

Design-led sustainable transition in organization: a framework to guide and evaluate employee change

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doi.org/10.21606/iasdr.2023.533

Design for Sustainability Transition (DfST) is gaining popularity in both academia and practice, seeking to guide socio-technical systems toward more sustainable futures through design but remaining a high-level approach that is difficult to evaluate. The DfST authors disagree on the designer's role during the transitions, leaving it open to exploration. Organisations play a crucial role in influencing the socio-technical systems and solving the climate crisis we are experiencing but need to be guided through change. Working on employees and their practices makes it possible to initiate a snowball effect capable of triggering the necessary cultural change both in organisations and society. The Design-Led Innovation approach can be a valuable guide in the cultural transformation of companies, connecting strategic aspects with more pragmatic ones, such as products or services solutions. This exploits the role of the Design Innovation Catalyst as a change agent to facilitate the introduction of design as a driver of change. This paper proposes a conceptual framework based on Design-Led Innovation and Social Practice Theory to guide the sustainable transition and evaluate the change brought to individuals' practices. Through a 12-month collaboration with an Italian secondary packaging company, it was possible to test the framework and its impact on design-as-practice. The results consolidate the validity of Design-Led Innovation for Sustainable Transition, showing its potential and limitations. The role played by the Design Innovation Catalyst proves to be crucial in facilitating transition and leading to changes in practices.

Keywords: *design for sustainability transitions; design-led innovation; social practice theory; corporate culture*

1 Introduction

The recent IPCC Report (2023) unequivocally confirmed the damage caused by the excessive use of fossil fuels. The document encourages governments and organisations towards a decisive change to succeed in limiting the temperature increase to 1.5°C compared to pre-industrial levels. To achieve this goal, humanity must reduce its emissions by 48% by 2030 (IPCC, 2023). The necessary changes are not only related to environmental aspects but are coupled and further complicated by social and economic problems. The topic of governing and promoting change towards sustainable solutions has



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become central in the last two decades, attracting interest from the academic community (Markard et al., 2012). Markard et al. (2012) defined sustainable transitions as long-term, multi-dimensional transformation processes through which socio-technical systems shift towards more sustainable production and consumption methods. Transitions thus imply a coordinated and voluntary effort by a diverse set of actors to achieve long-term goals. To understand such processes, conceptual frameworks and theories were initially developed in the field of social sciences and policy-making (e.g. Multi-Level Perspective, Transition Management, etc.), giving rise to the well-established sustainability transitions studies (Grin et al., 2010; Markard & Truffer, 2008; Smith et al., 2010). Although some academics in the field of Design had already attempted the integration of theories related to sustainable transitions since the second half of the '90s, it was Irwin in 2015 who popularised this field among academics and practitioners, coining the term Transition Design (Irwin, 2015; Irwin et al., 2015). In the researcher's vision, design(er) has a lead role in guiding and redesigning community lifestyles and transformation. Design for Sustainability Transitions (DfST), or Transition Design, thus aims to guide socio-technical systems towards more sustainable futures through design and by promoting technological, social, organisational and institutional innovations (Ceschin & Gaziulusoy, 2019; Irwin, 2015).

A socio-technical system is a set of elements and their links necessary to fulfil a social function, and includes technologies, policies, markets, social practices, cultural meanings, infrastructures, etc. (Ceschin, 2012; Geels, 2004). Organisations are considered multiminded socio-cultural systems, defined as a collection of individuals with their own goals and purposes who voluntarily choose to come together using common means and sharing the same end (Gharajedaghi, 2006). Today, the fundamental role of corporations in solving the climate crisis and pushing towards a more sustainable society is widely recognised (McKibben, 2012; Perrow & Pulver, 2015). These can influence socio-technical systems by disseminating new technologies and generating new knowledge and meanings capable of influencing people's values and lifestyles (Gaziulusoy et al., 2008). Although complex, promoting change in corporate culture (and society at large) can have a positive spill-over effect. It often involves individuals (Melazzini, 2021), their actions and habits, which is why one of the pillars of DfST is the Social Practice Theory (Irwin et al., 2015). The latter puts individuals' practices at the centre and identifies their core elements and changes over time (Shove et al., 2012). The ability to drive cultural change is not a new theme to design (Zurlo, 1999). Indeed, Bucolo et al. (2012) point out that one of the founding values of design and its dissemination is to propose a Design-Led cultural transformation. The approach proposed by the author relies extensively on the designer's role as a change agent, enabling the entire corporate system to be influenced by close collaboration over long periods (Wrigley, 2013, 2017). Through Design-Led Innovation, the project becomes a means of contamination, collaboration and dialogue between the designer (as change agent) and the employees. Given these assumptions, Design-Led Innovation emerges as an established design approach capable of influencing the practices of individuals and corporate culture towards sustainability. Thus, it becomes necessary to understand how a Design-Led approach affects the individual practices of a company's employees and how to evaluate the change itself. The article then proposes a conceptual framework to guide and assess change. This was tested through a 12-month collaboration with an Italian secondary packaging manufacturer during a Transformation Project to change corporate culture through Design-Led Innovation. The results proposed in this paper

consolidate the value of Design-Led Innovation for sustainable transitions, contributing to the field of DfST by describing a method to guide and assess the change.

In the following sections, the theoretical aspects behind the conceptual framework will first be explored by analysing DfST, Social Practice Theory, and the connections with Design-Led Innovation. Then the methodology and sample will be outlined, mentioning the structure of the Transformation Project. Finally, the latter's effects on the individuals involved will open a discussion of the potentialities and threats of the DLI approach for guiding a sustainable transition.

2 Background knowledge and conceptual framework

Design for Sustainable Transitions (DfST) emerged in the late 1990s and gained attention after the Changing the Change conference in 2008 (Gaziulusoy & Oztekin, 2019). It was later popularised by Irwin (2015), who defined Transition Design based on Kossoff's (2011) theories. The main aim of DfST is to guide socio-technical systems towards more sustainable futures by promoting technological, social, organisational, and institutional innovations (Ceschin & Gaziulusoy, 2019; Irwin, 2015). This involves systemic changes that aim to alter production, consumption, and social patterns (Geels, 2005; Loorbach, 2010). However, the extensive Gaziulusoy and Oztekin's (2019) literature review revealed some differences between the main authors, particularly about theories, design methods and tools, and the designer's role. The review analyses the four research streams developed by respective authors: Gaziulusoy, Ceschin, Joore and Irwin and Kossoff. The differences have been summarised in Table 1. Among these, Irwin has strongly influenced this research with his sociological basis focused on individuals and their needs while still following System Innovations and transition theories (Irwin et al., 2015; Kossoff, 2011). For her, the designer can grasp social, economic, political, and environmental connections to solve problems on different spatio-temporal levels and propose solutions capable of changing and improving people's lives (Irwin et al., 2015). These concepts are expressed through the Transition Design Framework, consisting of four primary and interconnected aspects: Vision for Transition, Theories of Change, Posture and Mindset, and New Ways of Designing.

Transition Design employs, among others, Social Practice Theory as a cultural theory to understand how society evolves, is organised and how it can move towards more sustainable futures (Irwin et al., 2020; Reckwitz, 2002). The originality of this theory lies in its focus placed on practices (such as eating, driving, washing and designing) and not on the individuals or their aggregations (Shove & Walker, 2010). Although there is no unambiguous and accepted definition in the literature of what a practice is, most authors refer to it as a set of shared elements among individuals who reproduce them over time (Nicolini, 2017; Schatzki, 2002; Shove et al., 2012). These need to be performed by many users with frequency, becoming recurrent. Shove et al. (2012) also define the "life" of practices. According to them, practices consist of three basic elements: materials, competencies and meanings (Figure 1). The three elements of practices are neither static nor exclusive. Changing or breaking the connections between one or more elements makes it possible to change the practice itself or lead it to decline (Shove & Pantzar, 2005). When these connections are broken, individual elements survive. Moreover, for a practice to survive, it needs "carriers" who reproduce and transfer it, causing its natural modification (Shove et al., 2012). Practices can also aggregate, forming bundles (defined by weak links based on the reproduction of practices in the same place) and complexes (ties based on dependencies between practices such as proximity, temporal sequence, synchronisation or co-existence). Finally,

practices fight and collaborate to gain resources (such as time, space, and money) from carriers, who have limited time in the day to spend on each one (Shove et al., 2012).

Table 1. Perspectives of leading authors in the field of Design for Sustainability Transitions

	Gaziulusoy (Gaziulusoy, 2010; Gaziulusoy et al., 2010; Gaziulusoy et al., 2008)	Ceschin (Ceschin, 2012)	Joore (Joore, 2008, 2010)	Irwin and Kossoff (Irwin et al., 2015; Kossoff, 2011)
Theory and conceptual framework	Sustainability science; complex adaptive systems; system innovations and socio-technical transitions theories; futures studies (scenarios); product development; business strategy	Product-service systems; strategic design; system innovations and transitions theories (Multi-Level Perspective, Transition Management, strategic niche management)	Industrial design; systems engineering; sustainable product development; system innovations and socio-technical transitions theories	Chaos and complexity theory; Goethean science; holism; needs theory; everyday life discourse; indigenous knowledge; post-normal science; social psychology; social practice theory; alternative economies; socio-technical system innovations and transitions theories
Designer's role and agency	Decisive and creative agency (possibilities to create new products, services and meanings) but limited by timeframe.	Multiple roles designing and experimenting PSS and the transition paths for including them in society.	High possibilities related to product development but the agency and role decrease as the project's scope gets larger.	The designer is a bridge between different actors and disciplines, able to work and propose solutions in everyday life's levels and domains.
Methods and tools for guiding ST through design	Scenario development; Niche system implementation; Proprietary tool based on forecasting and backcasting	Scenario development for PSS concept vision; Tools to formalise vision strategies; Tools to manage network of actors; Evaluation tool for transition process	V-Cycle System Innovations model	Case study; Forecasting and Backcasting

The design field has recently started to explore Practice Theory, looking at design not as the work of an elite group of professionals and their way of thinking and doing, but as a practice composed of the three elements. With this in mind, Kimbell (2009) defines design-as-practice as a way of perceiving it as a habitual mental and physical activity governed by norms, which naturally involves objects. The practice of design is also carried out by numerous individuals worldwide, who interpret and differentiate it according to contexts, geographical location and culture, causing it to evolve

repeatedly over time (Kimbell, 2009, 2012). Through design-as-practice, it is possible to highlight the role design plays in a company and the social orders it creates according to its importance. It is also possible to easily identify the weak points of the design practice within a company and then change and direct it towards a more sustainable approach, influencing the entire corporate culture.

Although briefly summarised, the characteristics of the practices described above through the lens of Shove et al. (2012) constitute the unit of analysis through which it has been possible to analyse the effectiveness of the approach and interventions carried out in the company under investigation and described below.

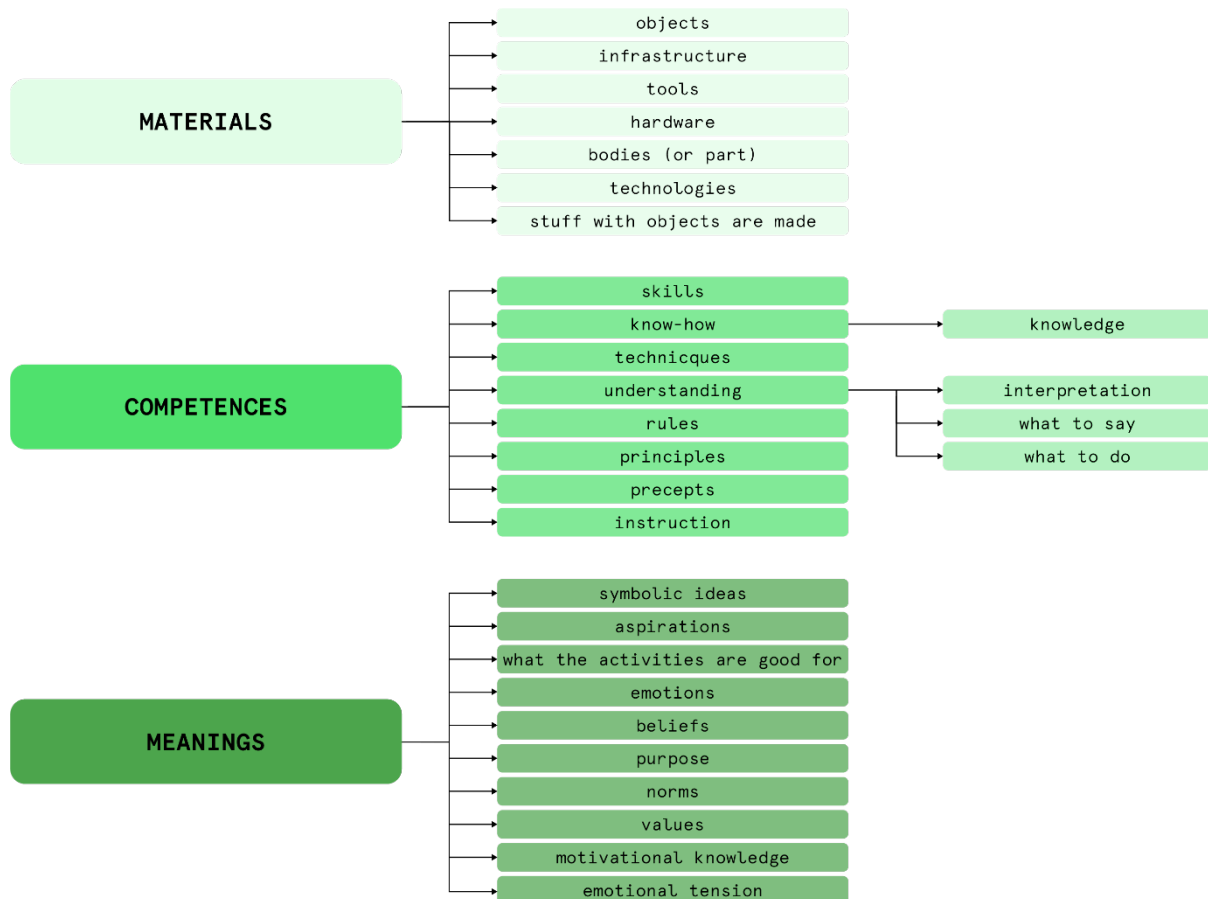


Figure 1. Practice elements derived from the literature (Reckwitz, 2002; Røpke, 2009; Shove et al., 2012; Shove & Pantzar, 2005).

2.1 Design-Led Innovation: an approach to implement a socio-technical system transition

Although design and designers can play an essential role during sustainable transition projects, both at a tactical and strategic level, DfST remains a high-level approach (Ceschin & Gaziulusoy, 2019; Loorbach, 2010). The latter can identify new values, technologies, practices and transition pathways to achieve future goals but needs support from more structured design approaches to achieve true transformation (Ceschin & Gaziulusoy, 2019). This is also reflected in the role currently assigned to the designer during sustainable transitions, where is mainly engaged in the initial stages, a role that still needs to be explored and should aspire to involve all levels of the system during transformation and long-term projects (Gaziulusoy & Oztekin, 2019).

Design-Led Innovation (DLI) could provide a concrete answer to this need, offering itself as a well-established approach in the design field, clarifying the designer’s role and guiding transitions from a higher to a more practical level. DLI is defined as a process during which a set of tools and methods allow design to penetrate within a company to provoke cultural transformation and drive innovation (Bucolo & Matthews, 2011a; Dong, 2015; Townson et al., 2016). DLI aims to establish a connection between different stakeholders throughout the process to transform corporate culture by founding a positive dialogue about future goals (Bucolo & Matthews, 2011b). The DLI Framework emphasises this aspect, placing product development in a continuum with strategy and connecting every design aspect with the corporate vision (Figure 2) (Bucolo et al., 2012; Bucolo & Matthews, 2011a). The vision and future scenarios are thus a driving force for DLI, guiding design and becoming a driver of change (Bucolo & Matthews, 2011b; Bucolo & Wrigley, 2014; Wrigley & Bucolo, 2012).

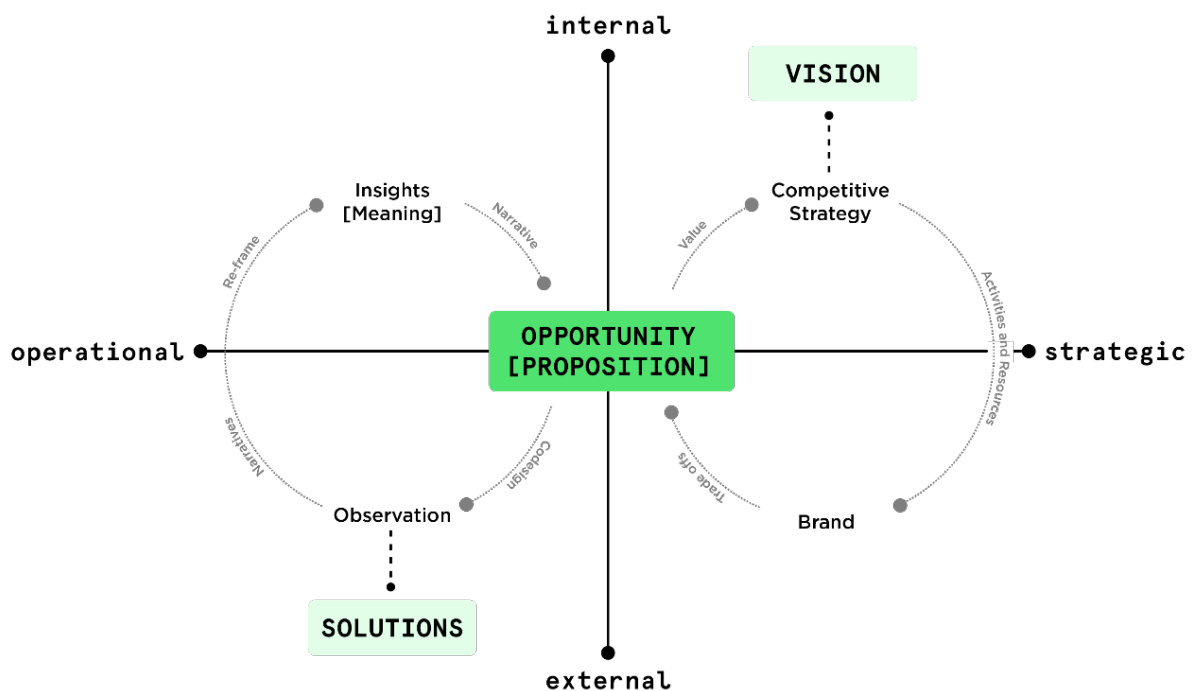


Figure 2. Design-Led Innovation Conceptual Framework. Source: Bucolo & Matthews, 2011a.

Due to the need to integrate and transform the corporate culture, the DLI transformation projects are long-term ones, usually between 12-24 months, through which the Design Innovation Catalyst (from now on Catalyst) can experience the corporate context and propose collective design interventions (Price et al., 2014; Townson et al., 2016; Wrigley, 2017). These are defined and contextualised to allow the company integration and cultural change, representing a non-linear path which, as its creators point out, does not always have the desired results and could not be standardised (Figure 3) (Bucolo & Wrigley, 2014; Price et al., 2014; Wrigley & Bucolo, 2012). Catalyst is also a facilitator of contamination and relationship, first and foremost among the academic and business worlds, as he/she needs to engage with both (Wrigley, 2017).

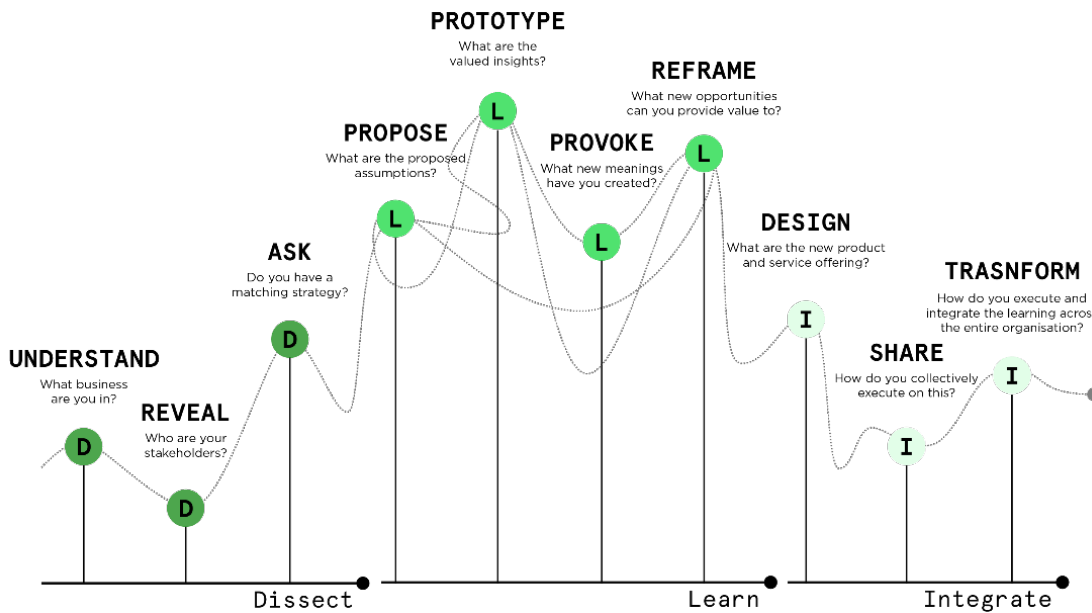


Figure 3. Design-Led Innovation Framework. Source: Bucolo & Wrigley, 2014.

2.2 Research assumption and conceptual framework: assessing the impact of dli on corporate culture transformation through social practice theory

Design can influence corporate culture with tools and methods to enable organisations to make a sustainable transition (Melazzini, 2021; Zurlo, 1999). Its strength lies in its ability to act on people, which individual actions subsequently can change and influence the culture of the entire company (Miles, 1980; Wagner & Hollenbeck, 2005). The power of connection and contamination generated by the DLI Framework lies in its capability to provoke cultural change involving individuals within different company departments, finding common ground in the project. These make it possible to influence the links between the elements of practices (materials, competencies and meanings) while introducing new ones. The Catalyst plays a fundamental role in this process, acting as a director and facilitator, steering the change and providing new elements capable of disrupting the status quo of current practices and corporate culture. The path of the DLI Framework thus becomes a strategic plan for the Catalyst to design and introduce new elements of practices, adapting it to the organisation's characteristics and evolution (Bucolo & Wrigley, 2014). Thus, the research assumption is that: The Design-Led Innovation approach can drive a company's sustainable transition by provoking a change in corporate culture.

Following that, a research question emerges: How can a Design-Led Innovation approach influence a company's employees' elements of practices (materials, skills and meanings)?

This allows the construction of a conceptual framework capable of validating the research assumption. Through the Social Practice Theory, as interpreted by Shove et al. (2012), it is possible to assess the impact of the change introduced to individuals' practices through the various phases and interventions characterising DLI (Figure 4). The elements of the practices (materials, competencies and meanings) thus serve as units of analysis of the effectiveness of the DLI approach, making it possible to verify the state of the art at an early stage and the end of the Transformation Project. In particular, to facilitate the analysis, it was decided to intervene mainly in the design and material selection practices, integrating working templates, introducing new materials, bringing in new knowledge on regulations,

principles and good practices, and trying to develop soft and hard skills, stressing the benefits that this brings, the values of sustainability and trying to create a voluntary push of the employees towards these purposes. In the role of Catalyst, the researcher had the opportunity to work closely with a company for 12 months, bringing new elements of the practices and trying to influence them with a sustainable perspective.

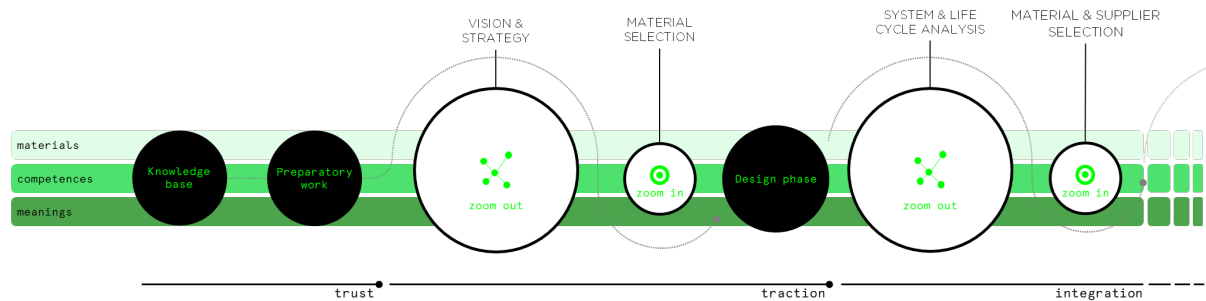


Figure 4. Conceptual framework of the study.

3 Methodology

This research is based on qualitative data collected from a single longitudinal case study (Pettigrew, 1990; Yin, 2017) conducted between 2022 and 2023 within an Italian corrugated secondary packaging company. The research adopted the Participatory Action Research (PAR) methodology since it allows for an in-depth analysis of a real-world context (Gray, 2004). PAR enables the people under investigation to be involved democratically and not to be seen as mere subjects of an experiment, the researcher at the same time is seen as an agent of change, and the data is generated from the researcher’s direct experience with the participants (Gray, 2004). Furthermore, PAR seeks to involve the actors who would most benefit from the research outputs, thus providing practical contributions to the community while at the same time nurturing the academic (Jones, 2018; Lewin, 1946). This is achieved through a cycle of activities, including problem diagnosis, active intervention and reflection (Coughlan & Coughlan, 2016). Action Research is mentioned by Price et al. (2014) as an ideal methodology to support Catalysts to understand better the pragmatic role of Design-Led Innovation within companies of different sectors. This is also supported by the cyclical nature of both DLI and Action Research.

3.1 Empirical context: the company and employees involved

The company under analysis was founded in Lombardy (Italy) in the 1960s, and over time it has grown by expanding to the European market. Now it has approximately 500 employees and produces 400.000 boxes daily in its nine factories worldwide. Just after the Covid-19 pandemic, the company structure underwent some changes, which were also ongoing during the research period. The firm sells business-to-business products, designing and producing cardboard and/or PE packaging. Sustainable design is one of the company’s cornerstones, proposing mono-material cardboard solutions if possible, and minimising material use (CONAI, 2020). In day-to-day business, sustainability is not confined to a single figure but is interpreted as a shared responsibility. To improve its sustainability performance, the company decided to collaborate with the Design+Strategies Research Group within the Design Department of Politecnico di Milano to integrate and disseminate sustainable design knowledge more widely and continue the path of sustainable transition through the

transformation of the corporate culture. To improve the effectiveness of the change and find a tangible element around which the dialogue could revolve with the company's figures, the topic of design and material selection for sustainability was identified. This topic was used as a means and a trigger for internal dialogue. Furthermore, a focus on materials aligns with the objectives of the DLI Framework, connecting design aspects (such as materials) with high-level dimensions (such as corporate vision and strategy). To achieve cultural transformation through the project, the employees mainly involved were the three members of the company's design team and two managers (Table 2).

Table 2. Details of employees involved

Employee code	Department	Role	Years spent in the company
A	Design department	Junior designer	Less than 1 year
B	Design department	Lead designer	More than 5 years
C	Design department	Senior designer	More than 10 years
D	Supply Chain & Purchasing department	Manager	Less than 1 year
E	Design department, Sales & Marketing	Manager (then General Manager)	More than 10 years

3.2 Methods of data collection

The author of this article collected primary data during the entire Transformation Project and application of PAR methodology, focusing on the impacts and consequences of the introduction of new materials (as working templates and design tools), competencies (as knowledge, soft & hard skills, and techniques) and meanings (as new values and symbolic ideas). Data were obtained through the use of several methods listed below:

- Participatory observation: Carried out throughout the Transformation Project to verify the state of the art and the change. The opportunity to be physically inside the company allowed the researcher to immerse himself in the company culture, promote the elements of the practices, and observe the internal mechanisms and attitudes of the employees (Muratovski, 2016). The introduction of the researcher within the company allowed for numerous informal exchanges recorded within a Research Journal (Given, 2008)
- Research journal: To facilitate the subsequent coding process, at the end of each day spent within the company context, voice notes were recorded containing the highlights and interactions through which elements of the practices emerged. In total, approximately 125 minutes of audio were collected.
- Semi-structured interviews: 6 semi-structured interviews were conducted in the first phase of the Transformation Project with management figures and designers. Each interview lasted, on average, about 65 minutes and was recorded, transcribed and analysed. To promote an ethical approach, all interviewees were informed about the recording and confidentiality of the information (Harvey, 2011).
- Workshops: As will be explained later, these represented dedicated moments through which to introduce elements of the practices formally and through which give a more concrete shape to specific sustainability concepts. Four workshops were organised, each with a

specific topic. Depending on the topic, activities, concepts and the evolution of the employees, each workshop (and Transformation Project phase) was designed to introduce specific practices elements to transform design and material selection practice (Figures 5, 6, 7).

3.3 Data analysis

Data were analysed through an iterative content analysis (Given, 2008) of the vast amount of information collected throughout the Transformation Project. The purpose was to highlight the major changes in the daily working life of the company's employees, later focusing on the employees involved in the project and monitoring changes in the individual design and material selection practice over time. The data coding process was applied to all methods and exploited the conceptual framework and elements of practices from the literature. In particular, the data were first grouped using the three macro categories (materials, competencies and meaning) and then into their micro categories (Figure 1). Subsequently, the recurrences and relationships between workshops, employees and elements of practices were studied. This allowed the construction of narratives related to individual employees and conclusions on the effectiveness of DLI.

4 Transformation project activities

4.1 Building trust

In line with what other authors have pointed out, the introduction of the Catalyst within the Design department has raised scepticism, so the first period was used to build trust and integrate the researcher within the team (Price et al., 2014; Wrigley, 2017). Indeed, the activities carried out in the initial stages aimed at creating a close relationship with the individuals through participatory observations and informal dialogues integrating a few practice elements (Figure 5). Only later, semi-structured interviews were conducted to gain an in-depth understanding of the product and strategic design processes.

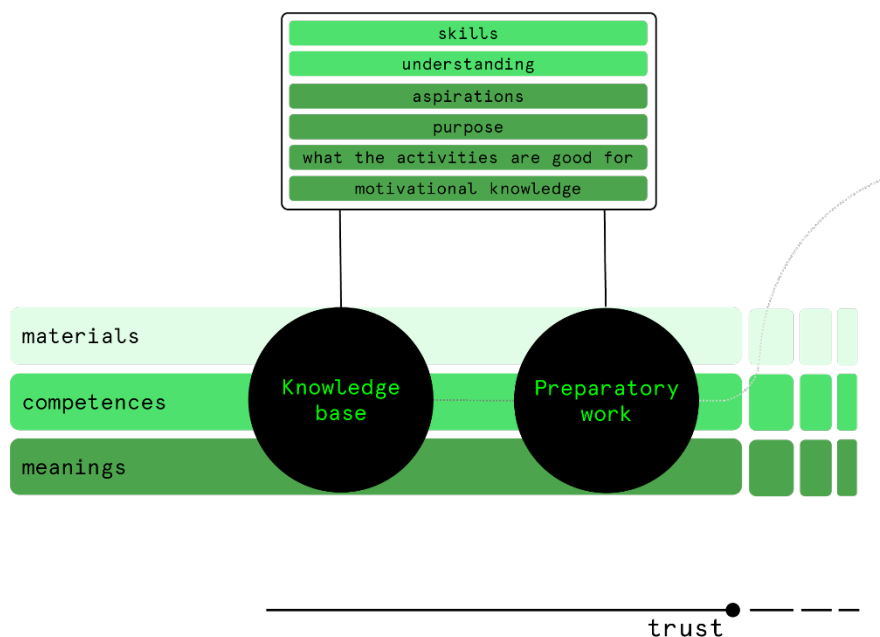


Figure 5. Practice elements integrated during the first phase of the Transformation Project (Trust).

4.2 Gaining traction

The second phase of the Transformation Project involved close collaboration with the company and its employees. The Catalyst continued to integrate and provide practice elements on an ongoing basis (Figure 6), as well as to evaluate the impact of the workshops and practices along the way. In addition to participatory observations and informal dialogues, two Workshops were designed and organised with a thematic focus. Both of them took advantage of group work dividing participants into teams. The first workshop focused on vision and strategy, guiding participants to create future scenarios through scenario-building techniques (Carella & Marengoni, 2022). The second one focused on products, specifically on their materials, using Ashby's method to perform material selection (Ashby & Johnson, 2009). At the end of the two innovation workshops, the results were used to generate two briefs, one per group, and design a pack, respectively. The design phase, facilitated by the Catalyst, proved to be particularly effective in integrating the elements into the daily practice of the employees. In the later stages, the employees reported how the change in design practice and outputs were traced back to the experience in collaboration with the Catalyst. This phase bridged to the final step of the Transformation Project, using the design outputs as elements for future analysis and starting a deeper integration of the elements.

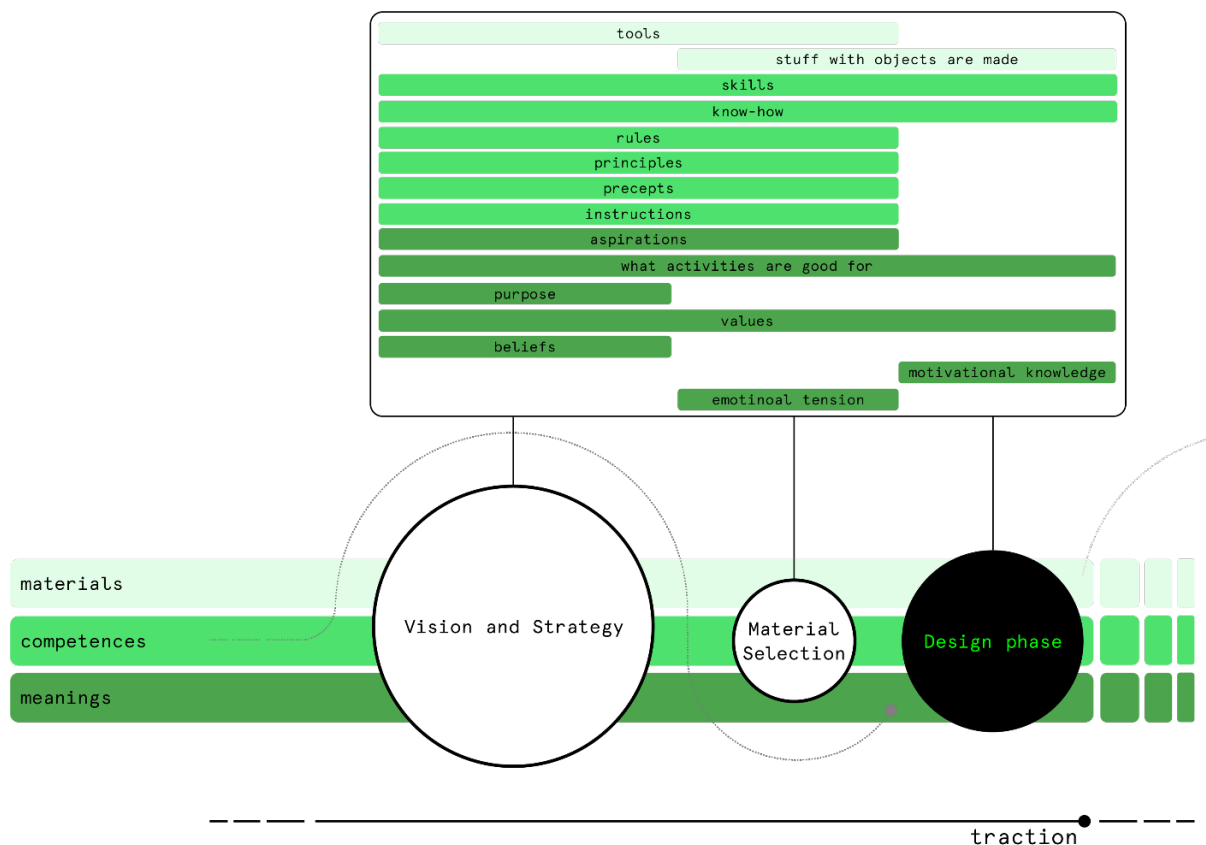


Figure 6. Practice elements integrated during the second phase of the Transformation Project (Traction).

4.3 Element integration

The last phase of the Transformation Project aimed to integrate the elements of practices within the daily project activities (Figure 7). The same modus operandi as the previous phase was adopted, continuing with participatory observations, informal dialogues, and two Innovation Workshops. The first one focused on life cycle and system analysis using the Flow Mapper, a digital tool for systemic

and visual analysis of resource flow (Zeeuw van der Laan & Aurisicchio, 2021), while the second workshop aimed to innovate material and supplier selection by leveraging Ashby's multi-criteria material selection method (Ashby & Johnson, 2009). The focus on system thinking and design allowed Catalyst to involve employees from almost all company departments. As a result, the employees' interest and emotional involvement gradually increased over time. This made it easier to integrate new practice elements into everyday life and promote their dissemination at different company levels thanks to the facilitation role of the Catalyst. At the end of the Transformation Project, the design practice was highlighted as more collaborative and multidisciplinary, regularly involving multiple figures in the concept generation phase, showing a stronger tendency to explore more disruptive and sustainable options. This resulted in an increased number of projects assigned to the Design department focused on sustainability, and related to the topics covered during the workshops, such as reusable boxes or compostable and biodegradable packs.

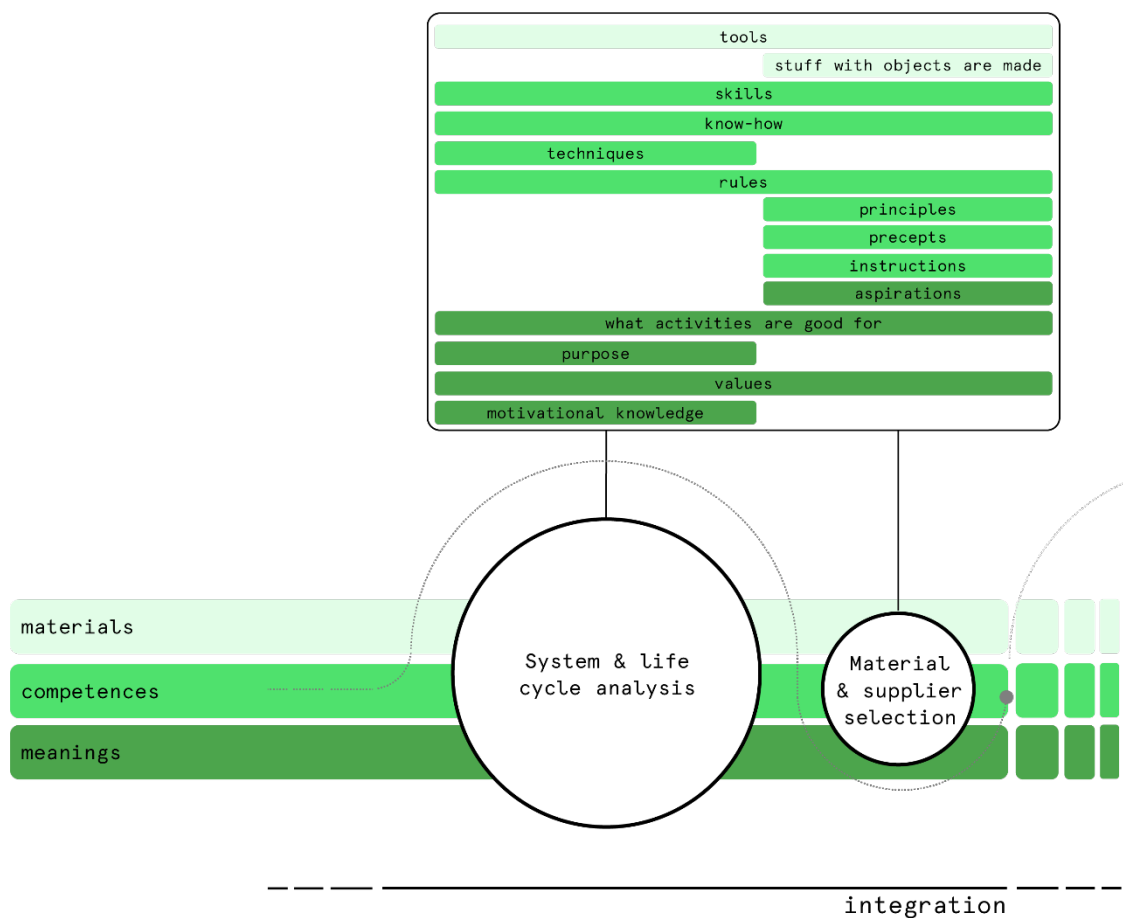


Figure 7. Practice elements integrated during the third phase of the Transformation Project (Integration).

5 Influence on individuals of the elements of practices

To assess the influence of the DLI approach on practices in depth, an analysis of individuals was also carried out, identifying the state of the art at the beginning of the Transformation Project and its end.

5.1 Employee A

Employee A started the Transformation Project with a foundation on sustainable practice, making some connections to sustainability in some design aspects. Indeed, the employee showed

competencies (in particular know-how and knowledge) related to design practice for sustainability, but lacking in tools, some competencies (know-how and knowledge related to systems thinking) and meanings (aspirations, what things are good for). This emerged early in the Transformation Project and during the first innovation workshop. Subsequently, employee A showed the integration of knowledge and know-how related to systemic design principles, sharing design concepts with the team, and the purpose and values of sustainability in the workshop activities. Employee A's growth and change of perspective were also evidenced by the number of sustainable pack projects assigned and being selected to teach in a packaging design course.

5.2 Employee B

Employee B, thanks also to a longer experience within the company, showed strong skills in sustainable design from the start, especially knowledge of materials, hardware and tools. However, he/she showed a lack of understanding of the meanings of this (aspirations, values, and emotional tension). Throughout the Transformation Project, became progressively more and more open to listening to different ideas and collaboration with the Catalyst. This progressively led to more frequent cooperation and the embracing of new meanings-related elements. During the third workshop, Employee B stated, "The shape of that component, which I created to minimise materials together with Catalyst, was also useful to me afterwards. In fact, I took it up for another project". Furthermore, during participatory observation, employee B showed a progressive interest in the tools of the workshops, keeping and browsing them during the working days.

5.3 Employee C

Employee C has a very long experience in the world of packaging; almost the entirety of his career has been focused on this product sector. Specifically, more than 10 years have been spent in the company under analysis allowing him to know the system and business dynamics. This led him to develop strong introversion, disillusionment and resistance to change. The design practice and its constituent elements were firmly rooted in sustainable design skills, rules and precepts; on the contrary, the materials and meanings were fragile, if not wholly lacking. Employee C's participation in the company's innovation workshops was delayed due to the Covid-19 pandemic and other company commitments. Still, he/she gradually began to show signs of change towards the end of the Transformation Project, particularly regarding meanings, showing his interest in the values of sustainability, new motivation to broaden his knowledge, and being more open to collaboration. However, unlike Employees A and B, the design practice mainly remained the same for Employee C, but single elements emerged during informal dialogues and collective discussions.

5.4 Employee D

Employee D showed strong strategic and systemic competencies from the beginning of the Transformation Project but rarely connected to the meanings and materials. In particular, tools, hardware and stuff which objects are made showed weakness; aspirations, emotional tension and purpose were lacking too. Due to the role within the company and the need for frequent business trips, daily collaboration was less than in other subjects. However, employee D was able to participate in all innovation workshops. Furthermore, at the end of the second phase of the Transformation Project, a strategic project was initiated with the collaboration of the Catalyst, thus enabling the introduction of practice elements. During the collaboration course, the understanding and interest in some tools emerged, but integration was not noticed in daily practices.

5.5 Employee E

Finally, Employee E has a long career and experience in design and strategy, showing knowledge about techniques, rules and precepts of sustainability. Elements related to sustainability were also highlighted about materials (tools and stuff of which the objects are made) and meaning (values, what activities are good for, and intentions) but conflicting and overshadowed by other business-oriented meanings. Because of the role, Employee E's constant presence and participation in the workshops were not possible, allowing him to attend only the first two but staying up-to-date on activities and objectives. The rooted presence of previous competencies made the introduction of new ones and the adoption of more sustainability-oriented meanings more difficult. The activities carried out during the workshops did, however, engage employee E who showed interest in the tools and their meanings. This was seen in the procurement of more reusable pack projects. However, the effectiveness of the course and the introduction of the elements of the practices remains to be determined on employee E.

5.6 Overall results

The contamination with Catalyst and the workshop activities influenced and broke the routine by providing insights and making the employees reflect. The individual analysis shows that the DLI approach is effective when carried out with constant participation and commitment, leading changes in daily practices and the corporate culture. The cases of employees A and B are emblematic of this. They had the opportunity to follow the Transformation Project in its wholeness, highlighting how the practice elements, particularly competencies and meanings, were assimilated and integrated into the design practice. Those employees who had the opportunity to follow the Transformation Project partially showed limited results. Employees C, D and E, indeed, demonstrated the assimilation of new elements of the practices, but the integration still did not lead to a change. The success of the integration of practice elements through the DLI approach is supported not only by the participatory observations made by the Catalyst but also by pragmatic evidence, such as the use of innovative solutions in the packs developed in the final period of the collaboration (September-December) and the choices made during the innovation workshops. It was highlighted how, despite the increasing difficulty and the constant rise of variables to be considered during the workshops (to spur multidisciplinary, dialogue and systemic thinking), the cards and choices made from a sustainability perspective were always present. It is indeed emblematic how during the second workshop, the group consisting of employees A and B, together due to the Covid-19 contagions, addressed the material selection process by using sustainable characteristics and attaching great importance to it. The second group also used sustainable characteristics, although with a lesser degree of relevance. Despite the complexity and the number of cards available, both groups identified and used sustainability features during the selection of materials and suppliers in the fourth workshop. This highlights how competencies and meanings attributed to the well-being of the environment affected the practices.

6 Discussion and conclusions

The research proposed in this article aims to contribute to the field of DfST by providing a more pragmatic view from the field. For this purpose, the DLI approach has demonstrated its potential in driving the sustainable transition, focusing on the realisation of innovative solutions and the promotion of cultural transformation within an organisation. This change was verified and analysed using Practice Theory, mapping the elements included and the changes made to design-as-practice

(Kimbell, 2012). The results confirmed the initial hypothesis, showing how voluntary interference in the elements of practices causes a cultural change and a sustainable transition of a company. Using design actions and facilitation through the Catalyst makes it possible to identify the elements necessary for the transition, incorporating and promoting them during the different moments. The methodology also makes it possible to customise the path, adapt it to the company's demands and needs, and tailor the intervention and practice elements according to the cultural context (Bucolo & Wrigley, 2013, 2014). Contextualisation is a crucial element for both DfST and Social Practice Theory; where for the former, it is essential to contextualise interventions according to the assets and knowledge of local communities, and for the latter because practices are diversified according to contexts (Irwin et al., 2020; Røpke, 2009; Shove et al., 2012).

However, the analysis has highlighted some risks, echoing what other research has shown. Firstly, the study showed how the transition is difficult to control (Gaziulusoy & Ryan, 2017; Irwin et al., 2020), in fact even in this case, despite the inclusion of new practice elements, it was impossible to define a priori which of these would take root (Shove et al., 2012). Furthermore, it has been highlighted that a significant commitment is required not only from the Catalyst (Bailey et al., 2019; Price et al., 2014; Wrigley, 2017) but also from employees and management, collaborating consistently to maximise exposure to new practices elements (Hallstedt et al., 2013; Rizos et al., 2016; Schulte & Hallstedt, 2017). The risk is a low level of integration, causing change only in some company departments. In this research, this could be due to the social bond developed between the employees of the Design department and the Catalyst, embedded within the team and with whom empathy has been built (Price et al., 2014). Indeed, close and empathic ties allow for an easier transition of practices and elements in a community and the attraction of new carriers (Shove et al., 2012). Thus explaining the results of employees A and B compared to the others. In this sense, the figure of the Design Champion could contribute. The CEO and top management usually nominate this and it has an advocacy role throughout the company, increasing the success of the design-led change (Wrigley, 2017). In this research, the figure of the Design Champion was not defined. Nevertheless, employee B performed this role on his/her initiative, supporting the Catalyst and facilitating the dissemination of elements within the company. His/her spontaneous application and non-managerial role, however, limited the effectiveness.

From a theoretical point of view, the research also contributes to Social Practice Theory. This shares the experience of a voluntary practice change and confirms Kimbell's (2009, 2012) understanding. By breaking down design practice into materials, competencies and meanings, it was possible to analyse and influence it, showing the analytical value of this theory. Furthermore, the research showed how it is possible to think of design as a complex of practices, as this coexists and is carried out in succession and frequency to others with their materials, competencies and meanings (Shove et al., 2012). An example of this could be material selection. The latter, in addition to being dependent on design practice and defining the material world, adopt supporting technologies and tools (software and templates), is characterised by competencies and knowledge (soft and hard skills, rules and principles, among others), and finally is the bearer of meanings, giving sense to the material itself and being attributed to emotions and values. In this new light, even intervention in material selection practices can be interpreted as a change to design practice and corporate culture, extending the purely technical purposes attributed to it so far.

6.1 Limitations and further research

The research was conducted within an Italian secondary packaging company with a specific structure, characteristics, objectives and human capital. Although this can be positively interpreted since it allowed the opportunity to test the methodology and conceptual framework pragmatically, this can also be considered a limitation, having been tested in a single context. Developing the framework in a different organisation would be useful for its validation and highlight the constant variables that allow the process to be successfully reproduced under specific conditions. A further limiting factor is time. This research was carried out over 12 months, following the indications provided by the DLI approach. However, transitions and cultural changes do not have predefined timeframes but differ and diverge according to the types of practices (Shove et al., 2012). By diversifying this variable, the results could be different, and the effectiveness of the integration of the elements could be improved.

The research results show that DLI can guide the sustainable transition of a company. However, this approach is based on a User-Centred perspective (Bucolo & Matthews, 2011b). This research placed the three aspects of sustainability (environmental, social and economic) at the centre of actions showing the potential for a paradigm shift, moving the focus from User-Centred to Planet-Oriented, aligning with the latest developments in the design world and overcoming an anthropocentric view (Tironi et al., 2022). Subsequent research could explore the changes a Planet-Oriented focus could have on the DLI Framework.

References

- Ashby, M. F., & Johnson, K. (2009). *Materials and Design: The Art and Science of Material Selection in Product Design* (2nd ed). Elsevier.
- Bailey, M., Chatzakis, E., Spencer, N., Lampitt Adey, K., Sterling, N., & Smith, N. (2019). A design-led approach to transforming wicked problems into design situations and opportunities. *Journal of Design, Business and Society*, 5(1), 95–127. Scopus. https://doi.org/10.1386/dbs.5.1.95_1
- Bucolo, S., & Matthews, J. (2011a). A conceptual model to link deep customer insights to both growth opportunities and organisational strategy in SME's as part of a design led transformation journey. In A. Ip, J. Cai, J. Liu, & G. Tong (A c. Di), *Design Management: Towards a New Era of Innovation—Proceedings of the 2011 Tsinghua* (pp. 243–250). Innovation and Design Management Association Ltd.
- Bucolo, S., & Matthews, J. (2011b). Design Led Innovation: Exploring the synthesis of needs, technologies and business models. *Proceedings of Participatory Interaction Conference 2011*. Participatory Interaction Conference 2011, Sønderborg, Denmark.
- Bucolo, S., & Wrigley, C. (2013). Design-led innovation as a means to sustain social innovation enterprises. *Business Design Conference - a discursive summary*. Business Design Conference.
- Bucolo, S., & Wrigley, C. (2014). Design-led innovation: Overcoming challenges to designing competitiveness to succeed in high cost environments. In G. Roos & N. Kennedy (A c. Di), *Global perspectives on achieving success in high and low cost operating environments* (pp. 241–251). IGI Global.
- Bucolo, S., Wrigley, C., & Matthews, J. (2012). Gaps in Organizational Leadership: Linking Strategic and Operational Activities through Design-Led Propositions. *Design Management Journal*, 7(1), 18–28. <https://doi.org/10.1111/j.1948-7177.2012.00030.x>
- Carella, G., & Marengoni, E. (2022). Envisioning the Future: Scenario-Building Techniques. In *Transformation by Design: Planning design strategies and services for the next generation digital challenges*. Maggioli Spa.
- Ceschin, F. (2012). *The introduction and scaling up of sustainable Product-Service Systems. A new role for strategic design for sustainability* [PhD Thesis]. Politecnico di Milano.
- Ceschin, F., & Gaziulusoy, A. İ. (2019). *Design for Sustainability: A Multi-level Framework from Products to Socio-technical Systems*. Routledge. <https://doi.org/10.4324/9780429456510>
- CONAI. (2020). *Progettare Riciclo: Linee guida per la facilitazione delle attività di riciclo degli imballaggi a prevalenza cellulosica*.

- Coughlan, P., & Coughlan, D. (2016). Action research. In *Research Methods for Operations Management* (2a ed.). Routledge.
- Dong, A. (2015). Design × innovation: Perspective or evidence-based practices. *International Journal of Design Creativity and Innovation*, 3(3–4), 148–163. <https://doi.org/10.1080/21650349.2014.943294>
- Gaziulusoy, A. İ., & Ryan, C. (2017). Roles of design in sustainability transitions projects: A case study of Visions and Pathways 2040 project from Australia. *Journal of Cleaner Production*, 162, 1297–1307. <https://doi.org/10.1016/j.jclepro.2017.06.122>
- Gaziulusoy, İ. (2010). *System Innovation for Sustainability: A Scenario Method and a Workshop Process for Product Development Teams* [PhD Thesis]. University of Auckland.
- Gaziulusoy, I. A., Boyle, C., & McDowall, R. (2010). System innovation for sustainability: A scenario method and a workshop process for product development teams. *4th International Conference on Sustainability Engineering and Science: Transitions to Sustainability*. Auckland, New Zealand.
- Gaziulusoy, I. A., Boyle, C., & McDowall, R. (2008). Planning for system innovation in product development teams of manufacturing companies: Criteria development for a scenario method. *3rd International Conference on Sustainability Engineering and Science*, Auckland, New Zealand. <https://openrepository.aut.ac.nz/handle/10292/3698>
- Gaziulusoy, A. İ., & E. Oztekin, E. (2019). Design for Sustainability Transitions: Origins, Attitudes and Future Directions. *Sustainability*, 11, 3601. <https://doi.org/10.3390/su11133601>
- Geels, F.W. (2004) From sectoral systems of innovation to socio-technical systems: Insights about dynamics and change from sociology and institutional theory. *Research Policy*, 33 (6/7): pp. 897-920.
- Geels, F. W. (2005). *Technological transitions and system innovations: A co-evolutionary and socio-technical analysis: A Co-evolutionary and Socio-Technical Analysis*. Edward Elgar Publishing Ltd.
- Gharajedaghi, J. (2006). *Systems Thinking: Managing Chaos and Complexity: A Platform for Designing Business Architecture* (2° edizione). Morgan Kaufmann.
- Given, L. (2008). *The SAGE Encyclopedia of Qualitative Research Methods*. <https://doi.org/10.4135/9781412963909>
- Gray, D. E. (2004). *Doing Research in the Real World* (3rd ed). SAGE.
- Grin, J., Rotmans, J., & Schot, J. (2010). *Transitions to Sustainable Development: New Directions in the Study of Long Term Transformative Change*. Routledge. <https://doi.org/10.4324/9780203856598>
- Hallstedt, S. I., Thompson, A. W., & Lindahl, P. (2013). Key elements for implementing a strategic sustainability perspective in the product innovation process. *Journal of Cleaner Production*, 51, 277–288. <https://doi.org/10.1016/j.jclepro.2013.01.043>
- Harvey, W. S. (2011). Strategies for conducting elite interviews. *Qualitative Research*, 11(4), 431–441. <https://doi.org/10.1177/1468794111404329>
- Intergovernmental Panel on Climate Change - IPCC. (2023). *Climate Change 2023: Synthesis Report of the IPCC sixth Assessment Report (AR6)* (Fasc. 6). IPCC (Intergovernmental Panel on Climate Change). <https://www.ipcc.ch/report/sixth-assessment-report-cycle/>
- Irwin, T. (2015). Transition Design: A Proposal for a New Area of Design Practice, Study, and Research. *Design and Culture*, 7(2), 229–246. <https://doi.org/10.1080/17547075.2015.1051829>
- Irwin, T., Kossoff, G., Tonkinwise, C., & Scupelli, P. (2015). Transition Design Overview. *Carnegie Mellon School of Design*. https://www.academia.edu/13122242/Transition_Design_Overview
- Irwin, T., Tonkinwise, C., & Kossoff, G. (2020). Transition Design: The Importance of Everyday Life and Lifestyles as a Leverage Point for Sustainability Transitions. *Cuadernos del Centro de Estudios de Diseño y Comunicación*, 105, Artículo 105. <https://doi.org/10.18682/cdc.vi105.4189>
- Jones, P. (2018). Contexts of Co-creation: Designing with System Stakeholders. *Systemic Design*, 3–52. https://doi.org/10.1007/978-4-431-55639-8_1
- Joore, P. (2008). The V-Cycle for system innovation translating a broad societal need into concrete product service solutions: The multifunctional centre Apeldoorn case. *Journal of Cleaner Production*, 16(11), 1153–1162. <https://doi.org/10.1016/j.jclepro.2007.08.007>
- Joore, P. (2010). *New to Improve—The Mutual Influence between New Products and Societal Change Processes* [PhD Thesis]. Technical University of Delft. <https://doi.org/10.13140/RG.2.1.3904.2720>
- Kimbell, L. (2009). Beyond design thinking: Design-as-practice and designs-in-practice. CRESO Conference, Manchester, UK.
- Kimbell, L. (2012). Rethinking Design Thinking: Part II. *Design and Culture*, 4(2), 129–148. <https://doi.org/10.2752/175470812X13281948975413>

- Kossoff, G. (2011). *Holism and the reconstitution of everyday life: A framework for transition to a sustainable society* [PhD Thesis]. University of Dundee.
- Lewin, K. (1946). Action Research and Minority Problems. *Journal of Social Issues*, 2(4), 34–46. <https://doi.org/10.1111/j.1540-4560.1946.tb02295.x>
- Loorbach, D. (2010). Transition Management for Sustainable Development: A Prescriptive, Complexity-Based Governance Framework. *Governance*, 23(1), 161–183. <https://doi.org/10.1111/j.1468-0491.2009.01471.x>
- Markard, J., Raven, R., & Truffer, B. (2012). Sustainability transitions: An emerging field of research and its prospects. *Research Policy*, 41(6), 955–967. <https://doi.org/10.1016/j.respol.2012.02.013>
- Markard, J., & Truffer, B. (2008). Technological innovation systems and the multi-level perspective: Towards an integrated framework. *Research Policy*, 37(4), 596–615. <https://doi.org/10.1016/j.respol.2008.01.004>
- McKibben, B. (2012). Global Warming's Terrifying New Math. Rolling Stone. <https://www.rollingstone.com/politics/politics-news/global-warmings-terrifying-new-math-188550/>
- Melazzini, M. (2021). *Design Thinking for boosting Creative Confidence in individual employees* [PhD Thesis]. Politecnico di Milano.
- Miles, R. H. (1980). *Resourcebook in Macro Organizational Behavior*. Scott, Foresman.
- Muratovski, G. (2016). Research for designers: A guide to methods and practice.
- Nicolini, D. (2017). Practice Theory as a Package of Theory, Method and Vocabulary: Affordances and Limitations. In M. Jonas, B. Littig, & A. Wroblewski (A c. Di), *Methodological Reflections on Practice Oriented Theories* (pp. 19–34). Springer International Publishing. https://doi.org/10.1007/978-3-319-52897-7_2
- Perrow, C., & Pulver, S. (2015). Organizations and Markets. In *Climate Change and Society: Sociological Perspectives* (pp. 61–92). Oxford University Press.
- Pettigrew, A. M. (1990). Longitudinal Field Research on Change: Theory and Practice. *Organization Science*, 1(3), 267–292. <https://doi.org/10.1287/orsc.1.3.267>
- Price, R., Wrigley, C., Matthews, J., & Dreiling, A. (2014). Design Research for the real world: A Design-led Innovation Model for Action Research. *Nord Design 2014*, Helsinki, Finland.
- Reckwitz, A. (2002). Toward a Theory of Social Practices: A Development in Culturalist Theorizing. *European Journal of Social Theory*, 5(2), 243–263. <https://doi.org/10.1177/13684310222225432>
- Rizos, V., Behrens, A., Van der Gaast, W., Hofman, E., Ioannou, A., Kafyeke, T., Flamos, A., Rinaldi, R., Papadelis, S., Hirschnitz-Garbers, M., & Topi, C. (2016). Implementation of Circular Economy Business Models by Small and Medium-Sized Enterprises (SMEs): Barriers and Enablers. *Sustainability*, 8(11), Articolo 11. <https://doi.org/10.3390/su8111212>
- Røpke, I. (2009). Theories of practice—New inspiration for ecological economic studies on consumption. *Ecological Economics*, 68(10), 2490–2497. <https://doi.org/10.1016/j.ecolecon.2009.05.015>
- Schatzki, T. R. (2002). *Site of the Social: A Philosophical Account of the Constitution of Social Life and Change*. Pennsylvania State University Press.
- Schulte, J., & Hallstedt, S. I. (2017). Challenges and Preconditions to Build Capabilities for Sustainable Product Design. *21st International Conference on Engineering Design*, Vancouver, Canada.
- Shove, E., & Pantzar, M. (2005). Consumers, Producers and Practices: Understanding the invention and reinvention of Nordic walking. *Journal of Consumer Culture*, 5(1), 43–64. <https://doi.org/10.1177/1469540505049846>
- Shove, E., Pantzar, M., & Watson, M. (2012). *The Dynamics of Social Practice. Everyday Life and how it Changes*. SAGE Publications Ltd.
- Shove, E., & Walker, G. (2010). Governing transitions in the sustainability of everyday life. *Research Policy*, 39(4), 471–476. <https://doi.org/10.1016/j.respol.2010.01.019>
- Smith, A., Voß, J.-P., & Grin, J. (2010). Innovation studies and sustainability transitions: The allure of the multi-level perspective and its challenges. *Research Policy*, 39(4), 435–448. <https://doi.org/10.1016/j.respol.2010.01.023>
- Tironi, M., Albornoz, C., & Chilet, M. (2022). Problematizing Human-Centred Design: Notes on Planet-Oriented Design. *diid — Disegno Industriale Industrial Design*, 77, Articolo 77. <https://doi.org/10.30682/diid772022c>
- Townson, P., Matthews, J., & Wrigley, C. (2016). Outcomes from Applying Design-Led Innovation in an Australian Manufacturing Firm. *Technology Innovation Management Review*, 6, 49–58. <https://doi.org/10.22215/timreview/997>

- Wagner, J. A., & Hollenbeck, J. R. (2005). *Organizational Behavior: Securing Competitive Advantage*. Thomson/South-Western.
- Wrigley, C. (2013). Educating the «Design Innovation Catalyst» for change. In K. Sugiyama (A c. Di), *Proceedings of the 5th International Congress of International Association of Societies of Design Research (IASDR)* (pp. 3547–3557). Shibaura Institute of Technology / Japanese Society for the Science of Design.
- Wrigley, C. (2017). Principles and practices of a design-led approach to innovation. *International Journal of Design Creativity and Innovation*, 5(3–4), 235–255. <https://doi.org/10.1080/21650349.2017.1292152>
- Wrigley, C., & Bucolo, S. (2012). I just want to design a sexy flying car! Teaching design-led innovation to designers. In A. Villela (A c. Di), *Projecting Design 2012: Cumulus Working Papers* (pp. 71–76).
- Yin, R. K. (2017). *Case Study Research and Applications: Design and Methods*. SAGE Publications.
- Zeeuw van der Laan, A., & Aurisicchio, M. (2021). The Flow Mapper: A Tool to Model Solutions for the Circular Economy and Put Systems Thinking into Action.
- Zurlo, F. (1999). *Un modello di lettura per il Design Strategico: La relazione tra design e strategia nell'impresa contemporane* [PhD Thesis]. Politecnico di Milano.

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Acknowledgement: This research was funded by the partner company (not mentioned for privacy reasons) in collaboration with the Design Department of the Politecnico di Milano. The author would like to thank the employees for their kind collaboration and participation. The author would also like to thank Prof. Francesco Zurlo and the Design+Strategies research group for the valuable discussion.