

# Design for Sustainability Transitions in practice: Reflections from the field through two case studies in organizations

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## ABSTRACT

Design for Sustainability Transitions (DfST) is a relatively recent design approach gaining traction to support systems innovation. However, this remains a high-level approach, and there is limited experience in translating elements such as visions into concrete outputs (e.g., products or services). Furthermore, designers and researchers have only access to theoretical knowledge, which they use to translate frameworks and processes into specific contexts. For this reason, the article aims to bridge the gap between theory and practice, describing two transition projects within companies and contextualising the processes described theoretically, thereby facilitating their understanding and the reinterpretation of the DfST process. The research adopts an exploratory and inductive approach, based on Grounded Theory. It uses qualitative data collected through two longitudinal case studies, analysed through Reflection on Action and Open Coding. The results emphasise the importance of interpreting the process with flexibility to interpret and contextualise the theoretical frameworks present in the literature. Furthermore, the results highlight two macro-categories of factors (Contextual and Human) that act at different levels and during all process stages, influencing strategic and operational choices and outcomes. Indeed, the factors emerged change the importance of each stage and the methods and tools adopted.

**Keywords:** strategic design, design for sustainability transitions, design in organization, design practice, case study.

## INTRODUCTION

More than 50 years ago, Horst Rittel identified a category of complex “wicked” problems for which traditional design processes were inadequate (Rittel & Webber, 1973). One of these key challenges is the transition toward sustainability, which must be addressed at all levels, from corporate production and consumer habits to the broader societal mindset. In this context, companies play a dual role: while they contribute to the problem through their manufacturing processes, they also have the resources to develop solutions. Early businesses responses focused on incremental end-of-pipe solutions, later evolving into cleaner production and eco-design strategies (Simons et al., 2001). More recently, the academic design discourse encouraged a shift from product-centric solutions toward more systemic ones, moving from micro-level (individual products) to an increasingly broader, macro-level perspective (Ceschin & Gaziulusoy, 2019). Design for Sustainability Transitions (DfST), or Transition Design, has emerged within this evolution. Unlike other approaches centred on single actors, DfST involves a network of stakeholders, addressing the technical, organisational, socio-

cultural, institutional, and ecological dimensions of the companies' system (Öztekin & Gaziulusoy, 2020).

This new paradigm reframes design from producing discrete objects to shaping relationships, interactions, and experiences within complex systems (Irwin et al., 2020). DfST tackles sustainability as a “long-term, multi-dimensional, and fundamental transformation process” of socio-technical systems (Markard et al., 2012), requiring reevaluation not only of production methods and artefacts but also of how society consumes and accesses goods and services (Manzini, 2002). This systemic outlook connects DfST with Strategic Design and Systemic Design. In both approaches, creating a complex network of stakeholders becomes a design challenge, where professionals apply their principles, tools, and methods to influence strategic decision-making within organisations, drive long-term choices, and involve several stakeholders (Calabretta et al., 2016).

While various scholars have contributed to the field by proposing theoretical frameworks (Ceschin, 2012; Irwin, 2018; Öztekin & Gaziulusoy, 2020), some of them also designed for application within organisations (Ceschin, 2012; Gaziulusoy, 2010), DfST remains a “high-level”, relatively recent approach (Italia, 2024), with limited experience in generating concrete outputs such as products, services, or integrated systems (Van Selm & Mulder, 2019). Furthermore, DfST application in business contexts is still limited because of a lack of practical guidelines, tools, and frameworks. Researchers and practitioners seeking to implement this approach have access only to a body of theoretical knowledge, which they must independently translate into structured methodologies and contextualise, leading to potential misalignments between theory and practice (Van Selm & Mulder, 2019).

Given the recognised relevance of DfST in organisational contexts for addressing sustainability challenges, and the current lack of practical experiences to make these methods more accessible to practitioners, this article aims to analyse two transition projects from the field. The goal is to enhance the process replicability based on the specific corporate context in which a project is implemented. Based on the findings, the study proposes a set of variables to facilitate the practical adoption of DfST, thereby supporting researchers and practitioners in applying these principles in real-world projects.

## 1. THEORETICAL BACKGROUND

In recent years, a growing number of researchers have focused on investigating the relationship between design and sustainability, leading to the rise of various approaches to address this issue. Ceschin and Gaziulusoy (2019) mapped the most used approaches, highlighting their evolution, characteristics, and how the problem is addressed. The authors showed a trajectory from micro-level interventions on products and their components (through green design, eco-design, life cycle design) toward macro-level strategies, targeting territorial and socio-technical systems. Indeed, over time, the design approaches evolved by integrating other disciplines like psychology (Emotionally Durable Design, Design for Sustainable Behaviour) (Chapman, 2005; Lilley, 2009) or other research fields (Biomimicry and Cradle-to-Cradle Design) (Benyus, 2002; McDonough & Braungart, 2002). Alongside this evolution, there has also been a broadening of the design perspective, revealing a discipline capable of shaping systems and relationships, over just individual products, as in Sustainable Product-Service Systems (S.PSS) or Systemic Design (Bistagnino, 2009; Manzini & Vezzoli, 2003).

More recently, DfST has emerged as an even broader approach, aiming to guide the transformation of entire socio-technical systems by developing processes and relationships through design methodologies and tools (Ceschin & Gaziulusoy, 2019; Gaziulusoy & Öztekin, 2019). Leveraging both the design process and its output, especially adopting participatory-based approaches, DfST aims to address complex and ill-defined problems, aiming for sustainable and desirable futures (Irwin, 2018), tackling the multiple dimensions of the system (Öztekin & Gaziulusoy, 2020). In this perspective, the designer assumes the role of a mediator, facilitating multilevel and multi-stage dialogue among stakeholders that can drive change (Dewberry & Johnson, 2010).

Terry Irwin, a leading figure in DfST and developer of the Transition Design Framework (TDF), outlined three key phases of a DfST project (Irwin, 2018). The first is *Re-framing the present and the future*, where stakeholders collaboratively participate in an envisioning process, defining concerns, aspirations, and obstacles to the desirable future. The second, *Designing interventions*, analyses problems across different levels and timeframes. The interventions designed in this phase are conceived as interconnected stepping stones toward the envisioned future. The third, *Waiting and observing*, recognises that complex systems, self-regulated by their stakeholders, tend to respond to the transition process in various ways, making it essential to assess changes (Irwin, 2018; Kossoff, 2011).

Other authors have also developed theoretical frameworks and processes that describe different stages of a transition through design. Gaziulusoy (2010) developed and tested a method for creating scenarios and strategies with companies. The process involves an initial preparatory phase of understanding the system, risks and social functions, a second phase of developing the vision and defining stakeholders and products/services, and finally a phase of defining an action plan. Subsequently, Gaziulusoy and Öztekin (2019; 2020) revisited the process of transition through design from a theoretical perspective, integrating it with Transition Theories and Practice Theory, defining three phases: *Reflection for action*, *Reflection in action*, and *Reflection on action*. Ceschin (2012) developed a conceptual framework for introducing and scaling up S.PSS. From his perspective, the process involves an incubation phase, socio-technical experimentation, scaling up, and implementation of the vision. Although not explicitly linked to the DfST, the Framework for Strategic Sustainable Development, or The Natural Step, also presents similarities, namely starting from a vision, identifying gaps with the present, defining concepts and preparing a roadmap to bridge the gap (Broman & Robèrt, 2017). More recently, Italia (2024) developed a conceptual framework that frames the design-led transition process within companies and combines output development with organisational culture change, identifying three phases: trust (of knowledge of the system and stakeholders), traction (for the creation of the vision and integration with key elements of the system), and integration (for comparison and integration into the system). A product/service design phase bridges the traction and integration phases.

Although DfST and Strategic Design are grounded in somewhat different theoretical foundations, the analysis of DfST processes reveals that the two design approaches can be compared, highlighting several overlaps in terms of design process, attitudes, objectives and capabilities (Calabretta et al., 2016; Carella et al., 2024). Both are oriented toward addressing ill-defined, systemic challenges, dealing with future theories and sustainability issues, and analysing problems from a broader perspective. In both disciplines, the designer acts as a mediator between several stakeholders, adopting cross-sectoral language and participatory co-design principles. Additionally, both research fields are oriented towards developing

integrated sets of tangible and intangible artefacts, comprising products, services, and other media, capable of addressing social and sustainable innovation at a technical, organisational, socio-cultural, and institutional level (Öztekin & Gaziulusoy, 2020). Furthermore, Freire (2017) and Calabretta et al. (2016) outline Strategic Design processes that echo what has been outlined above in DfST; namely, an analysis of the system, a definition of the vision for the future and the steps to achieve it (backcasting), and finally the design of products and/or services that help to achieve that future.

The similarities between Strategic Design and DfST allow us to understand how systemic considerations and challenges can be integrated into corporate transformations aimed at sustainability, and how design can play a role. Despite these considerations, DfST remains a relatively recent approach, with its frameworks, practices, and tools still under development (Ceschin & Gaziulusoy, 2019; Irwin, 2018). Literature acknowledges that DfST is currently a “high-level” approach (Italia, 2024) with limited experience in generating concrete outputs such as products (Gaziulusoy & Ryan, 2017; Irwin et al., 2020; Van Selm & Mulder, 2019). While the DfST mindset is essential for comprehending and addressing systemic challenges, more pragmatic approaches such as Eco-Design, Emotionally Durable Design, or S.PSS are needed to translate strategies and visions into tangible outcomes, as in the Strategic Design approach (Ceschin & Gaziulusoy, 2019). This DfST lacks, implies that it is up to the designer’s sensitivity to absorb the DfST mindset and integrate it—when necessary—with other sustainable design approaches suitable for the specific project context.

This characteristic makes DfST inherently symbiotic with other sustainable design approaches, allowing it to benefit from each of them, based on the specific demands of the project context. However, this versatility also complicates the development of processes and frameworks, as well as their practical application and implementation. At present, researchers seeking to implement this approach have access only to a body of theoretical knowledge, which they must independently translate into structured methods.

Currently, there is a lack of practical approaches and experiences that effectively translate DfST principles into replicable tools and methods from a transition perspective, especially when applied in businesses. Therefore, the article aims to describe two transition projects within companies and the contextualisation of the processes described theoretically by various authors in practice. Through the analysis of experiences, the article identifies key variables crucial to a DfST project. It leverages this knowledge to offer a broad and flexible view of the DfST process, contextualised within businesses. The research results would be a valuable resource for researchers and designers, facilitating the theoretical integration of DfST principles and their practical application in real-world projects.

## 2. METHODOLOGY

This research has an exploratory and inductive nature, aiming to reduce uncertainties in the application of DfST with businesses and generate new generalisable understandings. For this reason, qualitative data were collected through two longitudinal case studies (Yin, 2017), which provided the opportunity to both observe and implement change within its natural context. The longitudinal case study method was considered appropriate as it allows the investigation of a complex phenomenon with blurred boundaries (Yin, 1994), and captures the temporal perspective inherent in sustainability transitions and their design within organisations.

The selected case studies are two research projects developed in collaboration with two companies: one during a doctoral thesis and the other a master's thesis. Both were grounded in DfST theories and aimed to trigger long-term change within the two companies with a broad impact on the system. In addition, the authors of this paper directly designed and conducted the projects, bringing a unique perspective from the field and allowing an analysis of the process and the dynamics from within. Therefore, the documents produced during the projects (e.g. theses, reports, publications, and other materials) were used as primary data sources.

The research process was based on Grounded Theory (GT) (Strauss & Corbin, 1998), to analyse the phenomenon inductively from the collected data. In particular, the research followed two main phases: a first phase of knowledge of DfST theories and processes, and a second iterative phase of comparison, analysis, and coding (Figure 1).

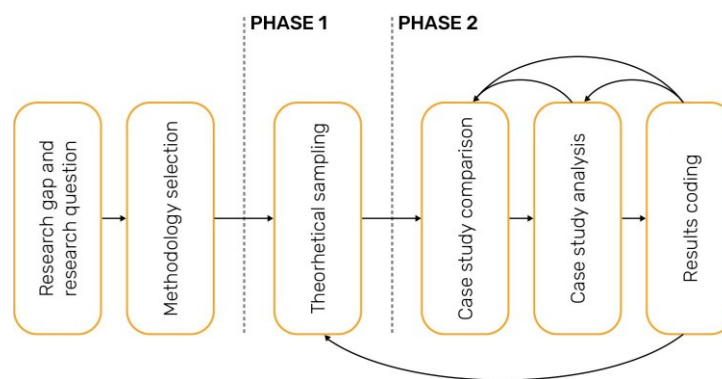


Figure 1: Research process adopted.

During the first phase, a thematic literature review was conducted to provide an overview of the existing application of DfST within business contexts. The thematic literature review helped to obtain state-of-the-art knowledge without being constrained by it in developing new understandings. For this purpose, databases such as Scopus and Google Scholar were queried using keywords such as 'Strategic Design for Sustainability, Transition Design, Design for Sustainability Transitions, Process' without time filters. Within them, the results and main authors were analysed. Through this review, it was possible to identify the perspectives and models briefly mentioned in the previous section.

The second phase involved a deliberate a posteriori Reflection on Action (Schön, 1984), analysing the decisions taken and activities carried out in the two projects. Following GT principles, analysis and coding were based on Open coding, alternating iteratively between cross-case comparison and the formulation of questions to support the labelling or definition of concepts (Gray, 2004). Following this procedure, the authors compared the two cases by systematically analysing the DfST processes applied. To ensure consistency, the authors agreed on a shared terminology to define methods, methodologies, and phases of DfST processes analysed. Adopting definitions proposed by Crotty, methods are "techniques or procedures" while a process is defined as a methodology, plan of action, or strategy behind the adoption of particular methods (Crotty in Sedlmair et al., 2012). Additionally, a phase describes the goal of a set of methods within a design process (Easterday et al., 2014).

To facilitate the comparative analysis and coding process, questions based on the 5Ws were used to investigate the phases of the two case studies, their motivations, and the results, highlighting similarities and differences. In practical terms, the data were collaboratively analysed, coded and compared using visual (Miro) and spreadsheet (Excel) tools.

### 3. CASE STUDIES

The two longitudinal case studies selected deal with:

- **Case Study 1** (21 months): Integration of sustainability within the corporate culture and selection of packaging materials from sustainable sources.
- **Case study 2** (12 months): Increasing the company's competitiveness by developing sustainable product-service system strategies for public bodies.

Although with different time frames and limited duration, both cases were considered DfST projects as they target long-term changes within companies and their systems, aiming to realise more sustainable solutions. Furthermore, the projects meet the criteria already considered by Flittner et al. (2022) (i.e., 1. Long-term future perspective; 2. Systemic alternative sustainable futures; 3. Collaboration of multiple stakeholders around the shared goal).

#### 3.1. Case Study 1: Integrating sustainability into products and corporate culture

The first case study involved a collaboration with a medium-sized Italian manufacturing company in the secondary packaging sector. With around 500 employees and a daily production of 400,000 boxes, the company offers customised protective packaging solutions across sectors such as automotive and electronics. As part of its expansion and organisational change, it funded a doctoral research project to embed sustainability into its operational practices and facilitate a long-term sustainable transition. Alongside strategic goals, the company sought tangible outcomes, particularly the identification of more sustainable packaging materials. In concrete terms, the collaboration involved the part-time integration of the PhD candidate into the company's design department, with regular thematic workshops held with staff.

In line with Gaziulusoy (2010), Gaziulusoy & Öztekin (2019), and Italia (2024), the initial phase of the transition project focused on understanding the corporate ecosystem, allowing subsequent activities to be aligned and coherent. A three-month analysis was conducted using qualitative methods (i.e., interviews, participatory observation, and literature review) combined with Strategic Design tools, such as positioning maps and SWOT Analysis (Cautela, 2007). This phase clarified the role of materials within the company, the corporate and sustainability culture across key processes (e.g., product and Strategic Design, material selection), and the barriers to the introduction of new competencies.

Based on these findings, four workshops were designed following the main aims derived from the literature: (1) Vision and strategy, (2) Material Selection, (3) System and Life Cycle Analysis, and (4) Material and Supplier Selection. The workshops involved five key figures in the company (three designers, one supply chain manager, and one from sales and marketing), supported by other figures with specific expertise. All workshops were facilitated by the designer-researcher using tailored canvases.

The first workshop applied scenario building and backcasting - as defined by Irwin (2018), Gaziylusoy (2010), Broman & Robèrt (2017), Italia (2024) - drawing on trends and megatrends. Divided into two groups, participants envisioned alternative futures through scenario matrixes, and developed corresponding roadmaps, linking more tactical activities. This led to the second session more aligned with the company's tactical needs: a collaborative material selection process tailored to the packaging sector, supported by custom cards and canvases. The results of the workshop crystallised material characteristics, defining useful features for future products. Building on the insights that emerged, two design briefs were developed - one focused on reuse, the other on recycling - leading to the co-development of two packaging concepts using eco-design and Cradle-to-Cradle Design. The third workshop exploited Systemic and Strategic Design, using a digital tool to map the Resource Flow System and assess the impact of both concepts. The final session returned to material and supplier selection, combining sustainability criteria with practical constraints, emphasising the systemic implications of design decisions along the value chain - in this case applying eco-design with a systemic perspective.

As suggested by Irwin (2018), an ex-post evaluation was conducted through participant observations and structured interviews after a four-month break. The results obtained in this phase were compared with those obtained from the system analysis to highlight the change. As a result, the reuse-based proposal was set aside, while the recycling-focused concept was put into production, helping the company experiment with new designs and materials, expand its ecosystem, and implement the steps defined in the initial phases of the transition project and vision. Notably, it was observed how the employees integrated sustainability into their practices. This is highlighted by the words of one of the employees during the final interview, who says:

In my opinion, sustainability is not including the material itself, i.e. using recycled materials, from renewable sources, but [...] it addresses all the management flows of material purchase and resale, from the transport of materials to suppliers; it's the whole life cycle.

In conclusion, the design-led transition enabled the achievement of project outputs (vision and new packaging), organisational outcomes (change in corporate culture), and systemic impacts (introduction of new players in the value chain), setting the conditions for long-term transformation, providing strategic and tactical guidance for long-term transformation.

### 3.2. Case Study 2: Developing product-service system strategies for public bodies

The second case study focused on a service-oriented microenterprise supporting the digital transition of businesses and public institutions. The company provides software solutions and turnkey technological services, covering site inspections, installation, and after-sales support. With a team of five employees and additional external contractors, the firm operates within the Italian microenterprise context, where innovation and sustainability are typically limited (ISTAT, 2021).

This transition initiative emerged through a bottom-up process, triggered by increasing competitive pressures in the conference system market during and after the COVID-19 pandemic. Seeking to differentiate itself by prioritising sustainability and quality over volume, the company engaged in a DfST process structured through a series of workshops over four months, developed in collaboration with a master's thesis.

Consistent with Gaziulusoy (2010), Gaziulusoy & Öztekin (2019), and Italia (2024), the initial phase aimed to understand the organisational ecosystem to guide the following activities coherently. A preliminary assessment, conducted collaboratively with staff, combined Strategic and Systemic Design tools, informal interviews, and a literature review. This analysis confirmed a highly competitive (red ocean) environment (Kim & Mauborgne, 2014), highlighting also inefficiencies in the supply chain and opportunities for improvements in distribution, communication, and outreach.

Drawing on these findings, four workshops were designed: (1) Vision and Future Thinking, (2) Idea and Concept Generation, and (3–4) Systemic and Sustainable Strategy. Participants included the CEO, two software developers (contributing asynchronously), the designer-researcher, a client stakeholder, and an external product-service designer, whose presence enriched discussions on market needs and supply-chain challenges. The workshops took place at a company's client's venue.

The first workshop employed forecasting and backcasting techniques (Irwin, 2018; Gaziulusoy, 2010; Italia, 2024) to construct a plausible and desirable 10-year scenario, using trends and megatrends as inputs. The second session focused on generating concepts aligned with this vision, supported by a custom tool that explored incremental and radical opportunities, later assessed through a Prioritisation Matrix (Zhang et al., 2022), combining Strategic Design with approaches such as S.PSS or Systemic Design. The third workshop refined selected concepts via Strategic Design, integrating tools inspired by the Ten Types of Innovation framework and a customised Innovation Tactic Deck (Keeley et al., 2013). The final workshop introduced life-cycle design approaches to identify opportunities for improvement across the service and product lifespan, drawing on frameworks by Ceschin & Gaziulusoy (2019) to align the company's strategy with sustainability objectives.

The effectiveness of the transition project (Irwin, 2018) was assessed through short-term qualitative and quantitative tools (Italia & Zurlo, 2022) and pre- and post-project interviews. These evaluations confirmed the project's capacity to foster innovation and strategic alignment. The main product of the process - a socially inclusive participatory governance platform for public bodies - emerged as a sustainable differentiation factor for the company. A feasibility study is currently underway to examine its implementation. Although not an initial objective of the DfST process, this new service offering influenced the company's medium- and long-term strategic planning, prompting organisational restructuring, supply-chain optimisation, and rebranding activities. In doing so, the company aligned its goals with broader societal meta-objectives, contributing to wider socio-technical transitions (Gaziulusoy et al., 2008). This shift is reflected in the CEO's words during one of the final interviews:

"These workshops have increased our awareness of sustainability, especially from a social perspective, an aspect we had only partially considered as a service provider. [...] Despite being carried out alongside a major external event, this process was one of the catalysts that enabled us to respond to it, triggering the organisational and identity changes we are facing today."

Overall, the transition process fostered a deeper organisational awareness of sustainability and activated an innovation trajectory that is now informing the company's strategic direction, strengthening its value proposition, and reshaping how it presents itself to the market.

## 4. DISCUSSION

### 4.1. The transition process through design within businesses

Although concise, the two case study narratives provided insight into how the DfST processes drawn from the literature can be adapted and implemented within businesses. To create a link between theory and practice, the design approaches, methods and tools that complemented DfST and helped to achieve concrete results during the transition projects were briefly outlined. These results led to outputs that represent steps toward the future and the envisioned change. The DfST process adaptations respond to business needs, reflecting project variables that impact its execution and the inherent tension between long-term strategic and short-term tactical aspects, theory and practice. Using an inductive approach, is possible to reflect on the phases of a transition project, challenging and redefining them.

A first insight concerns an initial, often overlooked phase: the establishment of collaboration. Whether triggered by external (research/design institutions) or internal (from companies themselves) business actors, through personal networks or targeted outreach, this unstructured step significantly shapes the project's trajectory. Indeed, at this stage, timeframes are negotiated, a company "champion" is identified and engaged, and the needs and challenges are defined. These early interactions often serve as a starting point, revealing – or catalysing – broader opportunities for system innovation. In the first case study, this phase was characterised by the definition of the topic for a doctoral scholarship, initially focused on tactical aspects (materials), then broadened to strategies and systems. In contrast, in the second case, the partnership emerged as a bottom-up request, leading to smoother negotiation of topics, timelines, and involvement.

Once collaboration is formalised, the process typically begins with a context analysis. This phase combines quanti-qualitative methods to understand the company's strategic objectives, organisational and value-chain structure, organisational and market dynamics, product portfolio, and the sector-specific challenges. In addition, the analysis is necessary to map the system, its current actions, and (later) create effective and meaningful solutions. At the same time, relational dynamics come into play, fostering empathy with participants, facilitating the development of the project and exchanging information and ideas. The case studies show that research activities could be both field and desk, and are ethnographic, strategic and environmental, using typical Strategic and Systemic Design tools or methods. These activities may occur individually, asynchronously, or collaboratively, depending on various factors.

The next phase focuses on envisioning sustainable futures. Through sustainable future scenarios shared between internal and external stakeholders, it will be possible to better understand the vision and goals of the company and its system (Gaziulusoy et al., 2008; Irwin,

2018). Visioning provides the basis for backcasting, which connects future aspirations to concrete actions, identifies systemic interdependencies, and highlights organisational changes (e.g. cultural shifts, integration of skills, new assets) required to realise the new offering. This phase can also include and focus on the company's aim (e.g., finding new sustainable materials), facilitating dialogue with stakeholders, and making more theoretical and abstract activities perceived as more concrete (e.g., showing how to achieve ambitious and distant goals). Visioning is a central theme in DfST, but depending on the methods adopted, it can be combined with Strategic Design or other techniques.

The third phase operationalizes the insights by developing one or more solutions, thereby transforming strategic long-term objectives into concrete, short-term outcomes. Indeed, the results of the previous activities (research and vision) converge in the co-construction of a project brief, guiding collaborative development among system stakeholders. Here, it is possible to create meaningful concepts through the facilitator and the results of the previous phases. The goal is to realise something concrete and tangible, a boundary object - whether products, services, PSS, events, spaces, or other artefacts - that embodies previous efforts and facilitates stakeholders in visualising and eventually redefining the vision. Furthermore, at this stage, established approaches linked to tangible outcomes, such as eco-design, Cradle-to-Cradle or S.PSS come into play, supporting the materialisation.

In the fourth phase, the solutions are compared with the value chain and the socio-technical system. Solutions are tested against systemic interdependencies to identify discontinuities or undesirable negative impacts. This phase enables an extended dialogue, highlighting the connections that underlie the solutions and opening up new horizons, thereby challenging what was previously developed. Consequently, approaches such as Strategic and Systemic Design are particularly useful at this stage. This phase is necessary in transition projects with companies because, unlike other cases from the literature, the presence of external stakeholders in the previous phases is not guaranteed.

Finally, as envisaged by Irwin (2018), the process pauses to assess the integration and implementation of the solutions and objectives initially set. This allows the company to experiment and develop the conceptualised solutions independently, checking the technical feasibility or the possibility of new partnerships. However, it must be emphasised that implementing solutions may take time and may not be the only sign of change. Integrating tools and methods or new competencies may also indicate a business ecosystem transformation. For this reason, the assessment of the impact of the transition project depends on its objectives and observes short-term results like project outcomes, organisational outcomes and systemic impacts (e.g., the commercialisation of a product/service, the development of new design strategies, partnerships, or practices).

This highlights a contradiction dictated by the timing of system innovations compared to projects involving corporate and academic stakeholders. While the former can take decades, the latter are often linked to shorter-term funding. Therefore, it becomes challenging within the limits of a design-led transition project to assess the long-term success of a design disruption, which instead can grasp weak signals in the short to medium term. Future research could address this paradox by identifying how to design and capture these signals of long-term change.

Although the steps of the process described above align with the literature, analysis of the two case studies reveals that each phase has a different importance and depth because of the

company ecosystem's needs (Figure 2). Indeed, the transition projects highlight how the four phases outlined and echoed in the DfST theory need to be interpreted as flexible stages to be contextualised, providing companies with the objectives necessary to innovate their goals in line with the socio-technical system. Ideally, these could be considered iterative, drawing on the results of phase 5 to redefine the backcasting steps and continue with the change. However, this process clashes with the contradiction mentioned earlier in the collaboration between academia and businesses. Moreover, it should be emphasised that the objectives of the phases dictate the design approaches and tools, which can be hacked and integrated by the designer-facilitator.

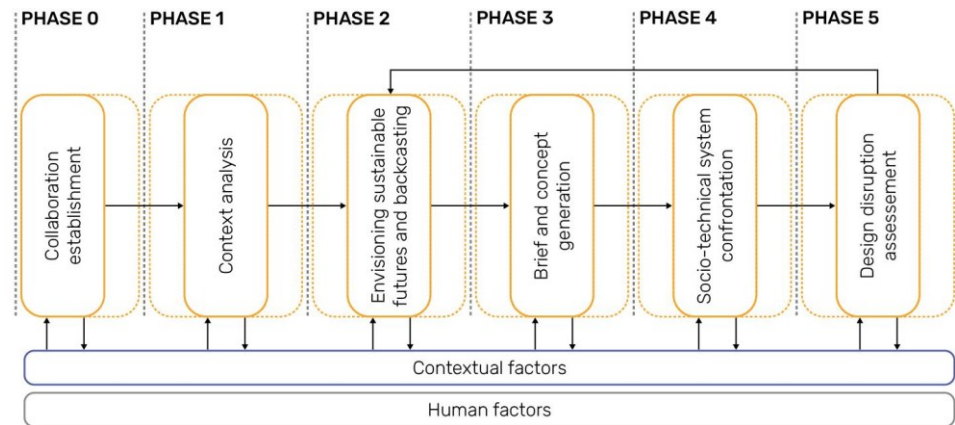


Figure 2: Transition process in organisations through DfST.

## 4.2. Factors influencing the design and development of a transition project

As indicated above, the DfST process in organisations must be contextualised and may vary due to recurring factors. These factors can be interpreted as variables influencing a project's development, orientation, and effectiveness. They operate at multiple levels: systemic or strategic (defining the overall structure), operational (guiding implementation), and relational (shaping social dynamics). This occurs across the different stages of a transition, where they influence strategic choices, operational processes, and project outcomes.

Through the cases, two macro-typologies of factors emerge: contextual and human.

- **Contextual factors** refer to the circumstances in which the project unfolds. They include the organisational profile and its readiness, the project (and company) objectives, the system boundaries, the stakeholders involved, and the timeframe. These elements influence the scope and orientation of the process. Table 1 summarises the contextual factors for each case study.
- **Human factors** relate to the interests, skills, and values of the actors involved. In company-based transition projects, three main actor groups can be distinguished: 1) designers/facilitators, 2) internal stakeholders (e.g. company employees), and 3) external stakeholders (e.g. actors within the value chain or system boundaries). Relevant human factors include interpersonal skills, system influence, ability to select and guide methodologies and tools, knowledge transfer and creation, engagement,

positioning, design knowledge and reliability. A detailed definition of these factors is provided in Table 2 (Appendix).

Both categories may influence either the project as a whole or specific phases. Contextual factors, for instance, may determine the priorities and implementation methods, thereby shaping the research methodologies and tools adopted. Human factors, on the other hand, can impact the effectiveness of the steps and the project, while also providing criteria for identifying participants across phases. For instance, the first case study had a longer overall duration with a short context analysis because of the researcher's opportunity to "live" the company, but expanded the second and third phases because of the transition project's aim (material selection). Conversely, the second case study was shorter overall, yet dedicated more time to phases 0 and 1, given the limited timing. However it had fewer workshops in the fourth phase, thanks to stakeholder engagement during the first phases. These variables led to different tools, greater or lesser depth in some phases rather than others, and the integration or exclusion of research/co-design actions.

The list of factors is not intended to be exhaustive, but highlights those most impactful in design-led business transitions, whose relevance may vary across projects and contexts, and may evolve further as the projects unfold, requiring continuous monitoring and iterative negotiation.

**Table 1: Summary of the contextual factors within the two case studies**

| Contextual factor                                                                                                                                                        | Case study 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Case study 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Organization profile:</b> The organization's type, size, internal expertise, culture, and knowledge base.                                                             | <ul style="list-style-type: none"> <li>• Manufacturing company</li> <li>• Medium-large company</li> <li>• Packaging Design, Supply Chain Design and Management</li> <li>• Culture based on productivity and efficiency</li> <li>• Basic Design and Sustainability Knowledge (mainly looked by the projects)</li> </ul>                                                                                                                                                                                                                                 | <ul style="list-style-type: none"> <li>• Service company</li> <li>• Micro enterprise</li> <li>• software development, B2B technological provider</li> <li>• Company's culture based on quality above quantity</li> <li>• None or basic Design and Sustainability Knowledge</li> </ul>                                                                                                                                                                                                                     |
| <b>Project eco-system boundaries:</b> The size and limits of the organisation's ecosystem under consideration (e.g. supply chain, value chain, or territorial ecosystem) | <ul style="list-style-type: none"> <li>• Supply chain and company (extended to Value Chain through the researcher network)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                  | <ul style="list-style-type: none"> <li>• Company and Value Chain</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Timing of the process:</b> Time availability offered by the stakeholders involved in the process                                                                      | <ul style="list-style-type: none"> <li>• Process overall timing 3 years (PhD thesis)</li> <li>• 4 months: company analysis involving employee</li> <li>• 4 workshops across 8 months (2 to 3 hours for each workshop)</li> <li>• 2 months final system analysis (after 4 months of stop)</li> </ul>                                                                                                                                                                                                                                                    | <ul style="list-style-type: none"> <li>• Process overall timing 1 year (MSc thesis)</li> <li>• 2 months company analysis involving employee</li> <li>• 4 workshops across 4 months (2 to 3 hours for each workshop)</li> </ul>                                                                                                                                                                                                                                                                            |
| <b>Project objectives:</b> Change and output to be achieved at the end of the transition process                                                                         | <ul style="list-style-type: none"> <li>• Promote sustainability in the corporate culture</li> <li>• Find new sustainable materials for packaging</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                            | <ul style="list-style-type: none"> <li>• Promote sustainability in the corporate culture</li> <li>• Find new business opportunities in the evolving market landscape</li> <li>• Strategic reorganization of the company (corporate identity, value chain optimization, market positioning, and partner network)</li> </ul>                                                                                                                                                                                |
| <b>Stakeholders involved:</b> Actors involved during the different stages of the transition process                                                                      | <p><b>DESIGNER/FACILITATOR</b></p> <ul style="list-style-type: none"> <li>• PhD Candidate (University expert)</li> </ul> <p><b>INTERNAL STAKEHOLDER</b></p> <ul style="list-style-type: none"> <li>• Technical Department (3 people)</li> <li>• Strategic Buyer &amp; Supply chain management (1 person)</li> <li>• Sales &amp; Marketing (4 people)</li> <li>• Other department (3 people)</li> </ul> <p><b>EXTERNAL STAKEHOLDER</b></p> <ul style="list-style-type: none"> <li>• Material, sustainability and design expert from academia</li> </ul> | <p><b>DESIGNER/FACILITATOR</b></p> <ul style="list-style-type: none"> <li>• MSc Student (University expert)</li> </ul> <p><b>INTERNAL STAKEHOLDER</b></p> <ul style="list-style-type: none"> <li>• CEO</li> <li>• CFO</li> <li>• Software developers (2 people)</li> </ul> <ul style="list-style-type: none"> <li>• Final customer (employee from a client organization)</li> <li>• Experts in Strategic Design and future thinking</li> <li>• Sustainability and design experts from academia</li> </ul> |

## 5. CONCLUSIONS

Adopting a field perspective, this article bridges theory and practice in DfST. The analysis of two case studies highlights two macro-categories of contextual and human factors that shape transition projects' development, orientation, and effectiveness. The factors provide practitioners with a checklist of variables to consider when designing a transition project. The case studies also shed light on the stages of transition processes within companies, confirming insights from the literature while identifying an often-overlooked initial phase in which the terms of collaboration are defined. The reinterpreted process provides a valuable heuristic that adapts theoretical models to practical organisational realities. Overall, the findings illustrate how theoretical frameworks can be adapted, interpreted, and contextualised in practice, highlighting the similarities between Strategic Design and DfST, and leveraging experience in the former to bridge high-level and concrete aspects in the transition project.

Despite these contributions, the study presents some limitations. The interpretative process remains partly subjective, shaped by the active role of the researchers. Although the two researchers conducted cross-referenced analyses to reduce bias and broaden perspectives, confidentiality constraints and the volume of data prevented the application of protocols that enable multiple independent interpretations. Future research and case studies should involve external researchers, allowing for the sharing and validation of results. Moreover, the study draws on limited case studies within a single national context (Italy); therefore the findings are context-dependent, limiting the transferability to other industries, cultural contexts, or organisation types. Future research should expand the scope by examining additional cases from different sectors (e.g., agriculture, finance, public utilities) and geographical locations to test, refine and validate the results obtained.

Furthermore, the case studies suffer from a lack of long-term analysis, since they design transitions over 10 to 15 years but only observe the first 2 to 3 years because of funding reasons. Although comparisons were made in each case study (through interviews and document analysis) before and after the interventions, according to the process, future research could include interactions that assess the medium- to long-term impact, 5 or 10 years later. Finally, the contextual and human factors that emerged from this research deserve further investigation by transition projects that take them into account from the beginning, analysing how they interact with each other, with the process, and evolve.

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## APPENDIX

Table 2: List and definitions of Human factors

| Human factor                              | Definition                                                                                                                                                  |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Interpersonal capabilities                | Capability to communicate, and bridge to other stakeholders                                                                                                 |
| Do not influence system actors            | Capability to step back and assume an impartial, overarching role that respects and empowers others' perspectives without imposing one's own worldview      |
| Methods & tools selection and development | Capability to develop tools aligned with organizational needs                                                                                               |
| Capacity building & knowledge transfer    | Capability to design and implement a path that integrates competencies and fosters knowledge transfer within a co-creation network of diverse stakeholders. |
| Engagement capabilities                   | Capability to actively involve participants by creating a process that is dynamic, interactive, and engaging.                                               |
| Positioning                               | Principles, beliefs, and attitudes towards sustainability and transition                                                                                    |
| Design knowledge                          | Actors' understanding of design processes, which shapes the structure and complexity of the proposed tools.                                                 |