SUSTAINABLE ENERGY FOR ALL BY DESIGN

Edited by Emanuela Delfino and Carlo Vezzoli

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the Learning Network on Sustainable energy systems

FEEDING A WORLD WHO CAN GROW

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ABSTRACT

The proposed contribution deals with the problems concerning the quality of life of the population in countries in the process of development- particularly of school age and working - that gave their nutritional intake (daily) need a balanced approach to combat the incidence and incremental food its significant social and economic repercussions. In fact, in recent decades, the right dietary intake generated pathologies: celiac disease, diabetes, cardiovascular and vasculopathy.
The idea is an innovative automatic distribution system for food & beverage, to different temperatures. It is a system-thinking product that guarantees, especially in countries development, high feed efficiency (nutritional value and quantity correct), a security protocol spread (garrison to viral contamination) and the enhancement of local foods (promotion products to protect the territory).
In developing countries, the poor nutritional quality intake, size and epidemiological the socio-economic impact of malnutrition are such that this aspect a true social and health emergency.
It means starting from the experiences of developed countries, through the use of skills multidisciplinary (food, socio-political, business administration, industrial design and ergonomics, electronic and mechanical technology) for the development of the project, as well as direct Angolan participation, Uganda and other African countries through the support of the government and university institutions, to experience the effectiveness of the results.
The poor nutrition is therefore a problem "welfare" and social large dimensions, not only in order to degeneration of the patients' bodies, but also to the very low social contributions and labor caused by physical dysfunctions.

KEYWORDS
1. From indigenous production to automatic deployment;
2. Design (no waste) for food and beverages;
3. Balanced nutrition.

SOLIDARITY AND ALIMENTAR COOPERATION WITH THE AID OF FOOD AND BEVERAGE'S AUTOMATIC UNPUBLISHED SYSTEMS.

Davide Bruno, the author of the research (paper), intends to address challenges in developing countries concerning the quality of life of the African population – especially children and working life – that with their nutritional intake (daily) need, with particular emphasis and urgency, a balanced nutritional intake to counter the unbalanced food and its incidence and impact in social and economic terms. Indeed, in recent decades they have spawned diseases such as: celiac disease, diabetes, cardiovascular and acute vasculopathy.

In the alternative, the idea is to develop an innovative system of industrial products to promote automatic distribution of food and drink locally grown and directly produced (ready meals or preserved in pakaging) in differents temperature (from 4° to 65° c). It seems to use, in the context of a food distribution, a system-product that can be guaranteed, particularly in the developing countries, a high feed efficiency (proper quantity and nutritional values), a security protocol (garrison to viral contamination) and promotion of native foods (promotion of territory).

From the experience of developed countries, developing new products to support the food industry (local and international), through the use of multidisciplinary expertise (industrial design and ergonomics, electronic and mechanical technology, business management, socio-political and food) for the development of the project, and the direct participation of the Central African countries through the support of the Government and the Universities to experiment the effectiveness of results.

Angola, Uganda, Botswana, Namibia, the Congo, etc are African countries among the most attentive and sensitive to the continent, through their nutrition policies and internal and external skills (in some cases like Angola, a bridge to the neediest States), are without a doubt, the physical places where transfer culturally project's idea (both from formation and application).

In developing countries the poor nutritional intake quality, size, epidemiological and socio-economic impact of malnutrition are likely to make this look like a medical "own social urgency"; in this context the "mal" nutritional aspect is among the first headache because of socio-economic instability. The food problem also occurs with dramatic clarity to the lowering of the age groups (6-22 years).
The incorrect nutrition is therefore a problem "relief" and large social, not only as regards the degeneration of organs of patients, but also to a very low contribution caused by physical dysfunctions. The author states that in reference to the World Health Organisation's definition of "nutrition" like "a dietary intake that aims to develope a person at its highest potential in physical, psychological, social, educational, employment and, in relation to its physiological or anatomical deficiency and the environment", intends to operate in terms of advancement and innovation through the establishment and development of an integrated strategy of bio-psycho-social to improve the effectiveness/efficiency of the nutritional process in the distribution level.

Today, in developing countries the poor nutritional intake quality, size, epidemiological and socio-economic impact of malnutrition are likely to make this look like a medical "own social urgency"; in this context the nutritional aspect is among the first headache because of socio-economic instability.
The incorrect nutrition is therefore a problem "relief" and large social not only as regards the degeneration of organs of patients but also to the low social and occupational contribution caused by physical dysfunction; this raises the question of the definition of more effective methods and tools for quantitative and qualitative monitoring of food and beverage.

Today it is becoming more and more important the issue of food distribution in schools, canteens, in cooperatives, and more generally in collective spaces. Consider, purely by way of example, the given local, peacefully due to global realities, provided by Milan Entertainment on waste: "end up in the trash of our canteens 140 tons of food every three weeks."

It is becoming increasingly difficult to keep the diamond pipeline, (from preparation to distribution) with food quality parameters for expressed meals (hot and cold), sweet and savoury snacks, drinks (hot and cold). It is even harder for structures, both with indoor kitchen or with outside catering, to prepare fresh food and in according to a customized nutrition plan. Also often comes in quantities well in excess of the demand.

Also consider that with the increasing pace of globalization and tourism, food security has become a major concern for public health.
In 2012 a sample of 511 street foods in Ghana, by the World Health Organization, has shown that most had microbial analysis beyond the acceptable limits, and a different sample of 15 street foods in Calcutta have proven to be "nutritionally unbalanced", providing energy of 70Kcal for every rupee spending.

The acronym which the author proposes is the way to solve the problem of balanced nutrition and elimination of food waste in Africa: "nourishing the planet by improving the quality of locally grown and produced food distribution directly (hot or cold) with the help of technology."

Consider the waste and poor quality of food, proper nutritional intake due to cost containment, can be fought with technology in close service of those involved in entertainment but also of distribution. The automatic distribution system is a distribution mechanism that allows you to gain important insights to optimize costs in terms of food and gain a high quality food and nutrition out of every place of work or study.
Should therefore develop an efficient "hybrid" model, in which man, at the center of a system that guarantees the quality, together with the perfect techniques and quality machines/containers, offers superior quality and reduction of squandering of goods.

Consider also that the "street food" is the consumption of food and beverages sold in a road or other public place, such as a market or a trade show, from a street vendor or seller, often from a portable stand.
Historically, the street food was bought because the homes were not equipped with a kitchen. Today in African rural and urban street, the street food is a habit established.

Most of the street foods are also categorized as either finger foods and fast foods, and are less expensive on average, meals at the restaurant. According to a recent study by the food and Agriculture Organization, 2.5 billion people eat street food every day.
People buy street food for a number of reasons:

- "ethnic" meals;
- the possibility of eating quickly;
- reasonably priced.

Street Food so it can be considered a healthy and inexpensive meal, a way to socialize and in some situation a real sensory experience and values. Africa in particular has to stand out in the world for an innovative offer of Street food that takes into account the country's cultural content.
The strengths to be exploited to make Street Food another excellence would be:

- Food and street food with short chain products that respect the environment and for the development of rural areas in Africa;
- instruments of fruition, ecological materials and functional;
- innovative means of distribution.

It is analyzing the possibility of developing new automated distribution systems, to large scale, to govern the correct amount of food dispensed. The first problematic aspect is in fact, a better price, waste, increase product quality and convey so controlled and stored foods properly.

A further problematic node is linked to the continued availability of fresh food (perishables), which often results in the need to reconfigure the distribution service at the expense of cost containment.
It is therefore a necessary procedure which arises from the interpretation of the territory with the aim of supporting local communities, through the ability to control the correct nutritional intake, availability and variety, consistent to their lifestyle, food and drink.

The idea of the author is an automatic distribution system spread across the territory, with architecture and design such as to facilitate human-machine relationship (and implementation) of a lens: the "disponibility to distribute and to distribute local food balanced in amount and protein contents".

An informal, friendly product/system having the purpose of fertilize growth opportunities and steer people toward a sustainable food nutrition in the world; a product system that integrates clearly the logic of development and support conscious, central themes of nutrition in policies on the African continent.

This is a new challenge that draws its origins from deep roots and the idea of a vending machine's intelligent system "touches" the heart of the matter: how to contribute significantly to the planet's nutritional process, restoring the energy needed to return to live properly: with a food system based on contributions needed to people.

The methodological approach is aimed at achieving the following objectives relevant in terms of innovation:

O.1] discovery of a functional and behavioural methodology on bio-psycho-social model, to optimize the complex relationship between nutritional health, individual, personal and environmental factors;

O.2] impact assessment of functional and psychological-social factors-eating in the use of automatic system related to the following areas: individual properties (indoors), out (urban areas), jobs, social contacts;

Or.3] identification of procedural protocols of field testing for the definition of the system of the exigencies of users and for the subsequent classification of concepts related to performance, to aids and equipment for use on completion;

O.4] identifying guidelines and experimental design of automatic distribution systems capable of stimulating the human-machine interaction through normal daily activities;

Or.5] study of virtual interfaces to adjust and adapt existing products to local needs.

Pursue power principles to spread the best lifestyles. Develop ideas to realize vending machine that can aids local production of food and beverage.

It is developing two ideas for the creation of a category of technology products to support the balanced and controlled distribution of food. The food and drink they refer to the dual type: sweet and savoury snacks and drinks in the short/medium storage according to advanced principles related to the culture of street food; food grown and collected by local territories (km 0) for processing into food prepared and stored at temperatures above 65 degrees.

In the last case, the distribution system is designed specifically for workplaces, schools, public spaces, offices, etc. Each person can fill own order on-site or remotely, with traditional systems or apps, with personal computer or tablet. Reservations are sent in a telematic system to the cooking centres that prepare dishes needed to rent. The dishes are then loaded into vending machines with just a few clicks. The dish is preserved within the vending machine and, depending on the type, it maintains the proper temperature: for the hot temperature is above 65 degrees for preserving food hygiene regulations, if it is a cold dish at 4 degrees according to the standards of international law.

For the consumer, it is sufficient to introduce a "coin", a key or magnetic badge, or by mobile phone, an acknowledgment, and automatically the distributor, after recognizing the user and its reservation, presents dishes ready to be consumed.

As regards the development of a distributor of classic products (sweet and savoury snacks and drinks in the short/medium storage) "packaged", for public spaces or street food, the idea is the development of balanced distribution of products, a balanced disbursement according to the food and nutritional needs during the course of 24 hours and with a design compatible to the territorial and rural urban system: an innovative way to distribute food on the territory and to promote the culture of short chain, always derived from local food production (km 0): organic foods and healthy for the personal well-being and the environment and maintain the tradition of street food on a global level.

Developing the idea of an innovative model of product for distribution of food and beverage (a system at different levels of employment). Then build an excellence of food distribution, controlled and certified. Basically the central purpose is aimed at:

- to develop a project for the development of industrial products in the vending industry in EU and non-EU, with special reference to developing countries;
- to highlight the originality of results as highly innovative and original social characterization. Infact, there are no distributors in international markets monitored for temperature, type custom food and distribution capacity effective during 24 hours in total;
- to define the basis of a system of automatic distribution to the end user, able to balance the nutritional values necessary to guarantee a correct intake;
- to develop new materials for food preservation, packaging, geometric systems of packaging, functional aesthetic design and a new process of "distribution and instant communication."

Expected impacts as a result of the introduction of the idea, are three levels of integrated planning and management of distribution process/manufacturing and food's vending machine.
At the strategic level:

- reduction in costs required for production of food requirements;
- greater autonomy and social participation of persons;
- reduction of costs relating to the procurement and processing of raw materials and processes;
- increased socialization and cost-quality improvement.
- At the tactical level:
- exploitation of bio-psycho-social approach, within the nutritional pathways as a tool able to significantly improve the overall quality of food;
- dissemination of a culture of observation/measurement of features and user requirements/process lifecycle, through experimentation, prototyping and testing of automatic distribution systems, space and equipment, tested in research;
- reduced costs for commissions and businesses for the setting up of elements, components and sub-automatic systems designed for the real needs of users.
- At the operational level:
- development of a framework of rehabilitative actions in the field of nutrition, functional and behavioral, of easy reproducibility in a high-quality model for the selfcare;
- reducing the cost and time of distribution of food to the real needs of users;
- processing of data obtained with the testing of the system as a function of scientific validation.

The author of research believes that you can build relationship, through the experience of a project on the field, appropriate and consistent with African development policies by starting an early involvement with the States of Central Africa and southern Africa.

The original appearance of the idea is "to know first how much and what is consumed."

Every detail is studied and analyzed in order to be functional, as well as efficient, and to ensure the best possible maintenance, promoting cleanliness and hygiene. Another aspect is to humanize the machine, by optimizing the

functionality, guaranteed by technology and with an aesthetic that makes it an item to show and not to hide, almost a work of “active” art that interacts with humans.

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the Learning Network on Sustainable energy systems

SYSTEM DESIGN FOR SUSTAINABLE ENERGY FOR ALL
A new knowledge base and know-how developed within the LeNSes European and African project

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ABSTRACT

This paper presents the results of the Learning Network on Sustainable Energy Systems (LeNSes) an African-European multi-polar network for curriculum development on Design for Sustainability (DfS) focused on Distributed Renewable Energy (DRE) and Sustainable Product-Service Systems (S.PSS), i.e. System Design for Sustainable Energy for All (SD4SEA). The project has been funded by the European Union (EU) 2013-2016, Edulink Programme and involves four African and three European universities offering design-specific programmes of study. The results are articulated in knowledge-base and know-how outcomes. Regarding knowledge level the paper highlights the design role within the framework of the S.PSS applied to DRE and how they can be used to develop and implement sustainable energy solutions for all in the African, or more in general low and middle-income context. The discussion is supported by the presentation of projects shaped in the courses regarding sustainable energy product service systems involving for example cooking, mobility, lighting, and healthcare. The United Nations' Global Action Agenda [1] highlights indeed action areas for the achievement of long-term sustainable development as Modern Cooking Appliances & Fuels, Distributed Electricity Solutions, Grid Infrastructure & Supply Efficiency, Large Scale Renewable Power, Industrial & Agricultural Processes, Transportation, Buildings & Appliances.From the know-how (design methods and support tools) point of view they consist in a new modular and adaptable package of learning resources focused on System Design for Sustainable Energy for All (SD4SEA); in pilot courses at African Higher Educational Institutions (HEIs) targeted at undergraduate and graduate students, practitioners and companies; and in an open web platform for distributed production and transfer of learning resources (lectures, tools, case studies, student projects…) in this area.

Key Words: Sustainable product service system design, Distributed energy, Partipatory design, Copy left

1. INTRODUCTION

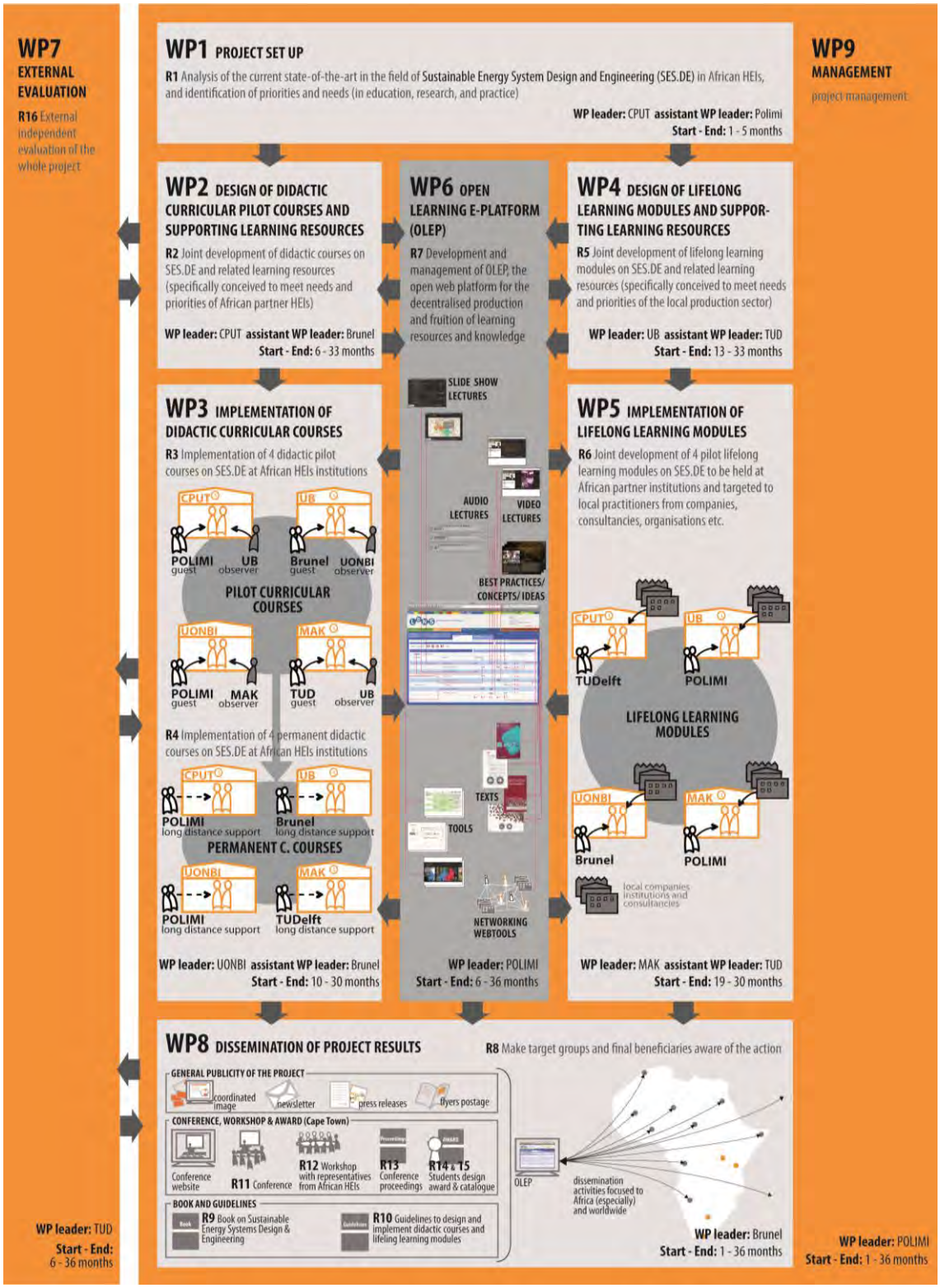
A study conducted by Rogelj, McCollum and Riahi (2013) on the compatibility of the 'Sustainable Energy for All' initiative with a warming limit of 2°C shows that achieving the three energy objectives (ensure universal access to modern energy services; double the share of renewable energy in the global energy mix; double the rate of improvement in energy efficiency) could provide an important entry point to climate protection, and that sustainability and poverty eradication can go hand in hand with mitigating climate risks. But the researchers warn that the likelihood of reaching climate targets within the scenarios depends also on a variety of other factors, including future energy demand growth, economic growth, and technological innovation.
Therefore securing energy for all within the existing environmental boundaries requires further political measures and financial resources. According to Nilsson (2012) "Investment costs for these pathways are large but often profitable for society and most of them have already been set in motion. Still, progress is slow and must be accelerated at national and regional levels. Carbon pricing is necessary but not sufficient: beyond this, governance responses need to be put in place to induce transitions through scaling up a diversity of supply and demand options. White and green certificates, feed-in tariffs, technology standards and removal of fossil subsidies are important first steps already under way. These contribute to nurturing and scaling up new technological regimes, as well as destabilizing old and unsustainable ones."
Results of innovations have to be evaluated considering the associated risk of a rebound effect. The rebound effect is the reduction in expected gains from new technologies that increase the efficiency of resource use, because of behavioral or other systemic responses. For example the availability of energy produced though PV panels can drive to the installation of air conditioning units which were not considered as needed before.
The evaluation of the PSS sustainability is thus very important and at the same time it is very difficult. A first effort concerns the definition of system boundaries because environment is an open system, furthermore it has to be taken into account that the modification of an element brings not predictable changes in the system.
Distributed Renewable Energy (DRE) has a key role ensuring sustainable energy for all since increased access to energy and improvement in energy efficiency could also result in more total energy consumption and pollution. DRE represent a promising opportunity to couple several benefits: economic ones (reduced cost of energy, increased reliability), ecological (efficiency gains, reduced emissions) and socio-ethical ones (democratisation of access to energy, participation and independence of local people). Specific environmental benefits of a DRE are based on the fact that they are non-exhaustible resources, have low greenhouse gases emission, lower environmental impact for extraction, transformation, distribution (low energy transmission losses).
Moreover Distributed Economies (DE), small scale locally-based demand/offer models, based on DRE are a good intervention scale because as Johansson et al. (2005) explain they "allow for the local community to possess higher ownership and consequently gain more power in directing these systems in ways that add quality to their lives." They also "have the great advantage of bringing many of the fundamental issues of sustainable development (even those of an ethical value) closer to the individual, both as a consumer and as a producer." An important element is thus the direct involvement of users that can be experimented in S.PSS co-design workshop to elicit also tacit needs (Martin and Schmidt, 2001). In this context as Bannon (2006) argues "Design teams and users must be prepared to acknowledge each others competencies and to realize that effort must be made by both parties to develop a mutually agreed upon vocabulary of concepts that can be shared across the different groups that comprise the project. It is no easy task for different disciplines and work activities to accomplish this, and it is in this area that additional research would be valuable." Education, concerning both the overall diffusion of scientific knowledge on sustainability and the training on specific know how, is also very important to support the development of sustainable energy solutions for all.

2. METHOD/APPROACH

The study identifies the convergence between the S.PSS and DRE models as promising approaches to provide sustainable energy solutions for all by increasing its access. The project partners have collaboratively developed new curricula and lifelong learning activities focused on these combined approaches.
More in detail in a first phase, each partner gathered and shared knowledge from previous didactic and research experiences in the field of locally-based System Design for Sustainable Energy for All, and African partners shared specific needs and priorities involving local companies, associations and NGOs.
The results of these activities is the base for the following phase consisting in the design and implementation of the didactic pilot modules. At this stage, all the necessary inputs for the implementation of the didactic pilot courses and teaching subsidies have been developed in collaboration between African partners, European partners and with the support of the local associates (companies, consultancies and organisations operating in the energy sector). In a

first round, the pilot modules implementation are carried out through an exchange modality: each African partner hosts a course, and acts as observer in another course implemented in another African partner HEI. Each European partner collaborates in the implementation playing the role of a guest school. In the second round, courses are integrated in the African partners' curricula (with a long distance support by European partners).
The following phase has been the design and implementation of lifelong learning pilot modules. At this stage deals all the necessary inputs for the implementation of professional training modules for companies, consultancies and organisations has been produced. As a pilot case, each African partner (in collaboration with European partners) developed and delivered professional training to the respective local companies, consultancies and organisations.
The method adopted in the courses development and implementation is founded on the participation of local stakeholders, the involvement of an interdisciplinary design teams and the deployment of Distributed Renewable Energy (DRE). The courses' specific contents are defined through the collaboration of different stakeholders from research and practice community, such as experts in ethnography, ergonomics, engineers, architects and designers as well as staff and managers from local companies, associations and NGOs sharing their knowledge and experience and S.PSS are developed observing users' needs and priorities. This Multi-competence approach integrates different toos into a design method increasing the quality of final results (Brannen, 2005).

In parallel with the didactic curricular and lifelong learning activities, all the acquired knowledge - such as lectures (slide shows, texts, audio, video, etc.), case studies classified per set of criteria and guidelines, students' projects and System Design for Sustainable Energy for All tools - is collected in an Open Learning E-Platform (OLEP) to be freely and easily accessible in a copy left and open source modality, so forth enabling others in the design community worldwide to acquire them free of charge, with the possibility to replicate, modify, remix and reuse. Since this is an open package, it will continue to be updated even after the end of the project.
The whole process of curricular and lifelong learning activities design and implementation is constantly assessed by an independent external evaluation and the results of the implementation of both the didactic curricular courses and lifelong learning modules are collected and used in a number of dissemination activities. Finally, a book on System Design for Sustainable Energy for All will be published, and a set of guidelines to support HEIs in implementing didactic courses and lifelong learning activities. Most importantly, the OLEP represents itself the main dissemination tool: the OLEP is in fact aimed at facilitating the adoption, adaptation of the project results by other HEIs to activate similar courses on this emerging and challenging new discipline for design.



[Figure 1] LeNSes Process: main activities and expected results (legend: WP = Work Package; R = Result)

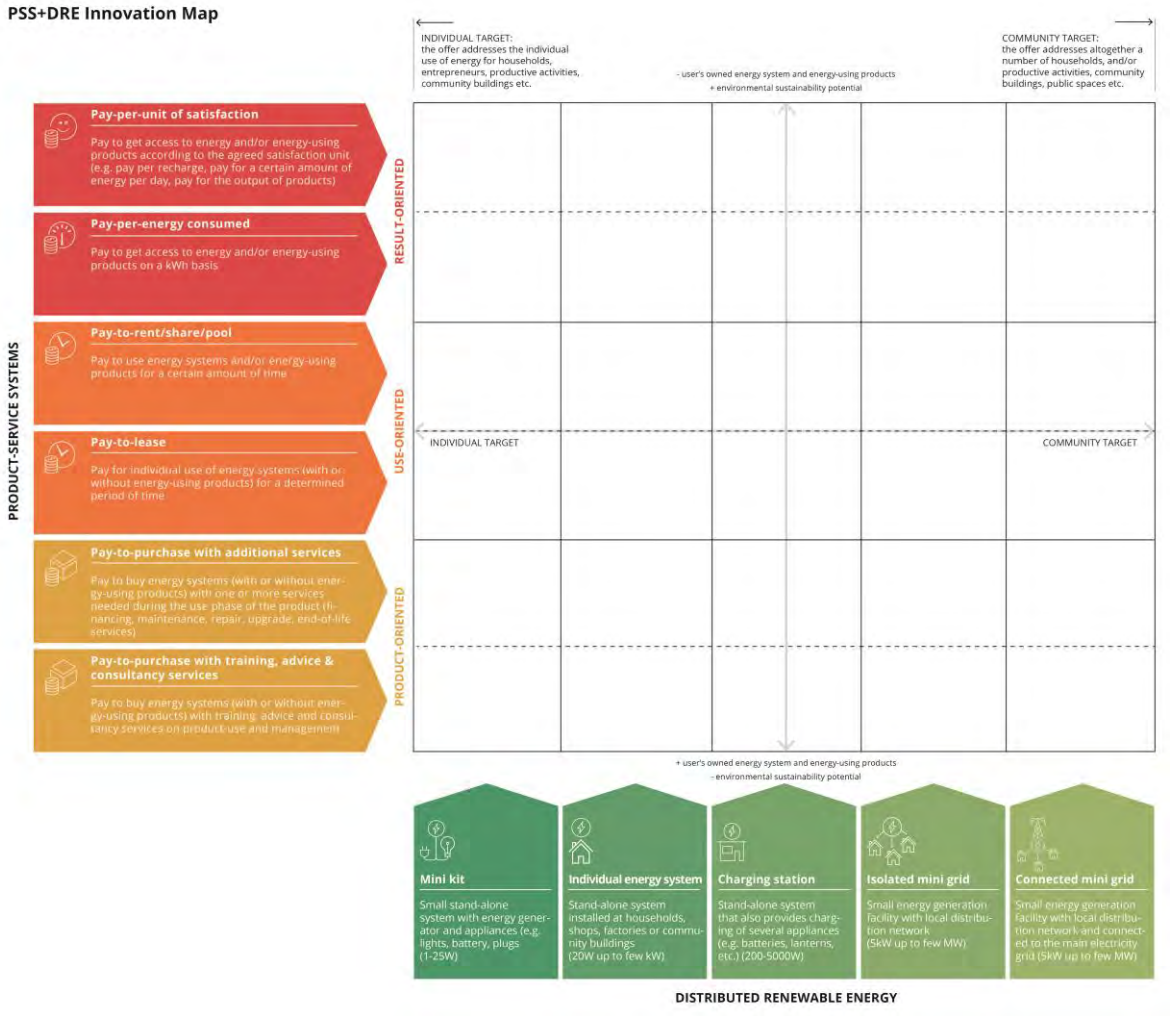
3. TOOLS

The courses gave also the opportunity to apply and test newly developed tools to design S.PSS applied to DRE. The main are below shortly introduced:

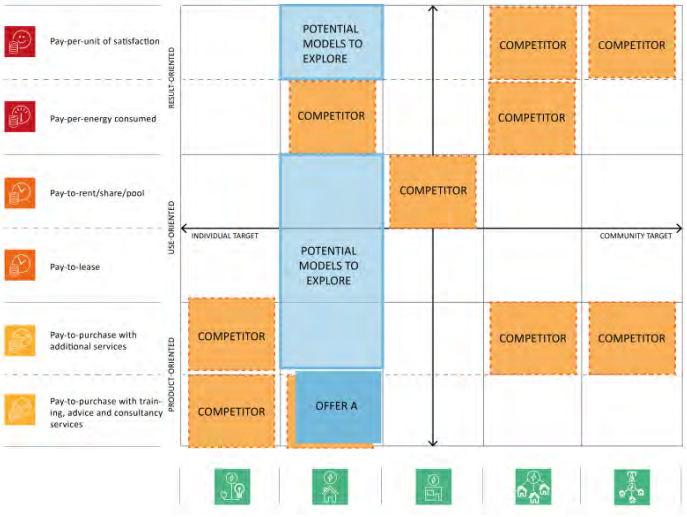
. PSS+DRE Innovation Map;
. PSS+DRE Design Framework and Cards;
. Energy Stakeholder System Map;
. Design Orienting Scenario (SDOS) for S.PSS&DRE;
. Sustainable Energy for All Idea Tables and Cards;
. Innovation Diagram for S.PSS&DRE;
. S.PSS&DRE Concept Description form;
. Estimator of Distributed Renewable Energy load/need and production potential (E.DRE)

3.1. PSS+DRE Innovation Map

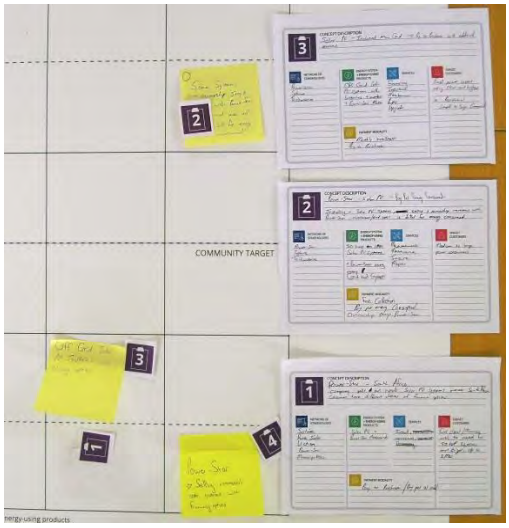
It's a tool for classifying PSS models applied to DRE, positioning company's offers, analysing competitors in the market and exploring new opportunities. The tool can be also used for generating new concepts of PSS+DRE (Emili, Ceschin & Harrison, 2016a; 2016b).



[Figure 2] PSS + DRE Innovation map: format



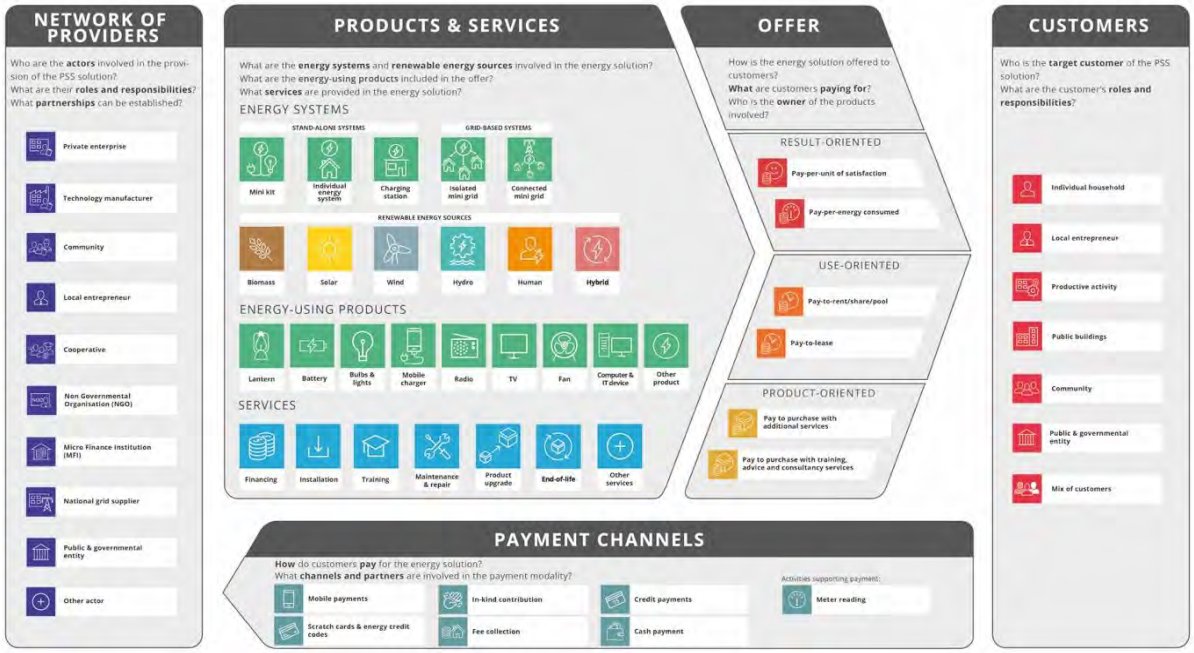
[Figure 3] *PSS + DRE Innovation map: sample application*



[Fig 4] *PSS + DRE Innovation map: working draft*

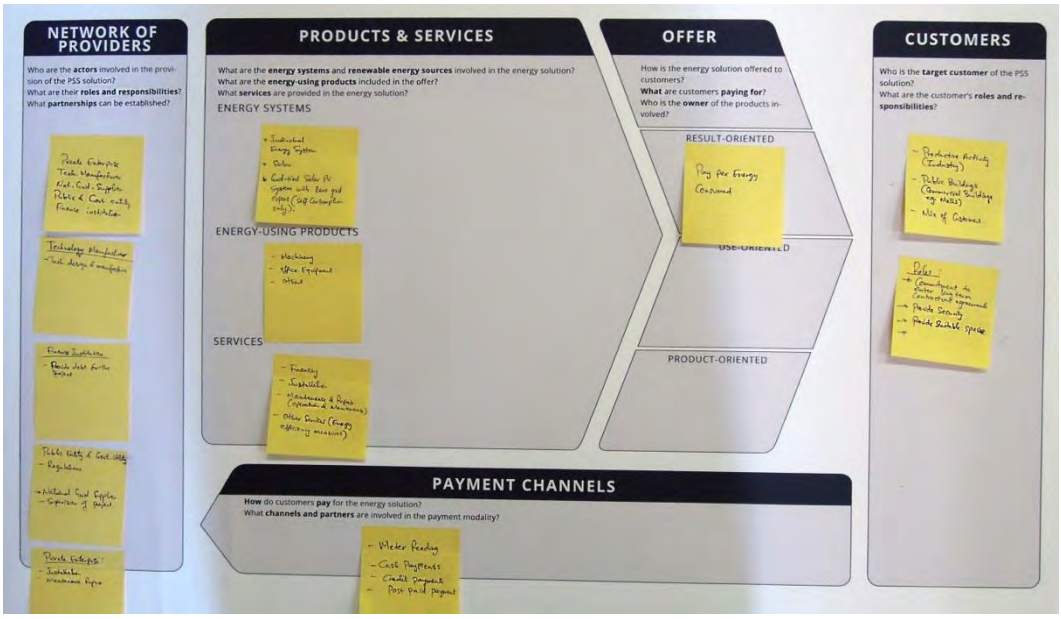
3.2. PSS+DRE Design Framework and Cards

It'a a tool for visualising all elements of PSS applied to DRE and support the idea generation of new concepts. The Framework is combined with a set of cards that collects guidelines, key factors and case studies that aim at supporting the design process of PSS applied to DRE. The cards are divided according to the elements of the framework: network of providers, products, services, offer, target customers and payment channels (Emili, Ceschin & Harrison, 2016c).



[Figure 5] PSS + DRE Design framework and Cards

[Figure 6] PSS + DRE Cards

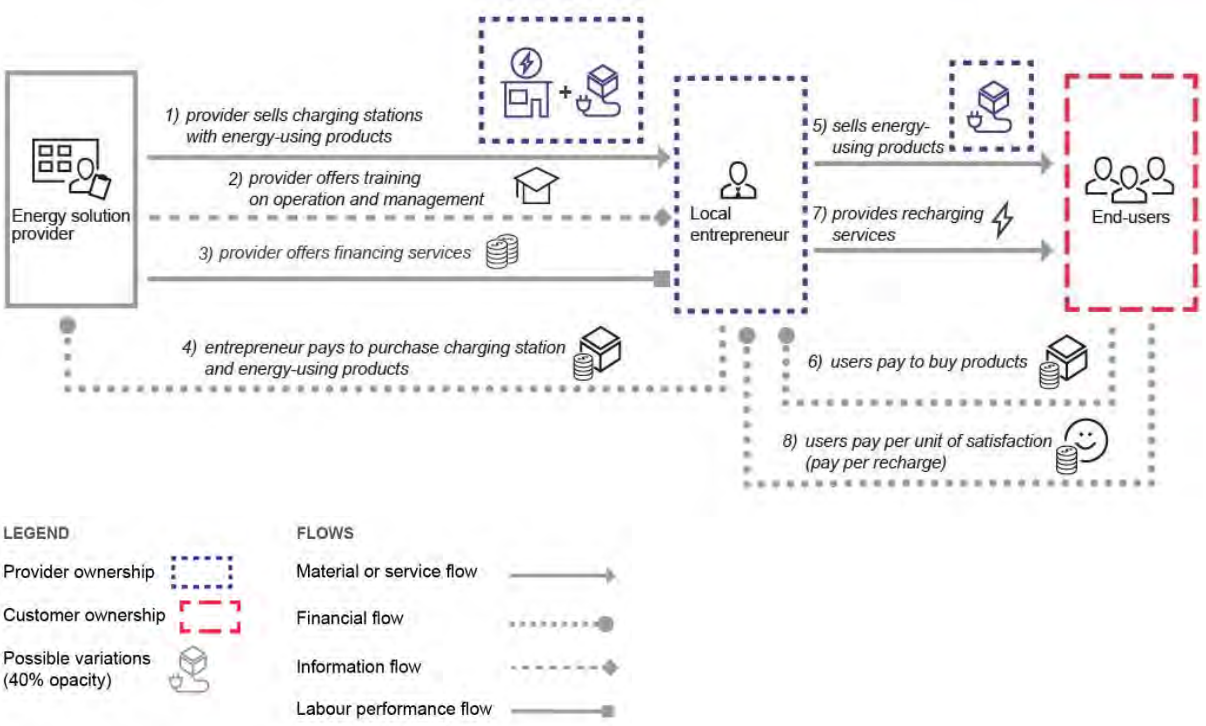


[Figure 7] PSS + DRE Design framework: working draft

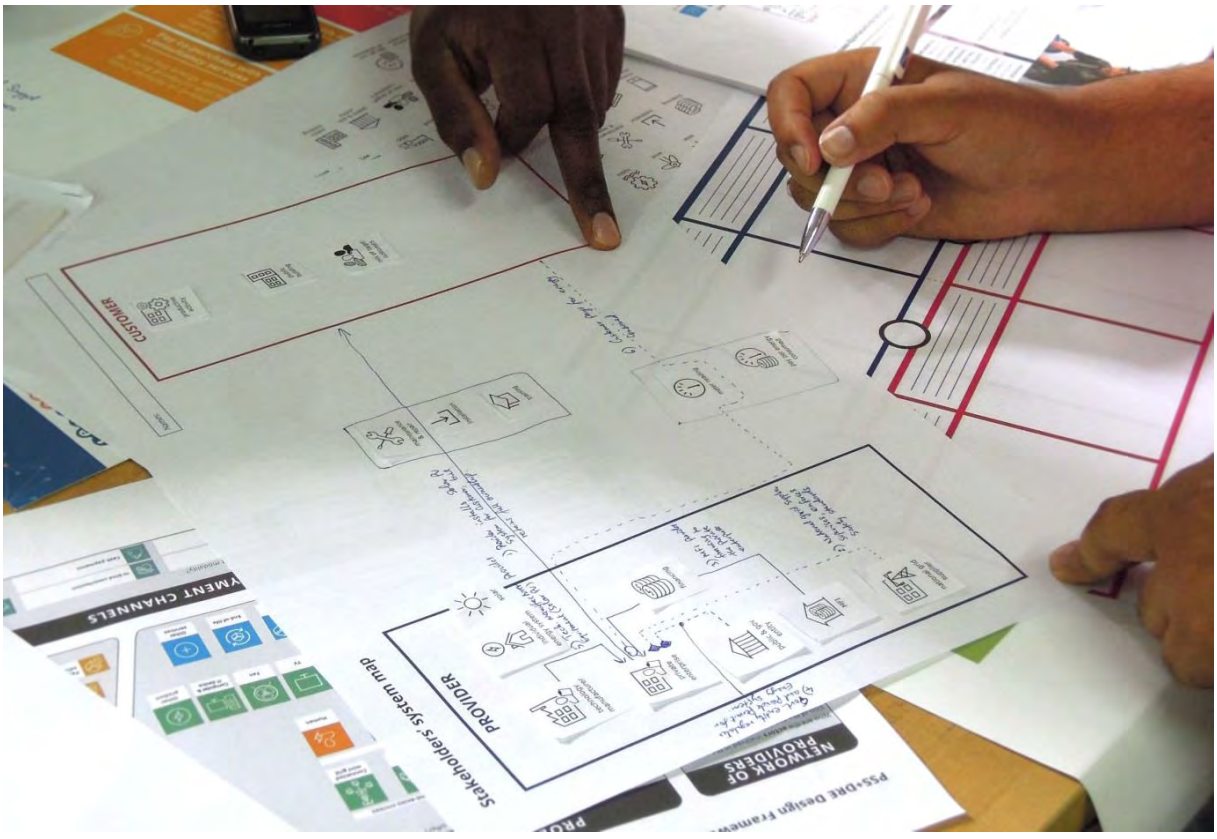
3.3. Energy Stakeholder System Map

It'a tool to visualise the network of stakeholders involved in energy systems (Emili, Ceschin & Harrison, 2016d). A set of energy-related icons and flows can be used to shows the stakeholders and their interactions (in terms of material, financial and information flows). The tool is an adaptation/development of the Stakeholder System Map tool (Jégou, Manzini, Meroni 2004).

[Figure 8] *Icons for S.PSS applied to DRE*



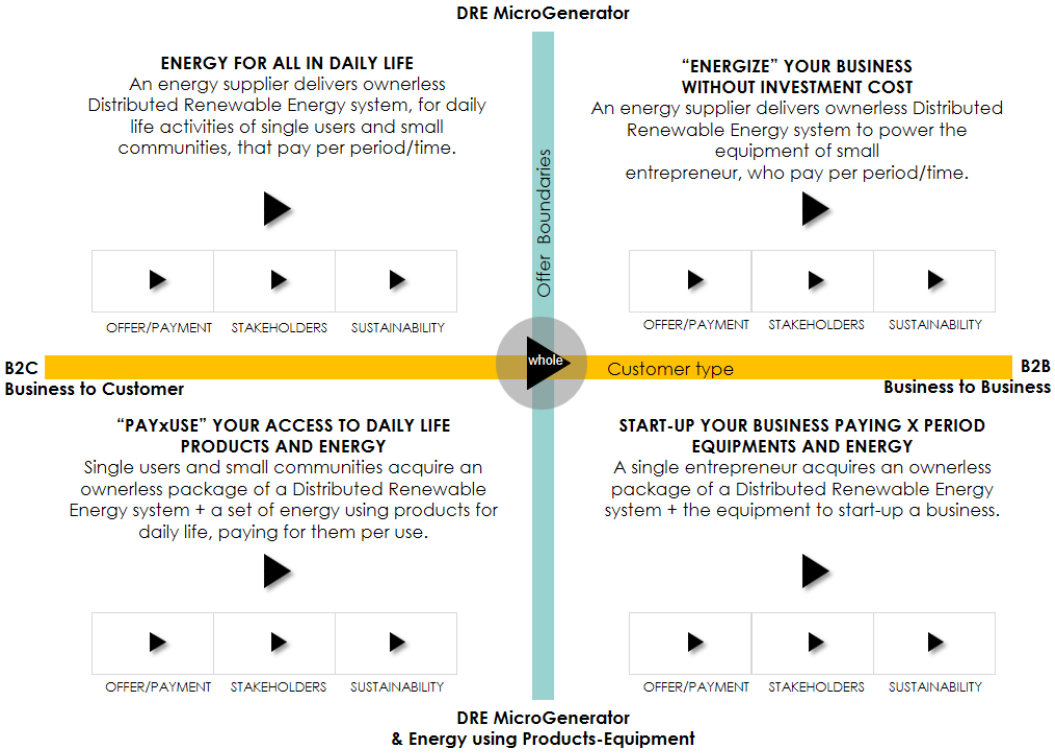
[Figure 9] Example of Energy System Map



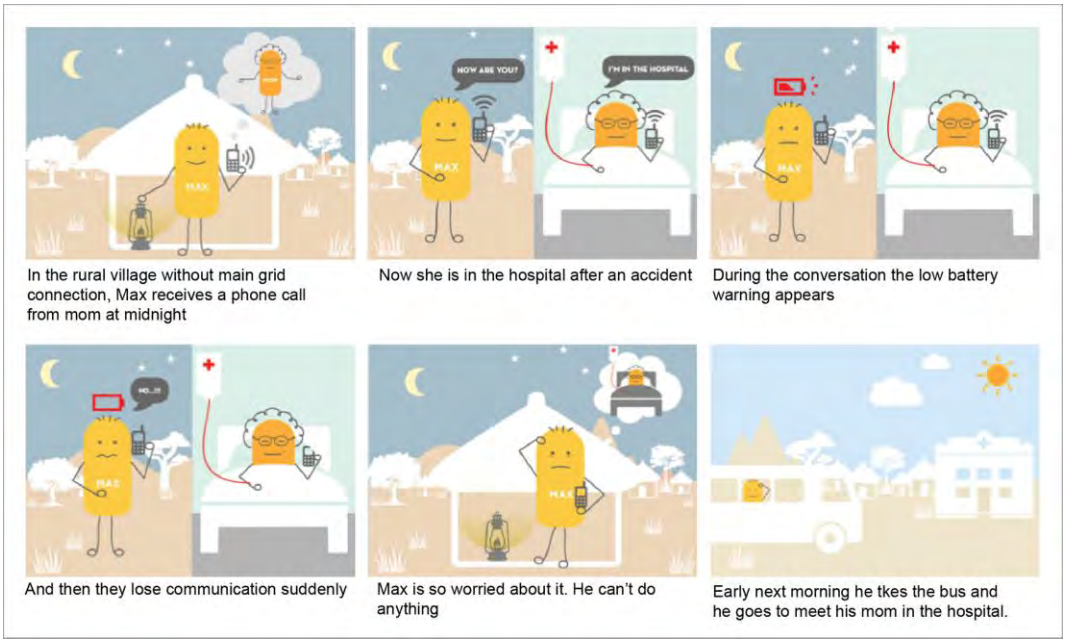
[Figure 10] Company using the tool for visualizing their S.PSS offer

3.4. Design Orienting Scenario (SDOS) for S.PSS&DRE

It's a tool to inspire and inform designers to design towards radically new social, economic and technical visions, based on the LeNSes project research hypothesis: Sustainable Product-Service Systems (S.PSS) are a promising model to diffuse Distributed Renewable Energies (DRE) in low and middle-income contexts. The System Design Orienting Scenario (SDOS) for S.PSS&DRE presents four visions narrated through a series of interactive videos accessible through a navigator file. (Vezzoli, Bacchetti, 2016). The tool is downloadable (free and copy-left) in digital version from www.lenses.polimi.it.



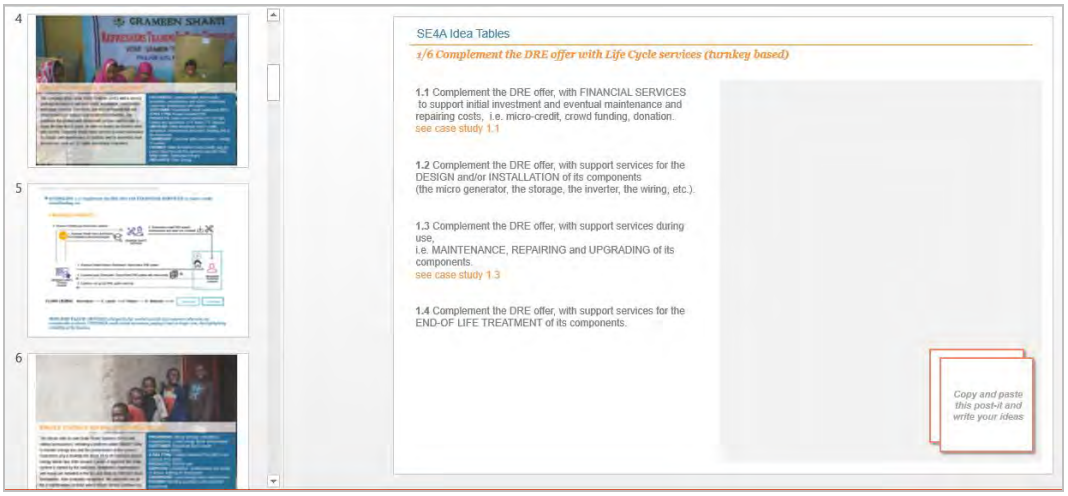
[Figure 11] Design Orienting Scenario for S.PSS&DRE, visions navigator-interactive file



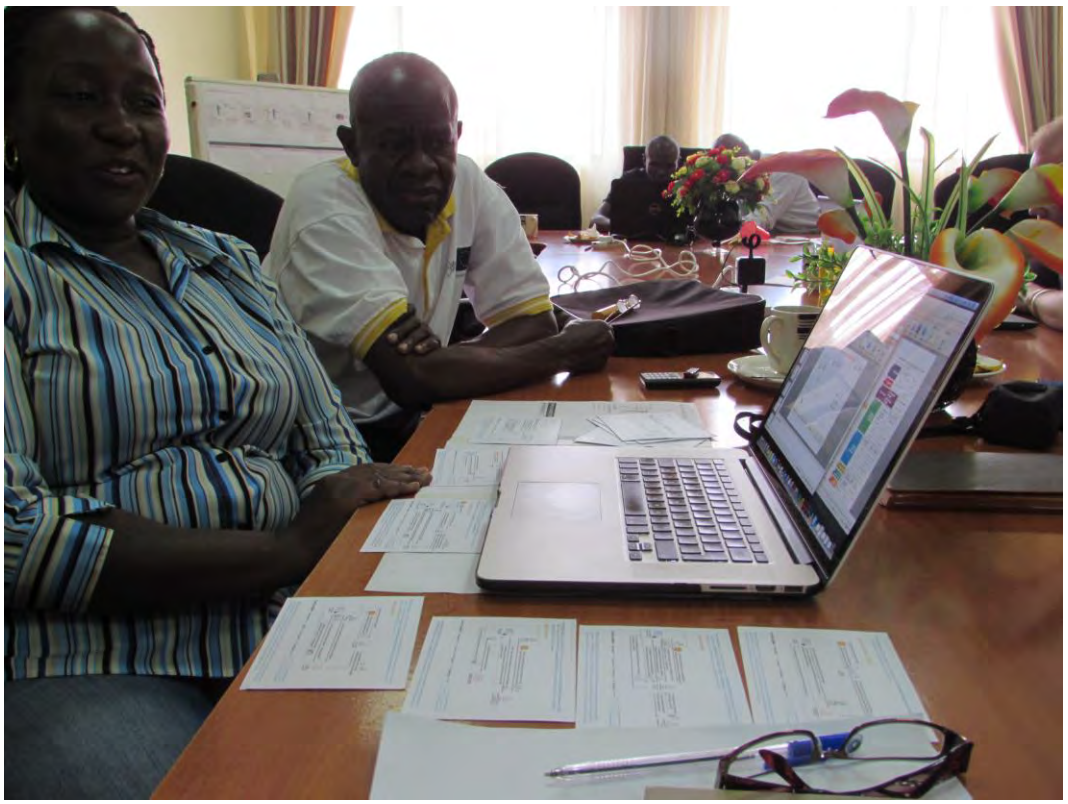
[Figure 12] Screenshot from the Design Orienting Scenario for S.PSS&DRE

3.5. Sustainable Energy for All Idea Tables and Cards

A tool to generate Sustainable Energy for All ideas. The tool is based on six tables with guidelines and sub-guidelines, to orientate the design of key elements of S.PSS applied to DRE. A set of case study cards can be used as supportive examples related to the guidelines. The tool is downloadable (free and copy-left) in digital and paper version from www.lenses.polimi.it.



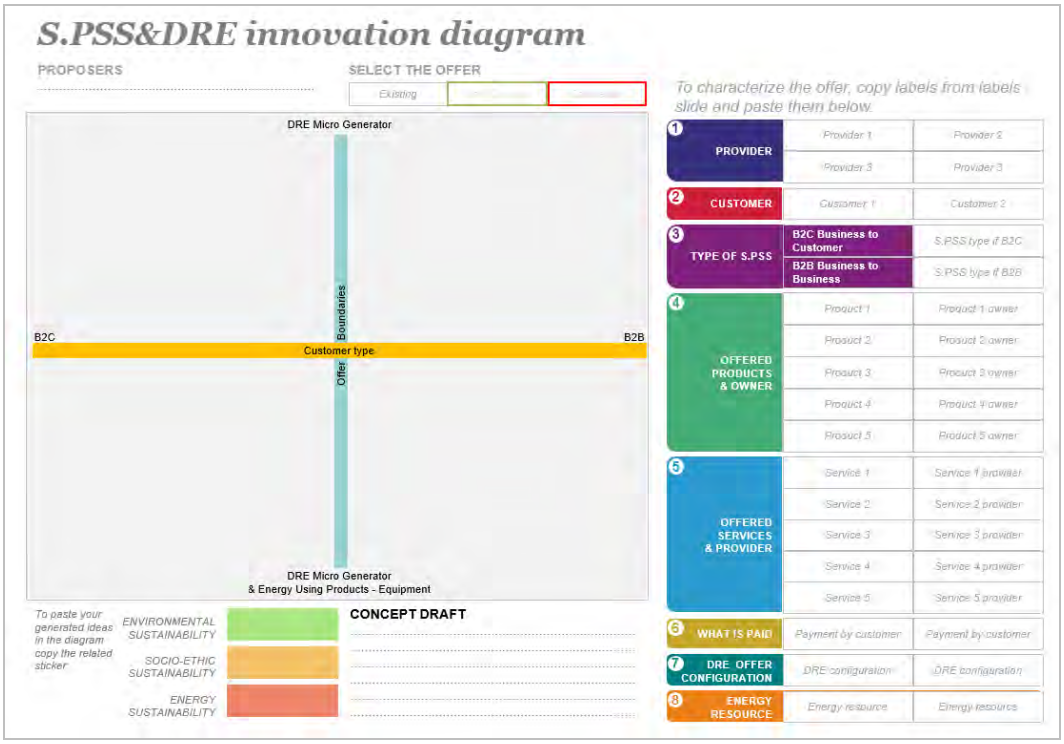
[Figure 13] Sustainable Energy for All Idea Tables and Cards, the tool (digital version)



[Figure 14] Companies using the Sustainable Energy for All Idea Tables and Cards to generate new Energy for All ideas (digital version with paper cards)

3.6. Innovation Diagram for S.PSS&DRE

It's a a tool to design, re-orient and/or analyze, energy offer models, towards new S.PSS&DRE concepts. The tool allows selection and clustering of (environmentally, socio-ethically, energy) sustainable ideas within its polarity diagram, starting the design of new S.PSS&DRE concepts. Furthermore, it provides the characterization of the designed S.PSS&DRE concepts through a set of labels and suggestions. The tool is downloadable (free and copy-left) in digital and paper version from www.lenses.polimi.it.

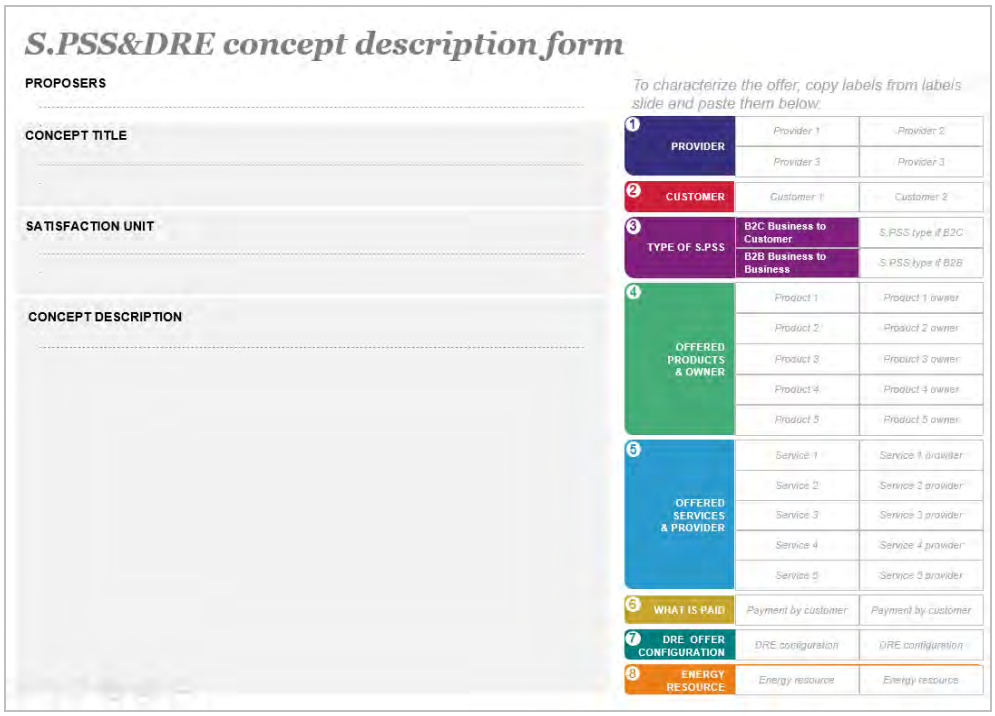


[Figure 15] Innovation diagram for S.PSS&DRE, the tool

[Figure 16] Companies using the Innovation diagram for S.PSS&DRE to re-orient their business offers

3.7. S.PSS&DRE Concept Description form:

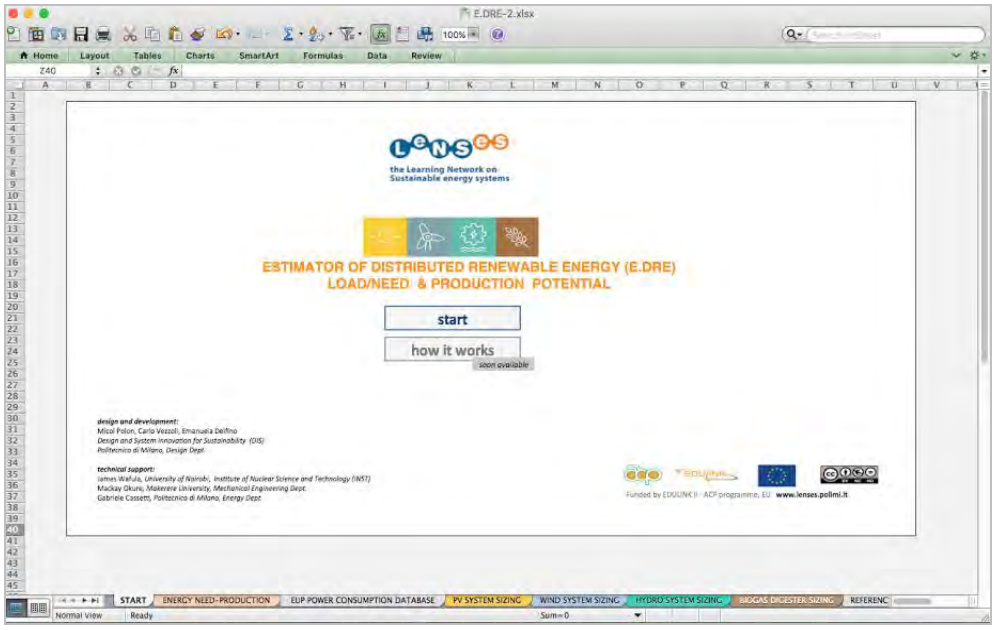
It's a tool to visualize and detail S.PSS&DRE concepts. The tool allow the definition of S.PSS&DRE concept title, unit of satisfaction and description, together with concept characterization through a set of labels and suggestions. The tool is downloadable (free and copy-left) in digital and paper version from www.lenses.polimi.it.



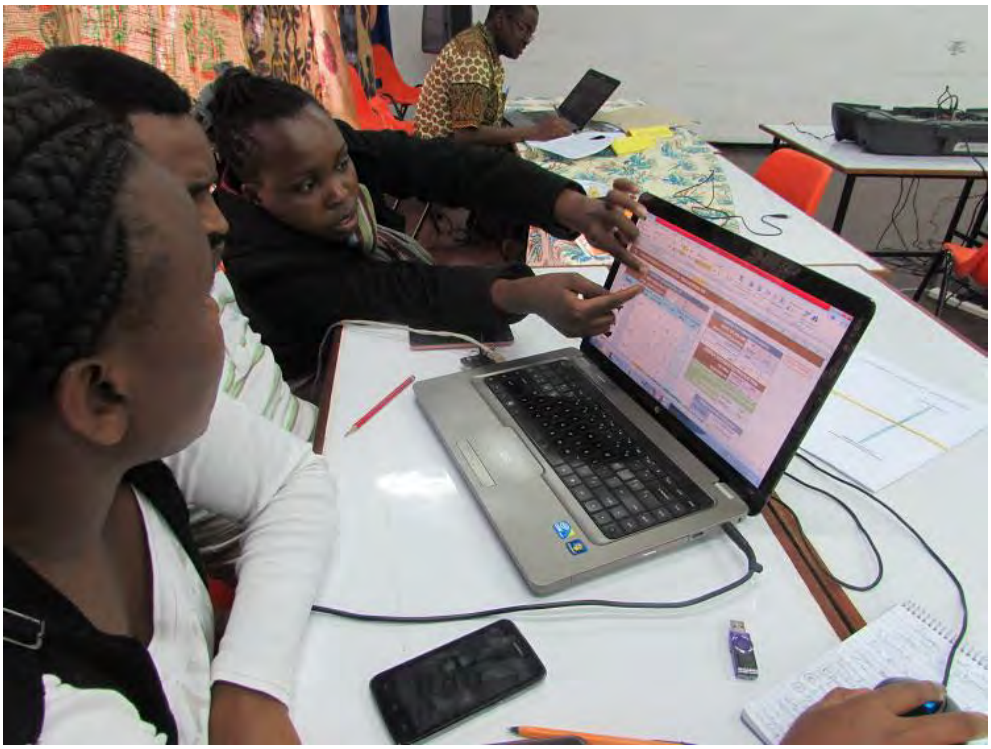
[Figure 17] S.PSS&DRE concept description form, the tool

3.8. S.PSS&DRE Estimator of Distributed Renewable Energy load/need and production potential

It's a a worksheet tool developed to support the design of DRE system, in order to guide the evaluation of the energy demand and need of the designed system concept, to assess the best system configuration and estimate the energy production potential. The tool integrates some existing and available databases and websites to allow getting data required for the evaluation and the dimensioning of the system concept (e.g. Geographical Assessment of Solar Resource irradiation). The tool is downloadable (free and copy-left) in digital and paper version from www.lenses.polimi.it.



[Figure 18] S.PSS&DRE Estimator of Distributed Renewable Energy load/need and production potential, the tool



[Figure 19] Students using the S.PSS&DRE Estimator of Distributed Renewable Energy load/need and production potential

4. FINDINGS

The projects activities have validated the research hypothesis that S.PSS applied to DRE is a promising approach to diffuse sustainable energy in low/middle income contests (for All). This has resulted throughout a literature review and case studies conducted by various partners, available in the (case study section). It has also been tested and validated by students and companies in curricular course and lifelong modules also collected in the same OPLEP. There are there main reasons for this: selling the access rather than DRE hardware ownership reduces or even avoids initial investment costs of DRE hardware; reduces or avoids running cost for maintenance, repair, upgrade, etc. also too high for low and middle-income people; leads to involvement of local rather than global stakeholders, increasing local employment and skills, i.e. local empowerment.
The research hypothesis has been characterized as follows: "A S.PSS applied to DRE is a promising approach to diffuse sustainable energy in low/middle-income contexts (for all), because it reduces/cuts both the initial (capital) cost of DRE hardware purchasing (that may be unaffordable) and the running cost for maintenance, repair, upgrade, etc. of such a DRE hardware (that may cause the interruption of use), while increasing local employment and related skills, resulting in a key leverage for a sustainable development process aiming at democratizing the access to resources, goods and services."
As a consequence arose a new knowledge-base and know-how on the role of the design in this framework, i.e. the emergence of a new discipline "system design for sustainable energy for all" highlighting a new role in (system) design for sustainable energy for all from "appropriate technologies" design to "appropriate stakeholder" design addressed to S.PSS allied to DRE. This discipline can be defined as "the design of a Distributed Renewable Energy system of products and services, able to fulfil the demand of sustainable energy of low and middle-income people (all) - possibly including the supply of the Energy Using Products/Equipment system - based on the design of the innovative interactions of the stakeholders, where the economic and competitive interest of the providers, continuously seeks after both socio-ethically and environmentally beneficial new solutions".

5. PRACTICAL IMPLICATIONS

The project has stimulated and increased the inter-institutional networking between HEIs in the African and with European HEIs not only related to educational contents but also to other academic issues such as collaborative research and administrative capacity building. Staff representatives of the different universities have worked together in the implementation of the pilot courses and have taken advantage of opportunities for 'virtual staff mobility' cooperating with other educational practitioners and/or experts online through the OLEP. Different in-depth classes has been prepared according to renewals energy local opportunities as for example wind exploitation in South Africa.
Local companies, consultancies, NGO's, public institutions were directly involved in the design and implementation of curricular courses, assuring that all the relevant and specific needs are addressed. Technologies applied in the different S.PSS depend from the peculiarities of the economic regions as for example PV Panels in Botswana and further innovation can be proposed taking advantage of the knowhow of the partners as for example emerging PV film printing under study at Poltecnico di Milano.
Through the OLEP geographic location is no longer a barrier to access to state-of-the-art research results and teaching materials. The matter of access to knowledge becomes even more crucial in a research field like Design for Sustainability and Sustainable Energy for All, characterized by being quite recent and therefore not extensively disseminated as well as rapidly developing (Vezzoli & Ceschin, 2011). Teaching materials prepared by partner institutions on fundamental disciplines (i.e. Physical principles, business tools…) and for similar educational and societal contexts enable teachers to speed up the process of developing new courses which enabled them to spend more time on implementation (teaching) than preparation (course development). Re-use of work of knowledge is encouraged and new ideas can evolve (Baranuik et al. 2004).
The OLEP platform provided students access to not only the educational materials of their own HEIs but also many others. This enabled them to acquire knowledge independently from outside, as well as being taught about the latest developments in Design for Sustainability (DfS) applied to S.PSS and DRE and get insights and inspiration of (real life) projects of other student teams which are localised and contextualised to the African setting. These new open knowledge supports a transformation of mind models in new generations from a product design approach to a product service system approach.

6. ORIGINALITY/VALUE

The innovation of the project described in the paper is twofold: firstly by developing unique curricula based on design for sustainability focused on S.PSS and DRE applied to the African contexts, and secondly by delivering it through an open platform free and in copy-left. This will equip design students in African universities with a broad knowledge base, as well as effective methods and tools with which to play an active role in the development and diffusion of sustainable energy systems.
The role of design in this context, as well as regarding other environmental problems, is to drive the application of technologies. In fact, according to Maldonado (1992) "innovative practice should take place not as a series of disconnected events, but as a process that incorporates continual controls of such events once they take place, such that the effects, predictable or otherwise, created by technological innovation on the physical, economic and social environment can be kept in check".

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the Learning Network on Sustainable energy systems

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- Brunel University London, College of Engineering, Design and Physical Sciences, Department of Design, London, United Kingdom

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- Delft University of Technology, Delft, The Netherlands
- University of Nairobi, School of The Arts and Design, Nairobi, Kenya
- Makerere University, College of Engineering, Design, Art and Technology, Kampala, Uganda
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UNIVERSITY OF BOTSWANA

Nutrire un mondo che può crescere.
Solidarietà e cooperazione alimentare con l'ausilio di sistemi inediti di distribuzione automatica dei prodotti food & beverage.
Davide Bruno

Buongiorno a tutti. Con vivo piacere porgo il saluto mio personale, a voi tutti, ai signori relatori del convegno di oggi, alle autorità qui presenti. Voglio esprimere il mio più profondo ringraziamento a chi ha deciso di ammettere il mio progetto di ricerca a questo importante appuntamento internazionale.

Un ringraziamento particolare va a Carlo Vezzoli in testa, e a tutti coloro che hanno collaborato per fare sì che questa conferenza sia effettivamente un importante confronto nel territorio africano.

Con questa ricerca intendo affrontare le problematiche nei paesi in via di sviluppo riguardante la qualità della vita della popolazione africana – in particolar modo in età scolare e lavorativa – che con il proprio apporto nutrizionale (quotidiano) necessitano, con particolare evidenza e urgenza, un apporto nutrizionale bilanciato per contrastare l'incrementale incidenza alimentare sbilanciata e per le sue rilevanti ripercussioni in termini sociali ed economici. Essi, infatti, negli ultimi decenni hanno generato patologie quali: celiache, diabetiche, cardiovascolari e vascolopatiche acute.

In subordine, ritengo che sia urgente, oggi, mettere a punto un innovativo sistema di prodotti industriali per favorire la distribuzione automatica degli alimenti direttamente coltivati e autoprodotti localmente food & beverage a differenti temperature. Si tratta di impiegare, nell'ambito della distribuzione alimentare un sistema-prodotto che possa garantire, soprattutto nei paesi in via di sviluppo una alta efficacia alimentare -valori nutrizionali e quantità corrette-, un protocollo di sicurezza diffuso -presidio alle contaminazioni virali- e la valorizzazione degli alimenti autoctoni -promozione di prodotti a tutela del territorio-.

Ho avviato studi iniziali basati sulle esperienze dei paesi industrializzati, mettendo a punto nuovi prodotti di supporto all'industria alimentare (internazionale e locale), attraverso l'ausilio di competenze multidisciplinari per lo sviluppo del progetto, e la diretta partecipazione dei paesi Centroafricani attraverso il sostegno del Governo e delle Istituzioni Universitarie per sperimentarne l'efficacia dei risultati.

Stati come l'Angola, l'Uganda, il Botswana, la Namibia, il Congo, sono Stati Africani tra i più attenti e sensibili nel Continente, attraverso le loro politiche nutrizionali e capacità relazionali interne ed esterne -in alcuni casi come l'Angola, un ponte verso gli Stati più bisognosi-, sono senza dubbio, i luoghi fisici su cui trasferire culturalmente l'idea di progetto.

Nei Paesi in via di sviluppo lo scarso apporto qualitativo nutrizionale, le dimensioni epidemiologiche e l'impatto socio-economico della malnutrizione sono tali da rendere questo aspetto una vera e propria urgenza sociale e sanitaria; in tale contesto l'aspetto mal nutrizionale è tra le prime causa di instabilità socio-economica. Il problema alimentare, inoltre, si manifesta con drammatica evidenza all'abbassamento delle fasce d'età (6 – 22 anni).

Nel merito, trovo calzante la definizione dell'Organizzazione Mondiale della Sanità di "nutrizione" come "insieme di apporto alimentare che mira allo sviluppo di una persona

al suo più alto potenziale sotto il profilo fisico, psicologico, sociale, occupazionale ed educativo, in relazione al suo deficit fisiologico o anatomico e all'ambiente", intende operare in termini di avanzamento e innovazione attraverso la definizione e lo sviluppo di una strategia integrata di tipo bio-psico-sociale e di criteri progettuali inclusivi per migliorare l'efficacia/efficienza del processo nutrizionale a livello di distribuzione alimentare.

Oggi, nei Paesi in via di sviluppo lo scarso apporto qualitativo nutrizionale, le dimensioni epidemiologiche e l'impatto socio-economico della malnutrizione sono tali da rendere questo aspetto una vera e propria urgenza sociale e sanitaria; in tale contesto l'aspetto mal nutrizionale è tra le prime causa di instabilità socio-economica.

Quindi, la scorretta alimentazione costituisce un problema "assistenziale" e sociale di grandi dimensioni non solo in ordine alla degenerazione degli organi dei pazienti ma anche al bassissimo contributo sociale e lavorativo causato dalla disfunzioni fisiche che pone la questione della definizione di più efficaci metodi e strumenti per il monitoraggio quali/quantitativo e la corretta modalità distributiva dei prodotti food & beverage.

Oggi sta diventando sempre più importante il problema della distribuzione del cibo nelle scuole, nelle mense aziendali, nelle cooperative, e più in generale negli spazi collettivi. Si consideri, a puro titolo esemplificativo, il dato locale, pacificamente riconducibile alle realtà globali, fornito da Milano Ristorazione sugli sprechi: "finiscono nella spazzatura delle nostre mense 140 tonnellate di cibo ogni tre settimane".

È ormai sempre più difficile mantenere la filiera distributiva, (dalla preparazione alla distribuzione) integra e con parametri di qualità alimentare per le pietanze espresse (cibi caldi e freddi), gli snack dolci e salati, le bevande (calde e fredde). Lo è ancora di più per le strutture, sia con cucina interna sia con catering esterno, poter preparare cibo fresco e secondo un programma alimentare personalizzato. Inoltre spesso viene fornito in quantità molto superiore alla richiesta.

Inoltre si consideri che il ritmo crescente della globalizzazione e del turismo, la sicurezza del cibo di strada è diventata una delle principali preoccupazioni di salute pubblica. Nel 2012 un campione di 511 cibi di strada in Ghana da parte dell'Organizzazione Mondiale della Sanità ha dimostrato che la maggior parte registrava analisi microbiche oltre i limiti accettati, e un campione diverso di 15 cibi di strada a Calcutta hanno dimostrato di essere "nutrizionalmente sbilanciato", fornendo circa 70Kcal di energia per ogni rupia spesa.

La strada per risolvere il problema delle nutrizione bilanciata e l'eliminazione dello sperpero alimentare in Africa ritengo che possa tradursi in un acronimo appropriato quale: "Nutrire il pianeta migliorandone la qualità della distribuzione dei prodotti alimentari direttamente coltivati e autoprodotti localmente (sia caldi che freddi) con l'ausilio della tecnologia."
Proviamo a considerare lo spreco e la scarsa qualità dei cibi, gli apporti nutrizionali corretti, a causa del contenimento dei costi, possono essere combattuti grazie alla tecnologia a stretto servizio di coloro che si occupano di ristorazione ma anche di distribuzione. Il sistema di distribuzione automatico è un meccanismo di distribuzione che permette di trarre importanti spunti per ottimizzare i costi in termini di derrate alimentari e di ottenere un alto valore qualitativo e nutrizionale dei cibi su ogni luogo di lavoro o di studio.

Sarebbe quindi opportuno mettere a punto un efficiente modello "ibrido", in cui l'uomo, al centro di un sistema di cui è garante della qualità, unitamente alle macchine / contenitori tecniche perfette, offrono qualità superiore e riduzione di sperpero delle merci.
Consideriamo inoltre, lo "street food" è il consumo di cibi e bevande vendute in una strada o altro luogo pubblico, come ad esempio un mercato o una fiera, da un venditore ambulante o il venditore, spesso da una bancarella portatile.
Storicamente, il cibo di strada veniva acquistato perché le case non erano dotate di una cucina. Oggi nelle aree rurali e urbane africane lo street food è un'abitudine consolidata. La maggior parte dei cibi di strada sono anche classificati sia come finger food e fast food, e sono meno costosi in media, dei pasti al ristorante. Secondo uno studio recente dalla Organizzazione per l'Alimentazione e l'Agricoltura, 2,5 miliardi di persone mangiano cibo di strada tutti i giorni.
Le persone acquistano street food per una serie di ragioni:

- "gusto etnico"
- la possibilità di mangiare rapidamente
- prezzi ragionevoli.

Lo Street Food quindi può essere considerato un pasto sano ed economico, un modo per socializzare e in alcune situazione una vera e propria esperienza sensoriale e valoriale.
L'Africa in particolare deve saper distinguersi nel mondo per un'offerta innovativa di Street food che tenga conto dei contenuti culturali del paese.
I punti di forza da valorizzare per rendere lo Street Food un'altra eccellenza sarebbero:

- offerta di street food con prodotti della filiera corta nel rispetto dell'ambiente e per la valorizzazione dei territori rurali africani;
- strumenti di fruizione, materiali ecologici e funzionali;
- mezzi di distribuzione innovativi.

Si tratta di analizzare quindi la possibilità di mettere a punto nuovi sistemi di distribuzione automatica, a larga scala, per governare la corretta quantità di cibo erogata.

Il primo aspetto problematico è infatti, contenere il prezzo, gli sprechi, aumentare la qualità del prodotto e veicolare quindi cibi controllati e conservati correttamente.

Un ulteriore nodo problematico è legato alla disponibilità continua degli alimenti freschi (deperibili), che molto spesso comporta la necessità di riconfigurare il servizio di distribuzione a scapito del contenimento dei costi.

In sostanza deve essere una procedura necessaria che trae origine dall'interpretazione del territorio con l'obiettivo di sostenere le comunità locali, le imprese e le persone orientandoli verso la cura del sé, attraverso la capacità di controllare l'apporto nutrizionale corretto, la disponibilità e varietà, coerente al proprio stile di vita, dei cibi e delle bevande.

La mia idea si traduce in sistema di distribuzione automatica diffuso sul territorio, con un'architettura e un design tali da semplificare il rapporto tra uomo/macchina (e la messa in pratica) di un obiettivo: la "disponibilità a distribuire e far distribuire prodotti alimentari locali bilanciati nelle quantità e nei contenuti proteici".
Un sistema prodotto amichevole/informale, che abbia lo scopo di fertilizzare opportunità di crescita e orientare le persone verso una nutrizione alimentare sostenibile nel mondo; un sistema prodotto che s'integra chiaramente alle logiche di sviluppo e

sostegno consapevole rispetto alle tematiche centrali di nutrizione nelle politiche del Continente africano.

Una sfida del tutto inedita che trae origini da radici profonde e l'idea di un sistema di distributori automatici intelligenti "tocca" con determinazione il centro della questione: come contribuire, in maniera significativa, al processo nutrizionale del pianeta, restituendogli l'energia necessaria per tornare a vivere correttamente: con un sistema alimentare basato sugli apporti necessari alle persone.

Insomma, è necessario perseguire principi di alimentazione per diffondere i migliori stili di vita. Sviluppare idee per realizzare sistemi automatici di ausilio alla distribuzione dei prodotti locali food & beverage.

Due idee alla base di tutto che ci permettano di realizzare una famiglia di prodotti tecnologici di supporto alla distribuzione bilanciata e controllata di alimenti. I prodotti alimentari e le bevande fanno riferimento alla duplice tipologia: snack dolci e salati e bevande a breve/media conservazione secondo avanzati principi legati alla cultura dello street food; alimenti coltivati e raccolti dai territori locali (a km. 0) per essere trasformati in cibi preparati e conservati a temperature superiori ai 65 gradi.

In quest'ultimo caso, il sistema di distribuzione è pensato ad hoc per i luoghi di lavoro, le scuole, gli spazi collettivi organizzati, gli uffici, ecc. Ogni persona può compilare la sua ordinazione o in loco o in remoto, con sistemi tradizionali o app, dall'ufficio personal computer o tablet. Le prenotazioni vengono inviate in maniera telematica ai centri di cottura che preparano i piatti necessari alla locazione. I piatti vengono poi caricati nei distributori automatici con poche e semplici operazioni. La pietanza è conservata all'interno del distributore e, a seconda della tipologia, viene mantenuta all'idonea temperatura: per i piatti caldi la temperatura è superiore ai 65 gradi per la conservazione dei cibi come da normativa igienica, se invece è un piatto freddo a 4 gradi secondo le normative di legge internazionali.
Per il consumatore è sufficiente introdurre una "moneta", una chiave o un badge magnetico o mediante mobile phone, un sistema di riconoscimento, e automaticamente il distributore, dopo aver riconosciuto l'utente e la relativa prenotazione presenta i piatti richiesti pronti per essere consumati.

Per quanto riguarda lo sviluppo di un distributore di prodotti classici (snack dolci e salati e bevande a breve/media conservazione) "blisterizzati", per spazi collettivi o da street food, l'idea è rivolta alla messa a punto di tecnologia di carico dei prodotti, dell'erogazione bilanciata in funzione delle necessità alimentari e nutrizionali durante l'arco delle 24 ore e del design compatibile al sistema territoriale e rurale e urbano: un modo innovativo per distribuire prodotti alimentari il territorio promuovere la cultura della filiera corta, sempre derivata da produzioni alimentari locali (km. 0): cibi biologici e salutari per il benessere personale e dell'ambiente e mantenere la tradizione millenaria dello street food a livello planetario.

Gli impatti previsti, sono riconducibili a quattro livelli di programmazione e gestione integrata del processo distributivo/alimentare e della produzione di sistemi di distribuzione automatica.
- diminuzione dei costi necessari per la produzione del fabbisogno alimentare;
- riduzione dei costi concernenti l'approvvigionamento, distribuzione e trasformazione delle materie prime e dei processi;

- valorizzazione dell'approccio bio-psico-sociale, all'interno dei percorsi nutrizionali, come strumento capace di migliorare in modo significativo la qualità globale degli apporti alimentari;
- sviluppo di un quadro di azioni rieducative nel campo nutrizionale, funzionale e comportamentale di facile riproducibilità funzionale allo sviluppo alimentare in un modello altamente qualitativo per la cura del sé;

Personalmente nutro la convinzione che è possibile costruire un rapporto di relazione, attraverso l'esperienza di un progetto sul campo, adeguato e coerente alle politiche di sviluppo dei africani avviando un primo coinvolgimento con gli Stati dell'Africa centrale e dell'Africa meridionale.

Infine mi sia consentito affermare che l'aspetto originale dell'idea è "conoscere prima quanto e cosa verrà consumato". Ogni dettaglio è studiato e analizzato per essere funzionale, oltre che efficiente, e per garantire la migliore manutenzione possibile, favorendo pulizia e igiene. Un altro aspetto è umanizzare la macchina, attraverso l'ottimizzazione delle funzionalità, garantite dalla tecnologia e con un'estetica che lo faccia diventare un elemento da mostrare e non da nascondere, quasi un'opera d'arte "attiva", che interagisce con l'uomo.

Finisco qui il mio intervento, Vi auguro una buona giornata e un buon proseguimento. Grazie a tutti.