SoftHand Pro is being tested in laboratory and with final users. Different experiments are settled up to improve on diverse aspects: single parts and whole systems, mechanical and control issues<sup>7</sup>, usability, dexterity, and fitting are all being experimented with final users<sup>8</sup>.

The rest of this paper will focus on covering and finishing aspects as they are related to both aesthetics and her-

<sup>3</sup> Information and texts are taken from the official website: <https://www.ottobockus.com/prosthetics/upper-limbprosthetics/solution-overview/bebionic-hand/> (accessed 30/01/2019). The motto on the website homepage is: “The world’s most lifelike bionic hand”. “Comfortable, intuitive and precise, bebionic continues to transform the lives and abilities of amputees around the world. From helping them perform simple tasks like tying their shoelaces, to giving them back their control and pride.”

<sup>4</sup> In the main page of the SVO Hand official website is written a motto: “Grasp, hold, and be active”.

<sup>5</sup> Text from official website: <http://www.touchbionics.com/users-families/touch-bionics-difference>. Their motto is: “precision. power. intelligent motion”.

<sup>6</sup> The homepage video closes with a phrase “practical and useful device that will enable you to simply do more”.

<sup>7</sup> More literature can be found in Softpro project website ([www.softpro.eu](http://www.softpro.eu) – accessed 12/02/2019) and in EU project’s partners repositories.

<sup>8</sup> Users are currently testing the robotic hand in academic and rehabilitation centers around the world, such as: Mayo Clinic (Rochester), Shirley Ryan Ability Lab (Chicago), Hannover Medical School (Hannover), ETHZ (Zurich), Azienda USL Toscana (Massa). Tools adopted, among others are: Resnik 2013, AM-ULA; Hermansson 2005, ACMC; Light 2002, SHSAP; Bray 2001, AMPS.

meneutic issues, strongly related to the idea of social sustainability. Indeed, the hand research team involves a designer - who is also a tester - to improve the finishing concept design by considering also its aesthetic and social impact. The integration of contaminations coming from the Design and Humanities in the research flow, is fundamental to explore the relationship between prosthetic appearance and social sustainability, which already leverages on novel and unique self-interaction capabilities thanks to the adopted soft robotic approach.

Since no design literature is substantially available about the aesthetic and hermeneutic issues in prosthetic user satisfaction, a preliminary research was conducted on available studies, focusing - in particular - on the relation between users and their prosthesis and their social interactions. Interesting papers were found in the field of Biomedical Engineering and Rehabilitation area. The main issues emerging from the research in these fields, are factors associated with prosthesis acceptance or abandonment, prostheses rejection rates and psychosocial wellbeing related to prosthesis use. Some important statements emerge: Saradjian et al. (2008) observe that people's hands and arms are not only particularly important functionally, but socially as well. They are used for expression, communication and affection, with hands considered to be the second most individual and personal part of the human anatomy after the face, as already published by Ham and Cotton (1991) and Baumgartner (2001). Users describe an external shame and use the prostheses as a defensive behaviour to conceal their amputation as such they consider prostheses as an important help to manage social interactions (Saradjian et al. 2008).

Prostheses impact also in restoring the body image and improve functioning in a cosmetically acceptable way (Saradjian et al. 2008). Murray (2004) delineated two different approaches within the prosthesis's embodiment experience: those who have a strong emotional connection to it, experiencing the prosthesis as part of their body and those who merely intend it as a functional tool, no matter what it looks like.

Anthropomorphism is a raising issue, strongly related to social interaction, ensuring the prosthesis user to present himself in public, concealing his diversity. Often, the idea of normality is one of the first objectives to be achieved for the disabled people. Pullin (2009) - from a Design discipline point of view - reinforces this idea pointing out that in prosthetic limbs design field there are often two main approaches: the realistic and the functional one. The first is defined through the focus on human likeness, through the use of materials such as PVC and silicone and colours similar to the human skin. The second, the functional one, has its priority in functionality beyond appearance.

#### 4. A DICHOTOMY BETWEEN A MIMETIC VS NON-MIMETIC APPROACH

Often people experience a sort of repulsion against something that appears very similar to human (intended as life-like), but also is recognizable as alien. This phenomenon known as the Uncanny Valley in the research field of Engineering and Informatics helps in defining the idea of dichotomy between a mimetic and a non-mimetic approach in the finishing design for upper limb prostheses. Masahiro Mori, in the Seventies, proposed a model of relation between human likeness and people's comfort level: in general, more human-looking artefacts are perceived as more agreeable (comfort level), but this trend interrupts until testers experience artefacts that look so similar to humans that make them appear eerie, creepy (discomfort level). In his analysis Mori mentions directly prosthetic hands. Experiments let emerge that a natural look combined with an artificial feeling creates eeriness. This sensation is amplified by movements (such as unnatural dynamic dimension) and by other sensory aspects (tactile, such as material softness and temperature; or audible noises). This could lead to feelings related to fear and disgust. Other factors that could affect eeriness are proportions deviation from the human beauty standards, or colours and textures that evoke the idea of death. Poliakoff et al. (2013) let emerge that passive human-like cosmetic prostheses cause a non-familiar feeling and eeriness, while mechanical hands without any mimetic covering are considered less eerie.

Also, the state of art in upper limb prosthetic design can be divided in two different approaches: one oriented toward a mimetic, human-like design and another one that tends toward a non-mimetic design. It is possible to intend these tensions as opposing, as a dichotomy, as an issue that could be also managed by the design discipline. In these terms, the scenario of lower limb prosthetics has some interesting examples. The dichotomy between mimetic and non-mimetic approach seems to be partially overcome in prostheses for sport. Notorious examples are those such as the one worn by famous athletes as Oscar Pistorius or Aimee Mullins. In these kind of lower limb prostheses, design has found a form of conciliation between the formal aspects of technology (non-mimetic aspects) and the need of relation with the human body and its proportions (mimetic aspects). These prostheses transform the user's figure substituting the lower limb full mass with an elegant shapely gesture. Moriggi and Nicoletti (2009) confirm the social acceptance of these kind of prostheses keeping in relation aesthetics of prosthetics, technology and society<sup>9</sup>.

Keeping in mind that lower limbs do not represent a social interaction medium as important as hands, we ask the question: is it possible to search a mimetic vs non-mimetic dichotomy solution able to create acceptance and satisfaction in upper limb prosthetic users, comfort in social interactions and a society culture able to favour social integration? How can the designer's role be exploited - in complementarity with that of the engineers - to favor the cultural change towards a positive social acceptance of robotic prostheses?

<sup>9</sup>About the Pistorius case, Nicoletti defines it as the case that "has overthrown the ignominious prejudice of the amputee, transforming the impairment into a heroic virtue". The images of these athletes have travelled around the world, exalting the heroic aspects and leading to the idea of Superhumans, as presented for the promotion of the 2012 Summer Paralympics in London.

## 5. DISCUSSION: THE PROJECT'S DUALISM BETWEEN (DE)SIGN AND CULTURE

In the design community, it is traditionally welcome the idea that “objects have their own life, [...] in the sense that they reinforce social practices just as social practices reinforce them” (Molotch 2005). Also Miller (1987) rightly argues that while we shape things, things are shaping us. These ideas let emerge and assume the **consolidated bi-directional relation between individuals and objects/tools** (prostheses included!). While Miller (1987) underlines it from a cognitive and functional point of view, Molotch (2005) focuses on the (sociological) cultural point of view. So, prostheses - as all manufactured products - could be considered as composed by a tangible part - the (de)sign - and a cultural part (intangible). Both engineers and designers act on the tangible aspects of a product, designing its *materic* and formal characteristics that are experienced through perception. As Levi and Rognoli (2005) sum up, designers can manage the *significant potential of materials*. On the other hand, **design actions can be interpreted as cultural actions, mediated by perception**, understood as the way a concept is elaborated in human mind and then applied to mental reference frames (Pisano 1987). Rognoli (2005) links strongly the material expressive and sensorial dimension with the “*human's mind power in symbolizing*” that determines a reference culture and is objectified through perception. So, it is possible to assume that designers act on the sensorial level (through the “materic aspects” of the project), also by managing and redirecting perceptions towards aesthetic and functional values that contribute in qualifying a positive culture of a product. In the design community this project dualism has been often identified and theorised: the tension between **Form and Function** or the one between **Arts and Science** constitute basic principles. Moreover, looking at Humanities, Semiotics naturally balance these two elements: *signifier* and *meaning*. Van Onck (1994) affirm that a sign could not refer manifestly only to itself, but it constitutes an emotion's forecast. Continuing this design literature excursus, Pisano (1987) confirms these two aspects of the project, describing human-environment interactions. On one side there are *Physical interactions* (dimensions, shape and surfaces) and *Sensory interactions* (related to human senses, as sight, hearing and touch, with all the implications of their physiological apparatus). While on the other side there are described *Informational interactions* (as the conscious phase of perception) and *Cultural interactions* (referred to hierarchies of values and models, emerged from the accumulation of human experiences along its anthropological, social, generational and individual history).

Lastly, for the purpose of this paper it is very interesting to consider what is defined as the iceberg model of the ergonomic research which identifies different aspects of a project and places them on a pyramid with a submerged part, the metaphor of the iceberg. The visible (and tangible) part refers to usability, while the submerged part (intangible) refer to pleasantness that includes, among others, needs, desires, aspirations, emotions, dreams and attitudes. Pleasantness - investigated mostly by Human Factors studies can - in turn - be defined as social, psychological, ideological or physiological, according to the typology of involvement (Jordan 1999). Trough decades, design literature referred to these two different aspects of a project, the more tangible one, that designers could affect, and the less tangible one that is possible to generate thanks to the interaction with users (culture).

## 6. CONCLUSIONS

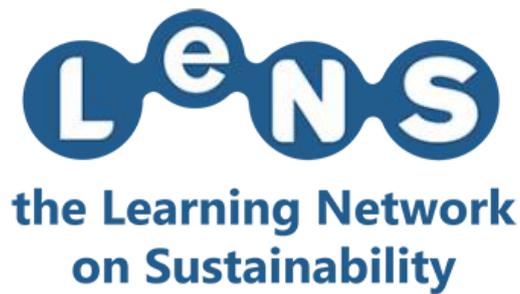
The previous theoretical analysis reveals the need of more in-depth studies where the design discipline could offer specific skills and tools to manage these emerging issues in designing upper limb prostheses. The design discipline could act as a process facilitator (Manzini in Rizzo 2009), offering specific tools to handle more intangible consequences implied in the design of innovative upper limb robotic prostheses. More and more frequently, designers are called to manage these aspects and use participative tools to brief and inform the design process, based on the User Centered Design approach. This approach could handle and inform the design process about the complex interactions emerged from this paper, using qualitative and contextualized tools, such as interviews, design probes, and more (Fossati 2018) in: (1) dashing the social contexts of prosthetic users; (2) deepening users' needs, desires and expectations about prosthetic design, in line with the concept of pleasantness (Jordan 1999) and intending the prosthesis is an intimate extension of the body (Biddiss et al. 2007). This kind of research could merge and deepen also researches about self-interaction and the body image theories; (3) deepening and conducting field research about social acceptance. Starting from the idea that an upper limb loss could no more concealed, but inspired by technology, the finishing/covering design aspects are being investigated in experiments by the IIT and Pisa design teams. Figures show the hand naked, without any finishing. Two different product concepts are currently being developed: one that looks at the mimetic prosthesis finishing design and a meta-mimetic one. Engineers and designers are currently testing the hand looking for better grasping, applying an empirical ergonomic approach to ameliorate usability. To improve grasp efficiency, preliminary findings suggest improving grip and increase contact surfaces between the hand and different objects. Moreover, usability is also intended to guarantee users safety, decreasing the user's postural compensatory movements. To this aim the prosthesis has to be considered as a part of a larger complex system which includes also the human body, the environment, real life objects and typical tasks. These experiments are intended to generate design guidelines for the covering/finishing design. On the other hand, to deepen the aesthetic perception of prostheses in society (non-disabled people, users or potential users) we developed a quali-quantitative survey composed of prostheses images (visual stimuli) and includes questions about feelings and emotions (differential semantic approach referred to adjectives used in the Uncanny Valley Model and the Stereotype Content Model).



[Figure 2] The SoftHand adaptable grasp, in black and clear hand version.

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## **DESIGNING SUSTAINABILITY FOR ALL OR CO-DESIGNING SUSTAINABILITY WITH ALL?**

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### **ABSTRACT**

The paper discusses the critical difference of modernist approach of designing for- and increasing approaches of designing with- or across-, in this case with/across the overall eco-system. The research aims to engage all possible agencies in urban environment for its shift from Anthropocene. Such attempts resulted in ratification of its own design field called Systemic Approach to Architectural Performance. The research by design is generated through real life community trans-disciplinary observations, gigamapping, full-scale prototyping and their performance reflections and re-designs, being called the 'real life co-design laboratory'. It is achieved through two layers: engaging the communities at place with prototypes as well as placing parametric recipes for DIY online. The prototypes are therefore also exhibits with QR codes leading to the DIY recipes to be locally adapted for specific parameters. This work is therefore oscillating between the 'bottom up' and the 'top down' approach, targeting the local specific communities worldwide.

Key Words: systemic approach to architectural performance; post-anthropocene; co-design; diy

## 1. INTRODUCTION

With Joachim's positivist designers foreseeing of sustainable futures perspective (Joachim, 2015), the newly ratified design field of '*Systemic Approach to Architectural Performance*' (SAAP) (Davidová, 2017) is focusing on a shift towards Post-Anthropocene in build environment through real time and real life actions. Dealing with complexity of real world happening in real time, it is '*resisting reduction*' (Ito, 2017) through so called '*real life co-design laboratory*' (Davidová, Pánek, & Pánková, 2018). There has been discussed similar notion of so called '*real-world laboratory*' or '*real-world experiments*' and similar concepts that are also engaging co-design through full scale prototyping are already meeting commercial architectural practice, such as Helen & Hard studio from Norway, Stavanger (Stangeland, 2018). However, such co-design processes are distinguished from the '*result*' and are final end product solution and result oriented (Bernert, Haaser, Kühl, & Schaal, 2016). This gives the end to the co- and re-design processes at the moment when the concluded proposal starts meeting the '*real life*'. There is therefore a critical difference between co-designing for- and co-designing with- and between real world and real life design. The second notions, respectively, are achieved in and through real time interaction and the end product is the generative real time and real life process itself. The discussed work is grounded in '*Performance Oriented Architecture*' and its '*non-anthropocentric architecture*' (Hensel, 2013), approached through '*Systems Oriented Design*' (Sevaldson, 2013). It is integrating into it such processes like '*anticipation, sensing, curation, collaboration, production, interaction, mobilisation, measures, adaptation and incubation*' for achieving '*ecological urbanism*' (Mostafavi & Doherty, 2016b, 2016a) within cultural landscape. Said in other words, the real life cultural environment adaptation towards Post-Anthropocene.

Performance in architecture was reformulated by Hensel as a driving concept for design that helps re-consolidate form and function into a synergetic relation with the dynamics of natural, cultural and social environments, and in so doing, locate performative capacity - '*active agency*' - in the spatial and material organisation of architecture, in the human subject and the environment through the dynamic interaction between these four domains (Hensel, 2010). However, this very progressive work, though focused on full scale prototyping and the prototypes performance, has been also struggling with the issues discussed in the above paragraph. It is ending in the moment when the so emphasised '*active agency*' starts taking place in real life.

Systems Oriented Design employs such '*active agency*' within its '*rich design research space*'. The Rich Design Research Space concept takes into account the physical, social, and cultural spaces, and the virtual and visual media spaces in which the research-by-design takes place. It is an integral approach to design that embraces many types of investigation, from analytical to intuitive and is to be reflected upon (Sevaldson, 2008). This work is fully integrating and transferring the above concept into the real life, in real time.

The fusion of the two above fields that is engaging '*Time-Based Design*' (Sevaldson, 2004, 2005) resulted in its own hands on real life co-design field, Systemic Approach to Architectural Performance. The meeting of the real time and real life world is achieved through generative agenda of '*prototypical interventions*' (Doherty, 2005) that aim for large output out of rather small but targeted generative input across the eco-system<sup>1</sup> within local specific environment<sup>2</sup> (Davidová & Prokop, 2018; Davidová & Zimová, 2017, 2018). Such field considers all co-living and co-performative generative processes as the co- and re-designed time based generative '*results*' that go even far beyond the life span of the initial interventions and is taking an active role in co-performing biosphere<sup>3</sup>.

## 2. CASES OF CO-DESIGN

This research by design is generating theory through, mainly not for profit, experimental practice. Therefore, many of the processes are not theoretically structured when occurring in real time. They are speculated and afterwards reflected upon and structured. This paper is one of such attempts that is to structure and define several cross-referenced generative co- and re-design types occurring within SAAP. This involves: 2.1. Speculative Co- and Re-Design; 2.2. Interventionist Co- and Re-Design; 2.3. Broadening Co- and Re-Design; 2.4. Feedback Loop Co- and Re-Design; 2.5. DIY Co- and Re-Design.

### 2.1. Speculative Co- and Re-Design

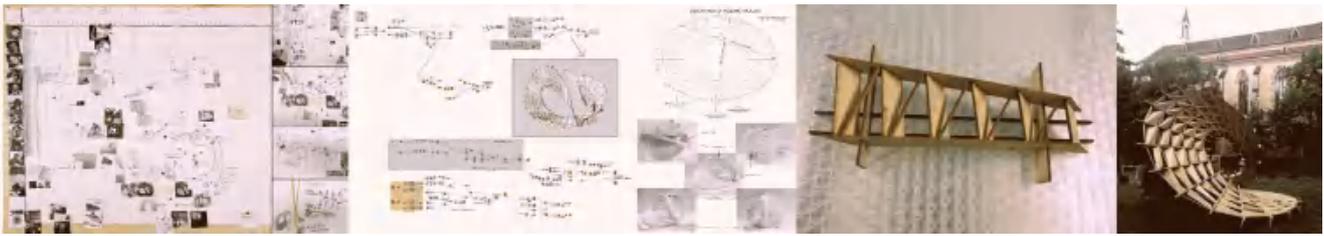
When dealing with sustainable design processes, their design tools are usually reduced to massive technological simulations and this have critical effect on the design itself (Thuvander, Femenias, Ollár, & Unterrainer, 2018). Speculative co- and re-design tries to avoid this through creative collaborative trans-disciplinary mapping of relations and investigating of what could be done. It usually takes form of gigamapping, visualising complex design of what it ought to be complexity (Sevaldson, 2018) and analogue and digital model making and prototyping (see Figure 1).

<sup>1</sup> Ecosystem was described by Allen and Roberts as an ecological system inside the system that includes the geophysical part. (Allen & Roberts, 1993)

<sup>2</sup> 'Environment is physical and biological surroundings of an organism. The environment covers non living (abiotic) factors such as temperature, soil, atmosphere and radiation, and also living (biotic) organisms such as plants, microorganisms and animals.' (Oxford University Press, 2004)

<sup>3</sup> Biosphere is 'irregularly shaped envelope of the earth's air, water, and land encompassing the heights and depths at which living things exist. The biosphere is a closed and self regulating system (see ecology), sustained by grand scale cycles of energy and of materials—in particular, carbon, oxygen, nitrogen, certain minerals, and water. The fundamental recycling processes are photosynthesis, respiration, and the fixing of nitrogen by certain bacteria. Disruption of basic ecological activities in the biosphere can result from pollution.' (Lagasse & Columbia University, 2016)

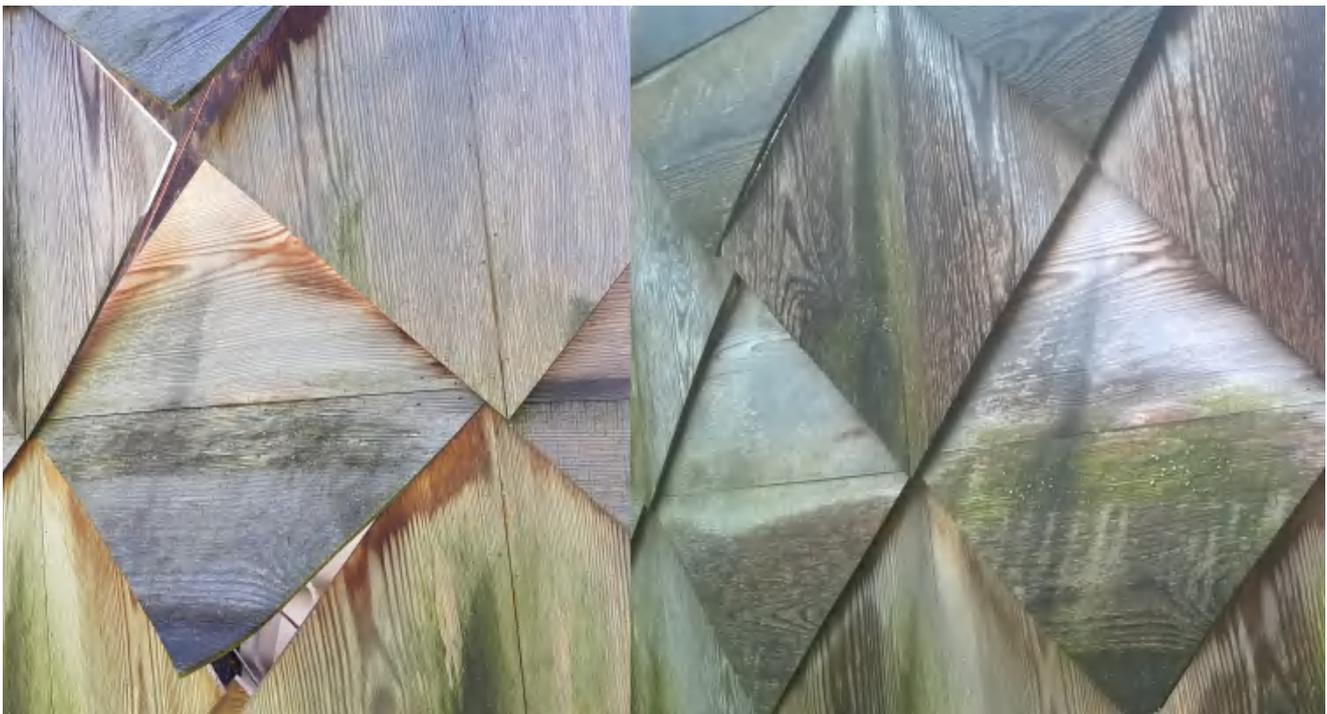
Different agents within these processes can usually keep on their tools' preferences and/or their combinations. This would be where typically the design process ends with the result that would be potentially realised and then left alone by its designers as discussed in the introduction. This is certainly not the case in Systemic Approach in Architectural Performance.



[Figure 1] Design Processes of bio-climatic responsive wood Loop Pavilion that was collective work of a studio at the Faculty of Art and Architecture at the Technical University of Liberec (FUA TUL) and the Faculty of Forestry and Wood Sciences at the Czech Technical University of Life Sciences in Prague (FLD CZU, led by Collaborative Collective and ARCHWERK. See from left to right the gigamapping process, digital modelling, analogue conceptual model sketching and working prototype for building technique of one rib from the pavilion's structure and the full scale prototype (photos and images: Pokorný, Prokop, Novotná, Hula, Kopecký and Okamura 2014)

### 2.2. Interventionist Co- and Re-Design

Interventionist co- and re-design takes on the generative and performative agenda of the full-scale prototype in real life environment across its eco-system. The prototypes give rise to cross-species opportunistic use of eco-systemic services, such as climate comfort (hygroscopicity of wood and air flow due to warping), clearing of air pollution (the algae and the wood's clearing capacities in case of air flow), urban furniture (the pavilions serve for people and animals), habitation (algae, plants and insects), nutrients (sugar in wood and blossoming plants on or around some of the prototypes, insects as a food source for birds and bats), etc. The performance of such services is however co-designed through integration of interaction across both, living and non-living, biotic and abiotic, agents (see Figure 2 Figure 4).



[Figure 2] Responsive solid wood screen Ray 2 co-performing with relative humidity, algae moisture sorption and temperature. The responsive wood panelling is moderating micro-climate: either producing humid air flow through its warping and moisture evaporation in hot and dry weather or sorping and enclosing it in humid and cold situation. This is moderated by algae moisture sorption: larger warping when dry and hot, prevention of warping in opposite direction when it rains. (photos: Davidová 2018 and 2017)

### 2.3. Broadening Co- and Re-Design

The prototypes' performance can be further on co- and re-designed by their performative and opportunistic users (see Figure 3). This can be supported by public festivals, where multi-genre and multi-disciplinary performers/agents are invited to improvise their prototype's and/or project's performance and use interpretation. Such opportunistic performances and uses have well developed in traditional architecture, specifically in extreme climates. This is because such opportunities were investigated and tested in harsh eco-systemic context over generations (Davidová & Raková, 2018). This includes but is not limited to climatic, socio-cultural, political, wealth and natural parameters of the eco-system. Extensive use and performance observations intensified by public events help to support rapid learning process since as much of the knowledge has been forgotten as well as in current times, we are experiencing rapid fast changes within all above listed parameters.



[Figure 3] From left to right different performers and users interpreting the performance of prototypes pareSITE, LOOP and TreeHugger at festivals reSITE 2013 and EnviroCity 2014 and 2017 (photos: Pedersen, Vajdová, Novotná, Škuta and Carrithers 2013, 2014 and 2017)

#### 2.4. Feedback Loop Co- and Re-Design

The built full-scale prototypes are of means of the true notion of what is the prototyping meaning. This refers to not only the performative capacity but to testing the prototypes' performance and experiencing failures in real time and real life to update further research by design development. The real life interaction, that is usually referred to as 'weathering' (Mostafavi & Leatherbarrow, 1993), is investigating the prototypes' experiments, performances, generative development, transformations and/or disintegrations over time and within real environmental conditions (see Figure 4). There is a 'reflective practitioner' (Schön, 1983) feedback loop amongst successes and failures when meeting real life environment that leads to both bettering our intuition as well as collecting soft and hard data to inform future designs or to update the existing ones. This specifically becomes critical when it comes to performance of the material that is of biological basis. Such performance of the material like wood largely develops over time (Davidová, 2017; Dinwoodie, 2000; Skaar, 2011).



Figure 4: Different life stages after extensive weathering of wood responsive prototypes from left to right: a responsive screens Ray 2 after five years and a Ray 3 after three years, both inhabited by algae, lichen and blue stain fungus (the Ray 3 screen has washed out sugar by salt for preventing an interaction with decaying species); responsive pavilion pareSITE after one and half year of struggling with the interaction of torqued forces within the geometrical structure of Möbius strip with weather extremes of two summers and one winter; a collapse of the LOOP responsive wooden pavilion after the gardener ignored the requirement of turning of the sprinklers that watered the sunny oriented half of it in arid season (the pavilion was afterwards rebuilt at different location) ; and a responsive insect hotel TreeHugger CZ after one and half year fully co-performing with surrounding eco-system, being inhabited by both insects and algae. The prototypes were built within the framework of Collaborative Collective, Defio, s.r.o., Oximoron, Re.Code.Nature, ARCHWERK, Architectural Institute Prague, FA TUL, FLD CZU and CoLAND (photos: Davidová and Novotná 2014-2018)

#### 2.5. DIY Co- and Re-Design

When receiving temporary commissions with unsafe development futures, their opportunities of reaching generative agendas had to be rethought. Therefore, the 'do it yourself' (DIY) generative concept was investigated and developed. The concept of tagging public space with QR codes did not appear purely by itself. It was learned from VR and AR games taking place at the festival EnviroCity (Davidová & Kernová, 2016) events where such interaction was necessary to reach the individuals' media. Realising we can connect the physical landscape with the digital, it clearly opened a discussion of possible co-creation opportunities, going beyond the scope of the festival itself. At that moment, we started placing out our DIY manuals and downloadable parametric codes on our blog (Davidová, 2016). The blog links in the form of QR codes were since then engraved or attached to our prototypes or just simply marked at different fairs events (see Figure 5) or published at professional web sites such as Rhino News (Davidová, 2018). Such way, the research by design is offering generative prototypes globally under the Non-Commercial Use and Modification Creative Commons Licence (Creative Commons, 2017) with the opportunity of local specific adaptation of the initial concept of the 'schools of thoughts' (Hensel, 2015).

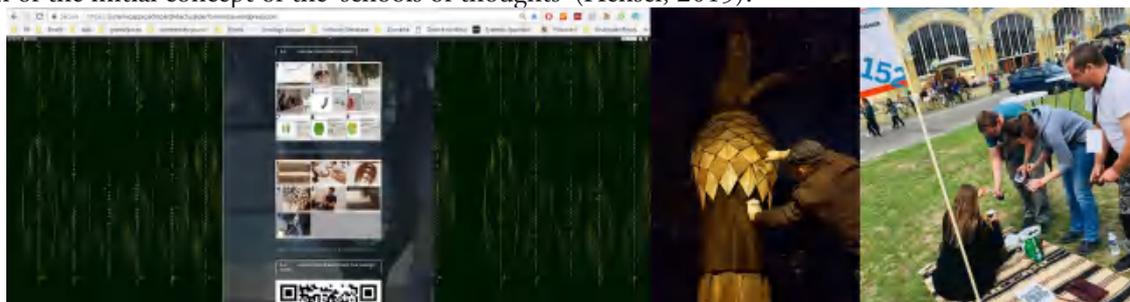


Figure 5: From left to right: A blog for DIY for TreeHugger CY with downloadable code, explaining the adjustments of local specific parameters; Our colleague from Collaborative Collective Ondej Michálek, updating TreeHugger CZ with engraved QR code after public request noticed within the community and on social media, like Facebook; Maker Faire Prague 2018 Cross-Species Eco-Systemic Refreshments Station offering DIY seed bombs of honey producing species and QR code leading to the DIY recipe of 'fast food restaurant for birds and bats', the TreeHugger insect hotel. (images and photos: Davidová and Horák Goryczka 2018)

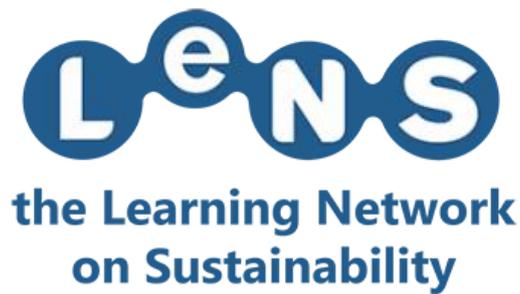
### 3. SUMMARY AND CONCLUSIONS

The above experimentation aims in and investigates co-designing sustainability with All - not for All – as an active agency that is co-performing in real life. This is targeted to be tested and achieved within ‘real life co-design laboratory’ because this is where we attempt to reach such co-performance and there is not always a reason and nor the time to only speculate, neither there is better and more relevant ‘laboratory’ that could test and approve the speculations. Such co-performances occurring within the ‘real life co-design laboratory’ are therefore to be co-created in real time across overall real life environment with both living and non-living, biotic and abiotic, agents. This is because humans are part of- and operate within- the overall ecosystem and they cannot shift from the Anthropocene alone just through the logics of the therm. Equally, it is not possible to reach such shift without the humans. This is because we cannot reach environmental justice without social justice and vice versa (Davidová & Zímová, 2018; Haase, 2017; McIntyre-Mills, 2014). The sustainability needs to be achieved by flourishing through and across All (Ehrenfeld & Hoffman, 2013). The exemplified prototypes’ real life co-performance co-creation to my believe illustrate well the situation of prototypical generative interventions. Life is not occurring in separate parameters and in static time. Holistically speaking, without ‘doing’ the shift towards Post-Anthropocene ourselves - means DIY - and together whilst involving All - means collaborative co-creation across the eco-system and biosphere – and mediating the ‘bottom up’ and the ‘top down’ approaches, we can never achieve sustainable environment adaptation of the cultural landscape we are living in and wish to survive or even flourish in.

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## **DESIGN FOR SOCIAL INNOVATION WITHIN A VULNERABLE GROUP. LESSONS LEARNT FROM THE EXPERIMENTATION VIVICALUSCA IN ITALY**

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### **ABSTRACT**

This contribution outlines the project ViviCalusca as an experimentation of enhancing social innovation within a vulnerable group in Milan, living in a public housing located in Vicolo Calusca. The aim of the project was to overcome their situation of fragility by engaging them in various activities and applying a set of diverse approaches and techniques, coming from theatre, sociology and design.

As researchers in design for social innovation, we mainly used co-design and service design methods and tools: more precisely we planned a path of light co-design sessions to activate a sustainable micro-economy of exchange and gift among people in the neighbourhood.

This project led us to reflect upon our contribution as designers within a group with such a level of social vulnerability: we understood that the co-design process itself was more important than results, as it worked better as a form of community engagement rather than producing effective 'design' results.

Key Words: Design for social innovation, service design, collaborative services, vulnerable groups.

## 1. BACKGROUND KNOWLEDGE: SOCIAL INNOVATION, VULNERABLE GROUPS AND POSSIBLE DESIGN CONTRIBUTION

In recent years, the concept of social innovation has become highly popular in different domains, raising the interest of policymakers, economic leaders, researchers and multiple types of organisations. Social innovation is widely recognized as a possible solution to tackle the most urgent challenges of our era and this popularity also generated a stress of the notion, stretching social innovation in so many directions that it is at breaking point (Grimm et al., 2013).

In this paper we specifically consider one possible definition of social innovation, developed within the European project SIMPACT, and characterised by an explicit connection with the notion of vulnerable groups: “a novel combination of ideas and distinct forms of collaboration that transcend established institutional contexts with the effect of empowering and (re-)engaging vulnerable groups either in the process of social innovation or as a result of it” (Rehfeld et al., 2015 p.6). Hence, this conceptualisation places emphasis on vulnerable and marginalised groups who are not able to fully participate in the economic, social, political and cultural life of the society.

Italian sociologist Costanzo Ranci analysed the current characteristics of social vulnerability, distinguishing between ‘old social risks’ (mostly connected with middle or old age) and ‘new social risks’ which do not affect only personal incomes, but also more complex aspects such as housing deprivation, unstable employment, tensions between work and childcare and the living conditions of the elderly. This means to reflect on solitude and isolation, on the integrity of relations between generations and the reorganisation of families around caregiving activities (Ranci, 2010). More specifically, vulnerable groups are those people who are more exposed to instability and weak integration in society: “it is from the instability of the social position occupied that the notion of vulnerability draws its relevance” (Ranci, 2010 p. 17).

The Vivicalusca project, which is the main object of this paper, was developed precisely to produce and answer to the local conditions of exclusion and instability of a vulnerable group: the community of inhabitants of the public housing located in Vicolo Calusca in the Italian city of Milan. In this context, social innovation may be considered as a possible solution to support the empowerment of a vulnerable group. According to the SIMPACT research, “social innovators develop products, processes and services linked to the development of social competences (empowerment) within these vulnerable groups in order to reduce their vulnerability, that is, the degree of exposure to the risk of structural exclusion” (Castro Spila, Luna and Unceta, 2016 p. 6). As researchers in design for social innovation, our contribution to the Vivicalusca project was to use our competences to promote “a constellation of design initiatives geared to making social innovation more probable, effective, long-lasting and apt to spread” (Manzini, 2014 p.60). More explicitly, to use design approach, methods and tools to engage people in a process of activation and possible re-inclusion.

During the whole project we adopted an approach known as community-centred design (Meroni, 2008): this approach provides for the presence of designers in the community for long enough to activate particular initiatives, creating a common and shared aim, enabling the community itself to pursue a path of innovation.

In particular, we used our competences in service design and co-design as our aim was to activate a micro-economy of exchange and gift among people of Vicolo Calusca. In fact, according to Manzini (2015), when dealing with design for social innovation, service design and co-design seem to be crucial: the first one focuses on the quality of interactions and possible relations, the second one focuses on the enactment of pluralistic processes that may contribute to build a community (or to reinforce it). Hence, in this scenario, design for social innovation (meaning a combination of community centred-design, service and co-design) was experimentally adopted to improve the conditions of a vulnerable group, enabling them to follow a path of activation beneficial on one side to overcome isolation and on the other to set favourable conditions for making things happen, from simple collective activities to actual collaborative services.

## 2. CONTEXT: VICOLO CALUSCA AND THE PROJECT VIVICALUSCA

The public housing complex of Vicolo Calusca is located in Corso di Porta Ticinese, in the very centre of Milan, and it consists of 162 apartments inhabited by 234 residents. The majority of residents is composed by elderly people who were originally migrants from South Italy and have lived in the neighbourhood for several years, then there are newly arrived migrants and few families. Some inhabitants are disabled and others are former inmates.

Most of the residents of Vicolo Calusca experience some of the problems that Ranci (2010) identified as distinctive of social vulnerability: integrated poverty, housing deprivation and critical living conditions in the elderly age. In particular, this last problem is the most diffused, because of a reduction in the informal care provided by families, a high number of elderly living alone, the presence of dependent people who require long term care assistance. According to Ranci (2011), the condition of vulnerability is characterized by a state of weakness which exposes a person to suffer negative consequences if a problematic situation arises. The elderly are vulnerable because they are highly exposed to damage: for example, dependent people may suffer severe impoverishment if they are alone or have no access to care services. A condition of vulnerability is experienced also by some migrants and families living in Vicolo Calusca, even if their degree of exposure is mainly due the instability of their situation, as they have insecure jobs and experience difficulties in the reconciliation of working and childcaring.

This diffused situation of social vulnerability in Vicolo Calusca is not ignored by local authorities who attempted to provide some services: within the complex there is the CAM office of the area (CAM stands for Multi-functional Aggregation Centre, it is a public service aimed at social participation and the development of recreational, cultural, educational and sporting activities accessible to all age groups). There is also a social housing service (from the Social Policies Department) which provides specific assistance to the elderly, responding promptly to requests for any kind of help and accompaniment.

In addition, in 2017, the Cariplo Foundation (a local philanthropic organisation funding projects that helps social and civil organizations to better serve their own community) issued a call for action specifically for the public housing complex of Vicolo Calusca, with the purpose to enhance the social cohesion of residents, create networks of solidarity between the inhabitants and overcome their condition of loneliness and fragility.

A consortium of partners composed of the local association 'Collaboriamo', the theatre company 'Le Compagnie Malviste', the research group of sociologists 'TraiLab' from Università Cattolica del Sacro Cuore and our research group POLIMI DESIS Lab, expert in design for social innovation from Politecnico di Milano, won the competition presenting the project ViviCalusca.

ViviCalusca was a 15-months project aimed at engaging and empowering the community of inhabitants of Vicolo Calusca. The project built upon the existence of an important collective space within the complex Vicolo Calusca, named 'Cohub' and owned by the Municipality of Milan. Collaboriamo, who was the coordinator of the project, run this space, with the objective to transform it into an actual community hub, a place for collecting the needs of the condominium and where to put in place collaborative solutions, sharing resources, skills and time. The Cohub was a small space placed in the courtyard of the condominium and it worked essentially as a venue for events and workshops dedicated to sharing economy, but, actually, residents of Vicolo Calusca did not consider that space as an asset to improve their daily life. We may say that residents neither considered the courtyard as a collective space. The inhabitants of Vicolo Calusca did not know each other, did not frequent each other, did not live the life of the courtyard. Hence, in the first phase, the ViviCalusca project attempted to organise a set of events and engagement activities to make people meet and socialise. This phase was in charge of Le Compagnie Malviste who applied a set of theatrical approaches and techniques to facilitate meetings and share moments.

Our work as design researchers should have come later, once the community was 'established', or, at least, once a group of more active people emerged to start a path of co-design sessions and develop some collaborative services to facilitate the daily life of the condominium. Actually, the first engagement stage needed much more time than expected: we may say that the whole project ViviCalusca was dedicated to this phase. There was a total lack of social cohesion, that, combined with the condition of social vulnerability, made the work of Le Compagnie Malviste more arduous and longer than planned.

During this phase we understood that our contribution as designers needed a strong revision, also because we discovered that numerous people had problems with literacy and cognitive engagement. Our aim was originally to support residents in developing sustainable collaborative services, in which users become co-creators and co-producers of the service (Jégou and Manzini, 2008). But, given that situation, it was impossible to plan intensive co-design workshops and use traditional service design tools as we already did in previous projects with other communities.

In the next paragraph we will describe how we adapted our methods and tools to this peculiar situation and, in doing so, we learnt important lessons on our role and contribution as design researchers in social innovation.

### 3.PROCESS: A SET OF LIGHT CO-DESIGN ACTIVITIES TO ACTIVATE A LOCAL EXCHANGE AND GIFT ECONOMY

Given the complexity of the context and the limited inputs collected within the first phase, the entire set of activities organized by POLIMI DESIS Lab were conceived as 'reflective attempts', meaning that we used a deductive approach and we were learning-by-doing (Schon, 1984). From time to time we were continuously learning something from the community and reflecting back in order to improve our next interventions in terms of efficacy.

Our primary contribution in the project ViviCalusca came right after the phase of general mapping of the context (resources, actors and places). The first activities that we organized were devoted to identifying possible areas of opportunities to activate collaborative services, social events or different sort of exchanges. We called this activity 'Ideas Stand' because was conceived as a stand where passers-by could stop and share their preferences among a set of ideas that we suggested. The stand was set up in the patio in front of the Cohub space, so as to be in a visible and transit area where to attract the inhabitants without excessive insistence or intrusiveness. We also made it look attractive, placing lights and small rewards for the contributors, in order to create a pleasurable experience, being aware that "attractive material and good food are crucial factors for the successful undertaking" (Meroni, Selloni and Rossi, 2018 p.160).

Building upon multiple case studies identified both within the context and outside, we elaborated a series of scenarios of activities that could be carried out in the neighbourhood. The scenarios depicted included: neighbourhood tours, neighbourhood living room (e.g. meeting space, reading groups, drawing), small domestic exchanges (e.g. help with shopping, small repairs), courses in handicrafts (e.g. embroidery, knitting, jewellery), dance groups, entertainment events (e.g. sporting events, cinema in the courtyard), cooking and eating together (e.g. cooking classes, neighbourhood dinners), second-hand market (e.g. flea market, clothes exchange), walking groups (e.g. mountain walks). We represented each scenario with a 'card' consisting of a representative image and an explanatory title so

that the cards could work as ‘boundary objects’ (Star, 1988; Ehn, 2008) that, through evocative representations could stimulate the imagination of the participants.

The co-design activity basically consisted in involving the passers-by in expressing a preference among the scenarios and order the set of cards according to it on a board. The ‘Idea Stand’ represents an example of co-design activity that has been developed to facilitate a participation which was playful and not too demanding in cognitive terms and timing. It can be defined as ‘street co-design’ (or rather, ‘courtyard co-design’), in the sense that no specific appointment has been given to people, who were asked to carry out simple activities in an unconstrained and conversational manner.

The ‘Ideas Stand’ was repeated during the event ‘Light up Calusca’ held in May 2018. The whole event was aimed at starting to connect the whole community through a collective performance led by Le Compagnie Malviste. Since the event attracted and engaged a lot of people of the community, it was a favourable occasion to replicate the stand.

With the ‘Ideas Stand’ we managed to collect contributions from 30 people overall, which is not significant considering the total amount of people living in the condominium, but, given the general situation of distrust and diffidence, it may be considered as a relevant number. In general, the qualitative insights gathered were more interesting than the quantitative ones: the most important result that the entire project team acknowledged, was the success of the party-event held in May. From that experience, we noticed that the most pressing need of the community was precisely ‘to be engaged in something’ and that the activities they received with greater enthusiasm were the entertainment activities organized by third parties, in which the active participation of the inhabitants is limited.

Starting from this first understanding, we downsized again our second intervention, aimed at mapping resources and actors. Since we realized that the engagement of the group could hardly be stretched to proactive initiatives, we designed a tool to collect those ‘talents’ owned by the community, useful to shape a first prototype of a micro-economy of exchange. We called this activity ‘Talent Board’. It took place in July 2018 during one of the weekly meetings coordinated by Le Compagnie Malviste and the social operators at the Oratory of the Church of Sant’Eustorgio, frequented by people who live in the neighbourhood. The activity consisted in the compilation of a card, the ‘Talent card’, on which each participant wrote his/ her own ‘talent’, understood as a competence that could be made available to others. The talents were intended as simple abilities such as cooking, sewing, teaching how to use a device and other sorts of domestic help. In the same way the ‘cards’ aimed at collecting what each one wanted to learn from the others. We collected all the filled card and hung them on the ‘Talent Board’ panel in order to start a discussion on possible exchanges, thus creating combinations. The exchanges included one to one and collective activities.

A total of 19 people took part to the ‘Talent Board’. Most of them were local residents over 65 years old and a group of girls, around 20s, from a host community not far from the project area.

One of the most interesting perspectives that emerged was that of a possible intergenerational exchange of skills between these two groups. According to this hypothesis, the older population of the neighbourhood could benefit from the support of the girls in improving digital skills and in the performance of daily tasks. The girls of the community, in return, could learn cooking tricks and practice conversation in Italian.

The value of the exchange, in this sense, has to be found in the interweaving of relationships rather than just in the skills and thus becomes a vehicle for social integration and light community activation.

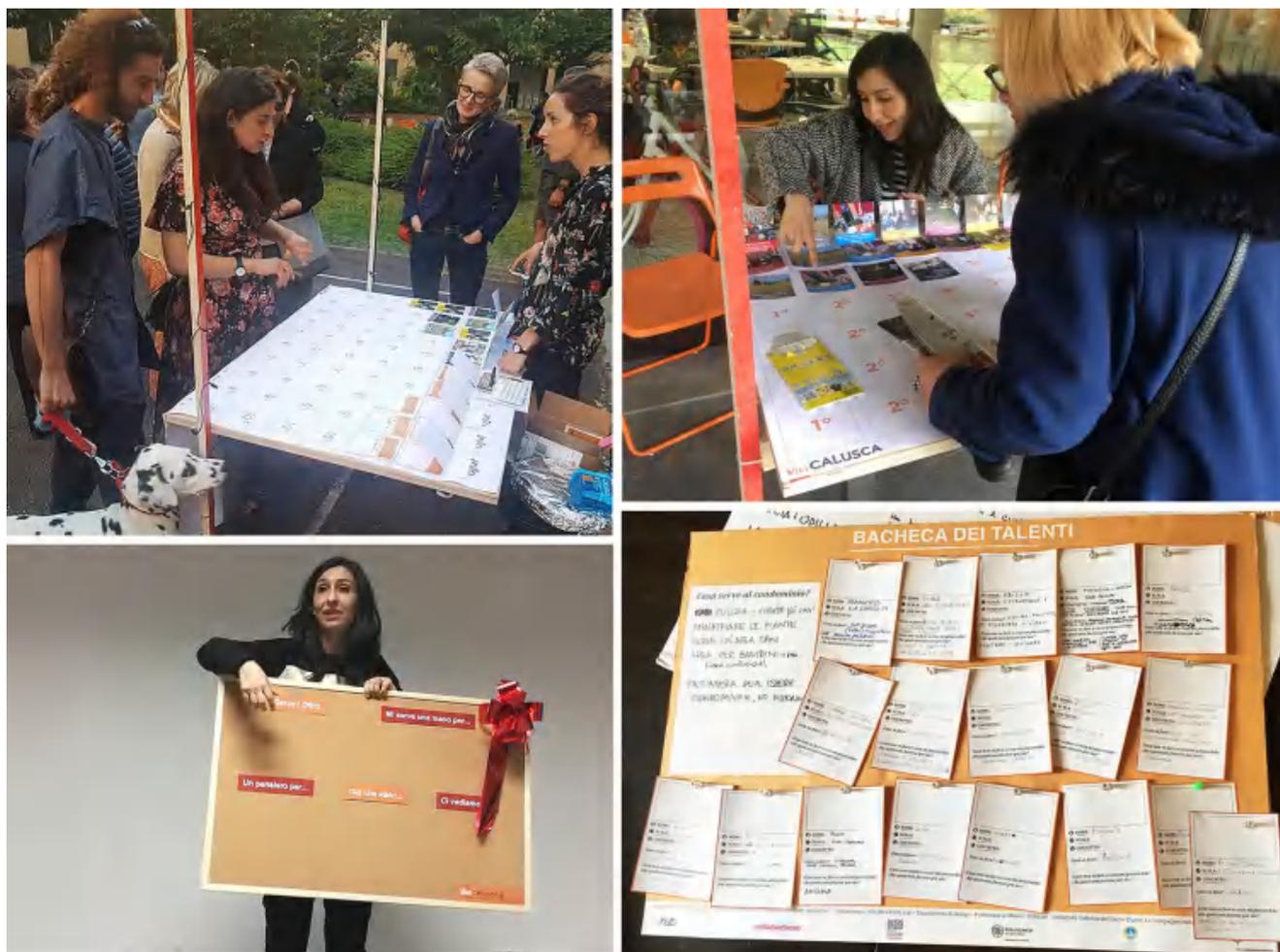
If in the described activity the notice board have been used in a metaphorical sense to stimulate the emergence of people’s talents, in the last phase, the notice board has become a physical object that can support and stimulate the interactions of the inhabitants. The notice board was organized according to precise categories, decided on the basis of previous experiments and also thanks to the creative conversation between the various partners of ViviCalusca and the social operators. The categories were:

- ‘Search/Offer’: it stimulated the search and the offer not only of objects, but also of activities and commissions.
- ‘Since I’m going...’: meant to become a ‘collector of requests’. For example, when a person goes to a place which is not easily accessible, he/she can notify it in and carry out a task for someone else.
- ‘See you in...’: the inhabitants are reminded of the next appointments organized by the social operators or other organizing bodies.
- ‘A thought for ...’: a more emotional category, useful to remember various occasions such as birthdays, deceased, days of memory or even simply a thought of support for those who are in difficulty.

The delivery was organized as a conclusive and symbolic moment during the closing event ‘Viva Calusca!’ on December 12th, 2018. The notice board was then placed in the concierge of the complex of Vicolo Calusca, with the intention of making it a real support and accelerator of potential collaborative services: the categories proposed, in fact, are mostly functional principles of gift and exchange economy, which, when properly implemented, can be transformed into efficient, effective, durable collaborative services and especially facilitators of social relations (Star, 1988).

#### 4. CONCLUSIONS

The main lesson learnt from the ViviCalusca project is that methods and tools of co-design and service design may be applied not necessarily to reach specific design results, i.e. a set of effective and efficient services. This is the main evident scope, but there are other secondary aspects that, in this project, became instead central, and they are all related to an adoption of co-design as a form of people engagement. Hence, the stress is on the co-design process itself, rather than on results.



[Figure 1] Some images from the 'Ideas Stand' and 'Talent Board' co-design activities

This reflection on the significance of the co-design process has been already developed by one of the authors in the final chapter of her book, 'CoDesign For Public Interest Services' (Selloni, 2017). She outlines a set of possible extensions of the value of the co-design process, ranging from considering it as a form of citizen empowerment, to regarding it as an important pre-condition to co-production, as a way for exercising democracy, or as a potential (social) innovation process etc.

The co-design process carried out within the ViviCalusca project consisted of a set of very simple activities in which the most relevant aspect was the mere fact of having performed them, therefore on what happened. This was important for the inhabitants, who were involved in something easy but new for them, and, above all, it was crucial for the social operators who worked in the complex since long time. This last aspect became clear at the end of the project, during the conversations among the partners of the consortium and such operators (essentially municipal workers from CAM office and social housing services) in which we became aware that our design activities brought innovation and vivacity in their traditional way of doing community engagement.

From the other side, the development of the project led us to reflect on our role as designers in such contexts. In order to be impactful and enable the effectiveness of the exchanges proposed, a longer time dedicated to the creation and cohesion of the community should be foreseen. Moreover, we realized that the co-design activity can be performed effectively just if supported by the social operators that act as mediators. Alternatively, we must acknowledge that we become actual social operators and we should determine if we are interested or not in using co-design to engage people in a process of activation and possible re-inclusion. And, if so, we should investigate if we own the skills to do that or we need to acquire specific social mediation skills and, thus, to enrich our set of competences and be aware that the focus is on the (social) process and not only on the effective (design) results.

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## **SUSTAINABLE DESIGN IDEA FOR ALL PEOPLE**

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### **ABSTRACT**

In today's society, in addition to the material aspect of supporting human existence, it is more of a spiritual level of conceptual things. Based on the review and research of China's 40 years of reform and opening up, combined with today's design trends. Green design is an inevitable development trend of interior design, and contemporary design shifts from "people-oriented" to "natural-oriented". Green design is an attitude that requires people to build a sense of greenness in their minds. In the green interior design, it is required to consider the coordination between the building and the surrounding environment, and use various energy sources in the natural world to create a sustainable living environment for human beings. It provides new ideas and new perspectives for the sustainable development of China's design.

Keywords: Sustainable ,Green design ,Ecology,Energy saving

## 1. THE RESEARCH BACKGROUND

Facing the increasingly fierce market competition and deteriorating ecological environment in the “post-crisis” era, “sustainability” is no longer just a fashionable academic discourse, but has become the focus of attention in various fields of society. The world is approaching the edge of unsustainable, such as global warming, climate anomalies, disasters, ecological degradation and so on, these hazards are borderless, if not make corresponding changes, the survival and development of the entire human will be seriously threatened.

The idea of sustainable development has been brought into the field of design, which has contributed to a fundamental change in the design concept. Design is a kind of sustainable development design in the planning process of transforming the world, forming a project or a product. It refers to the re-evaluation of any organization or individual design scheme under the guidance of the sustainable development idea, in order to achieve a positive and lasting harmonious symbiosis between the elements. The basic point of sustainable development design is to solve two problems: one is “what to design”, which is the object of sustainable development design; the other is “how to design”, that is, how to apply sustainable development design to each object, and put forward the feasible plan.

The sustainable design idea not only emphasizes the function, performance, structure, shape, color, material and other factors of product design, but also takes into account the environmental factors and human factors, from which the green design idea is derived. Greende-sign is also known as ecological design, that is, to reduce environmental pollution, improve resource utilization, reduce energy consumption of the design. Greende-sign is oriented to the whole life cycle of the product, in which the environmental attributes of the product, such as disassembly, recycling, maintainability and reusability, are emphasized. The final embodiment of greende-sign is the green product, which is the carrier of the green degree of the product, and its basic characteristics are as follows, based on the products and the partial reusable of the products; based on the products and the partial retrievable refurbishment and multiple processing of the products; in addition, the products can be safely processed at the end of their useful life. On account of this concept, Lvle et al. put forward the theory of regenerative design. That is, replacing the current linear flow with a “source-consumer center-sink” circulatory system, forming a regenerative system, in which the sink in the previous process becomes the source in the next process. According to the experience of Lvle, the strategy of realizing regenerative system in design and implementation mainly includes the following aspects, let nature do work, learn from nature, take nature as background, give priority to sustainability and so on. In recent years, the rapid development of industry has brought unprecedented civilization to mankind. At the same time, it has also led to the destruction of the world's natural environment and ecological balance. The contradiction between people and living space has become increasingly prominent. All of this has also attracted the attention of the whole world. People are increasingly aware that the environment we live in should be considered as a unified system, advocating environmental awareness among everyone, protecting our ecological resources, and eliminating excessive consumption and energy waste. Today, mankind has shifted from the “people-oriented” design thinking to the “natural-oriented” design thinking. In this thinking, human beings are considered as part of nature. According to statistics, more than 50% of the material materials that humans obtain from nature are used to construct various types of buildings and their ancillary facilities, which in turn consume 40% of the energy that humans derive from nature.

## 2. SOURCE OF ‘SUSTAINABLE DEVELOPMENT’

The comprehensive concept of ecology is an important source of sustainable development thinking. This term was originally derived from Haeckel's “General Ecology of Organisms” (1866). Haeckel uses this term in the sense of the relationship between the organism and its environment; a Bramme believes that “ecology” is also used to refer to “energy, environmentalism”; The broad term “ecology” refers to the environmental protection in the sense of protecting the environment in the sense of personal survival and protecting the environment in the natural environment. The three meanings of the above “ecology” overlap and relate to each other, forming the overall concept of “ecology”. In 1933, O. Leopold published a famous paper on “Earth Ethics”, proposing that nature is regarded as a functional overall view of nature, in order to determine the overall community of the Earth (or the Community of Communities). Sexual health and a sound ethical orientation incorporate human economic behavior and all other actions into the ethical norms that safeguard the overall interests of nature. This is like the principle of China's fallen leaves. The leaves grow from trees and absorb carbon dioxide to emit oxygen during the growth process, contributing to the sustainability of the earth. After the end of life, they fall into the land and continue to play the role of nutrients.

## 3. GREEN DESIGN AND SUSTAINABLE DEVELOPMENT CONCEPT

In the 1960s, American design theorist Babanak published the monograph “Design for the Real World”, emphasizing that design should consider “limited earth resources” and propose environmental services designed to protect the planet. In the 1970s, the “energy crisis” broke out, and Babanak's “limited resources theory” was widely recognized. The concept of “green design” was first proposed by AvrilFox and Robin Murrell in their book “Green Design” in 1979. In the 1980s, a wave of “green consumption” emerged in the United States, which in turn swept the world. At the same time, the French designer Stark proposed a simple green design concept and advocated the design principle

of “less is more”. In the 1990s, green design became a hot issue in modern design research.

In 2010, the International Organization for Standardization (ISO) issued the ISO26000 Social Responsibility Guide in Geneva, which regards sustainable development and environmental protection as the overall goal of the series, and summarized it as “maximizing human happiness” and “minimizing the environmental impact of production activities”. Binary combination optimization. Therefore, sustainable development, green concepts, environmental friendliness, and ecological safety have become the general requirements for guiding design. In September 2013, green design leaders from China and the European Union advocated the registration of the “World Green Design Organization” (WGDO) in Belgium to promote green design concepts on a global scale, leading the era of industrial change, consumption change and social change.

Since the party’s 18th National Congress in 2013, China’s green development path has vividly reflected the whole process of concept innovation, system innovation, science and technology innovation, management innovation and cultural innovation. In this understanding of ideas and consciousness, the ideas and actions of green design must be further deepened. Green design is a concrete understanding of the relationship between man and nature. It is a concentrated projection of sustainable development in the economic and social fields. It is a modern design that realizes the sustainable use of natural resources, the continuous growth of green wealth, the continuous improvement of the ecological environment, and the continuous improvement of the quality of life. Green design is essentially seeking to maximize the intersection of “natural green, economic green, social green, and spiritual green”.

In China, we have always adhered to the traditional consumption concept of thrift. Confucius, the “sacred god of heaven” in China, said that “it is more luxurious than Ning Hao.” Confucius believes that thrift is a virtue, which includes the awareness of cherishing natural resources and energy. In the era of big industry where the social economy is developing rapidly, the city is expanding and encroaching on natural resources. Under this situation, the traditional concept of “frugality” has implications for contemporary sustainable development design, that is, modern design must follow the path of sustainable development, first of all to meet its economics. The economic here means that the resources are not consumed in a large amount, the distribution of natural resources is equalized, and the resources that have been destroyed and wasted are re-integrated and utilized to achieve the “frugality” of resources and energy.

A large number of construction and industrial wastes often cause the city’s “gray zone”. Taking the green design of urban parks as an example, several urban parks in China that are sited on “decommissioned land” are often based on reasonable disposal of such garbage. Thereby repairing the ecology and even “feeding back” the ecological environment. Shanghai Jiang River Aite Park is located at the junction of residential areas and factories. A large amount of construction waste and clumps of weeds become the label of this land. On the basis of this, Bin Jiang Aite Park reuses waste materials to the maximum extent and fills them into stone cages with construction waste, which not only effectively blocks the pollution caused by nearby factories and road vehicles, but also activates the abandoned space into a new one. public space. Another example is that Wuhan Garden Expo Park is also built on the garbage dump. It uses local restoration technology and ingenious space to create a way to turn the garbage mountain into a permanent urban green highland, avoiding secondary pollution and greatly saving waste disposal costs. To achieve a “feedback” to the ecological environment.

For example, Singapore’s Gardens by the Bay covers an area of 101 hm<sup>2</sup>. The entire park consists of three parts: Bay South Park, Bay East Park and Bay Central Park. The Gardens by the Bay is Singapore’s vision of the “City Garden”, designed to enhance the contours of the world’s cities while demonstrating one of the best horticultural and artistic aspects of the garden.

Focus on cultural symbolism. The design of the Bay South Park is inspired by the plant structure of orchids. Orchid is the national flower of Singapore and a symbol of Singapore. Therefore, the design scheme uses the characteristics of orchids to conceive the spatial layout of the park and express the cultural connotation of the entire park. Throughout the design, the greenhouse represents orchids rooted at the water’s edge, while the topography, roads and energy exchange systems symbolize orchid leaves, shoots and secondary roots, and theme parks and supertrees are the main nodes of the flowers, all of which constitute A complete system.

Focus on the combination with urban space. The design takes into account the combination of the Marina Bay complex and the Marina Channel for a visual view of each other. Greenhouse gardens, super trees and air trails have become new space landmarks. It is optimized for walking, roads and public transportation near the park to improve park accessibility and integrate with the Gulf Recreation System.

Focus on sustainable development. The terrain design takes into account the influence of the wind direction, so that the main wind can play a breezy effect in the space; the shade, the plant-filled grille and the artificial structures such as the greenhouse and the super tree will make the park most of the area shaded. The shelter; the greenhouse demonstrates the combination of sustainable engineering and energy conservation; the park landscape lake acts like an ecological filter that absorbs the water from the park, cleans it with aquatic plants and drains it to the reservoir.

Vigorously promoting “green design” and upgrading the development level have become the modern pursuit of a new round of production and life in the world. The current so-called “modern design” has gradually upgraded from the traditional sense of architectural design, product design, process design, engineering design, urban design, etc. to the system design under the guidance of green development and low carbon development and recycling development. , smart design, industrial model design, regional development design, virtual scenario design and even top-level strategic design. The green design will enhance the green innovation awareness, green innovation level and green standards of products, procedures, models, industries, engineering and systems from the source.

#### 4. SUMMARY

Design is never a piece of paper, a good or bad design, the most important thing is to see whether this design has taken a long-term perspective from the beginning of its birth. The success of a design, its philosophy is very important, I think a sustainable design concept for everyone, need to do the following:

##### 4.1 The rational use of materials.

Nowadays, with the development of society, many non-renewable resources are becoming increasingly scarce, and people are constantly asking for them while constantly calling for them. The real sustainable development concept, the first thing that needs to be done is to use materials reasonably, copy non-renewable materials with modern technology, and protect non-renewable resources. Designers, in fact, producers must always have a sense of sustainable design when designing a product. For example, designers need to consider the environmental hazards of materials during processing or refining; designers can The design reduces the use of parts, which simplifies the repair, standardization and upgrade process and extends the life of the entire product.

##### 4.2 Establish a legislative system.

From a long-term perspective, sustainable development needs the support of the government, not only the financial approval, but also the legal constraints on people's behavior. There are many people now. Although they understand the meaning of non-renewable, they never formally attach importance to the protection of non-renewable resources from behavior and thought. They are used to their own past practices and refuse to accept sustainable development to protect the environment and maintain Ecological balance.

##### 4.3 Increase publicity and education.

Whether it is officials, people, businesses, and corporate designers, they are responsible for carrying out various forms of publicity and education activities on environmental protection issues, raising people's awareness of environmental protection, enabling people to understand the national conditions, understanding the status quo of the environment, resources, and energy, and enhancing the crisis. sense. Incorporating "sustainable design" into the compulsory courses of higher education, and educating students on sustainable design, so that students learn to follow a new ethics, morality and values.

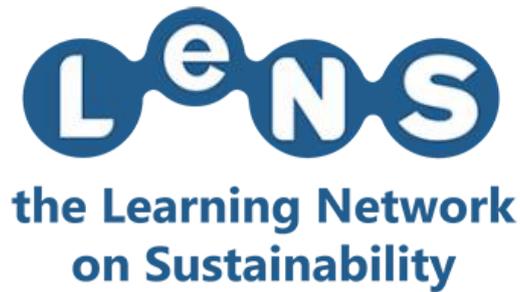
##### 4.4 Strengthen sustainable development design education.

Relevant colleges and universities can write design education content with the theme of "sustainable development" into relevant professional syllabus, such as urban planning, architectural design, environment (landscape) design, interior design, industrial (product) design, textile design, clothing. The syllabus for design, decoration design, etc. must clearly include "sustainable development" as a programmatic content in the outline: it is required to clearly list the subjects with "sustainable development" as a special content in the curriculum. And to organize the preparation of relevant textbooks. In the course of "Sustainable Development", which is offered in colleges and universities, it is required to combine the curriculum with the product development of the enterprise, and realize the situation of "government set up, school output, enterprise singing", give full play to the advantages of the three aspects, and help the government. Next, combine the professional education of the school with the projects and products of the enterprise. Turning the education of "sustainable development" into the supervision system of the government's environmental protection agencies, introducing education into the enterprise, and engaging design education in the product development stage of the enterprise, so as to achieve the product development stage mentioned above. The purpose of the environmental issues considered.

The sustainable development design reflects people's reflection on the environmental and ecological damage caused by modern science and technology culture, and also reflects the return of designer morality and social responsibility. In 1987, in the report of the United Nations World Commission on Environment and Development, "Our Common Future," "sustainable development" was defined as "the ability to meet the needs of the present and not to meet the needs of future generations." The development of harm", human beings should enjoy the power to live a healthy and productive life in a way that is in harmony with nature.

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## THE FUTURE IS FRUGAL

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## ABSTRACT

The Frugal Design Studio at Srishti has been working for the last 8 years to explore the future of design through the lens of frugality. In a consumerist world where resources are being recklessly used up, the natural environment is being degraded daily, it seems that there is not much choice – one definite path to the future is going to be frugal. This position paper explores and unpacks frugality as it can be applied to design. The paper attempts to understand frugality in the context of history of craft and design, everyday practices in India that are slowly disappearing, reasons why it is not subscribed to, projects done by the Frugal Design Studio and how it could be applied in the future.

## WHAT IS FRUGAL?

Being frugal and thrifty was considered a positive value all over the world, until it was overthrown by consumerism. The consumer age associated frugality with an unimaginative pragmatism. Frugality can be seen as miserliness, as a last resort in the face of ecological disaster, or more positively as a lack of clutter, as a calm and beautiful quality, as discernment and restraint as opposed to unthinking gluttony. In our attempt to explore frugality in the context of design, we have been influenced by several people and through our experiences in different contexts.

Gandhi proposed many future forward ideas, and the concept of Swadeshi or self-dependence is particularly relevant today. In Indian villages, people have lived for thousands of years in relative harmony with their surroundings. A 100 years ago, people lived in homes made from local material, wove their own textile, ate locally grown food, cared for their animals, forests, and lands; This is a perfect and utopian example of a low impact, minimal self reliant society. [1] Moreover, this was echoed in villages around the world before the Industrial revolution.

Swadeshi or the use of the locally made, in the context of production came at a time when industrial production was rapidly killing the handmade in India and the rest of the colonized world. For example, the beautiful handmade textiles of India were replaced by mill made fabric from Manchester. [2] The effects of this colonization have come a full circle today. The most exquisite muslin in the world was produced in Bangladesh about a 100 years ago. Today clothes of big global brands are made here using completely different means of production, that are disrespectful to individual skills, where people are used merely as labour, and their proud history in the textile crafts is devalued.

Buckminster Fuller has been an inspiration. Fuller was an engineer, architect, environmentalist, designer, poet author, teacher... In his book 'Operating Manual for Spaceship Earth' [3] Fuller says 'We have discovered that it is highly feasible for all the human passengers aboard Spaceship Earth to enjoy the whole ship without any individual interfering with another and without any individual being advantaged at the expense of another, provided that we are not so foolish as to burn up our ship...' One of Fuller's best-known works is the Geodesic dome, a polyhedral construction first designed by engineer Walter Bauersfeld and patented by Fuller in 1954. The dome worked in part thanks to a structural principle that Fuller coined - tensegrity. Tensegrity is a word made of two others - tension and integrity - and refers to the relationship and balance between tension (tightness or tautness) and compression (a force that shortens or squeezes something) in a structure. Integrity stands for making the strongest structure with least material.

## DEFINING FRUGAL

As a philosophy, frugal could mean making individual and focused choices that are not influenced or guided by the 'wisdom' of mainstream market forces and cultures that claim to know what is good for us. These choices should be about what we really need, and not subscribing to the suggestion the things we own become who we are.

Designers like Victor Papanek, Bruce Sterling and many others have urged the product designer to consider what he/she designs, and the impact this has on the world.

"... my products are festooned with baroque amounts of functionality and tied deeply into sophisticated, unstable networks of service providers. As an End-user in a destabilized high tech society, I take great comfort in useless functions; they may well be impractical, but they give me a sense of dignity, like the silk ribbons and gold braid on a Renaissance courtier..." - Bruce Sterling in Shaping Things [4]

In mainstream Industry, frugal is understood as engineering where frugal innovation is used to design products by reducing complexity, removing features that are not needed and adapting a product made for 'first world' markets for a 'mass' market by removing some of its 'frills'. A good example is the ECG machine designed by GE that is a hand held portable device, costs very little per patient to run and can be carried to remote locations as opposed to the larger more expensive ones normally used in hospitals. There are numerous examples of frugal innovation coming from the grassroots, like the Jaipur Foot, which is a low cost rubber-based prosthetic leg for people with below-knee amputations and has helped many people to overcome their leg disability. It was designed by Ram Chander Sharma in 1968 to be inexpensive, water-resistant, and quick to fit and manufacture.[5] Frugality could be defined as a value where we are prudent and careful with any kind of resource be it money, be it material, technology or time, not because we have to, but because we want to.

## NOW TO DEFINE DESIGN

Design has been through many interpretations through its relatively short history. Design has also been a response to social and cultural shifts of the world around us and has often interpreted these into form and material. 'Small is beautiful', 'Less is more' all came from the post war situation in the early 1900s. [6] The Bauhaus (1919 - 1933) saw industrialisation as a means to make good design accessible to all people instead of just the elite. In the late 1900s sustainability, network building and the need for 'appropriate' as opposed to 'better' became important. In 1997, UNEP (United Nations Environment Program) published "Ecodesign: A Promising Approach to Sustainable Production and Consumption"[7] to lay the foundation for widespread adoption of sustainable concepts in design.

Design deals with multiple dimensions of logic that sometimes compete for attention. As we create, we privilege one over the others to give ourselves direction and meaning. Some of these dimensions are formal or semantic, functional, material, emotional, systemic, and much more. Design becomes an optimization and depending on our beliefs and the people we design for, we may decide to put one quality on top. Can frugal be that quality?

Charles and Ray Eames made recommendations for design through the India Design Report in 1958. 'In a country that faces the food, shelter and distribution problems that India does, it might be well to take a close look at those things that constitute a "Standard of Living" in India. What are the real values? To what degree is snobbery and pretension linked with standard of living? What do Indians desire for themselves and for India?' [8] They speak of the *lota*<sup>1</sup> as being the perfect example of good design and hope was that design can appraise and solve the problems of our coming times with the same tremendous service, dignity and love that the *lota* served its time. [9]

In 2011, India Design Council published the National Design Policy [10], which describes design as a driver of innovation and is recognized as a key differentiator for providing a competitive edge to products and services. Design here has been approached as an add-on, as value addition in the market. It becomes not so much about need, 'real values' or about problem solving, but almost something to help sell a product or service. From being deeply internal it becomes completely external. Has design lost something in translation in the last 60 years?

## HISTORY OF FRUGAL IN INDIA

In India frugality is something we've always valued. Traditionally we have been careful with our resources and assigned more than a monetary value on the things we use. We have a rich culture in repair and reuse, supported by the availability of skilled people to mend just about anything. A good example of this are the *raffoogars*, who darn tears in fabric so finely and invisibly, they are really artists who save a beloved garment. This is only a small example of the value placed on a fine sari or shawl, beautifully crafted, well-worn leather footwear, the sensuous form of a kitchen utensil or a finely made wooden door. Things were made and used with care and as they grew older, their value only increased. We had access to people who were healers of these products, and went about their craft with the same care as the artisan who originally made them.

We can also see this kind of frugality in small workshops all over India, people who weld metal to make grills for windows and doors, people who repair appliances, people who run small tea shops and eateries, small traders, barbers and many more. There are dyers, cooks, the ironing men, *dhobis*<sup>2</sup>, sweet makers, all of whom are experts at their work. There are hundreds of different types of these service providers still, who use the simplest equipment and provide services that stretch the lifecycles of many products and materials. Each of these people run a micro enterprise that is well balanced and is customized to fulfil a specific need. Today this ecosystem, that has been alive and kicking for centuries is under severe threat from single use packaging, mass market brands, trend driven fast fashion and the rising cost of living.

Craft practices are inherently frugal and have been part of everyday life in India. Most things that people used were made locally, sold and used within a small geographical radius. In addition, out of that frugality came abundance in ingenuity, in form and beauty and in the spirit. Craft was hit by industrialisation and in the 1970s, it went through an especially low period due to the influx of cheaper and sometimes better machine made goods. Crafts persons became increasingly marginalised, and their products trivialised as 'ethnic'. [11] As the gap between markets and customers physically grew, customers had no idea about what they were buying and artisans had no idea who was buying their products. Today the situation has improved, but several craft practices are on the verge of extinction.

## WHEN WE ENCOURAGED TO BE EXTRAVAGANT

Industry and society has organised our lives so that consumption and extravagance are seen positively and frugality is seen as miserliness. Some ways in which this has been done are:

We don't see the whole picture - Most of the time, we don't think about where things come from or where they go. Water comes from a tap, excreta disappear into the toilet and milk is delivered in a packet. Where does the water come from, what happens to the excreta, are edited out of the picture.

Who makes our things? There was a time when the baker delivered your bread, when you chatted with the cobbler as you ordered your shoes, and the carpenter came home to build a chair. Today our things come in a box and we have no idea how or who made them. Industry focuses on the unboxing experience - we open a box and lo and behold a brand new phone is born. They emerge pristine and untouched and tell no story of where they come from. We love them briefly, but soon discard them for the next unboxing experience. And in that discarding we throw away so much. Can fresh relationships be built between the user and the maker?

What problems are we solving? Are these even problems? Much research goes into developing new technologies and every year our gadgets get smaller, more efficient and cheaper. The reality is that companies are designing obso-

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<sup>1</sup> *Lota* – traditional round pot in brass, silver, terracotta or plastic, can be used to store water, grains etc. comes in a variety of sizes, can be ornamented or plain

<sup>2</sup> *Dhobi* – washer men/women for clothes

lescence into their products so that we are forced to buy the new version. [12] To pay for the cost of development, companies need to sell more, we have to buy more and discard more. While our basic needs remain the same, we are convinced that we need faster and smaller devices to do the same things. How can this cycle of development-production-consumption-waste be broken into? Can all this development be diverted into more 'useful' channels?

Ivan Illich talks of the 'consumer society where there are inevitably two kinds of slaves: the prisoners of addiction and the prisoners of envy.' [13] How do we find freedom from this slavery?

## FRUGAL DESIGN AT SRISHTI

The Frugal Design Studio has been working for the last 8 years on projects that revolve around how we use resources – whether material, energy or technology to the fullest effect to develop an understanding of frugality. Can design become more discerning and conscious, seek an aesthetic in material and function that is authentic, so that the product is true to where and how it is made and who uses it? We believe that frugality combined with the power of new technology, small-scale, customized production, can change the way products are designed and made. Projects range from working with grassroots innovations, with craft, collaborations and workshops.

## THE INFLUENCE OF FRUGAL ON CURRICULUM

'So a way of doing leads us to a way of seeing, a way of seeing to a way of doing.' - K G Subramaniam [14]

We reworked our new program, Industrial Arts and Design Practices (IADP) in 2015, and we shifted the emphasis from a user/market led approach to making as a tool for thinking, as a way of learning and conceptualizing.

It is the way of seeing that we want to emphasise. Becoming aware of systems of production, how things are made in different scales, how technologies are creatively used allows the student designer to become aware of the materials he/she is using and the impact it has. Working first hand with people who make is an important way to becoming a more conscious designer and we have introduced the concept of locative making. Locative making is based on production within a specific geographic area, using available tools and skills. Hands-on making develops respect for materials, for people and skills, and could close the loop between thinking and making more frugally.

## COLLABORATIONS

Through projects we create collaborations with NGOs, communities, faculty and students to find answers to questions on frugality and the various ways it is present in today's bludgeoning urban world. One of them is about vulnerable communities as described by Selco Foundation. [15] There are large communities living in pockets in the heart of growing cities in our country who are denied basic rights of urban welfare because they do not possess proof of residency. They are commonly called 'squatters' or 'encroachers' who are brought into cities by the truckload to work inhuman hours and labour for a pittance. They usually look for seemingly unoccupied plots of land to set up blue-tarp shelters for themselves. They are poor and hence are hauled up on suspicion whenever there is a crime in the neighbourhood. The landlords want to evict them. They cannot get electricity connections or access to ration shops as they have no papers. On the other hand if they weren't there many of us may not be able to afford maids and drivers. Selco creates inclusive financial models so they can afford better products. For example a robust solar power system on a flexible loan policy is paid back through money saved on electricity.

An interesting project with Selco is Inventing Green where we worked to reduce the embodied energy of materials used to make solar products. We worked to imagine new ways to think and work with materials and manufacturing processes, form, and packaging using local skills, materials and craft practices wherever we could. We also developed curriculum using the Okala practitioner guide. [16]

Familiar Process, Unfamiliar Terrain was a project to understand and design for vulnerability in fishing communities in Udipi, Karnataka. One group attempted to design low cost toilets for fishing boats, while another worked on cooking facilities. The question that arose is that both toilets and kitchens are non-existent on the boat. So almost any solution is better than nothing. Cost is the obvious constraint, and safety and comfort had to be achieved in the most frugal way. These collaborations give us starting platforms of exploration, which leads to other courses and projects and components of teaching units. In turn students get opportunities to connect with complex issues that are otherwise not addressed.

## INTERNATIONAL WORKSHOPS

We have been part of several workshops that have involved mixed groups of participants from different countries and cultures. Exploring ways to think about frugality in different contexts with multicultural groups allows us to expand our vision. Some examples of these kinds of workshops are:

International Design Summer School (IDSS) 2016 where students from China, India and Switzerland explored how frugal design thinking could be applied in Zurich. The outcomes of the workshop were very ex-

ploratory, and mainly served to clarify what Frugal Design could be, could we look at issues around us through the 'frugal' lens, constraints being a spur to creative problem solving and systems thinking being a crucial part of Frugal Design

Behind Fences (May June 2017) was a longer workshop in run in Hamburg's Gegenwarts Akademie to explore what design can do for people on the run, shelter-less and without resources. Some thoughts that emerged are:

Membrane of osmosis/porosity along the border of the camp: Develop a number of activities to encourage informal mixing between inmates of the refugee camp and neighbours/citizens to encourage a sense of belonging

Financial sustainability: However liberal Germany's foreign policy may be, taxpayers pay for maintaining the large infrastructure of refugee camps. This sooner or later is bound to generate some resentment among the citizens. Can income-generating opportunities be created for the inmates?

Understanding refugee policy: People knew little of the details Germany's liberal refugee policy. From our research, we found there was no common resource, which could inform the common man on them.

Macro versus micro efforts: Does everything have to be giant scale? The idea was to introduce means by which a larger number of people could make a larger impact even if they each did some things in a small way.

'Frugal Design - Potential of the Thrifty' (2017) was a research project realised by the Design Department of the Zurich University in collaboration with Srishti and Selco Foundation. In a jointly organised workshop, we studied notified and un-notified slums where migrant workers live in Bangalore. Access to clean water is a basic service that is missing here and translates into dismal health conditions within these communities. Our larger learning through this workshop was that it is important to not allow the severe constraints of the context to restrict creative ideation. In fact in extreme situations, it is more important to think laterally. While the situation does need solutions immediately, band-aid kind of fixes will not have a positive long-term impact.

## WORKING WITH ARTISANS

Working with artisanal communities to document, map, develop new products, learn and explore is something we value. Our experience with craftspeople goes back 25 years and most of our ideas of design and frugality come from observing and learning from their practices. In one example we were approached by a wild life preservation organisation to design products for a community in an extremely remote part of North Bihar. Instances of poaching in the nearby forest were becoming frequent, and they wanted to find some alternative livelihood opportunity. This place was isolated and almost cut off from the outside world. They wove baskets using the moonj grass growing there and had never sold them before. This was craft in its purest form. This was the perfect example of the circular economy where the raw material grew wild, the tools were minimal, made by the blacksmith, baskets were exchanged, and older baskets were not discarded, but used to feed cattle, eventually going back to the earth. The women were extremely proud of their skill and much as we tried to simplify patterns, insisted that they were too proud to allow a hastily made basket to leave the valley. Here was frugality in practice and extravagance and abundance in spirit.

Ashok Chaterjee talks about craft in India as one practice that addresses most of the fundamental sustainable development agendas of our time: managing threats to the environment, promoting justice, equity and peace by bringing the deprived into the centre of concern, empowering women through recognition of their craft roles and contributions, offering identity and confidence in an era threatened by globalised uniformity, providing sustainable livelihoods to communities in their own locations, protecting them from the miseries of migration, and leaving a light carbon footprint to address the threat of climate change. [17]

## STARTING POINTS TO A MORE FRUGAL FUTURE (SPECULATIVE)

Modularity: Today companies go out of their way to not make things modular. What if products were designed to be modular, so that when one part is damaged or old, the defective part could be simply replaced?

DiY: The do-it-yourself culture is already well known and has been used by enthusiasts for a long time now. What can the designer do to encourage this, to make it easier for 'non-technical' people to make their own products?

Local Production: With emerging additive technologies products will be made in smaller, local workshops, instead of large factories. They will be customized, recycling will be built into material design and there will be less waste.

Combining hand-made with mass-produced components: The hand-made exists today at opposite ends of the spectrum. On one end, expensive 'designer' products are all handmade. On the other, there also exist ordinary things we see everyday and don't even recognize as handmade – strings of flowers, bamboo baskets, and much more, especially in the Indian landscape. Compare a handmade product with an industrially produced device. The value of the device is extremely high when it is first introduced and then rapidly plunges after a few months. Contrast this with a handcrafted heirloom whose value actually increases with age. Could we increase value by combining the hand-made with 'high' technology?

## USING FRUGALITY AS A DESIGN PRINCIPLE

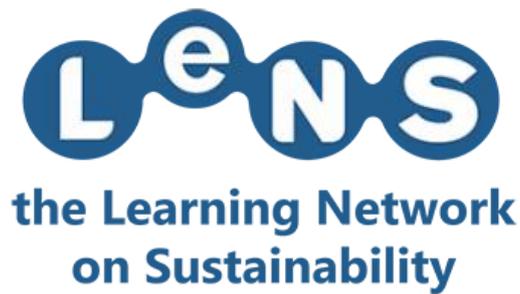
We are on the brink of the 4th Industrial revolution characterized by a fusion of technologies that is blurring the lines between the physical, digital, and biological spheres in the words of Klaus Schwab, Founder, World Economic Forum. [18] The biggest fear that people have about this future is inequality. Skilled people who embrace this new world will do well, but those who are semi-skilled may find themselves replaced by robots, which has already started in most automobile plants. According to a World Bank Report, [19] digital technologies will allow firms to scale up or down quickly, challenging traditional production patterns. The offshoot of this could be that manufacture will move to smaller local units, and will require specific skills - a combination of technological know-how, problem-solving, and critical thinking, as well as soft skills such as perseverance, collaboration, and empathy.

Revisiting the artisanal context, the maker works and lives in the same space not separating them physically or mentally. We have lost this to the current production economy, which does not just separate private and work time and space – it also separates the way we think and internalize. Can frugality move out the confines of a practice or academic definition and spread beyond the disciplinary domain to a more holistic state of being?

In the design process can we question - what are needs – and what are frills? There are more complex definitions where frugality could also be open to interpretation, going beyond material optimization. We can choose to be careful and conscious of what we make and use. We can design products that people really need and want, in small numbers, customised, products that are thoughtful and add meaning to our lives. We can choose to combine old and new technologies, include our artisans and be more creative in production so that products carry forward some of the magic of their origins, in thought and in making.

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## #ECOTERACY, DESIGNING AN INFO INCLUSIVE AND UNIVERSAL LANGUAGE OF SUSTAINABILITY

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### ABSTRACT

The 17 UN Sustainable Development Goals 2030 have been developed with the intent to transit towards a more sustainable society. This paper focuses in particular, in goals 10, 11 and 12 (10-reduce inequalities, 11-sustainable cities and communities, 12-sustainable consumption and production), and links these goals to the concept of Circular Economy (CE) via the co-construction of a new design artifact. Although important, the concept of CE seem to focus on organizations and industries, and still little research has focused on exploring citizen's role to achieve sustainability. This study attempts to provide a critical analysis of CE application within human sphere, through a design research methodology. A design artifact is developed through a co-creation workshop at BIN Porto 2018 which involved the collaboration of eight people, including academics, industry and government representatives. The artifact resulted in a visual, intuitive communication tool with four domains and multiple criteria. ESSA enables users to visually and intuitively understand the impact of the product/services they purchase and make more informed decisions on-spot. The artefact was publicly presented at the end of the Bin Porto 2018 event, and has received positive feedback. The present article focuses on the reflection of the artefact.

Key Words: Circular Economy, Design Research, Design for sustainable behaviour

## 1. INTRODUCTION

The need to shift towards more sustainable production patterns and migrating away from excessive consumption is a priority (Kates, 2018). However, it seems that the movement towards sustainable development is evolving rather slowly, shadowed by the discourse of economic growth. The concept of CE, an alternative paradigm which aims at regenerating and restoring ecosystems through efficient use of material and energy flows (EllenMac Arthur Foundation, 2015) has been discussed since the 60's (Boudling, 1966), and has gained new traction in the late 80's (Brundtland, 1987; Pearce and Turner, 1990). However, it seems that it has emphasized the industrial/production systems over social human systems (Lofthouse and Prendeville, 2018), which are an integral part for the transition.

Just as sustainability, the concept of CE, remain rather vague in literature (Millar et al., 2019, Geissdoerfer et al., 2017). In their review of 114 definitions of the CE, Kiechherr et al. (2017) revealed that only 11% of them included notions of sustainable development and only 13% refers to all the three dimensions of sustainable development i.e. environment, economy, society. Moreover, the interconnections between CE and sustainable development are not always clear, leading to multiple models, which partially address the problems inherent from the linear model (make-use-dispose). Some authors argue that discussions revolving around CE are made mostly from the environmental perspective leaving economic benefits under addressed, whereas others argue that the economic component has received the most attention. A more revealing result is the lack of attention to the temporal scale (future generations) and societal component, with only 1% of references made in CE definitions (social equity in present and future generations) (Geissdoerfer et al., 2017).

Numerous studies can be found to support industry to become more circular, but little research explores how the social and/or human components can lead to sustainable transformation. If CE is interpreted as a tool or an approach to achieve such sustainable development, then the societal component needs to be more emphasized within the CE discourse. Kiechherr et al. (2017) proposed CE to be defined as an “economic system that replaces the end-of-life concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes. CE operates at the micro, meso and macro levels with the aim to accomplish sustainable development thus simultaneously creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations. It is enabled by novel business models and responsible consumers”. This definition reflects all the dimensions of sustainability, while also putting forward a new element, previously unclear: the active role of consumer as a factor/element to achieve sustainable development. Indeed, within current discourses of CE, users/consumers still seem to have a more passive role (Lofthouse and Prendeville, 2018; Sanders and Stappers, 2008; Morelli 2007; Manzini 2011).

Design is a discipline places human experiences at the core of its practices and is recognized to be important for meaningful innovation (Dunne 2011). Through the construction of symbolic meaning then, design can be beneficial to (re)shape culturally dominant value systems (Lofthouse and Prendeville, 2018), going beyond its role within the technocratic context (eg. eco-design, cradle-to-cradle) and contributing to the development of alternative modes of leaving and doing (Manzini, 2015).

This research attempts to explore how consumers can be better involved within the CE discourse by co-creating a more inclusive sustainability language. The main argument reasons with Holden et al. (2017) which emphasizes that satisfying human needs, including enhancing human capabilities, can help ensure more social equity, and respect of environmental limits.

## 2. RESEARCH METHOD

To explore how consumers can be involved in CE discourse, the current study adopts a design research methodology (Buchanan, 2001) to create a new artifact with symbolic meaning, which can better enable the activation of the population, and facilitate the beginning of a bottom-up movement towards sustainability. Within design research, artifacts can be developed in situ, embedding design knowledge (Zimmerman and Forlizzi, 2008). Following the guidelines provided by Buchanan, the study (1) develops a new artifact (design language and matrix) in a reflective and iterative process of co-construction of meaning to solve a class of problem, and (2) reflects upon the potential use and impact of the artifact in-context.

The artifact was developed within the setting of Bin@Porto 2018 Circular Economy co-creation workshop, which lasted for three days. Eight people actively contributed to the development of the artifact, including academics, industry and government representatives, with backgrounds on environment, product and service design, engineering, architecture, as well as policy making. The internal development process followed a design thinking approach (Brown, 2009). First (1), within the context of CE, the team identified the main problem to be addressed based on three SDG 2030 (10-reduce inequalities, 11-sustainable cities and communities, 12-sustainable consumption and production). The participants (i.e. experts) shared experiences and co-constructed their understanding of the problem, based on their own background, knowledge of literature and/or case studies. Second (2), a set of ideas were proposed, combined and evolved to create a solution (design artifact). Third (3), a low-fidelity prototype of the artifact was developed and (4), a set of strategies were proposed to further develop the language and proceed to its implementation in industry. Finally, the artifact was publicly presented at the Bin@Porto 2018 event, and feedback was collected to enhance it.

### 3. RESULTS

#### 3.1. Problem definition

During the first stage of the process, the team democratically selected three UN SDG: 10 reduce inequalities, 11 sustainable cities and communities, 12 sustainable consumption and production. The combination of these goals triggered much discussion about waste versus resources, production patterns, and the role of design within product planning and development (e.g. life cycle assessment of products and services, planned obsolescence). After some discussion, the team decided to adopt a human-centred perspective, putting citizens and communities at the center of the discussion, thus reducing the emphasis of goal 12 (which usually puts forward a more organizational-centric view).

The results of this first stage and change of focus, enabled a more in-depth discussion on the role of citizens within sustainability. A more in-depth discussion on the role of citizens within sustainability was undertaken and the team concluded that the illiteracy about sustainability and inequality of access to information contributed to a perpetuation of the current status quo (unsustainable consumption). A more intuitive language of sustainability and inclusion of the info excluded population could hence potentially activate citizens, and provide an important input to start a transition, where citizens take a more active part in the sustainability discourse through their consumption choices.

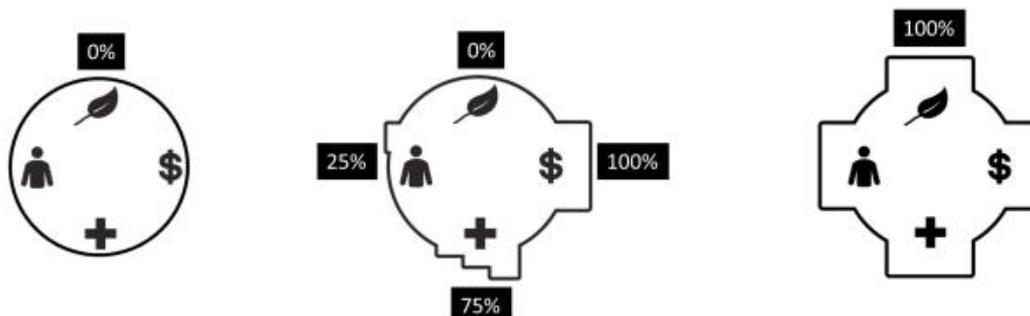
#### 3.2. Designing a new artifact

Two artifacts were developed to address the problem identified: a sustainability matrix (figure 1), and a visual infographic of sustainability (figure 2). The sustainability matrix (figure 1) establishes a connection between four key domains of sustainability and multiple criteria. The four domains represent the key axis of sustainability i.e. Economy, Social, Health and Environment or ESSA (Economia, Social, Saúde and Ambiente, in Portuguese language). Although not accessible for the users, the matrix (figure 2) provides important information about the criteria necessary for audits of products. For example, the environment domain can contain information about water use of energy, whereas health could contain criteria related with ethics (test on animals) or toxicity. A top class producer at the environment domain with excellent use of water criteria, can only remain in that position if no other producer is making a better use of water (through new techniques and/or technologies) (figure 3).

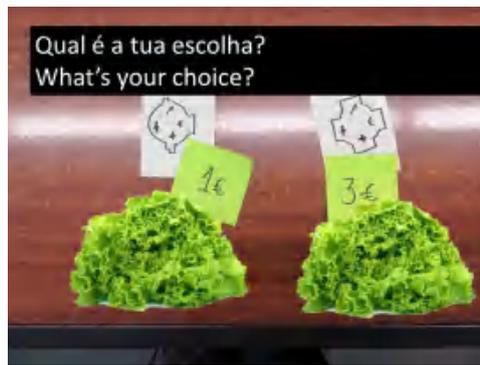
VEZORES CRITÉRIOS	AMBIENTE	ECONOMIA	SOCIAL	SAÚDE
ÁGUA	X		X	
ENERGIA	X			
EMPREGO		X	X	X
COMUNIDADE			X	
TERRITÓRIO	X	X		
TRANSPORTE	X	X	X	
COMÉRCIO JUSTO		X	X	
EFICIÊNCIA	X	X		
TESTES EM ANIMAIS	X			X
IGUALDADE			X	
SOLO	X	X	X	
COESÃO		X	X	
TOXICIDADE	X			X

[Figure 1] Sustainability matrix which relates domains (environment, economy, social and health)

Additionally, a new universal visual language was created to complement the matrix. The visual infographic in figure 2 was designed to: (1) integrate the four main domains of the sustainability matrix, providing a visual rank of the sustainability level of product; (2) be easy to read across people from different age groups and education levels; and (3) facilitate the comprehension of the quality of the product/service purchased/used enabling a more intuitive decision-making between apparently similar items (figure 3). In addition to this, the new language could integrate current certificates by association (e.g. bio certified products have higher classification in the environment component), thus reducing the loads of information currently displayed in packaging.



[Figure 2] ESSA, with the domains and their classification (left: worst case; right: best case)



[Figure 3] ESSA enables a more intuitive and informed decision at the time of the purchase of apparently similar products/services

### 3.3. Evaluation of the artefact

The design artifact, which resulted from the workshop, was formally and publicly presented to the Bin@Porto2018 audience via presentation and role play. Feedback was collected after the presentation via group discussion with members of the audience, and through one-to-one presentation with different companies, including IKEA. The feedback was mostly positive amongst citizens/consumers (e.g. “this is a language that I can understand easily, all those labels and certificates are sometimes hard to understand because they are so many now”). Feedback from industry was also positive however, one of the main concerns focused on the difference between sectors/industry, and the level of difficulty to categorize certain products and services.

The language presented herein is but a tool to start a transition of mind-set from the citizen perspective, and is aimed to be used as provocation for users to understand their own potential active roles within cities and communities. They can, if informed, create/demand change through daily consumption choices and enforce more transparency of the production process.

### 3.4. Working towards implementation

A strategy to disseminate the new language was established. A pilot case study within a specific sector/industry will be used to further develop the artifact and investigate its meaning for users, in context. Based on the case results, the language would be expanded to other contexts and sectors. Finally, upon iterative development of the language, a proposal for a new set of guidelines for policy implementation across sectors will be developed. This development program involves different key partners. Amongst the key stakeholders – citizens – the project would also include academia (including design practitioners, design educators, researchers as champions of the language), all sectors of activity (including industry), public administration with special emphasis on the local entities, as well as communities.

## 4. IMPACT ON SUSTAINABILITY

The current models of sustainability and Circular Economy are important to enable the transition towards more sustainable societies. However, they seem to focus more on organizational industries networks, where citizens have a little role. This study aims to respond to the call of Lofthouse and Prendeville (2018) by exploring how the transition towards a more sustainable model of society can be triggered by a bottom-up design approach, looking at the consumption model, and its potential influence and scale effect on the production model.

ESSA – a visual tool for all, about sustainability – and the sustainability matrix, were developed to support citizens making more informed decisions by bringing transparency to the quality and sustainable impact of the products and services they purchase/use. The potential of the replicability of ESSA started in this workshop has already been initiated in online social networks (e.g. #ECOTERACY, #ESSA) inviting more and more citizens to join a movement, demanding a clearer and more accessible information about sustainability.

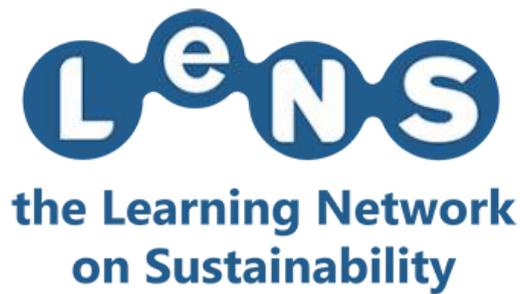
At this point, the research is only at the beginning. Future research steps focus on applying the tool on a pilot case study, and explore its impact on the choices customers make and create a development program with different partners. It is important to infuse the language within the design profession, as they are also potential champions of sustainability within the organizations they work in.

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## **CULTURAL AND NATURAL HERITAGE FOR ALL: SUSTAINABLE FRUITION OF SITES BEYOND PHYSICAL ACCESSIBILITY**

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### **ABSTRACT**

Heritage is defined as the set of all material, immaterial, natural and cultural assets, whose immense value is universal and belongs to all people, as a property of present and future world generations. It is therefore an asset to be preserved for future generations. However current design approaches used to implement existing Heritage's promotion strategies mainly use visual-centric design approaches, as a result of the anthropologic humans' legacy to live. Thus, people with sensorial-perceptive disabilities (i.e. blinds) are excluded from all design interventions and they rarely can enjoy of the Heritage. This paper presents the results of design researches focused on the role of Design for the inclusive and sustainable enhancement of Cultural and Natural Heritage, with an emphasis on the sensorial-perceptive fruition of sites. It combines Communication Design, Inclusive Design, Digital Modeling and Rapid Prototyping to develop a design framework useful to create sustainable and inclusive communicative solutions for the auditory-visual-haptic enhancement of Heritage.

Key Words: Cultural and Natural Heritage, Inclusive Design, Auditory-Visual-Haptic Enhancement, Sustainable Design Criteria and Design Guidelines.

## 1. INTRODUCTION

The 1972 UNESCO's 'Convention Concerning the Protection of the World Cultural and Natural Heritage' (UNESCO, 1972), defined the Heritage as the set of all material, immaterial, natural and cultural assets, whose immense value is universally recognized as belonging to everyone and, therefore, of property of the present and future world populations. Accordingly, the will to include future generations in the fruition of sites refers to: (a) the will to preserve the historic memory, the environmental condition and the social impacts of sites, and (b) the idea of Sustainable Development for the future enjoyment of sites in their present-day conditions. In over forty years, more than one thousand of sites, both cultural and natural, have been included in the 'UNESCO World Heritage List', which is the official list developed by UNESCO and including the names, the status and all technical-economic specifications concerning the sites composing the so-called UNESCO Cultural and Natural Heritage.

'Heritage' is an umbrella-term used to describe a large number of sites having a high collective value (Falser, 2015) and able to produce a number of horizontal effects – interdisciplinary and not only linked to the aesthetical beauty – such as: remarkable effects on local economies and wellbeing (i.e. the Great Wall in China, which is the most visited sites in the world produces income for the governmental administrators and for thousand of workers) (GHF, 2010), the lifestyle of pupations living in the surrounding areas (i.e. the Great Barrier Reef in Australia, which stimulates the development of many touristic services for tourism, diving and fishing; the site of Angkor in Cambodia, which is the main economic source for people living in the area and influence their lifestyle) (UNESCO WHC, 2013), the sense of identity (i.e. the Statue of Liberty in New York City, which is the archetype of the American sense of civilization and freedom) (Klamer, 2004; UNEP DTIE, 2005), the sense of collective protection from wars and contemporary threats (i.e. the Temple of Bel in Syria, destroyed by recent conflicts), etc.

In Design, the enhancement of Cultural and Natural Heritage has recently acquired a strategic relevance (Barcarolo, 2017). This interest is both related to the processes of conservation and sharing of artistic, historical, anthropological and cultural memories of sites and buildings, and to the new opportunities for developing enabling solutions, technologies and advanced processes to empower all end-users to visit and the enjoy the sites. A recent interesting topic concerning this new idea of sustainable-oriented enhancement is the capability of sites to be accessible and inclusive for all end-users; this idea, based on the social power of sites, switches the attention from sites to people: from technology-push approach (product centred) to socially inclusive concepts (human centred).

Recent advances in the area of Design for Social Inclusion have pointed out new positive ideas of people, evolving the paradigm of standard end-users into a more complete and holistic one described by real people, which have real needs, desires and capabilities (EIDD, 2004). The new idea considers end-users with both positive conditions (i.e. physical proportion, perceptive abilities, etc.) and negative ones (i.e. disabilities, anthropometric differences, cognitive deficits etc.); thus, even disabilities are now seriously taken into account in order to develop solutions that can meet the real needs of end-users for which, until now, only ad-hoc solutions have been produced. Even though this idea is not new within the design literature (i.e. Universal Design), the application of this concept in the domain of Heritage is new and it is able to generate new effects, radically oriented to the modern ideas of Social Inclusion and Social Sustainability, globally recognized as strategic (European Commission, 2010).

The hypothesis of this work considers the discrepancy between the real needs of people who want inclusive communicative solutions, and the ability of designers to develop them in a proper way. The design culture, which still considers the enhancement of Sites as the improvement of physical accessibility, must consider the visual enjoyment as a fundamental parameter to address the creation of new communicative solutions (Barcarolo, 2017).

The use of Design for Social Inclusion in the development of new sustainable-oriented generations of products and services allows to develop a radically new idea of Cultural and Natural Heritage 'for All', where all solutions, and in particular communicative ones – the ones able to meet both economic-touristic demands, promotion actions and socio-cultural values – are conceived to meet the socially inclusive idea of Heritage with real end-users' needs.

## 2. AIMS

This paper aims to present the results of theoretical-experimental PhD Researches focused on the role of Design for the Inclusive and Sustainable Enhancement of Cultural and Natural Heritage (Barcarolo, 2017); as such, the paper underlines the need to combine Communication Design and Inclusive Design as sustainable-oriented elements for the Heritage promotion, with new technological advances (i.e. Rapid Prototyping). Thus, the evolution of visual-centric design approach allows to consider, with new lenses, the condition of people with visual disabilities, as well as to understand the new role of communication in the inclusive valorization of Cultural and Natural Heritage.

## 3. METHODOLOGY AND RESULTS

In terms of research and design methodology, two phases characterize this work:

- The first phase proposes a new design framework for the sustainable auditory-visual-haptic enhancement of Cultural and Natural Heritage, composed by six Design Criteria and fifteen Design Guidelines useful for design a wide number of communicative 'for All' solutions. This new framework considers, also, new advances

in Digital Modeling (i.e. Laser Scanning) and Rapid Prototyping (i.e. 3D Printing) as additional sources for the designers' activities and industrial production.

- The second phase applies the above-mentioned new design framework for the sustainable and auditory-visual-haptic enhancement of Cultural and Natural Heritage in six<sup>1</sup> real cases studies of Italian Cultural Heritage. In particular, these experimentations have been used to test the data proposed and, later, to qualitatively evaluate the effectiveness of the new 'inclusive fruition' of sites. In this paper, the design experimentation presented refers to the Villa Venier Contarini in Mira (Venice, Italy).

### 3.1. A Comprehensive Visual Design Framework for the Inclusive Enhancement of Cultural and Natural Heritage

The design framework, useful for the design of inclusive-based and sustainable-oriented auditory-visual-haptic solution for the Cultural and Natural Heritage, is based on the analysis of four main Parameters, which have allowed to develop Design Criteria and, later, Design Guidelines:

- The haptic inclusive communication for the fruition of Heritage, which is relevant to know the processes and the design theories usable to produce solutions according to the Design for Social Inclusion theories.
- The human diversity and the understanding of potential end-users, to know the psychophysical and sensorial-perceptive conditions of real end-users that want to visit the Heritage, enjoying of its values.
- The digitalization of Heritage, including the analysis, the optimization of shapes and the parametric digital modeling of mathematical surfaces, useful to get relevant data needed for the production of effective inclusive communicative solutions, even for visually impaired end-users.

Design Criteria	Design Guidelines
1. Analyse the current communicative solutions (if existing).	1. Analyse the quality and the characteristics of the existing communicative project (if existing), showing all critical elements and negative aspects compared to the themes of Social Inclusion. 2. Analyse the effectiveness, the perceived satisfaction and the efficiency of the existing communicative project (if existing) compared to the characteristics of end-users. 3. Analyse the layout and the environmental relations of the existing communicative project (if existing).
2. Understand the tisting communicative-environmental	1. Understand the social, cultural, environmental and economic conditions within which the new inclusive communicative project will work. 2. Understand the dimensional, spatial, proxemic and anthropometric relations for the new inclusive communicative solution
3. Understand the limit end-users using a holistic approach.	1. Understand real end-users' needs (i.e. primary, secondary, explicit, implicit). 2. Understand the real end-users' psychophysical and cognitive-behavioural characteristics. 3. Understand the end-users' residual abilities to design enabling solutions.
4. Surveying and modelling the elements to be communicated.	1. Surveying the items chosen to implement the new inclusive communicative solution. 2. Modelling the subject to implement the new inclusive communicative solution considering the real end-users' characteristics.
5. Develop the inclusive project in (systems of) enabling communicative solutions.	1. Conceive an integrated design strategy to develop a new integrated communication of subject(s) to be represented. 2. Develop detailed enabling communicative solutions considering the collected data concerning the end-users and the environment on which they will operate. 3. Verify the enabling communicative solutions using appropriate groups of stakeholders to test and add more value to the design decisions already taken into account.
6. Implement the system of enabling communicative solutions.	1. Produce the system of enabling communicative solutions using sustainable industrial production systems, which allow to accurately replicate data and shapes chosen in the design stages. 2. Situate the system of enabling communicative solutions in the environment considering relevant parameters, such as: visibility, accessibility, autonomy, usability and pleasantness of use.

*The production of communicative solutions through prototypes made with rapid prototyping techniques (i.e. [Table 1] Design Framework for the Inclusive Enhancement of Cultural and Natural Heritage (Barcarolo, 2017)*

- 3D Printing) for fast production, even using DIY tools.

<sup>1</sup> the Civic Museum in the Castle of Conegliano (Treviso, Italy); 2. the Villa Venier Contarini in Mira (Venice, Italy); 3. the Torcello Island the Venetian Lagoon (Venice, Italy); 4. the South Theodorian Hall's mosaic floor in the Patriarchal Basilica of Aquileia (Udine, Italy); 5. the Roman statue of the Emperor Claudius at the National Archaeological Museum of Aquileia (Udine, Italy); 6. the 'Six Saints' plaster bas-relief in the Lombardic Temple of Cividale del Friuli (Udine, Italy) (Barcarolo, 2017).

The design framework shown in Table 1 is therefore intended as a design flow: from the analysis of contextual information – i.e. starting from the analysis of existing condition of sites – to the development of design solutions, and their production using rapid prototyping techniques and/or DIY tools. The idea to develop Design Criteria and Design Guidelines is motivated by the need to act both at the strategic level with stakeholders (Criteria) and at the design level with designers and makers (Guidelines).

### 3.2. Design Experimentation on the Villa Venier Contarini in Mira (Venice, Italy)

Villa Venier Contarini in Mira (Figure 1) is part of the UNESCO site ‘City of Vicenza and the Palladian Villas of the Veneto’ (UNESCO WHC, 2016), which includes twenty-four villas designed by Andrea Palladio in XVI Century. The villa complex is composed by a set of buildings and open spaces oriented along a North-South axis. The owners were housed in the main building, while the work areas were located in the ‘barchesse’ (outhouses) on sides of the building; in front of the main building there is an entrance garden and, on the back, a park. Two floors compose the central body of the villa: at the first floor – also known as ‘noble floor’ – there is a large living room with a loggia used for parties, the ground floor was intended for building’s services.



[Figure 1] Villa Venier Contarini in Mira (Venice, Italy)

The opportunity to collaborate with reputable institutions like Veneto Region, the Regional Institute for Venetian Villas, Confartigianato Veneto and Libero Accesso, allowed to start the 2013 project ‘Libero Accesso® in Villa’ [in English: ‘Free Access in Villa’]. The aim was to create some permanent installations that would have allowed to all users in an inclusive way, respecting their visual capabilities (IRVV, 2015; Barcarolo, 2017). To be more precise:

- To propose a model for the research and the innovation, able to make easier the multidisciplinary work and to enhance the sharing of know-how of the team involved in the project; this in order to achieve real results with benefits for end-users and stakeholders.
- To promote the use of the Design for All (DfA) Approach (the ‘design for human diversity, social inclusion and equality’ (EIDD, 2004)), as innovative, inclusive and sustainable approach useful to create user-friendly products and services usable by all end-users interested in the fruition of the Villa, including those with psychophysical or sensorial-perceptive impairments/disabilities, both temporary and/or permanent.

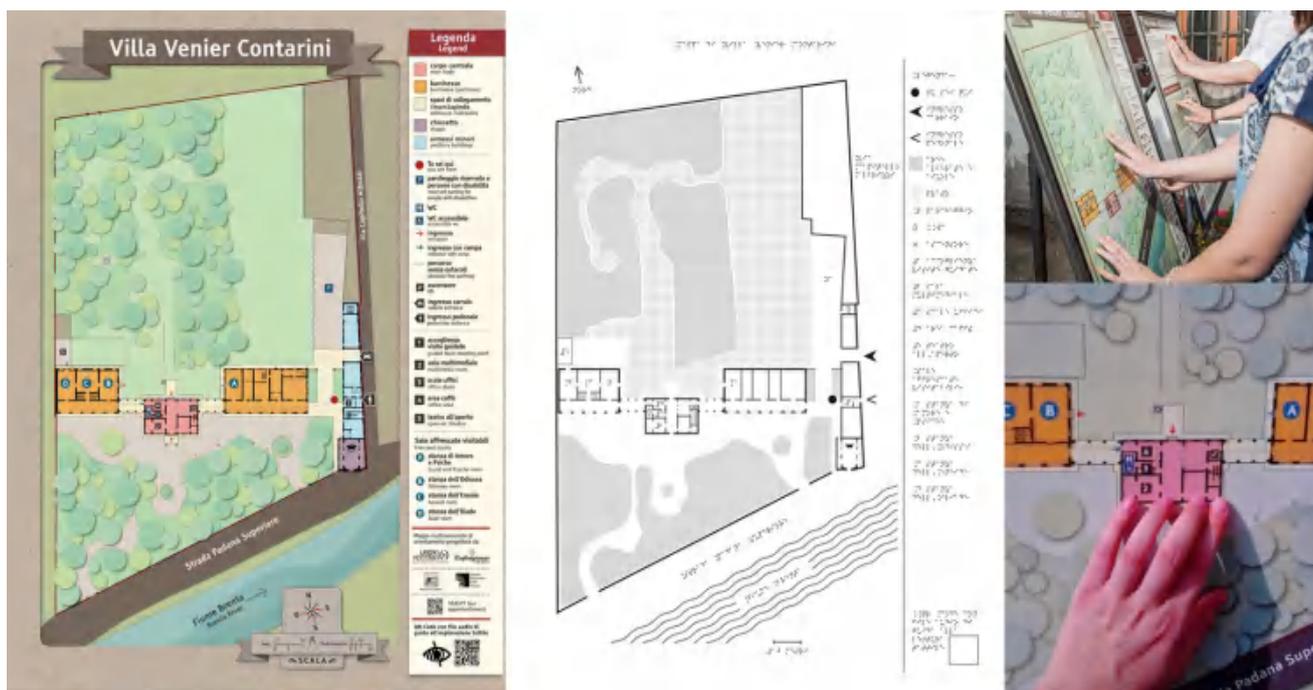
On the strategic point of view, the design experimentation has been addressed on the new idea to Venetian Villa as an ‘open and inclusive space’ able to empower all human diversities and the autonomous visit of people having different abilities. Consequently, the Head of IRVV expressed the need to have a simple and fast-replicable set of solution usable even for the others twenty-three villas composing the UNESCO site in the Vicenza area.

The use of the Design Framework for the Inclusive Enhancement of Cultural and Natural Heritage allowed to produce the early concept and, later, the specific design solutions for the inclusive fruition of the Villa (Barcarolo, 2017). The concept proposed was intended as a set of flexible and transportable visual solutions ‘for All’: solutions able to meet the needs both of end-users with some sensorial-perceptive and/or psychophysical disabilities and of able-bodied ones. In terms of designed solutions, a set of two visual multisensory and multimedia panels have been created to meet the project’s aims. In particular, the tangible solution is both visual and haptic, and shows:

- Contents: orientation and historical-architectural information.
- Modalities of fruition (for the cognitive empowerment): visual, haptic, auditory, etc.
- Graphics: use of emotional graphics inspired by historical maps and illustrations of fairy tales.

The calibration the double-layered communication – haptic + visual – has been done using insights from Tiphology domain. In fact, the communicative panels have been made using both braille texts and relief drawings made with transparent ink (haptic communication), and coloured visible texts and drawings (visual communication). The use of transparent ink, for braille texts and for schematic representations of plans, allowed to manage very well the

information and the amount of useful data – needed, for example by blind end-users – on representations having complex graphical details (i.e. photos, plans, etc.) (Barcarolo, 2017) (Figure 2). The final result is a communicative solution that empowers end-users and gives them the chance to freely visit the site.



[Figure 2] Double-layered visual-haptic communicative panels for the Villa Venier Contarini in Mira: visual communication (left), haptic communication (centre) and details of the fruition (right) (Barcarolo, 2017)

Finally, an additional multimedia solution has been developed to meet the needs of deaf end-users; in this case, a video clip accessible via smartphones and QR Code reproduces all information of the Villa using the LIS Language (Figure 3); this last solution allowed to perfectly meet the DfA Approach and to give completeness to the project.



[Figure 3] LIS video clip for the fruition of Villa Venier Contarini (deaf end-users) (Barcarolo, 2017)

#### 4. CONCLUSIONS

Since 80's, the international attention on the issues concerning the enhancement and the promotion of Heritage acquired a strategic relevance in terms of economic growth, local development of communities, enhancement of autochthon identity, historical preservation of human 'genius loci' – human legacy – and documentation of natural moulding effects. As it has been discussed, the protection and the enhancement of Cultural and Natural Heritage, including UNESCO one, is a priority mission for this and for the next generations; in the scenario of Sustainable Development, the issue of valorisation is important to support the sense of sustainability and inclusion linked to the fruition of the assets (i.e. protection of buildings and natural parks, valorisation of cultures, etc.).

In order to guarantee the maximum fruition, the Design community recognised the value of accessibility of sites as fundamental to give the chance to experience of buildings, monuments and natural sites; however, the traditional design approach tends to consider only able-bodied people or, in some cases, only people having physical disabilities. Today we know that these deficit conditions are only a minimum part of all potential conditions of customers interested to visit a site. In other words, people, today, are not well considered and included in the design processes and in the systems of territorial valorisation of Heritage, producing indirect limitations – exclusions – in terms of local and economic development, as well as in a lower quality of the sites' fruition.

The study here presented introduces new relevant advances for the scientific and design knowledge – i.e. literature – in the field of the enhancement of Cultural and Natural Heritage. The introduction of the Design for Social Inclusion in the strategic design actions allows to consider even people having sensorial-perceptive disabilities (i.e. blinds) who express the same will to visit a site as able-bodied people. Accordingly, this study demonstrated that it is possible to connect the need of visual enjoyment and visual fruition of Heritage with the design of communicative solutions conceived for this scope.

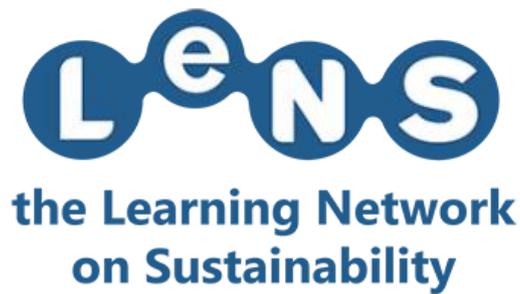
As shown in the case study on Villa Venier Contarini in Mira, it is possible to approach the issue of the enhancement of Cultural and Natural Heritage using innovative inclusive-based design tools (Design Criteria and Design Guidelines) useful to develop sustainable-oriented communicative solutions able to exceed the visual-centric design culture, empowering the touristic and economic offer of the Heritage both at local and at global scale.

## CREDITS

This paper shows an extract of the research results achieved by Paola Barcarolo during her PhD training. The writing of various paragraphs can be attributed to Paola Barcarolo, for '2. Aims' and '3. Methodology', and to Emilio Rossi for 'Abstract', '1. Introduction' and '4. Conclusions'.

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## **ADOPTION OF BIO-BASED ECONOMIES IN RURAL KENYA FOR IMPROVED LIVELIHOODS**

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### **ABSTRACT**

Good livelihoods are a key component to providing adequate health, sustainable energy and satisfactory education within communities. One approach to providing a means for an efficient system for rural communities in Kenya is the uptake of bio-based economies. The research is a social change research guided by the transition theory. Anticipated transitions of the transition theory are applied to understand the relationship of different social contexts within communities and impacts of various roles. The qualitative study aims to map community member's perceptions of available resources and how resources could be used to improve livelihoods. Kenya's rural areas are vastly distributed hence rural communities in Murang'a County represent a viable sample with which to test a bio-based economy approach. The study will contribute not only an understanding of hierarchies in roles within the process network, but also provide socio-economic development hypothesis towards the successful adoption of bio-based economies.

Key words: Bio-based economy, Good livelihoods, Rural communities, Transition theory.

## 1. INTRODUCTION

According to Bugge et al., (2016) a bio-based economy is centred on reduction of fossil fuel. The global focus on sustainability has increasingly been on various ways to reduce the use of fossil fuels among other environmentally friendly practices. The bio-based economy also focuses on material cycles that are efficient and sustainable, through using waste from one process as a raw material for another. The distributed bio-based economy emphasizes the production of and/or use of raw materials produced close to their point of use. The European Commission (2012) argues that the term “bio-economy” is still a matter of discussion and there has not being one standard meaning of the same. The commission goes on to argue that research by various forestry, agriculture and fisheries researchers, show bio-based economies as the process of using bio-based products as an alternative to fossil fuels. Bio-resources are produced from a variety of sustainable sources which include but are not limited to biomass, crop residue, dedicated crops and crop processing by-product.

Rural economies are gaining a wider and more complex relation with other sectors as well as industries. If well nurtured these relationships could lead to improved livelihoods within rural communities. Large portions of land in the Kenyan rural settings are used for agriculture. There are however other economic activities that take part in these communities that are directly or indirectly linked to the core agricultural activity. The integrated development of rural areas is based on a coherent and well-established network of the primary, secondary and tertiary economic and social practices within these communities. Inclusion of community members in establishing these relationships between the various practices would be more beneficial as community members are able to provide solution that they can own and be more involved in (Henry &Trigo, 2010).

One of the challenges faced by Sub-Saharan Africa is embracing the 2015 development agenda laid down in the United Nations’ SDGs. The main challenge is how the countries in this region could build economies that are more inclusive, sustainable and respond to the emerging needs such as environmental preservation, empowerment of livelihoods and community development. This will require governments to consider long term development goals and adoption of economies that ensure food security, improve livelihoods by diversifying economies and conserving the environment. Eastern Africa’s policy makers, researchers and corporate decision-makers have in the past decade had their focus on the bio-based economies particularly in the social and biological sciences. In Kenya the focus is on the implementation of these economies within the rural settings as a way of achieving the president’s big for agenda that encompass; enhancing manufacturing, food security and nutrition, universal health coverage and affordable housing (GoK, 2007).

The main research objective was to investigate to what extent (if any) bio-based economies have been adopted in Murang’a county (sample representing rural Kenya). The researcher’s other objective was to investigate the hindrances towards the adoption of bio-based economies in Murang’a county. Through the research the researcher sought to answer the question of whether the bio-based economies have been adopted and if not why by highlighting the benefits of the same.

## 2. TOWARDS A BIO-BASED ECONOMY

Developing countries stand to achieve global society’s stated objectives on hunger and poverty through focusing mainly on rural development. Despite increasing urbanization in these counties extreme poverty continues to be a rural phenomenon. Out of the world’s 1.2 billion extremely poor people, an estimated 75% live in rural areas and mostly depend on agriculture, forestry, fisheries and related activities for their livelihoods. Adopting sustainable bio-economies in rural areas has the potential to increase employment opportunities, reduce income disparities, increase security and reduce poverty at its very source in turn leading to improved livelihoods in these rural areas (Henry &Trigo, 2010).

Adopting bio-based economies in rural areas is one of the key contributors to improved livelihoods through improved environmental and economic practices. Bio-based economies can completely change a community and in Kenya could be a key factor in improving livelihoods within rural communities. This type of economy provides for establishment of industries that give opportunity for further growth of a community in a sustainable way. Activities within rural communities like agriculture, forestry and fishing have a great potential to be central to this bio-based economy providing the much needed raw materials for production of key bio-products like fuels, gases and raw materials for various industries. The public-good benefit of adopting these economies within rural settings include but are not limited to job creation through growth of industries, infrastructure development, improved health and security, and environmental conservation (Staffas et al., 2013).

### 2.1. Agriculture and the bio-based economy

Approximately 85% of the communities living in rural Kenya practice agriculture as their main economic activity. Agricultural activities involve a lot of human manipulation of the land and biosphere which in turn impacts the environment. Much of the environmental harm is associated with the use of fossil fuels either in the inputs like farm fertilizers and transportation of farm goods from one place to another. Agriculture is looked upon as one of the main providers of raw materials for various industries. This needs to be practiced sustainably ensuring that enough raw materials are provided for industries but at the same time natural resources are not impoverished (CARC, 2003).

One of the areas which can be sustainably improved is the proper management of farm waste and residue. Crop residues are available in very large quantities and can be used either as animal feeds, farm manure (hence avoiding industrial fertilizers), and in the production of bio-fuels that would help in reduced fossil fuel use. Crop residues also can be used to protect the soil from erosion and maintain the soil organic matter in the most natural way possible. The choice of crop in a farm is also an important consideration within these farms that should be taken into account. Farmers should be sensitized on crops for each season and on crops that maintain the soil fertility at all time (Bugge et al.,2016).

Government policies are important in ensuring a smooth transition to these bio-based economies. Policies on training and sensitization on the advantages of the bio-based economies need to be implemented as most people living in rural areas simply do not understand the benefits of these economies mainly due to lack of training. Policies on funding for various sectors in rural areas especially agriculture, fisheries and forestry should be integrated to include coordination of the various arms of the bio-based economies. This includes but not limited renewable feedstock supplies, seed supplies, sustainable fertilizers, water resources, energy security and trade. A major point of connection between agriculture and the bio-economy is in the field of public policy and institutional arrangements that regulate innovation, production processes and the allocation of intellectual property rights. Rural governance plays a key role in the effective implementation of the bio-based economies. With the devolution of various arms and bodies of the government most functions are now available closer to the people through local leaders. Rural governance enables training on bio-based practices through public gatherings. Through rural governance security is better provided within these rural areas, and infrastructure development is easily achieved like the improvement of roads enabling successfully implementation of bio-based practices (CARC, 2003).

The debate on the key components of bio-economy cannot be complete without drawing attention to the issue of societal coordination. Through societal coordination decisions are easily reached, thus bringing together different roles within society like the farmers, transport coordinators, those running industries, consumers and waste managers. This is simply narrowed down to communication and a need to adopt inclusive communication practices. There is however a need for a stronger focus on the interface between sociology, psychology and economics of a people to effectively understand how different arms respond to external drivers of the structure (Henry &Trigo, 2010).

**2.2.Common benefits of a bio-based economy**

Bio-based economies if properly implemented and adopted can provide important economic, social and environmental benefits. One of the best practices towards successfully adopting this economy is to clearly define the desired outcome then develop structures and policies that make those outcomes a reality. Transition towards a bio-based economy has far greater benefits to rural economies in terms of rural development, economic growth, reduces fossil fuel use (OECD, 2001).

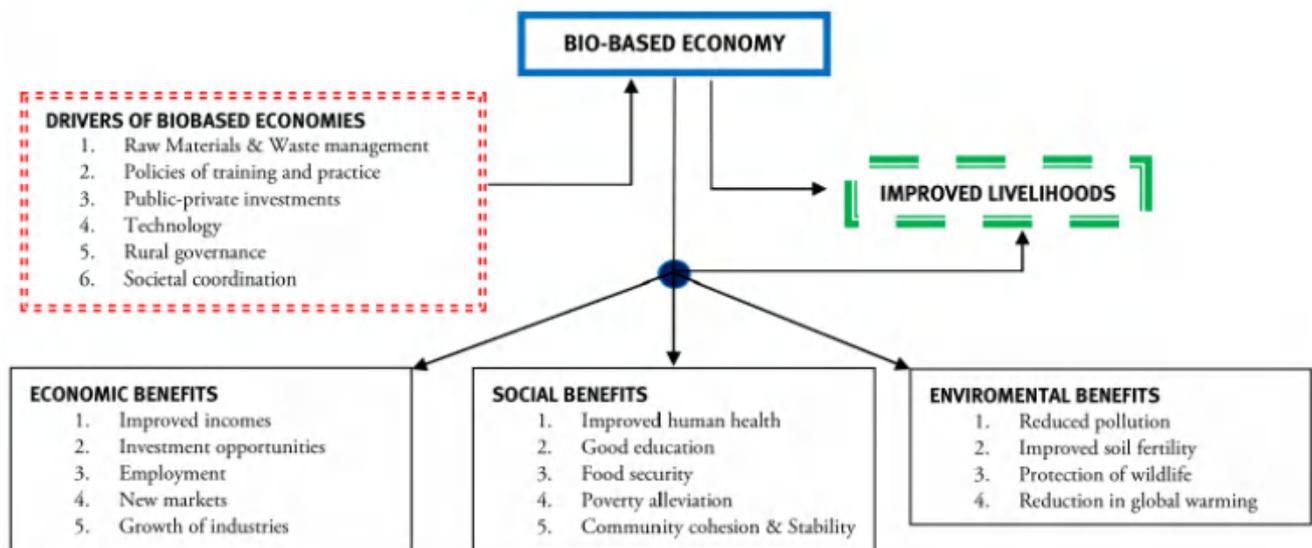


Figure 1; Benefits of a bio-based economy in rural areas/ communities

**2.3.Theoretical framework**

The research adopted the transition theory which argues that the systems upon which a society depends on must transition towards a more sustainable future. These systems include political, technological, economic and social systems. Transition theory proposes that for anyone to act as an agent of change they must apply planned course of actions with outlined expected outcomes by understanding the community systems within where the changes are expected. An anticipated transition was the main guide for the study. This dictates that adoption of bio-based practices within rural communities would yield various social, economic and environmental outcomes (benefits) towards sustainable rural communities and improved livelihoods (Retolaza, 2011).

### 3. RESEARCH METHODS

The research applied a qualitative approach assisted by a survey research approach. A transition research theory guided the research basing it on anticipated transitions brought about by various inputs which for the purpose of the research were discussed as drivers of a bio-based economy. The predictability of various economic and social benefits as outcomes of adopting bio-based economies was also discussed in this research (Yin, 2013).

The study's population is rural areas in Kenya but since they are vastly distributed geographically a case research design was applied Murang'a County being selected as the case study for the research. Samples were selected from Kangema constituency within Murang'a County using both purposive sampling and convenient sampling methods based on the samples's accessibility. The sample comprised of twelve (12) homesteads (distributed across the three wards in Kangema constituency) from where the objective was to investigate the bio-based practices applied and if none the hindrances towards the same and two (2) administrative officers from whom the objective was to investigate the government intervention towards the adoption of bio-based economies. The research applied both primary and secondary methods of data collection. The data collected was analyzed using both thematic method of data analysis and narrative data analysis method. Ethical considerations were put in place eg; the subjects were uncomfortable with photographs of their spaces so the researcher respected their request to maintain confidentiality (Yin, 2013).

Table 4.1 Research methods applied

COLLECTION METHOD	COLLECTION TOOL	TECHNIQUE	SIGNIFICANCE
Primary	Observation (Applied within the twelve (12) homesteads, and the environment within and around the community)	Observation involved the use of the naked eye to capture behavior and practices within the various homesteads. As the subjects requested nor to have photographs taken notes were taken instead (using a notebook) on the various bio-based practices observed and those not observed.	Through observation the study captured information that would otherwise not be captured by other means. Eg; It was easier to observe the use of animal and food waste.
Secondary	a. Interviews; Informal (Conducted in all the 12 homesteads)	The research applied twelve (12) interview guides with both open and closed questions. These informal interviews were used to gather data that would otherwise not be made available.	Informal interviews allowed an opportunity of asking follow-up questions. The interview mode created for a more involving data collection mode with the respondents.
	Questionnaire (Sent to the 2 administrative offices)	A list of questions was prepared prior to meeting the research subjects with the aim of answering the research questions. Three (3) questionnaires were sent to each of the two administrative offices a total of 6 questionnaires used.	The questionnaires were cost efficient and upheld the anonymity of the respondents. Through the questionnaires the study was able to cover all aspects of the research in a speedy manner.
	Publications Earlier research	Publications and earlier research on bio-based for the study were also used in data collection.  This was mainly through desktop research and visiting various libraries.	Through publications and earlier research, comparative studies on the various aspects of the research were conducted allowing for a better understanding of the bio-based economies.  These research methods allowed the generation of new insights for the study in a timely and cost effective way.
	Mass media	Online based research like paper articles and journals were also applied for the research. Most of the mass media research focused on finding data to answer the research questions through case study research.	Mass media research provided various successful case studies of adoption of bio-based economics in rural areas in various parts of the world. This was used as a basis to discuss the benefits of adopting the same within rural Kenya.

### 4. FINDINGS

Kangema constituency is an electoral constituency in Murang'a County, situated within central Kenya and is one of the forty seven (47) counties in Kenya. The constituency has a population of approximately 76,990 people and its total area is approximately 320 square kilometers. It is the 104th constituency in Kenya. The constituency is comprised of three (3) wards namely; Kanyenya-ini ward, Rwathia Ward and Muguru ward.

Approximately 87% of the area covered by the constituency comprises of rural areas. The main economic activity in Kangema constituency's rural areas is agriculture. Farmers keep various types of livestock and pets kept in 90% of these homesteads are dogs and cats. There's very little knowledge on bio-based practices or the advantages of the same within this rural community. This is mostly due to lack of training and support by both the rural government and the national government. Poor infrastructure like roads results to destruction of raw materials due to the time taken to transport to various trade centers. A lack of a well established public-private relationship has results to lack of adequate investments like industries to take up the raw materials produced also leading to wastage especially with overproduction as industries are far away. This has also led to insecurity (youth result to crime due to unemployment) and rural-urban migration.

There's very little wastage of crop and animal residue as the same are used for manure and feed for animals. The residues are also used for production of bio-gas within the few homesteads practicing the same. Most people only know of bio-gas production from seeing a small minority practice in the village. They also had knowledge of solar as a renewable source of energy as most used solar energy before the implementation of rural electrification program by the Government of Kenya which saw them switch to hydro-power as the main source of energy. Housing is mainly comprised of semi-permanent structured constructed using timber. The timber is sourced from cutting down trees within the area. Other building materials like iron sheets and masonry stones are transported from shops four kilometers away. Most of the community members' income comes from agricultural activities, mainly farming. The subjects would love an opportunity for sustainable practices that could improve their everyday living. Most houses are owned by the families and therefore no rent is paid and most are semi-permanent structures.

Table 5.1; Research findings from Kangema Constituency

Driver	Data Collection Tool	General Findings	Rio-Based Practise	Community Practices	Average Costs
Societal coordination	Interviews Observation Publications	Average land size is 2 ha per homestead. Farming is the main income source, earning each household approximately \$200 per month. Each homestead comprised of 3 households with 5 family members each; Total 15 people per homestead.	Labour on farms from within the community; employment. Farming usually planned around rainy seasons avoiding use of water to irrigate.	Lack of employments leading to rural-urban migration.	Average income per homestead is \$600 per month
Raw Materials & Waste management	Interviews (12 homesteads)	Raw materials sourced from farm produce. (Crops and animals).	Crop residues used as animal feed. Animal waste used as manure & for bio-gas production Food waste used as animal feed.	Raw materials transported to industries situated further away. Use of industrial fertilizers	Average cost of farm maintenance per month is \$150 per homestead.
Trainings & Policies. Rural governance.	Interviews (12 homesteads) Questionnaires (2 offices)	CDF office in charge of constituency development. Rural leaders lack open communication channels and an understanding of community needs like infrastructure.	Lack of training on bio-based practices. Lack of policies on bio-based practices & funding. Government bio-based initiatives for the community lacking.	Self-training on bio-gas production by observing neighbours.	
Public-Private Investments	Questionnaires (2 offices) Mass media	Investments are mainly on education (building schools), Using unsustainable materials.	A milk processing plant located five kilometres away. Churches occasionally offer seedlings to farmers.	Youth desperate due to lack of employment result to crime.	
Technology	Questionnaires (2 offices) Interviews (12 homesteads) Publications Earlier Research	Lack of basic understanding/training on technological advancements in bio-based practices.	Use of bio-gas for heating. Hydro-electric power; used for lighting and charging electronic devices.	Firewood and charcoal; used for Cooking and heating. Kerosene; used for lighting during power outages.	Average cost of energy used per month; \$20 per household.

Driver	Data Collection Tool	General Findings	Rio-Based Practise	Community Practices	Average Costs
Infrastructure	Questionnaires (2 offices) Interviews (12 homesteads) Publications Earlier Research	Main transport means is by road. The road network mostly dirt roads, with few gravel roads and a tarmac road to main town. Most houses are semi permanent.	People mostly walk to various destinations within the community. Few semi permanent houses constructed using mud brick and thatched.	Motorbikes & vehicles are alternate transport means Timber houses. cutting trees. Corrugated iron sheets & masonry stone sourced elsewhere.	Average cost of transport per month; \$15 per month per household.

## 5.CONCLUSION

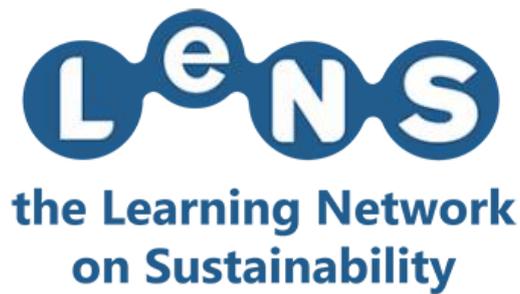
Kangema constituency is one of the constituencies in Kenya that directly impact the national economy through provision or raw materials for its industries. It is evident that these economies are not sustainable and more often than not are forgotten in the national government's development agendas. There's no documentation indicating that the county leaders have adopted bio-based practices within these rural economies. Kangema people and leadership are either ignoring or not aware that bio-based economies can work or can be replicated within their rural areas. Although bio-based economies have been adopted in various parts of the world, there are little or no interventions that have been done to improve the same practices within rural areas in Kangema constituency. The adoption of bio-based economies is yet to gain enough sensitization and awareness partly due to very little research and/ or documentation existing to highlight these practices in other area. It is through highlighting these bio-based practices and the success stories in various parts of the world's rural economies that we can improve the uptake of the same within the Kenyan rural setting.

From the research conducted, Kangema constituency's rural areas have very little or no bio-based practices within their economies. This is unsustainable when natural resources, environment and the sustainability of the communities are taken into consideration. As people seek to improve their livelihoods within the community settings they find themselves in, it is becoming evident that the rural economies need to shift their practices towards more sustainable ones as they also greatly affect the urban economies. The push to improve on the adoption of bio-based economies in rural areas in Kenya is further fuelled by the president's big four agenda (enhancing manufacturing, food security and nutrition, universal health coverage and affordable housing). The agendas are seen as strong drivers of bio-based economies and would lead to improved livelihoods.

Improvement of people's livelihoods is more than just improving their income. It is about making their way of life sustainable for their everyday living, improving the environment in which this everyday living is and ensuring continuity and prosperity of the communities. A bio-based economy can contribute to a more sustainable society, not only due to its positive impact on the environment through production of industrial raw materials, reducing dependency on fossil fuels and generating less waste but also due to the general growth it impacts on the society. With proper frameworks in place to facilitate adoption of bio-based economies the research findings can be used to ensure communities can have a positive impact on the environment and their surrounding communities within the research area and can replicated in other rural areas in Kenya.

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## DESIGN DISCRIMINATION–REFLECTION FOR CRITICAL THINKING

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### ABSTRACT

Design thinking based on problem-based learning is believed to promote reflective thinking in students. Students need to develop their reflective thinking habits to be lifelong learners and technical professionals. For this to happen, facilitators may first provide opportunities for getting students to reflect critically on their practice (for example through reflection journals) and secondly, guide reflective dialogue both between the facilitator and students, and also among students (Stein, 2000). In this paper, a framework is proposed to apply reflective design practice to nurture critical thinking, to go from the outside to the inside and influence changes in personal design decisions in Product-Service System (PSS) Design for Sustainability for undergraduate design students. The method is transferable to other disciplines as well.

Key Words: reflective, practitioner, undergraduate, design

## 1. INTRODUCTION

At Srishti Institute of Art Design and Technology, Bangalore, India students of the Bachelor of Design professional undergraduate degree programme, select some studio units in Business Services and System Design (BSSD) major in a choice-based system as part of their major or minor credits. The student mix in these units is multi-disciplinary from the second and third years together from the School of Design Business and Technology (6 majors, 200 students per year) and School of Law Environment and Planning (2 majors, 50 students per year). This research is from two BSSD studio units offered in 2017-2018 in Product-Service System Design for Sustainability – “Systems – Macro to micro look” and “How Systems Work or Fail – case studies”.

## 2. RESEARCH PROBLEM AND GOALS

**Situation:** Design educators use different tools to enable students to shape a reflective design practice within which their designs will reside to create impact. Students gather inputs through primary research (site visits, participatory planning) and secondary research (journal articles, texts, films, talks, multi-media, master classes, seminars and workshops).

**Complication:** The concept of sustainability in product-service system design has often been neglected in the present design world. In general design practice is more consumptive in nature and typically provides quick fixes at the micro-level. This has adverse negative impact on resources and the ecology and economy at a macro level and thus is unsustainable in the long run.

**Objective:** How can sustainability focused, contextual, self-directed work become part of a reflective design practice for students of design and engineering in undergraduate and graduate degree programmes?

**Overarching question:** How to propose a structured framework to enable reflective design practice in product-service systems for sustainability in a developing country?

Specifically, the desired result was located around the key issue of “How will design practitioners evaluate their own work and working process, and the work of others in relation to standards of the field of Product-Service System Design for Sustainability?”

## 3. THEORETICAL BACKGROUND

In modern thought, reflective practice is a conscious layering of the subtle over the tangible. This includes the thoughts, memories, emotions, feelings, beliefs and intuition over the observations made by the five senses and the resulting experiences. It enables a constant realignment, streamlining and sharpening of one’s work after sorting through uncertainty, instability, and conflicts to engage in a process of continuous learning and make it distinctive (Schön, 1983). Schön formulated his view on design in terms of “reflective activity” and related notions, especially “reflective practice,” “reflection-in-action,” and “knowing-in-action.” (Willemien, 2010). When a practitioner “reflects in action” his experimentation is at once all three – exploratory, move-testing and hypothesis testing. Exploratory testing is to see what follows, to get a reaction, and to play. Move-testing experiments have an end goal in mind. Hypothesis testing experiments confirm probable factors as causes for an effect in three ways – when they are simultaneously present or absent or vary along with an observed effect or phenomenon. “Reflective activity” may be defined as the “activity by which people take work itself as an object of reflection” (Mollo et al, 2004). All too often “the designer constructs the design world within which he or she sets the dimensions of his or her problem space, and invents the moves by which he or she attempts to find solutions.” (Schön, D. A. (1992).

In Indian traditional thought (Ghosh, Aurobindo. 2001) especially the Taittiriya Upanishad, there are five layers around the human soul. In general, external observations and inputs through the five sense organs create desires in manas (the sensory or processing mind), which together with chitta (consciousness, memory) are acted upon by ahankara (ego) to produce personal and distinct bhavana (emotions and feelings, likes and dislikes). These emotions and feelings are at the root cause of all human joy and distress. They could be conflicting and therefore need to be reflected upon with respect to dharma (idea of a law, or principle, governing the universe) by the buddhi (intellect, wisdom and the power of the mind to understand, analyze, discriminate and decide) to produce viveka (right understanding, discrimination, or discernment) for inner growth and knowledge. It is the buddhi, the discriminating faculty, and the freedom of choice that characterize us as human beings and the whole reason why emotions are generated from simple thinking.

Reflective practice was the basis of traditional Indian learning systems as seen even today in the heritage arts, crafts, and performing traditions. As an alternative to the post-colonial education system in India which is still predominantly Eurocentric many eminent personalities rooted in Indian philosophical thinking have influenced efforts towards indigenising the education system. The Indian thought on education shifted the focus of learning from the outside to the inside, from the teacher or facilitator to the learner in order to develop the learner’s individuality in harmony with society and nature. Swami Vivekananda believed that the process of learning is a gradual unfolding of the intrinsic quality of the individual through a mentoring process. Sri Aurobindo too placed emphasis on an all-round development of personality within the Indian experience. In his system of integral education he proposed five principal aspects relating to the five principal activities of the human being - physical, vital, mental, psychic and

spiritual (Ghosh, Aurobindo. 2001). “The chief aim of education should be to help the growing soul to draw out that in itself which is best and make it perfect for a noble use” – Sri Aurobindo.

Modern learning theories prescribe that deliberate reflection on the experiences of actions and responses is essential to produce insights (Loughran, 2002). This agrees with traditional Indian streams of thought. Reflective practice is self-directed and fosters critical thinking, problem solving, decision making, personal growth, self-knowledge of own beliefs, attitudes and values culminating in deep learning (Davies, 2012). Reflective thinking can be stimulated by both the learning environment and scaffolding methods as reported from a study on project based learning with middle school and college students (Hae Deok Song et al. 2006). Cowan’s 1998 three part model of reflection for, in, and on action shows the learning process as an overstretched spring than a cycle (Belton, Valerie et al. 2006). Typically facilitators model it and engage students in discussion or dialogue or students are asked to complete self-assessments or it is simplified to a design process consisting of activities and checklists (Reymen, Isabelle. 2001) or it is proposed as a conceptual model to guide and promote reflective design thinking (Hong, Yi-Chun & Choi, Ikseon. 2011). But it is not the same as a review process, it is usually not structured and not many tools and frameworks have been proposed for design practice as an independent personal process. So, this research attempts to pilot a framework based on Indian traditional thought for reflective design practice in studios.

#### 4. RESEARCH METHOD

Studio units are learning spaces in Srishti Institute of Art Design and Technology where students develop core disciplinary skills and knowledge, while navigating a trans-disciplinary environment. The two studio units (30 credit hours each), from Business Services and System Design (BSSD) major considered for this research were “Systems – A Macro to Micro Look” and “How Systems Work or Fail – case studies”. Abstracts of these units are below,

##### 4.1. Systems: a macro to micro look:

To understand the complex nature of systems and to know how macro factors in the economy, ecology and culture triad inform the Product-Service System Design for Sustainability at a micro level. What determines limits in the natural world, in economic systems and in social systems? Why is it important to think about the future? What is your responsibility to yourself, your community, and the world?

##### 4.2. How systems work or fail – case studies:

For anyone who designs, builds or maintains systems of any kind critical issues like quality and reliability and sustainability need to be addressed during the design stage itself. Learn from best practice case studies of system design in the areas of economy (example “Mumbai dabbawallahs”), ecology (example “Navdanya organic farming”), and culture (example “slow food movement”).

Each unit constituted a set of learning experiences and instructions including best practice system design case studies broadly around three themes for sustainable design – economy, ecology, and culture. Students produced acceptable evidences of their learning either through group work or individual study at three assessment intervals culminating in a final Product-Service System Design for Sustainability in one chosen area of the UN’s Sustainable Development Goals. These evidences were produced through open-ended, complex, and authentic performance tasks and design challenges to demonstrate four learning areas based on the UNESCO model – learning to know, learning to do, learning to live together, and learning to be. Individual differences and individual choices were welcomed and respected by the faculty. It accommodated self-paced, self-directed, contextual, and multi-disciplinary learning. A student was given time and space for reflection.

For the specific reflective design competency called “Learning to be”, students were assessed on learning to judge one’s own work and working process, and the work of others in relation to the standards of the field. Students chose two best practice Product-Service System Design for Sustainability case studies to reflect on per week over a five-week unit. These were drawn from a variety of videos, talks, books, and articles. The weekly assignment was to record individual reflections in a concise manner in one or two pages. They were given a framework for reflection with five layered open-ended questions to record intrapersonal outcomes going from the outside to the inside, from the specific to the general, from what they observed with their five senses to what they would envision as an ideal situation for that specific system.

Basic elements of the research method:

- Use five-layer design reflection framework
- Evaluate best practice case studies and examples
- Map affinity diagram from design reflections of students
- Analyse design principles and priorities for Product-Service System Design for Sustainability

The design reflection framework sought responses to five open-ended questions about the design to describe physical observations, identify causal factors, record felt emotions, make conscious decisions and imagine ideal situation. The intent was to go sequentially from the external to the internal, from the specific to the general while mimicking the natural thinking process according to traditional Indian thought. The conscious decisions and ideal future situation together could motivate a designer to look for ways to continuously improve the design further.

## 5. RESULTS AND ANALYSIS

About 300 to 400 reflections submitted by students in 2017-2018 from two units offered multiple times during the year were analysed further to map the terrain of design directions that students would like to take in Product-Service System Design for Sustainability.

For example, in one 5-week BSSD design studio unit (with 13 undergraduate students, 10 design reflections each), on the key issue of “How Systems Work?”, the mapping of the affinity diagram from design reflections of students revealed five design priorities (Figure 1),

- Build resilience in the system by influencing individual behaviour of stakeholders through collective clusters with shared responsibility
- Optimise functionality through service nodes interconnected in a cascading chain
- Improve user experience adding value at each touch point
- Embrace the local and the traditional
- Balance the ecosystem with respect to conversion of inputs to outputs



[Figure 1] Affinity Map: Co-create logical themes sorting from a random assortment of design reflections

These are not in any order of priority. Interestingly, these range from the apparent to the not so obvious. In that lies the value of the reflective framework as the findings could throw up surprises each time, as varied as the individuals reflecting. It can reorient design thinking in various directions while still converging on an overall design solution. Different travellers on many roads heading towards one destination.

In a similar 5-week BSSD design studio unit (with 22 undergraduate students, 10 design reflections each), on the key issue of “How to improve the quality and performance of product service systems?”, five design principles were synthesised,

- Reduce ecological footprint of materials;
- Enable local social entrepreneurship as it is also ecological - artisanal products, basic income, fair-trade, identity, culture, conviviality, survival, traditional solutions, bring back human interactions;
- Value ethics over profits to earn long-term trust and loyalty – design for needs rather than to create a need, truth, respect customer privacy, use human vulnerability for a better cause, principles, conflict free;
- Plan continuous improvement of community based cost effective solutions – community events, empower local women, collaborate with competitors for common good;
- Self-diagnose through participation and accountability of customers, employees and users – self-assessing, self-regulating self-recovering.

In another 5-week BSSD design studio unit (with 23 undergraduate students, 10 design reflections each), on the key issue of “How to design product service systems for sustainability with a macro-to-micro look?”, five design principles were synthesised,

- Design with nature – symbiotic, ecology, interconnected, interdependent;
- Ensure balanced throughput and closed loop cycling – cradle-to-cradle, self-regulating, feedback loops reinforcing and balancing, efficiency, ecosystems;
- Participate ethically to share the cause, share the effect – transparency, co-design, communication, inclusiveness, fair-trade;

- Be true to your roots – localisation, decentralisation, fair-trade, intercultural exchanges, local culture, pooling knowledge.
- Embrace inner transformation and design for generosity – empowerment, happiness, satisfaction

This framework is transferable to other disciplines also. For example, in Public Space Design (PSD) in a 5-week design studio unit on participatory planning (with 11 post-graduate students, 5 design reflections each and site visit observations), for the key issue of “How to reimagine Bangalore Central University campus as an urban commons?”, six design themes emerged,

- Conserve and integrate buildings in the heritage zone;
- Demonstrate energy efficient design of spaces;
- Upgrade amenities for better user experience;
- Enhance learning experience of the university network;
- Enable fluidity and accessibility between campuses;
- Bring in belongingness and attract diverse audience.

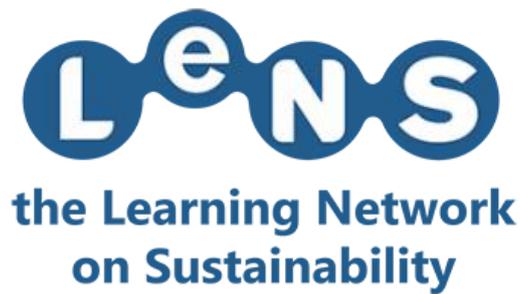
This is a prioritised list after a pair-wise comparison exercise. It gave students relative weightage of the six themes with corresponding focus areas to detail and enhance further.

## 6. IMPACTS ON SUSTAINABILITY

Reflective thinking in students enables them to become lifelong learners. This paper presents a framework for reflective design practice based on traditional Indian thought attempted for the first time in Srishti Institute of Art Design and Technology. It is a transferable framework that could work with students across institutions, across geographies and across sustainable design issues. It allows faculty and students to apply this framework and navigate through design for Product-Service System Design for Sustainability which many programmes are lacking in. It fosters a distinctive practice in sustainable design among design practitioners with deeply entrenched values, ethics, and morals emerging from a reflective design practice.

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## **ORGANIC FARMING AS A LIVELIHOOD OPPORTUNITY AND WELL BEING FOR SUNDARBAN FARMERS**

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### **ABSTRACT**

The challenges for small holding agriculture in India are quiet demotivating specially in the regions where education and awareness level is low and poverty is high. One such region in India is Sundarbans, West Bengal. Therefore the study was conducted with marginalised farmers of Sundarban. The study attempts to Explore different opportunities and challenges related to livelihood and wellbeing among extremely marginalised farmers through organic farming adoption. The study also identified different factors or categories realted to organic farming practice and evaluate the relationship between them. The farmers and eco volenteers from an NGO were interviewed and Grounded theory was applied to analyse the information. 42 items were itentified through Open coding , 7 categories evolved through Axial coding . Organic Farming Adoption is identified as the core category through Selective coding. Key words : Organic Farming, Grounded Theory , Sundarban , Livelihood.

## 1. INTRODUCTION

The Indian organic food market is growing at a faster rate compared to the developed nations (Singh & Verma, 2017). Though the domestic market is limited, the industry has immense export opportunities (Singh & Verma, 2017; Nandi et al., 2017). India is having the highest number of organic producers in the world (Willer et al., 2018). All these factors interested a significant number of corporate players to venture in this domain. More than 80 percent of organic farmers of India are small and marginal, holding less than 2 hectares of land (Mahendra Dev, 2014). The challenges for small holding agriculture in India are quiet demotivating. Some of those issues that marginal-small farmers have to encounter on a regular basis are imperfect markets which lead to generation of a small value for their product, product realization, absence of access to credit markets; poor human resource base; poorer access to public goods such as public irrigation (Mahendra Dev, 2014). In some cases many corporate players take an advantage of their situations and exploit them to develop their own market. Moreover skepticism or trustworthiness about organic production among the consumers is an important issue.

### 1.1. Why Sundarban ?

Sunderban accounts for one of the World's largest salt tolerant mangrove forest and declared as World Heritage Site in 1987. The deltaic region is intertwined by complex network of tidal waterways and mudflats. Wide range of fauna – 260 bird species, Bengal tiger, estuarine crocodile and Indian Python. On the other hand climate threats are quite evident in Sundarban. One major indicator is increasing temperature of water, Sundarbans is experiencing an increase in water temperature at a rate of 0.5 degree C per which is much higher in comparison to the observed global sea surface temperature which is increasing at the rate of 0.06 degree C per decade (Bhatt et al., 2018; Loucks et al., 2010). Scientific data shows that the rise in sea level is almost double than that of global average in last 25 years. There is a significant upsurge in the intensity of cyclones hitting the deltaic region (Bhatt et al., 2018). Heavy siltation and unhealthy disposal of solid waste from adjacent cities affected the soil and water in this region. The rivers in the Sundarbans do not receive fresh water from the upstream Ganges (Bhatt et al., 2018). Multiple such factors have disrupted the agriculture system of Sundarban. Agriculture is also being affected because of the high levels of salinity in the soils due to frequent high tides, cyclones and storm (Mukhopadhyay et al., 2018). Agricultural area had shrunk due to multiple reasons. Only 12% of the cropped area in the Sundarbans is irrigated through rain-fed ponds, tanks and canals; majority of the agricultural land is rain fed, the irrigation system is highly inefficient (Hajra and Ghosh, 2018). It has been observed that rainfall has become erratic and its intensity has increased causing further damage to the agricultural yield and variety reduction. There were six local salt-tolerant farmers' paddy varieties. Now they are just left with two varieties due to too much of mono crop culture.

Poverty in Sundarban has made these challenges even worse. It is one of the most densely populated parts of India. Population density of about 929 persons/square kilometers in 2001, which has increased to 1,082 persons per square kilometers in 2011. 44 per cent of the population living in this region is below the poverty line. The landholding among the farmers in this region is significantly low which is around 0.2 hectares on an average. Considering all the above mentioned challenges in this region the study attempts to explore farmers' life in Sundarban and multiple opportunities and challenges related to livelihood and wellbeing. The achievement of wellbeing can vary from escaping morbidity, mortality, being adequately nourished, having mobility etc. to complex ones such as being happy, achieving self respect etc. (Sen, 1993).

## 2. THE OBJECTIVE FOR THIS STUDY

- Explore different opportunities and challenges related to livelihood and wellbeing among extremely marginalised farmers through organic farming adoption .
- Identify different factors or categories related to organic farming practice and evaluate the relationship between them.

## 3. RESEARCH METHOD

Grounded Theory is applied to explore the opportunities and challenges among the farmers. Grounded theory was first presented by Glaser and Strauss (1967) out of an urgent need in the field of social science research. It is also a suitable approach in generating factors for different constructs (Parry, 2003). It is generally performed through three stages – Open coding, Axial coding and Selective coding.

Primary research for this study is being conducted through a continuous and active engagement with Sundarban based NGO operating in the region called Pashchim Chintamanipur. They started organic farming as an intervention in 2015 to create livelihood opportunity and wellbeing among this extremely marginalized farmers. 1000 farmers got enrolled at the initial stage which has now increased to 3770 farmers and quite a significant among them are women, spread across 23 villages. They have appointed 17 eco volunteers to supervise and monitor their activities. Average land ownership among these farmers are one bigha (In WestBengal 1 bigha = 0.1338 hectare). Therefore their land holding is around 0.2 hectares. Each land has a small pond which is a source of water for irrigation , helps in rain water harvesting and also perform some fishery activity.

Primary data was collected through interview and focus group discussion among the resource farmers, women farmers and eco volunteers of an NGO from Sundarban Region with a set of semi structured questionnaire addressing towards understanding their land holding and basic financial strength, challenges related to organic farming adoption etc. The transcripts from these interviews and focus group discussion are being used for open coding to generate exclusive items.

### 3.1. Open Coding

The interview of the farmers and some NGO eco volunteers are recorded verbatim. The recording was in local language. Initially a transcript was prepared in local language and then translated in English by an expert. Another expert was introduced to retranslate it back to the original local language. And both the transcript in local language was compared to check the deviation or distortion from the original in the overall theme or meaning.

The transcript in English language has gone through minor changes in this process. Then this transcript was used for open coding. The researcher did open coding on the data to identify concepts, which are also known as labelled phenomena (Goulding, 2002). Then the primary labelling was done based on the researcher identification in relation to its significance in the data.

Open Coding is an interpretative process by which data are broken down analytically. Its purpose is to give the analyst new insights by breaking through standard ways of thinking about or interpreting phenomena reflected in the data.

The following open coding process has been explained below with few examples. It has three sections: Excerpt, Primary label and Memo. Excerpt is a portion from the translated transcript; Primary label which is the key phrase or sentence or concept evolved from the extraction of the transcript which is also known as labelled phenomenon. Memos are integral part of grounded theory. Memo contains the explanation and the logic behind selecting the primary labels and their role in the context.

Excerpt 1 (Resource Farmer)

I have to spend lot of time and energy in preparation of compost and the soil. We are going through lot of struggle in the process of converting the land fit for organic farming. Sometimes with so much change in weather and also sometimes it is difficult to map right kind of soil with the seed. Then we don't get a market who will pay little more for this labour.

Primary label / Open Code : The primary label or the open codes from the above transcript are as follows.

- Lot of time and energy in the preparation of compost .
- Lot of time and energy in preparation of soil
- Lot of struggle in the process of converting the land fit for organic farming
- Frequent weather change is also a constraint
- Difficult to map right kind of soil with the seed
- No market to get a value for the labor

Memo : The primary label "Lot of time and energy in the preparation of compost" is one of the key concern that farmers mentioned and is a major limitation for getting into organic farming . Similarly "Lot of time and energy in preparation of soil" is another major limitation for organic food adoption. "Lot of struggle in the process of converting the land fit for organic farming" is something which most of the farmers have mentioned and not much government support are available for this, sometimes they feel that the NGO support is also not enough. "Frequent weather change is also a constraint" is an important parameter to be considered for organic food production. Change in weather is badly affecting the production, which is done organically. Many farmers have mentioned that it is "Difficult to map right kind of soil with the seed" as many areas in Sundarban has become extremely saline after "Aila" cyclone and also due to frequent flood and continuous contamination of different pollutant is changing the soil composition and hence creating multiple patches of different variety of soil. "No market to get a value for the labor" is a major problem across all marginalized farmers in India and definitely the challenge is even more when they are willing and trying to convert to organic farming practice. Most of the literature has mentioned about the challenge associated to develop market for organic farmers.

Excerpt 2 (Eco Volunteer)

The children see the kind of hard work they put in. Their parents are not getting enough money in return. So next generation is not much interested in it. Farming is not a glamorous work for next generation. They are always influenced by different television program and exposed to different types of lifestyles through that. They are strongly influenced by urban lifestyle. Sometimes they are interested to learn technology. But organic farming has no technology association in our place.

Primary Label/ Open Code

- Next generation is not much interested because organic farming is not much revenue earning.
- Farming is not a glamorous work for next generation.
- Next generations are strongly influenced by urban lifestyle.
- Lack of technology intervention in organic farming does not attract next generation.

Memo: "Next generation is not much interested because organic farming is not much revenue earning" is another major constrain for popularizing the knowledge related to organic farming across India. Due to too much

unhealthy media exposure going around kids and young adults are continuously getting attracted to those. Typical corporate attraction towards multiple short-term job market is continuously shifting their interest therefore “farming is not a glamorous work for next generation”. As “Next generations are strongly influenced by urban lifestyle” therefore its extremely degrading for them to pick up farming specially organic farming as a profession. And also “Lack of technology intervention in organic farming does not attract next generation”. Technology intervention can be a key-driving factor to attract next generation and definitely lot of young minds to innovate in farming domain for sustainable food production.

#### Excerpt 3 (Women Farmer)

I am interested to take up organic farming to take care of my family nutrition and also earn some money. I am empowered through organic farming and able to plan for my child’s development. I can manage my regular food and nutrition demand and sell surplus production, which is a source of earning for me. I use that money for my child’s private tuition. I take active part in family decision-making.

#### Primary Label

- I am interested to take up organic farming to take care of my family nutrition
- Sell surplus production which is a source of earning for me
- I am empowered through organic farming and able to plan for my child’s development.
- I take active part in family decision-making

Memo: “ I am interested to take up organic farming to take care of my family nutrition “ is a key statement. This gives an understanding that how women can be potentially channelized to organic farming which will eventually take care of family food security, nutrition and health. “Sell surplus production which is a source of earning for me”, this statement shows how organic farming can be a potential driver for poverty eradication and livelihood opportunity for this marginalized community. “ I am empowered through organic farming and able to plan for my child’s development.” This is another primary label, which highlights on child’s development through women empowerment. In this context it was being possible through organic farming adoption. They were being able to eat nutritious and healthy food and also their wellbeing and education are also being taken care off. “I take active part in family decision making”, this is also an important aspect of empowerment and adoption of organic farming made that possible to a certain extend.

### 3.2. Axial Coding

The next phase of Grounded theory has being performed with these open codes, which is called Axial coding. Once the open coding is over the researcher moved to axial coding to establish the relationship between the open codes, which are subcategories, and categories through contextual and theoretical understanding.

According to Corbin (1998), in order to test emerging hypotheses, relationship statements are made at the abstract level, not from raw data, but from concepts. This requires a different and more sophisticated coding technique, which is commonly referred to as ‘axial coding’ and involves the process of abstraction onto a theoretical level (Glaser and Strauss, 1967).

The categories are connected to sub categories through axial coding (Corbin and Stauss, 1990). In this study axial coding was performed to relate the different categories and sub- categories, which are generated, based on exploratory contextual understanding. Axial coding is the process of relating categories to their sub-categories. The coding is termed “axial” because coding occurs around the axis of a category, linking categories at the level of properties and dimensions (Corbin and Strauss, 1990).

All the primary labels were laid on one side and the categories on the other. Then they were mapped through affinity mapping exercise. Through this exercise large number of qualitative information get sorted into groups or categories. From contextual understanding the researcher attempted to explore the connections between sub categories and categories. For example “Labour intensive and lot of struggle at the initial stage”; “Next generation is not much interested because organic farming is not much revenue earning” are primary labels evolved from open coding. These primary labels, which are also called sub categories under axial coding, were connected to the category “Organic Farming Adoption”.

Table 1 : Subcategories and Categories Evolved From Axial Coding

SUBCATEGORIES	CATAGORIES
Organic farming adoption	<p>Labor intensive lot of struggle at the initial stage            Lot of time and energy in the preparation of compost .            Lot of time and energy in preparation of soil            Lot of struggle in the process of converting the land fit for organic farming            Mapping right kind of soil with the seed.            Next generation is not much interested because organic farming is not much revenue earning.            Farming is not a glamorous work for next generation.            Next generations are strongly influenced by urban lifestyle.            Lack of technology intervention in organic farming does not attract next generation.            Frequent weather change is also a constraint</p>

Market accessibility	Maintaining a continuous customer base is a challenge. Very difficult to keep the leafy vegetables fresh till the time of delivery. Sometimes fail to predict the demand. Lack of quality control. Lack of product merchandising and packaging.
Family Well being	Women are empowered through organic farming. Able to earn and plan for their child development. Able to take their own decision. Improved their respect towards environment. Take care of the quality of soil which got too much affected by inorganic fertilizers.
Health care and nutritional need	Grow fresh and good quality vegetables for family. Maintain cow for better quality milk for family. Maintain hen and duck for better quality egg and meat. Maintain and ponds to rear fishes. Each farmer's family is self-sustained to take care of their nutritional need. Lack of medical facility. Primary health care facilities are minimal.
Education and Awareness	Wide resource of indigenous knowledge related to farming. Wide resource of indigenous knowledge related to medicinal plants. Strong awareness and knowledge related to reptiles like snakes and crocodile. Strong knowledge about pisciculture (breeding and rearing of fish). Lack of medical awareness. Lack of technology knowledge. Lack of scientific knowledge.
Livelihood Opportunity	Low cost organic farming as a potential for economic development. Surplus milk produced by healthy cows is highly valued in the market. Eggs produced organically are of high demand in the market. Actively engaged in building ponds, rain water harvesting.
Women Empowerment	Women are interested to take up organic farming as a potential livelihood opportunity. Women feel it as a potential driver for their poverty eradication. Able to earn and plan for their child development. Able to take their own decision.

### 3.3. Selective Coding

Selective Coding is the process by which all categories are unified around a core category (Corbin and Strauss, 1990). Here in this study the selective coding on the data was performed to identify the central category. Selective coding is the process of integrating and refining the theory. The central category or the core category represents the main theme of the research. Here in the study the theme of the research focuses on organic food adoption. Other factors like Market Accessibility, Family Well Being, Health Care and Nutritional Need, Education and Awareness, Livelihood Opportunity, Women Empowerment revolve around Organic Farming Adoption. For example, Market Accessibility is one of the driving factor which is responsible to provide revenue from their produce. Therefore if that factor is strong enough then Market Accessibility will be a potential motivating factor for Organic Farming Adoption. Similarly other factors are in some way connected to Organic Farming Adoption through this Selective Coding technique.

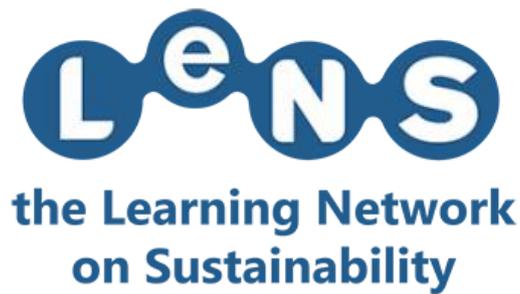
## 4. CONCLUSION

The application of grounded theory on the transcripts generated from the farmers' interview led to multiple dimensions related to adoption of organic farming as a livelihood opportunity.

The study generated around 42 items or primary labels through open coding technique. The Axial Coding technique under grounded theory contributed to 7 dimensions: Organic Farming Adoption, Market Accessibility, Family Well Being, Health Care and Nutritional Need, Education and Awareness, Livelihood Opportunity, Women Empowerment. Selective coding technique facilitated the identification of the core category, which is Organic Farming Adoption and established its connection with all other 6 categories. These categories along with the items can be used as a guideline for further research. The items evolved from open coding can be used for scale development process by application of exploratory and confirmatory factor analysis. The key attribute like Organic Farming Adoption can be a potential driver to economic development of this marginalised farmers. This will eventually contribute to farmers' livelihood and wellbeing.

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## **ERSILIALAB IN MILAN. A PARTICIPATORY EXPERIENCE TO DESIGN NEW WAYS FOR ROMA'S SOCIAL INCLUSION**

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### **ABSTRACT**

Urban poverty and its spatial manifestations are linked to social production of cities (ASF 2012). In this direction, ASF's understanding of exclusionary practices and processes in the built environment is based on the idea that spatial structures are the means and outcome of social relations.

ERSILIALab is a social/urban development programme in which ASF Italia aims at overcoming Roma's difficult living conditions in informal camps and at promoting relationships between Roma and their nearest neighbours — called *gadjé*, namely not-Roma.

Italian political agenda has been studying possibilities of Roma's inclusion for long, but no shared answers have been already achieved.

Since 2017, ASF Italia has been working in a Roma camp located in South-East Milan urban fringes. After a yearlong process, Roma and some neighbours have built together ERSILIALab's Carriage, a mobile public space to spread overlooked Roma's culture and to share mutual knowledge, providing a participatory opportunity for cross-cultural relations.

Key Words: Social and urban development, Roma inclusion, Self-promoting processes, Participatory design.

## 1. INTRODUCTION

### 1.1. Roma camps. The Italian context

In Italy, the majority of Roma communities are traditionally living in nomad camps. While some of these camps are defined as regular —namely legally recognised—, some others are just irregular. The vast majority of them is socially homogenous and spatially segregated, with no direct access to basic infrastructures and services. The greatest part of families living in camps are weakened by economic and social difficulties that deepen Roma's isolation and discrimination. Women and children are the most affected by these conditions, spending most of their time inside the camps. Furthermore, the poor and precarious living conditions in camps make it difficult to regularly attend school as well as to get and to hold a job.

Being located in peripheral and disconnected urban areas, camps are invisible to the city of *gadjé*<sup>1</sup>. On the one hand, the invisibility feature helps in building a protected environment in which developing mutual support inside the community, activating small improvement processes of living condition. But, on the other hand, it also consolidates the presence of the unjust law of the strongest, and hence of violence. In an invisible context, prevarication spreads and facilitates the grounding of illegal practices, building an uneven environment in which is difficult to trigger fair improvement processes. Isolation transforms camps in lost places that *gadjé* do not recognise as part of the urban fabric. Indeed, *gadjé* usually perceive Roma's environment as place of mistrust and fear as well as, in parallel, Roma perceive *gadjé*'s city with the same mistrust and fear, perpetuating the reciprocal feeling of distance between the two communities. Regardless of the real level of risk, this reciprocal distance turns into conflict where the invisibility status of Roma settlements falls —i.e. for political reasons as well as for new business interests on lands irregularly occupied by Roma. In these cases, conflict consists in evictions, with police clearing people from the camp. Evictions are frequently unannounced and repeated, worsening the high vulnerability level of people and regressing them along the path of social inclusion hoped-for by the State.

### 1.2. Roma camps. The Milanese context

Since 2012, the Municipality of Milan has been promoting *Linee Guida Rom, Sinti e Camminanti*<sup>2</sup>, a set of guidelines for Roma's full social inclusion, concerning health, work, housing, education, and rights. The general aim of these guidelines is to improve Roma's living conditions by overcoming life in nomad camps<sup>3</sup>. Up to now, the Municipality has worked on:

- a progressive dismantling of existing irregular camps, as well as of some regular ones;
- the realisation of three *Centri di Accoglienza Temporanea (C.A.T.)*<sup>4</sup>, that are temporary centres for evicted people —especially if families with children. In theory, these centres offer a maximum of 200 days of permanence and the opportunity to undertake pathways of social integration. To be accepted in a C.A.T., a family has to subscribe a *patto educativo*, an educational pact in which parents commit themselves to look for a job and to send their children to school;
- the realisation of one *Centro di Autonomia Abitativa (C.A.A.)*<sup>5</sup>, a temporary centre dedicated —in theory— to people who already started a successful pathway of integration by getting a regular job, in order to help them in consolidating financial and housing autonomy.

The Municipality's guidelines allow and foresee the presence of private third sector organisations to work in a C.A.T. and C.A.A., in order to promote Roma's integration, with a particular focus on school education, capability building, and women employment.

The guidelines also wish for a rising positive exchange between Roma and their *gadjé*-neighbour, but little has been done in this direction so far.

The current state of irregular camps is difficult to evaluate. A survey led by NAGA<sup>6</sup> shows that, as a result of reiterated evictions in the entire territory of the city, a very fluid and ever-changing situation has arisen since 2013 (NAGA 2015). Furthermore, NAGA's report highlights that a large proportion of the funds has been spent on emergency measures —mainly on evictions and C.A.T. management—. These measures are a primary concern at municipal level, but, at the same time, they actually constitute an obstacle for the building of long-term positive relations with neighbours by integration pathways —indeed, the physical localisation and configuration of C.A.T. reiterates the typical condition of spatial segregation and ghettoisation that features nomad camps.

### 1.3. Bonfadini camp and Sacile C.A.T.

Four regular camps are still open in Milan at present. One of them is the camp of via Bonfadini, located in South-East urban fringes. It has been established in a specific area that Municipality assigned to nomad camp-

<sup>1</sup> *Gadjé* is the exonym given by Roma to all the people that are not Roma.

<sup>2</sup> See Allegato 1 of D.G.C. 21/11/2012. These guidelines are coherent with Italian *Strategia nazionale d'inclusione dei Rom, dei Sinti e dei Caminanti*, pursuant to European COM (2011) 173.

<sup>3</sup> Many Roma are no more nomads, at most they are forced to nomadism by evictions. Living conditions in camps are usually very poor.

<sup>4</sup> In 2019 just one of the three C.A.T. was still open, but it closed on March 24th. It was the centre in which ASF Italia has worked.

<sup>5</sup> The camp is located in North-West outskirts of the city.

ing in 1987. Bonfadini camp is a case in point concerning spatial segregation, as it is a triangular buffer zone delimited by three railway lines, close to an industrial area now partially dismantled. The camp is utterly separated from the housing blocks and the facilities of the neighbourhood. Furthermore, the camp is accessible only through an underpass systematically flooded when it rains. Bonfadini camp is inhabited by approximately 20 families of Italian Roma<sup>6</sup> who gradually established a permanent settlement in which self-constructed barracks and houses replaced previous trailers. Even if no collective space is present inside the camp, children and women spend most of their time inside of it. Roma women are always busy in housekeeping and childcare activities, some of them are also working and a consistent number is alone in family management as their husbands are in prison. Children are daily walked to school by social workers from Somaschi Foundation, but unfortunately the youngest have just few opportunities to see their gadjé classmates out of school time, as Roma mothers scarcely have the time to accompany them out of the camp —the road between the camp and the neighbourhood is dangerous, thus children are not allowed to walk without an adult. The few positive relations that Roma mothers and children established within school fabric are not able to overcome the sense of mistrust that gadjé neighbours feels for the environment of the camp, considered as a no-go area.

In 2016, the spatial and social segregation of Bonfadini camp was made worse by the opening of Sacile C.A.T., a temporary centre located on the corner of via Sacile and via Bonfadini.

Sacile C.A.T., led by Casa della Carità Foundation, has no collective spaces and its physical boundary is delimited by a fence encompassing about 12 housing containers. Each container measures approximately 100 sqm and host promiscuously 5 families —each sub-unit is separated from the other four by a curtain. Some other smaller containers are dedicated to collective bathrooms and kitchens and, when the weather gets mild, the open space in-between containers gathers collective life.

The absence of a relational network outside Sacile C.A.T. hinders the social inclusion of resident families and pushes them to maintain their previous subsidiarity relations as well as their old cultural and economic practices, where the space is conceived as a resource to occupy, and the objects have to be accumulated. The main source of income of families hosted in C.A.T. concerns waste recovery and fixing, to put these objects back on the market in piazzale Corvetto Sunday market.

Gadjé neighbours are paralysed by cultural distance and incomprehension of Romani way of living, moreover they are sometimes victims of theft. As a result, fear and exasperation risk to turn in hate and racism. The surrounding neighbourhood —called Molise-Calvairste-Ponti— is very multi-ethnic and many economically fragile families live there, so it is featured by a great number of associations socially committed, a fertile place for working on social inclusion issues.



[Figure 1] Top left: Sacile C.A.T. Image by ASF Italia. Bottom left: A detail of Bonfadini camp. Photo by Matilde Saletta for ASF Italia. Top right: Aerial view of Sacile C.A.T. Photo by Elena Mocchetti for ASF Italia. Bottom right: Children playing in Sacile C.A.T.'s surroundings. Photo by Elena Mocchetti for ASF Italia.

6. These 20 Roma families are from Abruzzo; thus, they are Italian citizens, with all the typical rights and duties of all Italian citizens. In 2017, an official survey reported that the camp has 89 inhabitants: 21 children (0-17 years), 36 women, and 32 men.

## 2. OBJECT OF THE WORK

### 2.1. ASF Italia's first steps

In January 2015, being called from Somaschi Foundation, Casa della Carità, and Vitality Onlus —the third sector organisations already working inside Bonfadini camp—, ASF Italia conducted interviews and workshops with camp's inhabitants in order to inquire, with a spatial glance, their outlook on the camp and its neighborhood, as well as on wishes and expectations about their own habitat and work future. The majority of camp's women and youngsters were highly responsive to debates, being willing to get in the game. As the first results of the work looked very promising, between April and October 2015 ASF Italia organised a series of wider and more structured debates and participatory workshops<sup>7</sup> involving not only Bonfadini inhabitants and social workers, but also several voluntary associations of the same neighbourhood, neighbours' representatives, and experts coming from similar experiences, so to define some possible lines of action to improve Roma's living conditions in Milan. As a result, camp localisation and spatial quality of habitat emerged as two main key-issues in determining current and future dynamics of social inclusion/exclusion dynamics. Indeed, physical isolation catalyses the establishment of anti-social and anti-urban practices, and these latter exasperate unfamiliarity, distances, and unawareness between Roma and gadjé. To deal with the two identified key-issues, ASF Italia decided to work with Bonfadini Roma community by gaining their trust and leading them to a progressive development of their relationship with gadjé neighbours, local voluntary associations and work network, stimulating Roma's ability of self-promotion and encouraging concrete exchanges between Roma and gadjé, going beyond stereotypes.

In parallel, at the end of 2015, ASF Italia, Somaschi Foundation, Casa della Carità, and Vitality Onlus together with the Municipality, have started a critical and operative reflection on current models and tools of Roma's social integration, conceived as complementary and necessary devices to overcome life in nomad camps, towards proper housing conditions. Indeed, at that time a discrepancy was present between Municipality's official guidelines concerning Roma and effective institutional activities. The work of Municipality and local authorities<sup>8</sup> was deeply influenced by political pressures, often conflicting and contradictory, hindering a structured and coherent approach. Thus, a permanent channel of communication with Municipality has been opened in order to trigger a wider change of paradigm on Roma housing and living conditions.

### 2.2. ERSILIALab. The Relational Library and its Carriage

During 2016, ASF Italia's work with Bonfadini inhabitants and their neighbours has evolved in a spatial project called ERSILIALab. The Relational Library. Meanwhile, Sacile C.A.T. was established and its Roma community was involved as well. Women, youngsters, and kids —both Roma and gadjé— have constantly been the beating heart of the work, during all the participatory sessions and parties.

The project went through different phases because of external obstacles —mainly political— that recurrently asked its remodulation. In its first version, the Relational Library gathered Roma and gadjé's aspirations around the participatory realisation of a temporary wooden library, located in one of the neighbourhood parks —parco Alessandrini—, placed halfway between Bonfadini camp, Sacile C.A.T., and the rest of the neighborhood. The construction would have been supported by local associations and working activities. However, in the Spring 2017 —just a few weeks before beginning the realisation—, local authorities of Municipio 4 have started to openly oppose the Relational Library project on media, by riding the contingent wave of worsening characterising local political conflict. Thus, ASF Italia decided not to expose the Relational Library and all the people involved as an easy political target. This would not have helped the achievement of the project general goal, so the Relational Library conceived as a temporary pavilion was put on hold.

Nevertheless, a mixed, and willing group aggregated around ASF Italia's activities, and we developed together a new version of the project, in response to Municipio 4 interferences. The new project aimed at raising awareness and at promoting cross-cultural relations between Roma and gadjé, so to open the way to a future Relational Library. Thus, ERSILIALab and all its heterogeneous team conceived a sort of library without walls, starting from a reinterpretation of Roma carriage, so to diffuse and carry around Romani culture in the context of Municipio 4, as well as in the rest of the city.

In ten days of late Spring and Summer 2018, Sacile C.A.T. extraordinarily opened its gates to gadjé neighbours, Bonfadini inhabitants, and third sector volunteers, in order to design and build together ERSILIALab's Carriage. They have been ten days of feast and positive collaboration, defeating prejudices and mutual distances.

During the following months and up to now, the Carriage and its mixed team have been crossing the entire territory of Milan. The itinerant Carriage hosts a multimedia exhibition<sup>9</sup> and it is the foreground for public work-

<sup>7</sup> This set of activities composed by debates and participatory workshops was called *Abitare il dialogo - Fabbrica del dialogo con Il Suq delle Culture*, and it was led between April and October 2015 at *Fabbrica del Vapore*, Milan.

<sup>8</sup> Beyond Municipality coordinating power, at a local level we had to take account of Municipio 4 decisions. Milan is divided in nine wedged sectors; each sector is locally administrated by a Municipio. It may happen that the general Municipality and a specific Municipio belong to opposite political affiliations, thus all the local decisions are fought, slower, and sometimes in contrast with Municipality's broad strategy. Unfortunately, this has been the case of sector 4, the one in which Bonfadini camp and Sacile C.A.T. are located.

<sup>9</sup> The heterogenous building team decided to call this exhibition *Traghetando ERSILIA* —namely *Ferrying ERSILIA*— as the capacities of moving, evolving,

shops, aiming at introducing Romani culture, at promoting social inclusion and cohesion, and at triggering debate on current camps and centres living conditions in the city.



[Figure 2] Left and centre: Workshops with children from Bonfadini camp, Sacile C.A.T., and Molise-Calvaire-Ponti neighbourhood. Photos by Elena Mocchetti for ASF Italia. Right: A picture from ERSILIALab Carriage building workshop. Photo by ASF Italia.

### 3. ASF ITALIA'S METHODOLOGICAL APPROACH

When a new project of community enhancement starts, ASF Italia always pays great attention in identifying appropriate entry methods to get in touch with the community by building a state of reciprocal trust.

To promote development projects means to gradually create strong relations of confidence and sharing between very different groups —i.e. beneficiaries, their context, institutions, third sectors organisations, and so forth.

In this case, we decided to work with children, considering them as our entry point to build trust with both Roma and gadjé wider communities in Molise-Calvaire-Ponti borough. Since July 2017 we organised several workshops for kids and youngsters from Bonfadini camp and Sacile C.A.T., to better dig their specific wishes and needs. After a first group of workshops, we involved neighbourhood schools and local associations that are dealing with children in order to establish a tight-knit pilot group of willing Roma and gadjé children, keen to promote the project to their peers and families. The pilot group reflected the various communities involved: children from Bonfadini camp, from Sacile C.A.T., and from the neighbourhood were together as young ambassadors of an inclusive world. The pilot group attended a number of child-centred theatre and photography workshops on urban environment future, in order to work on mutual knowledge, on the overcoming of stigma, and on the creation of positive relations. By means of the artistic practices of theatre and photography, children nourished their imagination and wishes; they expressed the necessity of a new relational space, even if the Relational Library project was paused.

Working with children had a double result. On one side, it fruitfully enriched us as experts of urban development projects. On the other side, it has allowed us to acquire credibility in the eyes of their parents, who finally recognised us as promoters of 'the good of children' as a cross-cultural value.

Our work with children has gone on for a year. During this period, we established Il Tavolo di ERSILIALab, an operational heterogeneous team aimed at carrying out the project by following a mixed bottom-up and top-down approach. The Carriage building process represented a key-feature of cross-community strengthening. Indeed, the positive experiences of participatory building have been a fundamental step for Roma social inclusion and their mutual understanding with gadjé, permitting to envisage a common future, sharing the same neighbourhood. While building together the Carriage, we have listened to wishes and angers of every member of the team. This continuous state of heated dialogue has enabled the entire Tavolo di ERSILIALab to imagine collectively a different future for Roma in the neighbourhood—a fair future able to maintain the richness of Romani culture without putting Roma on the side-lines of gadjé's world.

ASF Italia always considers communities as main active promoters of their own development. Moreover, we conceive space not as an outcome in itself, but rather as a tool to produce fair and sustainable (self-)development.

### 4. CONCLUSIONS. THE DESTINY OF SACILE C.A.T. AND BEYOND

Following a Municipal ordinance, Sunday 24th March 2019 Sacile C.A.T. was permanently closed.

Some of the 130 people inhabiting the centre have been progressively relocated in other Milanese centres, while some others have just been dimessi, that is to say left on their own to face an immediate future on the street, probably followed by landing in an irregular nomad camp.

Roma's living conditions is an issue frequently affected by politics, whose rapid time of change of opinion is hard to match with a long-term strategy of social inclusion. Indeed, politics have been responding to Roma's social

inclusion need with emergency solutions —thus temporary solutions —, looking at Roma from time to time as a problem to be contained, or as a problem to be hidden, or as a problem to flaunt, depending on the political hue.

Roma families continue to be eradicated, moved, relocated, and, ultimately, confined. By doing so, many children have difficulties to regularly attend school and, moreover, they lost their local network of relations and friends. In the same way, it is very difficult for Roma adults to reach economic stability and autonomy if they periodically have to face the problem of finding a new settlement and organising a new shelter for their families. In these emergency conditions it is very hard for Roma adults to establish a mutual trust relation with *gadjé*, as it is not part of surviving priorities.

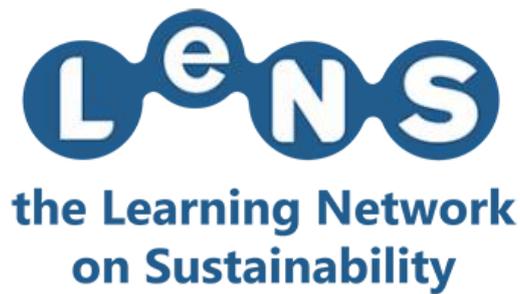
Moreover, the fast successions of hosting and discharging dynamics refers to a political level and not to a structured institutional one. This political level continuously reaffirms relationships of subordination between Roma —or another fragile subject - that need to be hosted, and public authority who hosts fragile subjects in a mere assistive logic.

The condition of urban marginality that affects a fragile group has a great and immediate impact on all urban society. Firstly, a well-structured —and implementable with no contradictions— response to urban marginality would permit to control the sprawl of exclusion phenomena, and, by so doing, to radically enhance all the urban contexts generally considered dangerous and degraded. Paradoxically, politics find difficult to look at the issue in this way, as they usually consider it as a 'solidarity' and 'social justice' problem, following a mere assistive logic, not considering the tangible consequences that urban marginality has on its spatial and social contexts.

As ASF Italia, we are now beginning a new design phase involving a great number of families previously living in Sacile C.A.T. The final aim is to facilitate them in establishing a self-construction cooperative to renovate and inhabit an abandoned public building — made available by the Municipality and located in the same Molise-Calvastrate-Ponti neighbourhood. This new project has started to take shape during the participatory realisation of ERSILIALab's Carriage. We are strongly working to fulfil this goal, so to contribute in promoting the self-development of a deprived community towards new decent living conditions.

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## **REVITALIZING MARGINALIZED COMMUNITIES FOR SUSTAINABLE DEVELOPMENT BY DESIGN**

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### **ABSTRACT**

This paper discusses the role of design in revitalizing marginalized communities facing economical, ecological, and cultural crisis. Using two rural towns in the US and China as locations for field study, this research team conducted interviews and observations, organized workshops and class projects, and participated in alternative agriculture practices to investigate opportunities for design research and design thinking methods to be utilized in the development of agricultural production, enhancement of economic growth, and improvement of community wellbeing. The paper concludes with recommendations for designers and community activists who might be interested in sustainable development for marginalized communities.

**KEYWORDS:** Sustainability, Rural Revitalization, Design for Social Change, Agriculture

## 1. INTRODUCTION

Over the past two hundred years, as cities around the world have accelerated with their growth (Ortiz, 2013), rural small towns have been struggling with economic and population stagnation and gradual decline. As of 2017, over half of the human population live in cities (Brinkhoff, 2017) with the United Nations predicting that in 2030, 3 out of 5 people will be living in cities. As a consequence, urban areas usually receive the most attention from designers (in a broader sense of the word, which might include many disciplines that create or plan visual forms to solve problems).

We argue that not only are these rural communities worth saving, but also that designers can help to change their present trajectory of decline and degradation. Rural communities are not simply there to support cities, or for the city-weary to seek refuge. Most of them have unique cultural heritages and natural resources that are important to all mankind. What is more, we believe that while the human society is facing potential impact and uncertainty of climate change, it is essential to help these marginalized communities to continue to grow and to function as innovation proving grounds, test-beds, and incubators to develop alternatives to urban lifestyles and the energy-intensive, globalized, industrial agriculture that currently supports them.

Agricultural production is highly industrialized in many areas around the world today. Industrial agriculture requires a very specific environment and landscape conditions to be economically viable. Consequentially, it means communities with fragile ecosystems, complex landforms, and unique geological conditions are economically marginalized and must compete by employing different approaches in how they conduct business. In the past three years, our multidisciplinary research team has been working with two rural communities in two countries. Though they face similar problems, the cultural context for these problems is quite different, which necessitates vastly different design solutions. The project focuses on adding economic value to existing businesses as well as creating new products and services that are unique to these communities. The aim of this ongoing project is to understand the problems and cultural context and constraints of these marginalized communities, identify effective business and innovative practices, and then harness design thinking to find new and innovative ways to revitalize local economy and achieve sustainable development.

We intend for this project to become a catalyst for change and an agent for design literacy education to help these communities understand the value of design. Through demonstration of our design solutions, we challenge the communities to examine the status quo and find alternative paths themselves to lead them out of poverty.

## 2. THEORETICAL BACKGROUND

With low living and start-up cost, rural communities can pursue alternative business practices and be a hot test bed for innovative ideas. We observed that more and more designers are getting commissions or choose to participate in the revitalization of rural communities. Their government officials have enlisted designers' help to guide the economic development of these communities to enhance the quality of life for their rural residents. For instance, since 2014, the Ministry of Housing and Urban-Rural Development of the People's Republic of China launched the "Beautiful Countryside" campaign and created a "Construction and Technology Innovation Alliances" with architects, city planners, environmental scientists, and agricultural experts. Opportunities to participate in the revitalization of rural communities are abundant for designers.

At the same time, we stress that designers' responsibilities have gone beyond merely creating functional and eye-catching artefacts. Design has become an important instrument for building business and social strategies to bring about great cultural and economic changes. Ezio Manzini (2015) stated that: "Cultural activists, grassroots organizations, and design activists are converging towards a range of initiatives whose purpose is not to offer immediate solutions to problems, but to spark interest in these areas and show, often paradoxically or provocatively, that there are different ways of seeing and resolving them." (p.46)

Many rural communities' most important industry remains agriculture. In recent years, more and more people have started to question the negative environmental impact of the large-scale industrialized agricultural production that depends on non-renewable energy (Holmgren, 2002). The surge of the "buy local" movement and the rising consumer demand for "organic food", show that consumers are also concerned about issues such as pesticide and pollution associated with large-scale industrialized agricultural production. In fact, consumers are willing to pay higher prices for locally grown foods (Tarkan, 2015) because as The Packaged Facts report (a market research firm) stated, "Local has become a shorthand descriptor that makes food sound high quality, fresher, more authentic, trustworthy, environmentally friendly, and supportive of the local community." Small farmers in rural communities are well positioned to be leaders in this movement.

John Ikerd stated (2008) that "The future of farming in America is a way of farming that balances ecological integrity and social responsibility with economic viability" (p.63). So what are the alternatives? Thousands of years of human farming practices generated a wealth of agricultural and ecological wisdom, many of which are suitable for marginal lands and demonstrate this "balance" that Ikerd was calling for. Examples include China's terrace farming,

Kaner Well desert irrigation systems, mulberry fish pond circular eco-system, etc. Contemporary practices such as small-scale organic agriculture, permaculture, vertical agriculture, forest farming, are some of the forms of alternative agricultural practices that we studied (Bloom & Boehnlein, 2015; Hemenway, 2009; Holmgren, 2002; Holzer & Sapsford-Francis, 2010; Mollison, 1988; Mollison & Jeeves, 2004; Mudge & Gabriel, 2014).

In particular, small scale and organic farming such as permaculture have gained a lot of following in recent years (White & Duram, 2013). We concluded that, while smaller scale agricultural practices may not be able to compete in terms of the efficiency of planting and harvesting with large-scale industrialized agricultural production, they are considered to have higher quality, greater nutritional value, and to be more ethical (Hinrichs & Lyson, 2007). We also concluded that smaller scale agricultural practices can produce more varieties of cultivars to satisfy more diverse consumers. Centred on these alternative agricultural practices, products and experiences can be designed to attract customers, thus, create new economic opportunities.

As stated above, one of the goals of this project is to create a new “design culture”: inspire residents in these communities to participate in the design process to create long-lasting changes. In the Multi-disciplinary Design Education in the UK Report (2010), Nick Leon, Director of Design London, was quoted to declare: “Successful innovation demands a systemic not a component approach to designing new products and services. Edison didn’t just design and patent a light bulb – he created an entire new system that changed our world” (p.14). It is important to take a systematic approach to extend the influence of this project to more than designed artefacts. We reviewed systems theory and explored using systems dynamics modelling to map out the variables and stakeholders in the design process to understand how design can alter these factors to cause social changes. In addition, following the footsteps of Victor Papanek (1972; 1995) and Buckminster Fuller, cases of design for social change were studied. Specifically, we investigated the science of design for behavioural changes (Wendel, 2013), especially for sustainability (Bhamra, 2011; Wortington, 2009).

### 3. RESEARCH METHODS

Based on our literature review and preliminary research of the subject, we established two assumptions for this research project:

- First, a multidisciplinary and systematic approach must be taken to generate a wide range of solutions;
- Second, design research and design thinking strategies can provide new ideas for solving complex problems in these regions because of their human-centred approach.

Next, we moved to select two communities for our field study, Makanda, USA, and Songkou, China to conduct our ethnographic research<sup>1</sup>. Our research team consists of two faculty members at SIUC, several external consultants in China and the US, and one undergraduate research assistant, and is supported by 30 to 40 undergraduate students. Collectively, we conducted a field study in both locations. We conducted interviews with local residents, officials, craftsmen, business owners, and designers, with the total number around 100 people. As is often the case in ethnographic research, most of these interviews were unstructured, and some of them were conducted via emails. Visual notes were compiled and analysed. The emerged insights were put into presentations by individuals or groups of students.

We also conducted several site visits at local enterprises, including locally owned farms, craftsman studios, and small businesses:

- Businesses in and around Makanda: Dayempur Farm and Centre for Sustainable Living, Rolling Oaks Alpaca Ranch, Five Hen Farm, La Colina Linda Farm and B&B, Flyway farm, Southern Illinois University Sustainability Farm, Neighbourhood Co-op, Little River Research, Hidden Valley Vineyard, etc.;
- Businesses in and around Songkou: Chopsticks factory, bamboo weaving studio, woodworking studio, Checkerboard Bed and Breakfast, Daxi Village Ecological Education Centre (interviewed the manager only, the centre was not open to the public), Songkouqi Hotel, Time Bank Café, Songkou Library, Open Union Cultural and Creative Co. etc.

### 4. RESULTS AND ANALYSIS

Throughout our research and design process, we have identified multiple opportunities to create new artifacts and experiences where design has the potential to play a leading role. These opportunities are divided into three categories: artifacts, marketing campaigns and strategies (they are not mutually exclusive).

#### 4.1. Artifacts

Design for diversified and alternative agricultural production; Design for Precision Farming; Packaging unique cultural heritage, etc. Figure 1 shows a set of hand-held tools designed for small-scale farming/gardening. The student identified common user needs in this scenario and designed the tools to attract younger users. Figure 2 shows a greenhouse with temperature-regulating wall and solar panels to increase production.

<sup>1</sup>. Rationales for choosing these two locations are available upon request.



[Figure 1] Carbon Tools by Zachary Weddle



[Figure 2] G2 Greenhouse by Ian Herndon

#### 4.2. Marketing Campaigns

Establish brand identities for niche and general market; Create and maintain a strong social media presence for the local business.

#### 4.3. Strategies for Eco-tourism, agro-tourism and other Attractions

Create products with strong local characteristics and uniqueness; Envision innovative reuse of abandoned commercial buildings to support economic development of underserved demographics.

### 5. IMPACTS ON SUSTAINABILITY

Though we have worked on this project for three years, we still consider that it is in its early stage. As designers, we are capable of providing a new perspective to policy makers and planners. With a multidisciplinary and participatory design approach, our work will encourage sustainable practices in small businesses, help alternative and organic agricultural business to thrive, and uplift underserved communities. We realized that we are not the first, nor the last people trying to tackle rural decline. However, as designers, we are capable of providing a new perspective to policy makers and planners. By working with our users, we can visualize solutions that are easier to adopt. Though we have worked on this project for three years, we still consider that it is in its early stage. We tentatively offer the following design recommendations from what we have learned so far:

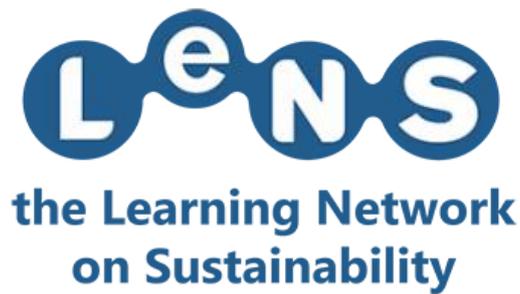
- Beyond Artifacts: Singular and isolated products and experiences cannot create high economic value and might not be sustainable. Innovative products, product platform, branding, and disruptive business models should be at the core of the revitalization of marginalized rural communities. Design solutions at all scales must be considered as a whole. We must take a systematic approach, which means we must consider the entire eco-system of products and services.
- Multidisciplinary and participatory design approach: we must take this approach in design for social change. The process might be messy and even chaotic, and the outcomes might not be glamorous or even tangible, it might require tremendous learning beyond just the design domain for the designers, but it has often proven to be the best way to realize real change.
- Simplified user experience: the development of easy-to-use, easy-to-understand service systems should not completely rely on high-tech and smart mobile devices but should fit your users' needs. In our case, high-tech products might be too expensive and even unnecessary to develop for rural communities. It is better to utilize tools, materials, and component parts readily available to residents but designers should provide creative ways to help these communities use them more effectively and in new innovative ways.

In October 2017, the World Design Summit released the "Montreal Design Declaration". The document declared that the international representatives of professional designers, architects, urban planners, landscape archi-

sects and other design-related disciplines attending the Summit had agreed to the following statement (2017, p.6-7): “Recognize the need for sufficient fiscal and human resources and capacity; Acknowledge the intrinsic capacity of design to serve as an agent of change and a source of creative transformation; Acknowledge the fundamental and critical role of design to create a world that is environmentally sustainable, economically viable, socially equitable, and culturally diverse; And confirm the value of working in a collaborative, holistic and integrated way to foster design of common benefit”. The “Montreal Design Declaration” affirms our belief that though designers’ roles in our society continue to evolve over time, there remains a common consensus in the design community that design is critical to economic and social development. It also reflects the consensus that designers must work together with other disciplines to help resolve difficult and complicated issues. It is this belief that led us to start this collaborative project, and it is our belief that our preliminary results prove that design is indeed crucial in helping to improve marginalized communities. It is our sincere hope that our work did contribute to the fulfilment of this grand mission of our professions.

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## **THE CONTRIBUTION OF COMMUNICATION DESIGN TO ENCOURAGE GENDER EQUALITY**

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### **ABSTRACT**

Gender divide is currently at the heart of the international debate, “Achieve gender equality and empower all women and girls” is the fifth goal of the ONU Agenda for Sustainable Development. From a communication design perspective, the issue concerns women’s representation in the media and the repercussions it has in reinforcing stereotypes. Mediascape in Italy still plays a crucial part in conveying stereotyped models that influence self perception and the resulting personal and collective identity. In this context we as communication designers have to intervene to develop new tools to change the ways of seeing, consuming and distributing images. This paper is focused on the ongoing research and experimentation activities conducted by the research group “dcxcg”, placed at the intersection of Communication Design and Gender Studies. Its main goal is to offer a critical view of the forms of representation of gender and to support new communication models in the educational context. Starting from the schematisation of the short circuit created when media make use of stereotyped models, amplifying and affirming the stereotypes themselves, the aim is to show where and how communication design can intervene on this vicious circle. This could be a contribution in generating positive actions and a step towards gender equality and empowerment in a wider perspective.

Key Words: Gender Equality - Communication Design – Visual Criticism

## 1. INTRODUCTION

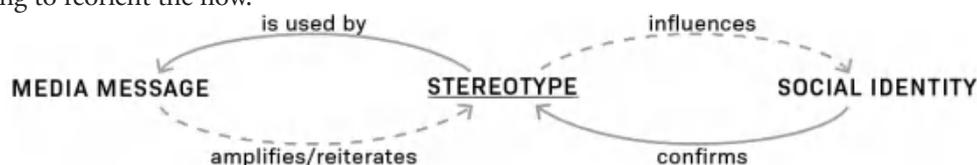
The paper faces the issue of the representation of woman from a communication design perspective, by examining the roles and contributions that the Communication Design has in the educational field, specifically in training future designers. A particular attention should be paid to the disciplinary contribution of communication design and the opportunities for relations and integrations between the domain of visual cultures and that of social sciences represented by gender studies. Gender divide has deep roots, it assumes different shapes depending on places, cultures and societies and it is closely related to the cultural and social dimension of Communication Design, how images are produced, distributed, and how people consume them creating models and behaviours. Theoretical contributions are represented mainly by essays from sociology and philosophy: Goffmann (1979), de Beauvoir (1949), Arendt (1989) and from the theory of representation, visual culture and semiotics: Berger (1972), Mitchell (2008), Volli (2002), Zingale (2012), Eco (2011) and from design theory: Schön (1983), Kolb (1984).

The ONU Agenda 2030 points out the central position of the gender issues in the international debate, and puts gender equality in the first places of the sustainability goals to reach by 2030: “achieve gender equality and empower all women and girls [...], end all forms of discrimination against women and girls everywhere”. The picture of 2018 painted by the “Global Gender Gap Report” still shows an alarming situation, in which Italy occupies the 70th place on 149 countries. In this context advertising and marketing, and in a broader sense the communication project, are at the center of a responsibility system (Calasanti T, Tech V., 2007) as reflections of a culture but also agents which contribute to create it. This was reiterated in the European Parliament Resolution (3rd September 2008, 2008/2038(INI)), about the impact advertising and marketing have on the equality between men and women. As Camussi and Monacelli reaffirm in “Questioni sul corpo in psicologia sociale”, mass media play a crucial role in building and perpetuating the culture of sexual objectification: they propose female and male images that will consequently be borrowed from most of the social actors. From a communication design perspective the issue mainly concerns the representation of women in the media and the contribution of the images themselves in confirming and strengthening gender stereotypes. Communication design is actually the area of the project that “gives form” to the content, it acts on the content itself and its mode of representation to develop objects, visual and communicative systems which enable the passage of contents by “putting them in the picture” and thereby make them available.

## 2. GENDER STEREOTYPES AND VISUAL COMMUNICATION

Media images are always vehicle for explicit or implicit messages and they very often communicate by models and stereotypes to be immediately recognizable and understandable to the social groups to which they are addressed. The term stereotype indicates the generalization of a simplified image of the reality due to limits of knowledge. “The stereotype is configured as commonplace and it can have both positive or negative features” (Capecchi, 2018). Barthes wrote about the definition of commonplace: “what counts is the evidence of the (already a thousand times) heard; it follows that a very coded form, like a proverb, may seem original to me, if I don’t know it yet. The “cliché” and the “stereotype”, [...] insisting on the mobile character of the production, denote the repetition of the form rather than that of the content”.

In this context the role of media is not to create stereotypes, but to confirm and strengthen them. As stated in the “Anticorpi Comunicativi” preface, advertising communication is not the place that creates stereotypes, but the place that amplifies the existing ones, strengthening them in an instrumental way with images and riding on the sensibilities of the cultural climate in which they are placed. In “Questioni sul corpo in psicologia sociale” Camussi and Monacelli reiterate how media models contribute to activate gender stereotypes that, in turn, are responsible for defining schemes of self, going so far as to condition both cognitive resources and emotional reactions in the face of sexist statements. Social reality and media representation are part of a vicious circle in which the media are at the same time a faithful and deforming mirror of reality (Baule, 2012), they draw on already consolidated models and return them stronger and amplified. The dynamic of the stereotype is therefore not unidirectional but circular. When an individual adopts stereotypical beliefs towards a target category and these beliefs are confirmed by the behaviour of one member of the group, these “retroactive evidences feed and make even more secure the initial beliefs of those who possess such stereotypes” (Capecchi, 2018). According to the Stereotype Threat Theory formulated by Aronson & Steele in 1997, “the existence of such a stereotype means that anything one does or any of one’s features that conform to it make the stereotype more plausible as a self-characterization in the eyes of others, and perhaps even in one’s own eyes”. Starting from these premises we wanted to outline the media process implemented by stereotypes (figure 1). The aim was to fix the crucial steps with the help of a notational system, to facilitate the deconstruction of the phenomenon and thereby to understand the role of communication design within the overall process. The ultimate purpose was to recognize the most appropriate spaces where acting to reorient the flow.



[Figure 1] Representation of the vicious circle of gender stereotypes

Stereotype is placed at the center of the scheme, social identity and the media message at the poles, highlighting the mechanism of self-feeding (or positive feedback) which results in the reiteration and amplification of the stereotype. Stereotype itself acts in turn on social identity by directing it and influencing the construction of individual and collective biographies.

From a sustainability perspective communication design can take part of the process on two levels.

### **2.1. Through the design of the media message**

The first level concerns choices and design methods put in place to arrive at the definition of the communicative artworks. The choices of the communication designer (whether they are aware or not) inevitably fall on the perception that the receivers have of reality. Hence the need to train responsible and conscious designers, capable of understanding and restoring the complexity of reality in order to cheat (Zingale, 2012) gender stereotypes; and the need for critical reflections on the use of expressive registers, rhetorical models, tools that the theory of directing construction and staging make available to designers.

### **2.2. Education for critical reading of media messages**

The second level takes into account the role that design can play in raising awareness of gender issues and in educating to a critical reading of the media landscape in which we are immersed. Through its design activities, it is the communication designer who is able and responsible for producing artworks that support awareness, awareness raising and user training. The visual alphabetisation of the receiver is essential in order to be aware of what he/she is watching and to be able to exercise a critical reading of the media message. Taking up the idea of “antibody”, the designer can act on the design thought and on the culture of the subject who uses the media message, to help make him/her “immune” to gender stereotypes. In this direction, visual cultures can give their contribution in terms of criticism, awareness and information, as well as responses to the need to rethink the formats and rules of visual communication.

These two spheres are necessarily related to each other and, in the scientific field, research, design and teaching merge. The research work and experimental activities of DCxCG - Communication Design for Gender Cultures, a research group born at Politecnico di Milano, within the Department of Design- find place in this framework. The group carries out a process of systematization of research about the representation of women in the media and a work of experimentation on activities that can stimulate the social responsibility of Communication Design also in the educational field. The aim the group claims is “to point out several aspects of the research: the assumption of different methods and methodologies; the value of experimental activities as an integrative part of basic research; the need of building tools for reflection and media education beyond stereotypes and reconstituted visual models”.

## **3. EDUCATIONAL ACTIVITIES TOWARDS A SUSTAINABLE COMMUNICATION DESIGN**

In 2015 the first course of “Communication Design and Gender Cultures” was introduced, addressed to students of the master’s degree from the Scuola del Design, Politecnico di Milano. It is a transversal course, open to students from the areas of communication, product, interiors, fashion, pssd. The aim is to raise the awareness of future designers on gender issues from the communication design perspective, using a multimodal educational approach (blended learning); for instance activities aimed at strengthening the critical capabilities of students and equipping them with tools that encourage deconstructive processes and responsible design processes. In order to achieve this objective, we worked to create an experiential dimension of learning that integrates theory and practice in line with Kolb’s Learning Theory, with the final output of a communication project (or the detailed definition of the concept) aimed at sensitising/awareness-raising on a specific aspect related to gender stereotypes and female representation in the media.

From a comparison with the Pyramid of Active Learning (Bonwell & Eison, 1991) the course is structured in different modules associated to different purposes and methods, which represent 4 pillars for educational activities.

### **3.1. Lectures (to remember, understand)**

The lectures are aimed at providing the theoretical basis for a critical reading of media images and the tools for deconstructing gender stereotypes. Through the presentation of and discussion about both negative case studies of gender communication and virtuous cases, the student understands the context and develops those “antibodies” useful, as a designer but also a consumer of communication, to take a conscious and critical point of view. The frontal lessons, resuming the Pyramid of Active Learning, are mainly placed on the first two steps: “remember - recognizing and recalling facts” and “understand - understanding what the facts mean”.

### **3.2. Side activities (to apply, analyze, evaluate)**

In order to activate the students to equip-themselves with tools for observation and critical reading of the context in which we live, side activities to be conducted independently have been experimented. One of the activities was the development of a personal diary about gender issues aimed at the careful and critical observation of the daily context and in particular of the media landscape in which we are constantly immersed, paying attention to both the explicit and the implicit. The outputs of side activities converge in moments of debate and confrontation, which allow to bring to light useful inputs and to open new areas of observation and reflection. The diary tool was aimed at stimulating self-reflection and careful observation of the context in which we live.

### **3.3. Field observation (to apply, analyze)**

The phenomenological observation and analysis of the reference background is aimed at investigating more circumscribed and specific aspects concerning modalities and forms of representation of women in the media. It is a structured research activity, aimed at collecting and sampling data using different exploratory methods, going deeper in terms of the amount of collected data. The purpose is to place media images at the centre of a re-examination and deconstruct the stereotypes isolating recurrences and analogies. The concrete application of tools and methods for deconstruction and analysis of gender stereotypes lays the foundations for responsible design choices able to trick the commonplace, interrupting the vicious circle.

### **3.4. Design output (to evaluate, create)**

The final phase of the course involves the design of a communicative artefact through which to reassemble recurrences and evidence emerged from the research, in order to produce a communicative action in shape of critical synthesis. By exploiting the potential of the artefact dimension it is also possible to promote processes of sensitization and awareness. These are therefore actions that can both operate on design thinking, if addressed to designers, and – albeit to varying degrees – talk to the target of communication increasing its visual culture. To better document the training programme described, some examples that may constitute case studies are given below. These are three projects that deal with gender stereotypes in different ways. In the first two cases (4.1 and 4.2) the subject of the analysis is the nature of the media images observed by assuming two different thematic centers (some media products for girls and communicative products from the publishing sector in the field of technology) while in the third case (4.3) behaviourally stereotypical acted by men and women in the use of technology are examined.

## **4. DEVELOPING ANTIBODIES THROUGH THE PROJECT: THREE CASE STUDIES**

### **4.1. “The phenomenon of tweening – coss-mediality in Violetta, Barbie and Winx”**

The work examines the phenomenon of tweening focusing on the representation of female figures in three case studies: Violetta, Barbie and Winx. The term tweening refers to the phenomenon of early adolescence, in terms of communication it concerns all those products, TV programs, advertisements, addressed to kids aged 6 to 10 years but that report the features (attitudes, poses, references) of products for teenagers. The project path was articulated according to the following model:

- the collection of visual material (images and videos) relating to the case studies, which led to an archive of images from different media;
- the deconstruction of stereotypes, obtained through an operation of sampling and isolation of visual recurrences, which allowed to implement the tools and capabilities of critical interpretation of the media message;
- the operation of critical re-reading and reassembly was obtained by designing a kinetic artwork (a video) based on the editing of the scenes and images collected, which has the dual function of summarizing the research and raising awareness of the theme. The video editing uses hyperbola as a rhetorical figure, exasperating the concept of reiteration of media images in a reinforcing dimension, in order to denounce the nature of the phenomenon. What has been obtained is therefore a communication tool useful to make evident visual features and reusable in different contexts with awareness-raising objectives.

### **4.2. “Thech(wo)men – denounce to the exploitation of the female image perpetrated by technological masculineism”**

This case concerns the representation of the female figure in the major magazines about technology. The first phases of the research were dedicated to the collection, sampling and observation of data, in this case a qualitative and quantitative analysis was carried out on the female figures found in the examined magazines. After a process of isolation of the salient features and visual recurrences, it emerged that the female figures collected were depicted according to expressive codes typical of the pornosoft universe, a parallel, that would make explicit the overlaps, was therefore created. The female figures represented on the covers collected from the technological field in fact shown some typical traits of the pornography sphere: plastic poses, shots, forms, mise en place, etc. The reassembly operation was based, in this case, on a flipping scheme, a “counter-narration” was developed through an overturning strategy. Materials have been reassembled to trigger a reflection on the theme of the woman objectification, assumed to be “ornament” or “object-display” when it comes to technology. In concrete terms, the final output consists of a web page of denunciation in which the protagonist is the mechanism of overturning. Through a scroll bar it is possible to slide some female figures, taken both from Playboy and from the magazines under study, on covers characterized only by the title (Playboy, T3, Jack...). The representations of women thus become interchangeable and scrolling through the different titles no longer allow the viewer to understand where they come from, making quite evident the spread of pornosoft as a transversal modality.

### **4.3. “Hack the Stereotype – a format to talk about gender gap in STEMS”**

The third case study differs from the previous ones because it shifts the attention from the woman representation in the media to the acted behaviors in approaching the STEM subjects, specifically coding. Drawing from methods characteristic of the field of anthropology, the project has been developed according to the following scheme:

- participatory observation activities,
- deconstruction and analysis of the participants attitudes,
- isolation of recurrent behaviours representative of gender differences,
- reassembly of the results through the design of a communication artefact.

The participatory observation was conducted with a group of students of communication design who were asked to carry out an elementary programming activity according to given indications. After a brief explanation of some coding notions, the nine participants were divided into three groups heterogeneous by sex, and they were asked on the basis of what they were explained earlier to program a simple web page. The activity was shooted in order to analyze similarities and behavioural differences between men and women. In this case, the attitudes of males and females and the roles they assumed within the teamwork were isolated and sampled. What emerged in terms of content confirms the tendency to consider coding as a predominantly male matter “by nature”. The individual attitudes were reassembled in a video in order to make them evident. This video has a dual function: to raise awareness among young people and to visualize the research.

The three cases were identified as representative of different research methods and kind of design outputs recurring during the course and aimed at practical experimentation and implementation of useful tools for conscious design. The aim is to train designers who are able to make responsible choices not only in the academic territory but also and especially in the workplace, where the communicative actions planned have a greater resonance and a real impact on the group of individuals who receive the message.

## 5. CONCLUSIONS

Through the exposition of the activity developed in the didactic field, the paper intends to underline the roles communication design plays against the vicious circle of gender stereotypes, focusing on the importance of training responsible designers. In a still alarming picture from the point of view of the representation of women in the media, the meaning we give to the concept of sustainable design concerns the quality of the impact that communication design has on social identity, specifically in terms of gender equality. The cases depicted show how it is possible to move towards a culturally and socially sustainable design model, and highlight the need to foster opportunities for discussion and confrontation in order to strengthen methods and experiment with new tools that communication design can provide to contribute to the achievement of gender equality. The paper was therefore intended to prove that in this context communication design is at the centre of a responsibility system. The aim is to strengthen its contribution to generate positive actions, lifelong learning and active encouragement towards a design that is culturally and socially “sustainable”. The activity presented can be considered a first step to develop educational activities aimed at building a solid and conscious visual culture. The DCXCG research group works in this direction, experimenting with didactic models that can stimulate the social responsibility and improve the “antibodies” of the designer, based on a multidisciplinary dimension which includes the domain of humanities and social sciences.

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## **APPLYING HUMAN-CENTERED TECHNOLOGICAL APPROACH FOR SUSTAINABLE BUSINESSES IN INDIAN INFORMAL ECONOMIES**

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### **ABSTRACT**

Informal sector in India is growing rapidly with the urbanization of the cities and increasing needs from its citizens. According International Labour Organization (ILO) report 2012, most of them are immigrants or laid-off workers, work for an average 10–12 hours a day, and remain impoverished. In India, street vending makes up 14% of total (non-agricultural) urban informal employment (ILO 2012). Although informal sector in India is majorly being represented by street vendors. They are exposed to harassments, advocacy issues, financial instability, livelihood related issues and many more. This has a direct impact on the sustainability of their businesses. Also, diversity in the methods of business adds to more complexity in the ecosystem. However, there have not been many attempts to bring about positive changes in the businesses of street vendors. This study was undertaken at the Digital Impact Square (DISQ), a TCS foundation initiative. The Author of this paper is presenting it by having worked on the project in the capacity of a Design Lead and mentor. The aim of the study is to bring certainty in the fruit vendors' business by applying human centered technological approach and analyse the outcome. The study uses primary and secondary data collected and analysed using human centered design approach to represent the mindset of street vendors in Nashik. The sample size for the research includes 80 fruit & vegetable vendors. The paper also includes the findings of an experiment conducted with 3 selected fruit vendors in Nashik. The insights from this study can be generalised for other geographies, as the study addresses both the human side of core issues in their business operations and potential technological interventions.

Keywords: street vendors, sustainable business, technology

## 1. INTRODUCTION

“Street vendor” term represents, an individual who is self-employed in informal sector, earning their daily wages by conducting any type of business on the street on a day to day basis. These businesses can be stationary or mobile without permanent structure or place. These individuals provide goods and other services to the people of the city at convenience, low price and a range of quality options. There are various different types of businesses in the ecosystem including, vegetable, fruits, cloths, utensils, barber shops to food stalls.

The tightly knit ecosystem of street vending in India, includes government administration, political parties, Town Vending Committee (TVC), unions, citizens, hotels, vendors, policy makers, municipal corporation, encroachment department, local *goondas*<sup>1</sup> and many more stakeholders at a time. During the research, it was observed that the value exchange happening at any point of time between these stakeholders is significantly dynamic. It has a direct impact on the livelihood of these street vendors and more so on their businesses.

Out of different types of street vendors; the subset of vegetable and fruit vendors was selected. Considering, the overall population, number of daily interactions with the customers, proximity of the vendors, number of transactions on daily basis, and dynamic nature of their business. During the research, it was observed that the street vendors spend majority of their time conducting business the street, in order to earn merely 100-200 rupees. This excludes preparations for business, buying raw goods, their time at home, managing their day to day household, etc. During the research, it was found that around 20-30% of their income goes in managing the risks at the business place like; encroachment, local nuisance, bribe, waste, etc. Different weather conditions also impact the businesses. For instance, street vendors who are selling food items get more business around winters more than summers, any type of street vendor faces losses during monsoon season due to uncertain and unfavourable weather conditions.

A day in their life consists of activities like; procurement, setting up, selling, transporting, attracting customers, negotiating prices, etc. Out of these activities, most important is building trust with customers, in order to have a steady and certain flow of business from them. Trust building includes, giving better deals, having personal connects with customers, increased number of interactions, convenience and quality assurance.

The sustainability of business for fruits & vegetable vendor, is very important as it helps them come out of their daily struggles and earn decent living. It also helps them achieve their aspirations toward respectful livelihood and to have an identity in the society. For continuous profitable business, surety in daily earnings, having set number of customers coming & buying produce, having credit line set with the traders; becomes very important. This leads to the significance of “certainty” in the business, as everything depends on it. The certainty in business for fruit & vegetable vendors, has various dimensions to it. That includes, customer base, credibility in the ecosystem, sustained sales, lower waste, better procurement strategy, financial strategy, and selection of business. Uncertainty in business is the most concerned area that needs to be addressed for any street vendor to be sustainable at any stage of business. The study tries to address the challenge by analysing and implementing interventions with fruit vendors in Nashik.

## 2. METHODOLOGY

For this study, the data was collected from around 80 fruits/vegetable vendors majorly in and around Nashik and Pune-Mumbai. Total of 6 unions were part of the study across all the three cities. The sample included stationary and mobile hawkers, sitting in the market and on the streets. The data collection was done on business sites, workshops, and other hawkers’ union gatherings. For the research, human centered research techniques like; brainstorming, unstructured interviews, personas, a day in a life, card sorting, and shadowing, were used. The data was synthesized in the form of ecosystem map, value exchange map and giga map. The pain points, aspirations and insights, were extracted using transcription of the interviews and grouping method. Although, the collected data was qualitative. It was quantified with actionable insights for the experiment. In order to enrich the finding co-creation workshops were conducted. The findings of the research were validated with experts, vendors and unions. The implementation of the technological intervention was carried out with 3 fruit vendors in Nashik. The selected candidates were chosen on the basis of their business type, day to day customer base, smartphone user, middle aged and have at least 3 years of experience.

## 3. LITERATURE REVIEW

Literature review was done to understand the nuances of street vending business and customers behaviours in the context of buying experience and of street shopping experience. In order to bring certainty in the business, it was very important to understand, how do they sell? What do customers expect? What are street vendors’ technique? What are customers’ buying psyche?

(David Mchardy Reid, Eugene H. Fram, Chi Guotai 2010) studied the operations of 80 street vendors in Da-

<sup>1</sup> Goonda: a hired thug or bully. Hindi street-language for a criminal.

lian, China. It shows their operations (e.g., buying, selling, and merchandising) are very similar to those of permanently anchored small retailers, and consequently they should be able to make similar societal contributions.

(Meshram, Kanika, O Cass, Aron 2010) suggest that street food vendors gain competitive advantage through their price based value offering while, whereas restaurant owners compete against street vendors by offering superior performance value. However, both firms seek advantages by maintaining close relationship with their customers.

The vendors in the street market understand how to sell products to target customers and how to emphasize commonality with the mainstream markets and where the difference lie (Emslie et al, 2007)

Walsh, J. (2010). In terms of the marketing mix, while there is some flexibility for smart street vendors to vary the product and the place where operations are conducted, it is clear that price is the variable which is the easiest to manipulate, and the one which is most commonly changed. Interestingly, research indicates that Thai consumers are keen to demonstrate that they are good at negotiating price and understand the value of a product: they are, generally, willing to pay more for a higher quality item and also expect to pay less for a lower quality item (Emslie et al, 2007) (Walsh, J. 2010).

According to Dholakia (1999), the rationale for shopping is making physical visits to a shopping site. It is considered as a household task as well as a form of recreation, relaxation and entertainment. Shopping is also considered to have the most positive attribute of being a leisure activity along with work (Dholakia, 1999). Study suggests that consumers of Indian unorganized retail market do not require the service paraphernalia offered by many retailers. Store environment plays a vital role for store patronage and repeat purchases which includes convenience, value for money products, etc. Sinha & Banerjee (2004) Terblanche & Boshoff (2006) suggested that retailers will have to accept that it is not only what they are marketing but also how it is done. The personal (face-to-face) interaction between retail staff and shoppers is of critical importance.

Das & Kumar (2009) studied the impact of sales promotion on consumers shopping experiences. A major finding reveals that keeping product satisfaction constant, sales can be improved by enhancing shopping experience which includes convenience of shopping, ease of locating products, easy check in and checkouts, customer friendly salespeople and customer friendly policies. Secondly finding reveals that purchase decision for the same product under same promotion at different stores may vary because difference in shopping experiences provided by different stores. Further this study shows that promotion plays a limited role on consumers buying behaviour where only small percentage of people are attracted to such sales promotion and wait for it. Study lastly emphasizes on the importance of shopping experience (ease of shopping, parking space, convenience etc.) for positively impacting consumer buying behaviour.

It was observed in literature review that customers expect, proximity, place of business, convenience, better deals, better quality and assistance in shopping. Customers also consider street shopping a leisurely activity. Interpersonal relations positively impact the buying behaviour. On the other hand, for street vendors, arrangement of the goods, better pricing, place to hawk, personalised deal for customers and personal connects with customers ensure certainty in business eventually bringing the sustainability.

#### **4. STAGES OF BUSINESS**

At any point of time, street vendor takes around 4-5 years to build credibility, trust and sustainable business in one ecosystem (area/society/city). In this cycle, they go through the cycle of Start, Sustain and Scale phase. Each stage here in the life cycle of street vending, is significant because it adds to their experiences and expertise in terms of conducting business. These experiences and expertise can broadly be defined in terms of procurement, communication, relationship building, negotiation skills, business acumen, finance, logistics, operations and more.

##### **4.1 Start**

This stage usually lasts for initial 4-5 years for any vendor entering the street vending ecosystem. It consists of activities like; figuring out right business, place to hawk, union support, bribe to the local authority, goods procurement-storage, etc. Initial days are of struggle to the hawkers, as he tries to find a place in the ecosystem and getting the know-how of the vending business. In this stage, he is most vulnerable due to his lack of experience. Majority of the vendors found to leave this profession in this phase. Hawkers are more experimental in this phase with the type of businesses that they conduct. E.g., changing the goods they are selling, changing the place of hawking, associating with different unions and labour organisation for support and security. This is the phase where financial security is needed the most.

##### **4.2 Sustain**

By this time, hawkers become comfortable with the surrounding and know how to work around it. Few things that are seen to settle down for them in this phase are; finalised business type. Proper customer base, a dedicated place to hawk, credit system in place with traders for procurement of the goods, relation with encroachment department, better communication skills to attract customers, financial literacy, etc. Majority of the vending population can be seen in this phase for the lifetime. This has various aspect to it; saturation at a time with business, comfort level of the vendor with the surroundings, not being able to manage existing business due to high volume of customer base, lack of financial options, etc.

### 4.3 Scale

This phase is something that very few vendors are able to achieve. These vendors usually have monopoly over other similar businesses due to their unique experience offering, popularity, product quality, competitive advantage, unique product offering, etc. Vendors in this phase, have their own shop, regularly increasing customer base and staff who is working for them. Majority the vendors envision this stage to come in their business when they start initially.

## 5. THE EXPERIMENT

The experiment was conducted in order to achieve the higher and sustained customer base. As it was found that vendors face loss in their business due to; no clear foresight to the day, week or month, wastage of produce, unclear understanding of market trends, competitive rates and unique positioning of the offerings. For the experiment, fruit vendors were given, specific insights in terms of arrangement of fruits for the day to come, customised bag with unique number printed on it (for more regular customers, tags printed with the unique number (for less regular or new customers), better lighting equipment (White LED), and training to adapt to new platform. Also, co-creation workshop was conducted to come up with promotional deals for regular customers from vendors' side.

In order to see the on-field validation of the findings and the effect of technological intervention on sustainability. The daily transactions of 3 different vendors were recorded on a digital platform and analysed for a month. Various analysis was done and given to vendors and customers like; daily sales report for vendors, weekly receipt & insights into the buying pattern for customers with suggestions, discounts to specific customers according to their purchase history, insight into trending fruits in the area to the vendors and today's market price of the produce to vendors.

## 6. FINDINGS

During the research and the month of the experiment, lot many insights were uncovered. It covers specifically the vendors doing the business of perishable goods (Vegetable and Fruits)

### 6.1. Findings of the research

For vegetable vendors, moving to fruit business is a promotion and looked at as more respectable and superior amongst the both. Vegetable vendors have as much as 60% margin whereas fruit vendors have 40% margin in the business but comparatively high valued transactions. Non-immigrant vendors are more value driven in the ecosystem and likely to conduct the business in the neighbourhood. Due to the only means of business, confiscation of goods and cart lead to vendors dwelling in anti-social activities. Due to lack of money on hand at any point of time, goods bought by vendors are on credit system. On the other hand, customers look for convenience and cheaper prices above all the other aspect due to informality of the business. Because of daily struggle of finding the new vendor, Customers usually have set of vendors from whom they buy regularly but there are chances for rapid dynamic changes. For vendors, lack of identity in the ecosystem and uncertainty in the business lead instability in their livelihood

### 6.2. Findings of the experiment

Customers felt that they were given special attention with the unique identification number. Vendors were ready to give definitive discounts because now they knew the value of customer coming to them. Customers came more often to the same vendor for buying goods even though they were not regular customers. The arrangement of fruits and overall outlook of the cart, led to higher sales and credibility. Customers looked beyond just the one time transactional conversation and got involved in the conversations about upcoming fruits and specific fruit demands. Vendors with the analysed data, were able to take better decision in terms of procurement, waste management, strategy for the day, and foresight to maximum footfall.

## 7. SUGGESTIONS

Technology can be a driver for bringing formalization in the ecosystem. The analysis of collected data on larger scale, can give formalized way of defining informal sector. The analysis can be in terms of, area wise earnings, demand, supply, population benefitting from the platform, total revenue estimation for municipal corporations, local GDP and local consumption rate. The data collected via platform can also be utilised by authorities in order to bring even distribution and management of street vendors across the city. The data can bring transparency in the ecosystem, enabling the vendors with evidences for advocacy and better policy formation. Evidences generated by the platform can be utilised by financial institutes to bring about financial inclusion for this population. The platform can be extended to other businesses in street vending with few modifications to attain larger impact and scale.

## 8.CONCLUSION

Street vendors across India, are progressive in terms of adopting the new business and strategy in order to maximize the profits. They still lack the use of technological approach to reach to the maximum potential of their own business and their ability to thrive. In the ecosystem, it is seen more learned and literate vendors are entering. The technological approach can change the way street vendors conduct their businesses and bring sustainable way of doing the business. Technology can help attract more customers, keep track of their finances, keep the waste lower and meet their personal goals as well. Informed decision making can lead to risk mitigation for the vendors, when they are exposed to numerous uncertainties. The Sustainability in the business can really be achieved via technological medium. The findings here give very definitive steps that can be taken in order to maximize the profits and bring certainty in the business.

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## **STUDY ON SUSTAINABILITY OF WATER MANAGEMENT SYSTEM IN TRADITIONAL VILLAGES IN WESTERN ZHEJIANG PROVINCE - TAKING SHEN'AO VILLAGE IN ZHEJIANG PROVINCE AS AN EXAMPLE**

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### **ABSTRACT**

Water management skills in the process of traditional village construction carry the wisdom and experience of ancient Chinese sages in understanding and utilizing nature, and are also an important manifestation of the formation and development of Chinese traditional water management culture. Taking Shen'ao Village in Western Zhejiang as a typical case, this paper focuses on how ancient sages created a unique water management system in Shen'ao Village based on a variety of water management forms through literature research and field investigation, and analyzes and studies the water management system in Shen'ao Village from four aspects of energy conservation, environment protection, health and comfort, and flexibility and long-term effectiveness, respectively, to explore the sustainable ecological concept behind the water management system. Through the study on the sustainability of the water management system in Shen'ao Village, excellent water management techniques and practical ideas are deeply excavated and drawn on, which can provide useful reference for the sustainable development of new rural construction in China.

Key Words: Western Zhejiang Province, Water Management System, Sustainability, Shen'ao Village

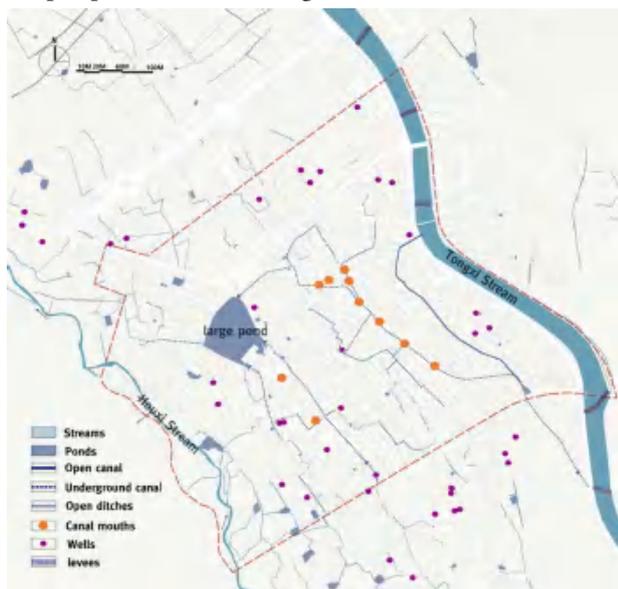
## INTRODUCTION

Shen'ao Village is located in Jiangnan Town, Tonglu County, Zhejiang Province, 16.5 kilometers away from Tonglu county town. Located in the valley and hilly area between Shizi Mountain and Qianshan Mountain, the village is high in the south and low in the north. The village is close to Tongxi Stream in the east and is close to Houxi Stream in the west, forming a pattern that two mountains confront each other in the east and the west, and two streams are diverted from the east and the west. The layout of the village is like a floating big raft, which means that it floats on the water surface and will not sink, and implies thriving and prosperity. An old street runs through the village from the south to the north, and is about 500m long and 3m wide. The village is named for its long and deep water diversion canal built under the street.

Shen'ao Village is the largest administrative village in Tonglu area and the consanguineous village of Shentu family. With its deep historical culture, complete architectural form and unique water management system, Shen'ao Village is one of the famous traditional villages in the south of the Yangtze River in Western Zhejiang Province. In April 2006, it was named the third batch of historic and cultural villages in Zhejiang Province, and then it was listed in the third batch of Chinese historic and cultural villages in 2007.

### 1. GENERAL SITUATION OF WATER MANAGEMENT SYSTEM IN SHEN'AO VILLAGE

The water management system in Shen'ao Village uses practical principles to conduct water management activities, showing the unity of functions and aesthetics. The water management system in Shen'ao Village is divided into two layers, i.e., a peripheral water system and an internal water system (as shown in Figure 1). The peripheral water system consists of Tongxi Stream and Houxi Stream, the natural water systems on both sides of the village, which are the basis of the water source of Shen'ao Village, and is the peripheral water management system for production irrigation, flood control and drainage. The internal water system is a combination of naturally formed and manually excavated water systems in villages, consists of underground canals, open ditches, canal mouths, ponds, wells and other forms, and is a small-scale water management system for domestic water demands. The diversity of internal and peripheral water management forms enriches the water management system in Shen'ao Village.



[Figure 1] Distribution Map of Water Management System in Shen'ao



[Figure 2] Tongxi stream (source: self-taken)

#### 1.1. Peripheral water system

The peripheral water system in Shen'ao Village consists of Tongxi Stream (as shown in Figure 2) in the northeast and Houxi Stream in the northwest. Tongxi Stream, also known as Yingjia Stream, originates from the Longmen Mountains and flows into the Fuchun River. During the rainy season, the water level will rise. In order to make rational use of water resources, after dredging and building for several times by Shentu ancestors, Tongxi Stream has become a water diversion place for daily life of villagers of Shen'ao Village, and also has the function of flood control and drainage. At present, Tongxi Stream is more than ten meters wide. Although there are obvious traces of artificial revetment, ancient levees for flood control can still be found in the riverbed.

Houxi Stream, also known as Zixi Stream, is a small tributary of Pinyuan Steam. It is one of the main irrigation water sources for cultivation in Shen'ao Village. The embankment of Houxi Stream is low and built with pebbles. Although it is located on the edge of the field, the winding, natural and peaceful stream style is more integrated with the surrounding environment.

Two streams surround the village. The peripheral water system conditions in Shen'ao Village are superior, water can

be available from both the east and the west. Not only can the needs of water diversion and irrigation be met, and the invasion of floods be avoided, but also a beautiful outlook of the peripheral water system in Shen'ao Village is created.

### 1.2. Internal water system

The internal water system in Shen'ao Village is mainly composed of a deep underground canal, open ditches, canal mouths, ponds, wells, etc. Each form has a clear division of labor, and its advancement exceeds that of the present urban water conservancy system. Shen'ao Village has an independent and perfect water supply and drainage system, and the water supply system implements water supply by quality. Although it was formed in the Ming Dynasty, the concept of the sustainable water management system has a certain scientific nature.

**Deep underground canal:** deep underground canal is a form of water management that reasonably introduces peripheral water sources into the village to meet the domestic water demand in the village. In the past, Shentu ancestors built a dam on Tangjiadu in the upstream of Tongxi Stream and dug canals to divert water on the west side of the dam. Water diversion is divided into two types, i.e., underground canal (as shown in Figure 3) and open canal, which can divert water section by section and are about 800 meters long. It is divided into two loops from the eastern entrance of the village as the boundary. In one loop, water is directly introduced into the village in the form of underground canal, which is located about 4 meters under the old street in the village, is basically in parallel with the old street of Shen'ao village, and has a width of about 1.5 meters and a height of about 2 meters. Local pebbles are used to build walls and arch crowns on the underground canal to ensure the safety of domestic water. At a certain distance, the underground canal is provided with dredging outlets to prevent the canal outlet from being blocked and make it more convenient for people to enter and exit for dredging. In the other loop, the form of open canal is adopted, and water flows into Tongxi Stream along the barge ridge in the east of the village to provide water for production and realize flood control and drainage, but at present few of it is reserved basically.

In addition to the underground canal under the old street, part of the underground canal is still under the dwellings. Locals call this underground canal which deeps into the ground as "Ao (underground canal)", because it is deep, so it is called "deep Ao". Because it is less affected by the outside world, the deep underground canal is the most complete water management form in the village.



[Figure 3] Underground canal (source: self-taken) [Figure 4] Canal mouth below dwelling (source: self-taken) [Figure 5] Open ditch (source: self-taken)

**Canal mouths:** canal mouths are connected with the underground canal. They are water ports built at distance for people to wash. The forms and sizes of canal mouths are different. Most of them are built with pebbles, and the stone goes deep into the underground canal to facilitate the villagers to work in the ports. At present, there are 11 canal ports left in the village. Six canal ports are located in the old street area. Some are located at the junction of streets and lanes, and some are hidden beneath residential buildings (as shown in Figure 4). This design not only shortens the distance for labor men to get water, but also has the function of shading the sun and rain.

**Open ditches:** in the water management system in Shen'ao Village, open ditches undertakes the drainage work (as shown in Figure 5), which plays a vital role in the drainage of the whole village. Shentu ancestors had considered setting gates in the design of open ditches to achieve the purpose of controlling drainage. The open ditches are about 0.6 meters wide and 0.5 meters deep, are connected with the courtyard drainage ditches, run through the whole village, and have the function of rainwater collection and sewage discharge.

**Ponds:** in addition to the large pond at the entrance of the village, the area of other ponds is relatively small, they are basically dustpan-shaped, walls on three sides are built with pebbles, and one side is paved with stones stretching into the water for people to use water. The pond is about 2-3 meters below the horizontal plane. Each pond has inlet and outlet underground canals, which are connected with each other. The water in the pond is groundwater and is clear. Each pond has a clear use function. At present, there are 3 drinking ponds (as shown in Figure 6), 14 washing ponds (as shown in Figure 7) and 1 large pond (as shown in Figure 8) in Shen'ao Village. The drinking ponds only play a role of water intake, and thus have a single step stretching into the water. The washing ponds are mostly used for washing, and thus are surrounded by steps on the four sides. The large pond is a gathering point of water management forms in the village, and is used for cleaning large-scale farm tools, cultivating fish, etc. In addition to the villagers' daily water use, the ponds also play the roles of fire prevention, groundwater collection and improvement of local microclimate, and enrich the village's water management system.

**Wells:** The function of wells is similar to that of the drinking ponds. During investigation, it was found that four drinking ponds had been changed into wells and some wells had been changed into drinking ponds. The biggest

differences of wells from ponds are that the space area is small and the layout is more flexible. The increase in the number of wells in the village is mainly due to this unique treatment method, which not only solves the problem of water use for villagers, but also creatively solves the relationship between site and water level.



[Figure 6] Drinking pond (source: self-taken) [Figure 7] Washing pond (source: self-taken) [Figure 8] Large pond (source: self-taken)

These five forms of water management are independent and organically connected, fully mobilize surface and underground water resources, form a complete water management system in the village. Nowadays, modern urban water system design is more developed, but most villagers still tend to traditional water use habits.

## 2. ANALYSIS ON SUSTAINABILITY OF WATER MANAGEMENT SYSTEM IN SHEN'AO VILLAGE

### 2.1. Resource and energy saving

The water management system in Shen'ao Village is embodied in three aspects, i.e., water system design, construction materials and water body staged treatment. The water system design was planned well before the construction of the village, which reduced the energy consumption caused by subsequent re-consolidation; local pebbles are selected as the construction materials to reduce the energy consumption during the transportation of foreign materials; and the water management system in Shen'ao Village gives a particularly outstanding performance in the water body staged treatment. The water management system in Shen'ao Village presents a structure of interlaced points, lines and planes. It is a safe and convenient technology to treat water resources stage by stage, and has the rudiment of modern urban water system design. For example, the water from the drinking pond flows into the next washing pond for washing, and finally flows into the large pond for sedimentation treatment, which can bring nutrients to the aquatic plants in the large pond, thus bringing food supply to fish and aquatic organisms. In this process, every time the water is settled downwards, the impurities in the water are certainly treated. In this way, the utilization rate of water in the village can be maximized and the water resources can be saved.

### 2.2. Environmental protection

Water environment protection is an important part of environmental protection. Shen'ao Village has independent and perfect water supply and drainage systems, which have no influence on each other. At that time, this concept of sustainable water use was advanced. The water supply system is to divert water from Tongxi Stream into the village through the underground canal to meet the domestic water demand of the villagers. The drainage system consists of surface open ditches. The open ditches run through the residential area and are communicated with the drainage ditches in the quadrangles. According to the geomancy of the Ming and Qing Dynasties, it is called "Unity of Four Types of Water". However, the water in the open ditches is not used as domestic water. Its main function is to collect rainwater in the courtyards and take away domestic sewage. The complete water supply and drainage systems, on the one hand, fully guarantee the safety of water environment for villagers, and on the other hand, minimize the environmental damage caused by floods and droughts in Shen'ao Village.

### 2.3. Health and comfort

Health and comfort are embodied in the humanized design of canal mouths. Some of the canal mouths are designed under the dwellings (as shown in Figure 9), and some are three or four meters under in the streets and lanes. The purpose of this design is to avoid discomfort caused by strangers' curiosity during washing of clothes, and to increase the privacy of communication between washers and people around them. At the same time, the design of steps at canal mouths begins with the vertical flow and then gradually turns to 45 degrees (as shown in Figure 10), which can widen the width of steps, and not only can expand the area for placing articles, but also can increase the safety of activities of the washers. Many villagers mentioned that, although every household has tap water, they still tend to wash clothes at the canal mouths. Firstly, the water quality is good; and secondly, the area is wide, it has the function of shading sunlight and sheltering from rain, and it is really the best place for washing.

### 2.4. Flexibility and long-term effectiveness

Flexibility and long-term effectiveness are embodied in the long-term effectiveness of the planning and design of the deep underground canal. When Shentu ancestors built the village, they put the planning of the water system (especially the deep underground canal) in the first place, planned streets and residential buildings above the deep underground canal, and minimized the external influence. This unique planning has ensured the long-term effectiveness

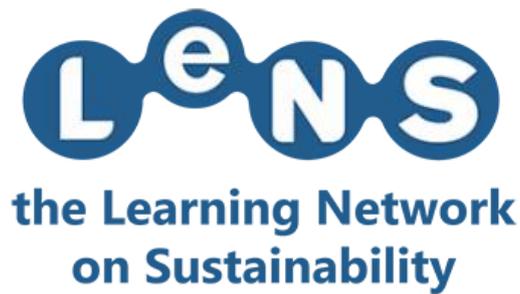
of the deep underground canal in the past hundreds of years. In the aspect of design, the size of the place for using water is more humanized and ergonomic. The design method of section-by-section water intake and dredging is adopted to prolong the service life of the water management system in Shen'ao Village, thus effectively prolonging the whole life cycle of the water management system in Shen'ao Village.

### 3. CONCLUSIONS

The water system characteristics of Shen'ao Village are typical in the villages of Western Zhejiang Province. Especially, the intelligent water management form design embodies the unique practical water management concept of Shen'ao Village. In the new rural construction, designers only pay attention to the sustainability of the buildings, but it is easy to ignore the impact of water system on the village. Water is the lifeblood of villages. Water resources are indispensable to the life and production of villages. In regard to how to make sustainable use of the existing water resources the sustainability of the water management system in Shen'ao Village provides us with good enlightenment.

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## **SUSTAINABLE RURAL TOURISM SERVICE SYSTEM DESIGN THAT BALANCES LOCAL REVITALIZATION AND EXTERNAL INVOLVEMENT—TAKING THE AKEKE AS AN EXAMPLE**

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### **ABSTRACT**

Poverty is still a difficult problem in the development of rural China. Rural tourism is experiencing a rapid development. Excessive commercial tourism development by external intervention, or unorganized spontaneous renewal of villagers, and even closed protection can not correctly protect the sustainable development of village ecology, culture and economy. This paper analyzes the design elements of traditional village tourism service system from space, function and experience. And summarizes the principal contradiction between local revitalization and external intervention from the perspectives of pattern, industry and culture. It is necessary to integrate local and external resources, and emphasizes external assistance.

Key Words: Sustainable Service System Design; Rural Tourism; Local Revitalization; External Involvement

## 1. INTRODUCTION

With the further development of urban civilization, urban residents are increasingly hoping to escape from busy city life for a simple and primitive ease. Traditional villages attract more and more tourists and external operators because of their large amount of tourism resources. Rural tourism is experiencing a rapid development boom. Industrial transformation has had an important impact on village landscape and culture. In this context, it is necessary to respond to the opportunities and challenges of village ecology, culture and industry from a systematic perspective and a sustainable approach.

## 2. DEVELOPMENT STATUS OF TRADITIONAL VILLAGES

### 2.1. Chinese Traditional Villages

The main research object of this paper is the traditional Chinese villages. The ancient villages should meet the following criteria: the material cultural heritage is self-contained, there are village planning, historical blocks, representative residential buildings, and some public facilities, such as temples. A large number of historical and cultural relics such as bridges, wells and theaters, as well as relatively distinctive regional characteristics and intangible cultural heritage (Feng Jicai, 2015).

### 2.2. Traditional Village Disappeared Crisis

Now traditional village is facing a crisis of disappearing. Urban culture continually erodes the regional characteristics of traditional villages, and the village tends to be homogenized. Cheap reinforced concrete and mass-produced industrial goods have replaced the traditional style of clothing, food, shelter and transportation in the village. Through the investigation and study of the villages near Akeke and the famous commercialized tourist villages (such as Wuzhen and Phoenix), the root causes of the disappearance crisis of traditional villages are summarized as follows.

- Excessive commercial tourism development. Because of the shallow understanding of local culture by external practitioners and the neglect of local culture and, the unrestricted development of tourism often leads to Cultural loss.
- Unorganized villagers spontaneously update. Depending on rich village resources, some villagers hope to promote the development of traditional villages characteristic industries. However, most of them did not establish cultural self-confidence and effective management mechanism to feed back the village.
- Closed protection. This kind of protection for traditional villages is the most comprehensive, but in practice, it neglects the objective needs of villagers to improve their income level and quality of life. It cannot solve the current situation of backward villages and poverty, and ultimately loses its ability to develop.

### 2.3. Living Sustainable Protection

The traditional village is a living heritage, and its use value needs to be continued. The sustainable protection of living heritage needs to emphasize the connection between the heritage and the users. The use value of the traditional villages is given by the villagers. The villagers are also the managers of the village heritage, and have the right to use, decide and manage the estate (Xu Jingyao, 2014).

The sustainability of living conditions in traditional villages is closely linked to the development of villages. Sustainable development must solve the problem of poverty. Villages are the land where villagers live and develop. Villagers are also the power for the development of villages. Traditional villages are in the period of industrial transformation. The reconstruction of local industries and the construction of urban-rural relations are the way to make traditional industries follow the trend of the times. Industrial upgrading can boost the living standards of villagers and strengthen the environmental protection of the region. In this process, it is necessary to carry out the isomorphism thinking of the social, industrial and spatial form of the village, absorb the advanced ideas of external industry intervention, expand the resource advantages of the local industry, and strengthen the protection awareness of the village ecological culture.

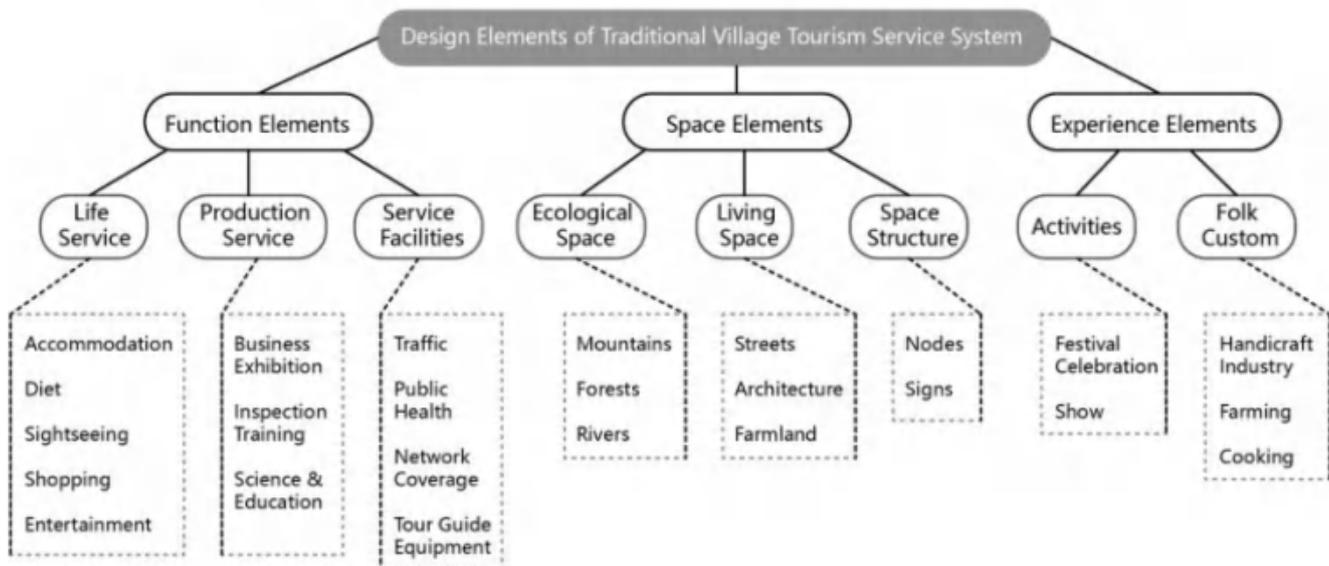


[Figure 1] Living Protection and Sustainable Development of Traditional Villages

## 3. RESEARCH ON THE DESIGN METHOD OF SUSTAINABLE TOURISM SERVICE SYSTEM

### 3.1. Design Elements of Traditional Village Tourism Service System

To design a sustainable traditional rural tourism service system, we need first coordinate the various elements from a systemic perspective. Through the collation of related literature, this paper analyzes the design elements of the traditional village tourism service system in terms of space, function and experience as follows



[Figure 2] Design Elements of Traditional Village Tourism Service System

### 3.2. Resource integration of local revitalization and external involvement

Main contradiction between local revitalization and external involvement:

- Historical pattern and scale development. The emphasis of local revitalization should be placed on the overall pattern of the extension of the village. The external intervention focuses on expanding the construction land, developing the scale of the village, and promoting the development of the industry.
- Villagers' income and industrial transformation. The protection of villages is inseparable from villagers, and the villagers have the desire and power to pursue higher incomes. When the income of migrant workers is greater than the farming in the villages, the villagers must choose to go out to work.
- Local culture and urban civilization. Because the villagers have less opportunities to receive education, they are at a disadvantage in competition with external operators. If foreign intervention is dominant, it would lead to the gathering of external culture and encroach on native culture.

Tourism stakeholders mainly include tourists, tourism, source government, host government, host community, universities and non-governmental organizations (NGOs). Each stakeholder's activities are two-way interaction and mutual influence.

Balancing the protection and development of traditional villages, we must balance the sustainability of the tourism industry and the village's ecological culture in the design of tourism service systems, integrate the advanced concepts and management methods of external intervention with innovative design thinking and the needs of local revitalization. Optimize the development elements and stakeholders to design a systematic sustainable solution. The external involvement can awaken the cultural pride of local residents, and promotes the growth of local revitalization through education and training. External intervention needs to be guided by the understanding of the local development, accept the guidance of systemic solutions, and combine the strength of local revitalization to jointly optimize the sustainability of traditional villages.

### 3.3. Traditional Village Sustainable Tourism Service System Design Strategy

The core of the protection and development of traditional villages is to create a multi-collaborative management model. The process of establishing mutual respect and trust between the local and the external is also a process of mutual learning.

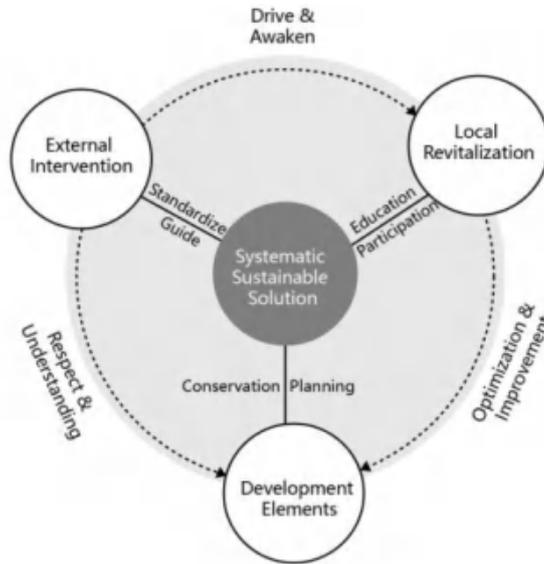
- External assistance. The village has not yet formed a platform for external communication. Villagers are in an occluded geographical environment for a long time, their thoughts are limited. Therefore, the communication in the early stage of planning usually relies on external intervention.
- Local participation. The growth of the community and the promotion of planning are synchronized. When the organizational capacity of the villagers is continuously improved and participation awareness is enhanced, the form of participation can gradually develop towards the village-led model. The villagers become the initiators and leaders of the village construction, and the community organizations become representatives of the villagers and the stakeholders.

### 3.4. System Design Method and Process

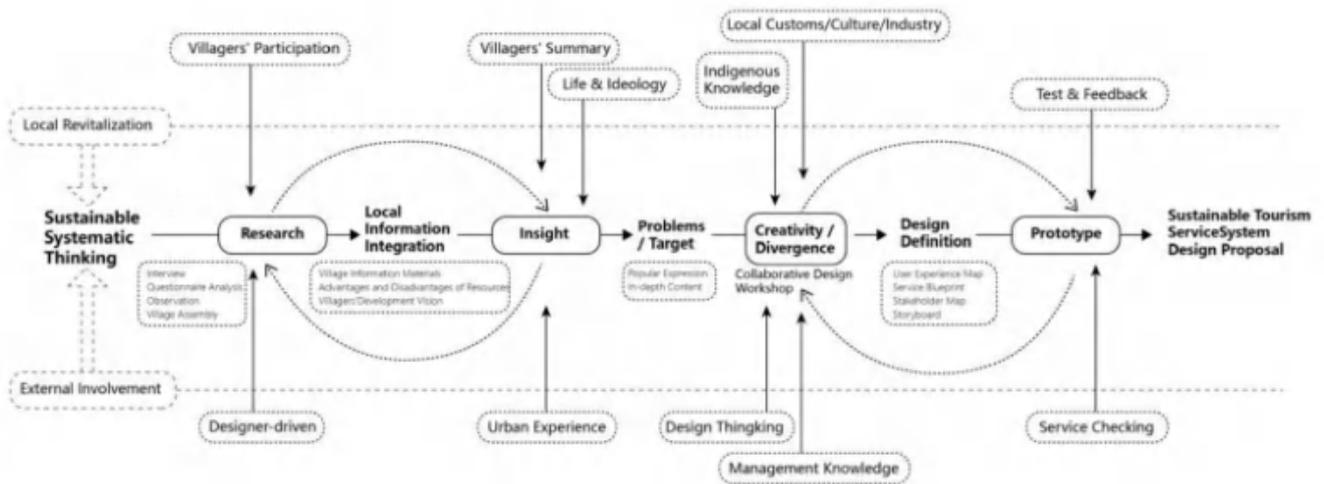
- Local information integration. The design of the tourism service system first needs to investigate and analyze the development of local villages, the awareness and attitude of the residents of the village community, the historical and cultural elements of traditional dwellings, and quickly collect information on village information, resource advantages and disadvantages, and villagers' development aspirations and development

approaches.

- Design goal determination. Through the organization of the design consultation meeting, the villagers will ask questions that need to be resolved. The designers will consult with the villagers on the spot with professional knowledge and government principles to jointly formulate planning goals.
- Design decision making. The designer should explain the plan as much as possible and the expected implementation effect, especially in terms of the interests of the villagers. On the basis of understanding, the villagers can make accurate opinions.
- Test and feedback. The villagers’ test and evaluation opinions can really affect the pros and cons of the design plan. Designers need to incorporate feedback into the process of dynamic design, repeatedly test and iterative polishing.



[Figure 3] Resource integration of local revitalization and external involvement



[Figure 4] Design strategy of sustainable tourism service system in traditional villages

#### 4. DESIGN PRACTICE OF SUSTAINABLE TOURISM SERVICE SYSTEM IN AKEKE VILLAGE

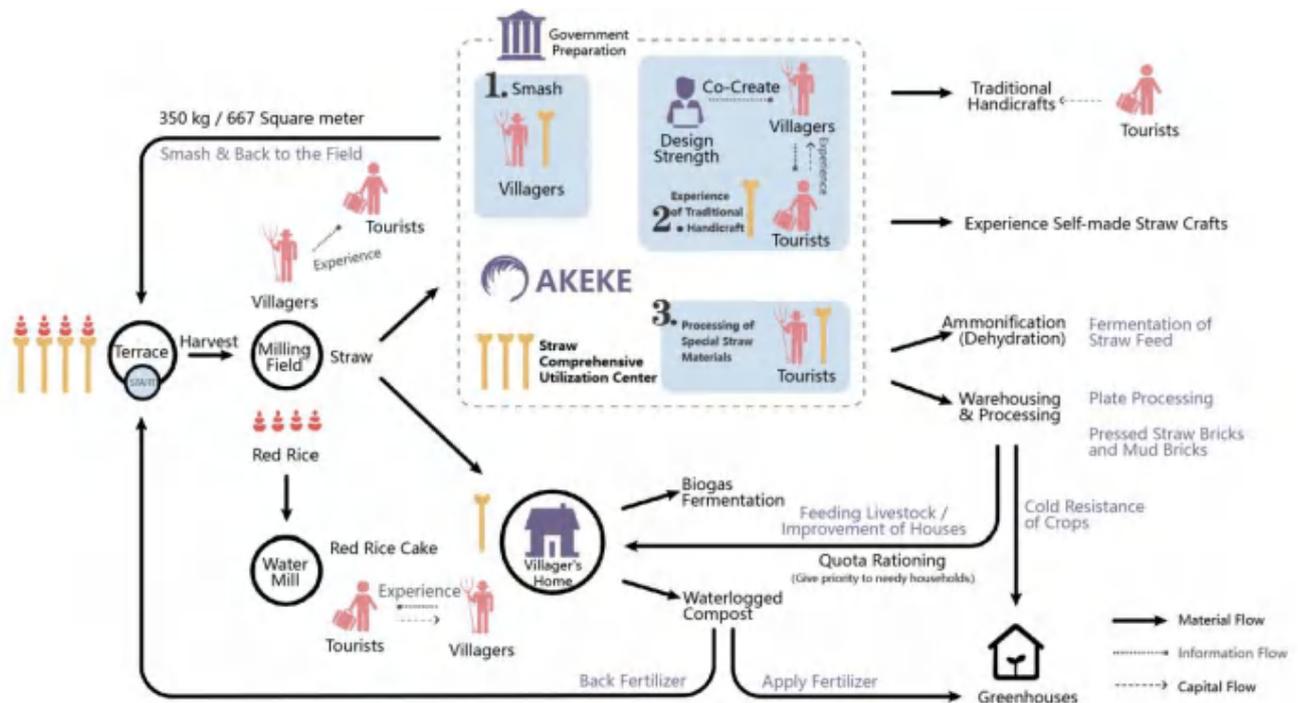
Founded in 1855, Akeke has retained its own festival customs, farming culture, folk crafts, religious worship. However, due to the lack of words, the preserved cultural crystallization can only be found in the lifestyles of villagers, the Hani terraces and the traditional villages. Yuanyang Terraced Field has successfully declared a world cultural heritage, which attracted a large number of tourists. Thanks to the restrictions of traffic conditions, Akeke’s traditional preservation is relatively complete. But the villagers still suffered from poor living conditions.

Yuanyang terrace red rice is the earliest domesticated ancient rice. The design practice uses local red rice as an entry point, try to arouse society’s concern about the protection of local villages and the improvement of villagers’ lives. The villagers have sustained benefits in the sustainable production operations assisted by external involvement, thus strengthening the protection and development of the water systems, terraces, agricultural production and village lifestyles.



[Figure 5] Akeke Village Landscape

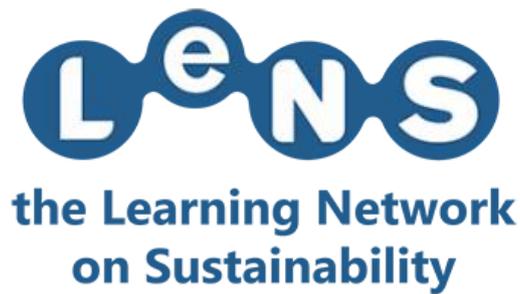
Akeke Red Rice Experience Tourism Service System promotes the benign circulation of red rice industry, activates farming, enhances the income of villagers, and transforms the red rice industry. The industrial transformation takes red rice as a starting point, tapping the opportunity points that can be combined in local agricultural, sideline products and handicrafts. And updating the single and closed industri structure with the help of external design thinking and management mechanism. In terms of cultural inheritance, red rice is used to restore farming practices, while reviving traditional handicrafts and showing the charm of traditional village culture. The service system provides a collaborative platform for local villagers and external tourists and business operators to enhance cultural identity in the reconstruction and experience of the red rice industry.



[Figure 6] Akeke Red Rice Experience Travel Service System Map

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## **DESIGN SYSTEMIC APPROACHES FOR SOCIAL COMPLEX SYSTEMS: BRAZILIAN CASE STUDY ON LAND REFORM SETTLEMENTS**

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### **ABSTRACT**

This article aims to discuss sustainability as a wicked problem and propose ways to design in social complex systems on emergent countries. To address these issues, this paper begins with a brief review of the literature on sustainability (ONUBR, 2018), wicked problems (Rittel & Webber, 1973) and complexity (Jones, 2013), followed by a brief presentation of the development of sustainability and complexity in design and new approaches to work on these scenarios (Ceschin & Gaziulusoy, 2016; Ryan, 2013; Bistagnino, 2017). In the sequence, a case of landless settlements of Maragogi city -AL- Brazil and its solutions for socio-ethical development will be presented and evaluated from a perspective of design for wicked problems solutions in complex contexts. It concludes with the presentation of ways to design solutions for wicked problems in complex social systems, such as Brazilians', contributing to the must needed reflection on the flexibility of design in the face of the world diversity.

Key Words: Systemic Design, Social Wicked Problems, Sustainable Development, Land Reform

## 1. INTRODUCTION

According to UN-HABITAT III Convention 2016: “(...) the persistence of many forms of poverty, growing inequality and environmental degradation remain among the biggest obstacles to sustainable development worldwide, and socio-economic exclusion and segregation space often manifest realities in urban cities and agglomerations” (UN-HABITAT, 2016 p.3). In peripheral countries, such as Brazil, in addition to urban areas, also rural areas exhibit complex social problems, which interact in a systemic, perverse, inseparable and co-emergent manner with environmental, economic, political and cultural problems (ONUBR, 2018) is whose solution is imperative to these balances inherent in sustainable development. To contribute to this process, this article provides an assessment of the potential application of systemic approaches to the design, the solution of highly complex social problems linked to sustainable development. More specifically, the article deals with wide field of possibilities for the design's role in solving the existing wicked problem in the processes of the Brazilian Agrarian Reform. This paper is based on the ideas developed for the on-going research thesis *Design and Gastronomy: the systemic approach of Design in the context of local sustainable development of small Brazilian communities*, developed in the Postgraduate Program in Design of the Federal University of Pernambuco, Brazil.

## 2. SUSTAINABLE DEVELOPMENT & SOCIAL WICKED PROBLEM

Many social problems, that interfere on sustainable development, are wicked: characterized by uniqueness, non-linearity, dynamics, contradiction, multi-causality and difficulty on its diagnosis (Rittel & Webber, 1973). For cross organizational, sectoral, territorial and professional boundaries, the traditional approaches to wicked problems are not effective (Mota, 2014 p.53) and demands intelligence and collective action to offer proper solutions for these wicked problems (Conklin, 2008). These solutions, in turn, do not obey the right-wrong logic, but the best-worst to face any situation at a given moment. Being highly susceptible to rebound effects, these solutions also tend to result in new problems, requiring constant feedback and other new solutions (Ackoff, 1974; Ritchey, 2011; Rittel & Webber, 1973).

Social wicked problems involve constellations of stakeholders, which may have conflicting interpretations as well as different life experiences, competencies, goals, and values.” (Ibid). In this scenario, the design plays an important role by bringing together skills able to map the systems, articulate the actors and the multiplicity of different points of view and reduce conflict in favour of the best and most feasible solutions. According to Peruccio “design to the complexity is to achieve an inch-perfect objective through the concrete structuration and arrangement of multiple factors, processes and multilevel interactions originated from a context that results from three closely connected spheres: Biosphere, Sociosphere and Technosphere.” (Peruccio, 2017, p.72).

As Germak (2008, p.4), in the past 30 years, the Design has filled this gap with systemic approaches, combining different areas of knowledge, it has proved effective in developing broad themes, working at various levels of depth and complex (ibid, p.5). New systemic approaches in Design are emerging as: product-service system design; service design; human-centred design; design for social innovation; design for territory; systemic design and, finally, design for system innovation and transitions (Ceschin & Gaziulusoy, 2016). This shows the maturity of the design and the tendency to take the complexity as a starting point for solving complex problems that hinder sustainability.

In his systemic approaches, Design comprises that complexity is a natural condition in which living systems and social systems are possible, where they develop and evolve. For its natural condition, Design should not be ignored in any endeavour in which social evolution and the break of a sustainable paradigm are meant to be achieved. From this perspective, systemic approaches takes the design complexity as its basis and principles under the understand that: “Fighting complexity is a lost battle. Designers and managers should assume that complexity is irreducible. They should develop “metacognitive” skills and new ways of thinking, conceptualize and how to intervene in projects, understanding and assuming a greater epistemological solution that this implies.” (Real et al., 2017, p.61). That said, the next section is dedicated to present a Brazilian wicked real social problem, for the Brazilian Agrarian Reform, based on a case study carried out in 2018, in the municipality from Maragogi-Alagoas.

## 3. LAND REFORM - BRAZILIAN SOCIAL WICKED PROBLEM

The poor distribution of productive land is a complex problem that plagues Brazil since colonization. Its deep roots and branches are intertwined and co-emerging with serious socio-economic and cultural problems, which keeps this country among the world's worst development indicators. Carrying the burden of maximum expression of inequality and wealth concentration, this situation leads to the dissolution of basic social structure and human rights, becoming part of the population outcasts of organized society (OXFAM, 2016). Under the law, the so-called ‘land reform’ is currently coordinated by the National Institute of Colonization and Agrarian Reform -INCRA, an independent federal agency created by Decree No. 1,110 in the 70s, with the “priority mission to carry out land reform, keeping the national register of rural properties and manage the public lands of the Union” (INCRA, 2011).

According to INCRA (Idem), land reform provides: 1) The devolution of democratic and land structure; 2) Production of staple food; 3) Generation of employment and income; 3) Fight against hunger and poverty; 4) Internal-

ization of basic public services; 5) reduction of rural-urban migration; 6) Promotion of citizenship and social justice; 7) diversification of trade and services in rural areas; 8) Democratization of power structures. 7) diversification of trade and services in rural areas; 8) Democratization of power structures. 7) diversification of trade and services in rural areas; 8) Democratization of power structures.

Following the Land Statute - Law No. 4504/64 (Brasil, 1964) establishing principles of social justice, sustainable rural development and increased production, Incra (s/d) seeks the implementation of a rural settlement model based on “economic viability, environmental sustainability and territorial development.” Regarding the beneficiaries, the agency’s activities in the field is guided by “promoting gender equality, and the right to education, culture and social security in the reformed areas. “the rural settlements are to meet the realities and specificities of each territory and each community can be divided into two groups and take the following forms (ibid): *Group 1*) traditional Settlement Projects (PAs); Agro-extractivist Settlement Project (PAE), Sustainable Development Project (PDS), Forest Settlement Project (PAF) and Decentralized Project for Sustainable Settlements (PDAS); *Group 2*) agrarian reform settlements projects recognized by Incra, created by other government institutions for public access to the PNRA policies.

The land to be converted into settlements are acquired through purchase by the federal government, divided into plots which its dimensions respect local laws and distributed by purchase and sale agreement to the settlers. The ultimate ownership is earned only after full payment of debts to the government. Within the land reform program also provides up financial support (access to rural credit) and technical assistance to the families contemplated for the start of their agricultural activities, to the extent of their autonomy (ibid). According to INCRA (2019), between 1971 and 2019, 9,443 settlement projects<sup>1</sup>, they conferred ownership of land to 973,580 families throughout the Brazilian territory. This number, however, is greatly reduced across the universe of families awaiting the benefit (Leite et al, 2004) in extremely vulnerable conditions. Popularly called ‘landless’ population, these families live long periods in camps, in tents made out of plastic and without any basic infrastructure such as water, electricity, sanitation, roads, schools, transportation, etc. Built on the edge of roads or private property, invaded in illegal actions of forced appropriation, these (un)human agglomerations are often filled with violent struggles from both sides, where the landowners, as the judicial staff, seek restitution of their land’s ownership.

Regarded as the ultimate expression of inequality, these camps expose the urgent need for integrated solutions that derive not only from land transfer and support to its productive use, but in ethical inclusion and socio-economic-cultural belonging reframing these Brazilians and their future generations as an integral and important part of a broader and more equitable system. In this sense, even if legally supported, Agrarian Reform, in practice, to fulfill their socio-economic and cultural function (re) structuring, requires multidisciplinary teamwork, multi-sector, multi-funds and multi-actors (Ferrão et al, 2015 p.57). The participation of Design, for its recognized skills in coping with wicked problems, can help to reintegrate this population in a sustainable and ethical perspective. However, the inclusion of Design as part of the leading solutions for the Brazilian Agrarian Reform is still not a reality. A preliminary literature search, considering Design in its various approaches, has shown that the existence of studies in this area are incipient when compared to the scale of the problem. Thus, in order to cooperate in the expansion of this theoretical and practical field related to Design and Brazilian Agrarian Reform, and more specifically on the role of gastronomy in the sustainable development of small towns, communities and differentiated societies, a survey was conducted along the rural settlements of Maragogi municipality in the state of Alagoas, whose procedures and results are presented in the following session.

#### 4. CASE STUDY - SETTLEMENTS OF MARAGOGI CITY AND COOPEAGRO

This section describes the empirical data collection performed by the COOPEAGRO - Cooperative of Small Farmers of Organized Maragogi municipality, Alagoas, Brazil. Based on an Exploratory-documentary research and being also part of the doctoral thesis (Design and Gastronomy: systemic approaches of design applied to the sustainable development of small Brazilian communities), this present research had two phases: 1) collection of theoretical data and 2) empirical data collection. In the theoretical phase sources in the areas of Design, Theory of Complex Thought, Wicked Problems, Economics, Social Sciences, Political Science, Public Policy and Food were consulted and the data collected was organized under the Chrocane Method of systematic literature review (Clarke & Horton, 2001). The results of this phase are a theoretical knowledge that supports this article. The empirical phase built on theoretical research had site visits and open interviews that respected the regulations of the Brazilian Ethics Committee using the Survey Method. The selection of settlements studied had as main criteria the time of consolidation of the enterprise and the cuisine as the main product and source of income of the settlers. To measure the level of maturity, we used the metric ‘Implementation Phases’, established by INCRA (2019). To accomplish the goals of this study were selected only ‘Consolidated Settlements’. To meet the criteria of ‘food as a source of income and lo-

<sup>1</sup>.The regulations on agrarian reform Rural Settlement define as a set of independent farms each other, installed by Incra where originally there was a rural property belonging to a single owner. (INCRA, 2019)

cal development', it was the type of crops grown and marketed by the settlers.

#### 4.1 Results & Analysis

The application of empirical data collection tools yielded the following overview: the Maragogi municipality had, in 2018, 19 settlements, 11 of which were consolidated and 07 were involved with COOPEAGRO - Cooperative of Small Farmers Organized. Founded in 2003, it has now 135 member-cooperatives, which represent less than 10% of the rural population of Maragogi. The COOPEAGRO provides technical support and seeps local production of fruits and vegetables, balance results between vocation of the territory, such as physical and edaphoclimatic structure and skills and previous knowledge of the settlers. The cooperative, which helped to solve the bottleneck of marketing of fresh products, with incentives, encouragements and projects, now houses a small processing unit of fruit pulps, concentrated juice and ice cream, sold in Alagoas (Figure 3).



[Figure 3] COOPEAGRO. (Font: Author and COOPEAGRO)

Regarding food security, respondents reported that no member fits in organic production because of the difficulties inherent in the certification process, "the properties are small and within a short distance in space. Any movement towards organic certification must be collective. However, in order to reach profit, the production must be intense and with minimal losses. This is not possible for organic production. However, there is an awareness campaign to reduce the use of pesticides." For wastes, according to the respondents, there is a circular feed utilization in creation and composting. As for water, the cooperative demand treatment of waste water from the pulping process, currently fully dumped in the common network collecting water.

In addition to fruits and vegetables, such as diversification of income sources was associated with the introduction of beekeeping, which simultaneously provides honey and contributes to environmental health; creation of flour mills for the processing of cassava product consumed on a large scale in northeastern Brazil and to expand the use of inputs from the banana plantations, aimed at social inclusion and reduction of gender inequality, such as the support of SEBRAE - agency mixed capital, created the Women of fiber Project promotes banana fiber crafts. In 2018, through the Alagoas Secretary of Agriculture, created a project for creation of fingerlings. Recently, also in partnership with the SEBRAE and Secretary of Tourism of Alagoas, established the Rural Tourism - *Visgueiro Trail*, promoting tourism in the settlements, with walks through pristine stretch of Atlantic Forest, visits to family farming, lunch with local cuisine, visit to the flour mill, among others. This route benefits from strong coastal tourism Maragogi and includes a rural area in the social agenda. All these products are exposed and are marketed in COOPEAGRO, open to visitors. Weekly cooperative conducts fair horticultural products from members and offers daily lunch breakfast and lunch made with local produce. Outside the physical space of COOPEAGRO, foodstuff produced in the settlements are sold at fairs in gastronomic establishments and the local hotel chain.

Analyzing the theoretical-empirical data, it can be said that the problems related to the Brazilian Agrarian Reform are from a wicked nature and to fulfill its socio-economic and cultural (re)structuring functionality, it is required a collective, multidisciplinary effort, multi-sector, multi-funds and multi-actors, with investment in the short, medium and long term. The distribution of land, per se, does not represent the dissolution of the previous system, but a turning point for the restructuring of the system through new elements. This restructuring must be accompanied and guided, being desirable that the whole process is preceded by multi-supported systemic planning that equalize objective and subjective questions and is constantly feedback and refocused through these feedbacks.

The process of creation and consolidation of rural settlements creates new structures, putting in the same system people with skills, stories, different knowledge and cultures, who have gone through a serious process of social marginalization, losing the sense of identity and belonging. The physical geographical boundaries provide working conditions, but there is an urge to the application of a belonging process in order to build from scratch their identity, negotiation and balance of the differences and finally, the development of tangible structure and intangible dynamic resulting from other cultural and social boundaries that unites and helps them communicate to the external environment. The territory acts as the backbone of issues related to land reform. The land, as the object of dispute, assumes many roles in relation to the settlers.

The theory predicts that the beneficiaries of it can produce its own economic growth and move upward. The data demonstrate that by joining the vocations of the territory and 'seated' can, yes, promote economic and social development to families which were previously living under vulnerable conditions. But also shows that not everything aligns with this proposal, there is need to diversify income opportunities in settlements to take advantage of all kinds of human vocation assembled. As for the object of research, gastronomy, the data support its alleged potential

as a leading actor for economic growth for small communities and for local social cohesion. It also shows that it is effective as a liaison and open up a dialogue just as the extra-social and cultural spheres, besides it also works as a differential promoter to territory-society-identity dynamics. Products of the studied settlements were in reality a common language among small farmers, as other social factors, preventing isolation and social exclusion.

Today, gastronomy is the main source of income of Maragogi settlements and the activities gastronomy' related complement the income and unemployment related issues by promoting minorities inclusion and gender equality. The COOPEAGRO has a strategic and fundamental role in the improvement and local development process, visualizing problems and demands, proposing and organizing projects, identifying sources and resources of all kinds for the sake of not only its members but of all the settlers of Maragogi-AL-BR. Good management of the cooperative and their sensitivity and openness to the demands of the region, has promoted its steady growth, increasing the return to the cooperative and encouraging new projects, always supported by multiple national and international entities. Lastly, it is stated that the process of land reform is not and cannot be limited to local settlements. It is a systemic process and should be taken over by the Brazilian population, in order to achieve an effective performance of equitable ethics for sustainable development.

## 6. FINAL CONSIDERATIONS

This article discussed sustainability as a wicked problem and offer ways to design in complex systems, more specifically in social systems on emergent countries, affirming that social problems are way more perverse and complex, representing concrete obstacles to overcoming the sustainability paradigm. In the context of emerging countries, as Brazil, the possible solution must involve all social stakeholders to address a social-ethical development a long-term. The participation of Design for its recognized skills in coping with wicked problems is strategic in the re-integration of the population within a sustainable, fair and ethical perspective. The systemic complexity of the issues involving the Brazilian Agrarian Reform, however, requires systemic approaches to design for the complex, whose methodologies are able to map the system and set to identify its boundaries, its structure and its multi-dimensional interactions, identifying actors and their roles, summon new actors, identify relationships, weaving new relationships, identifying conflicts and creating mechanisms for identifying new conflicts or rebound effects as well as possible ways to solve them.

Using graphic tools, translating their findings into a language that can communicate with participants, evoking and coordinating participatory codesign. Without giving up traditional strategies, systemic approaches to design, may offer theoretical and empirical knowledge appropriate to the complex social issues emerging Brazilian Agrarian Reform and adapt their processes to the guidelines of sustainable development. Like any complex question, the design should provide the short, medium- and long-term actions, based on continuous feedback and readjustments inherited in the dynamics of social processes that are involved.

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