Design, Design Thinking and Innovation:

The Electrolux Professional Practices Assessment

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Industrail PhD in Electrolux Professional
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The Electrolux Professional Practices Assessment

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Abstract

Keywords: Design; Design Thinking; Innovation; Management; Assessment; Electrolux Professional

The design thinking label assumed a plurality of minings since its first adoption in the design discipline and its subsequent developments in the management realm. Over its long journey, its different interpretations polarised the academic and practitioner audience eliciting appreciation and critiques. Today, the term coexists in different meanings. Still, both parties seem to agree on the positive impact of design thinking practices on organisations. Electrolux Professional is not an exception. Since the first adoption of the concept, the design department started to expand its influence, arriving to play a strategic role in the organisation's innovation dynamics. The literature suggests a correlation between design thinking practices and innovation, but what are their real implications and impacts on the company's innovation infrastructure?

This research exploited the Electrolux Professional collaboration to investigate the design thinking practices in context. Firstly, it proposes a historical transdisciplinary interpretation of design thinking. Secondly, it focuses on the Electrolux Professional case, inquiring about its innovation ecosystem, the design department and the implication design thinking had. Thirdly, it describes the development of a multi-level framework and a correlated tool to explore the practices and perceived impacts. Finally, the framework was used to assess the design thinking practices in Electrolux Professional and develop three models summarising the primary characteristics of the design thinking practices. The last part aims to evaluate the design thinking impact on Electrolux Professional's innovation system. Still, it is not concluded yet. The strategy is defined, and the monitoring system is being implemented, but data have not been collected yet.

On the academic side, this study strived to reconnect design thinking with the design discipline, giving the designers and managers new evidence of its impact on innovation. On the practice side, the framework and the evaluation strategy aim to offer practitioners valuable tools to manage and leverage design and design thinking in the organisational innovation discussion.

Acknowledgements

What an exhausting three years. This PhD has impacted my life in ways that go beyond research and what I expected before. Pushing me to the brink of emotion, anxiety, and uncertainty gave me priceless lessons about work and life. Now that I am at the end of this path, it is time to stop for a few moments and thank all the people who support me in this journey.

I would like to start by thanking Laura Badalucco, my thesis supervisor, for allowing me to explore any path I choose. I could not think of any other supervisor who gave me the freedom she did for my thesis and me. As a result, I could discover what interests me and create a thesis that both pleased my academic curiosity and helped further my profession. She gave me the laidback direction I required to grow in my independence and self-assurance, and I am grateful that he never questioned my competence when I felt insecure.

Second, I want to thank Michele Cadamuro and Davide Benvenuti, my associate supervisors in Electrolux Professional, for helping me through academic and personal ups and downs. Their unwavering faith in me from the very beginning helped dispel doubt. He also provided encouragement and practical help in the endless hours spent discussing design, design thinking, innovation and all the other aspects of work life.

Without my friends, with whom I have laughed, eaten, and studied for days and nights, the PhD would be incredibly lonely. Similarly, all my colleagues in Electrolux Professional, friends with whom I spent hours talking, working and hiking ups and down the dolomites. I always had a friend to turn to for immediate support, inspiration, and assistance whenever I needed it, regardless of the time of day or night.

To my mother and father lastly. Their unwavering and limitless belief in me throughout my life and PhD, as well as their unending encouragement, gave me the fortitude to become where I am today. This thesis is dedicated to my family.

Foreword

It is my great pleasure to write the foreword for this book, “Design, Design Thinking and Innovation: The Electrolux Professional Practices Assessment”, by my dear friend and colleague, Marco Limani. I have had the privilege of knowing Marco for several years now and have been impressed by his dedication and willingness to grow expertise in the field of design and innovation, particularly as it relates to the design thinking practices at Electrolux Professional.

I am the design & innovation director at Electrolux Professional and have worked in this field for over 20 years. As a leader, I have always strived to move design roles toward new frontiers and opportunities to support the business’s better growth. Innovation was one of the latest and more arduous ones we faced, and design thinking practices have been one of the most strategic actions we adopted to reach this new role. I first met Marco in 2018 when he was selected for an internship to support the creation of a new competence focused on innovation. After the internship, in order to continue the project with Marco and the University, we decided to finance and support a PhD scholarship with Iuav University on Innovation and Design Thinking.

We quickly established a professional and personal relationship, and I have had the pleasure of working with him on many projects over the past four years. During this time, I have seen firsthand the dedication and expertise that Marco brings to his work in design and innovation, specifically as it relates to design thinking practices. Marco’s work at Electrolux Professional has been instrumental in helping the company to improve the innovation team practices by applying design thinking principles. His research activities have led to significant company improvements, supporting the overall design departmental credibility on innovation.

This thesis is a theoretical and practical guide leading readers to the interconnection between design, design thinking and innovation, using the Electrolux Professional experience as a case on how to grow an organisational design competence on innovation. Marco’s extensive experience and research in the field make him uniquely qualified to write about this topic. He has a wealth of knowledge and experience, having worked on the topic since its first attempts to push the design on innovation and been involved in virtually all real-world situations over the process that brought the design to become the design and innovation department. This practical experience gives his work value behind the pure theory. I have had the pleasure of being involved in the research for this book and have been impressed by the level of detail and practicality it offers.

During the PhD, we had frequent and regular reviews with the team; we conducted design thinking practices assessment, sorting the mechanisms and impact of different internal activities and creating relatively practical cards to be used as a guide before and after a design thinking process. It has been a strenuous but worthwhile activity that allows reflection among the team and triggers good suggestions for our daily practice and the thesis.

In conclusion, I highly recommend this book to anyone looking to understand the design thinking and innovation practices at Electrolux Professional or those looking to apply design thinking for leveraging design in innovation in their organisation. It is a valuable resource written by a highly qualified and experienced author who helped Electrolux Professional grow its innovation ecosystem and internal processes. It will significantly benefit readers, just as it has been for Electrolux Professional and me.

Michele Cadamuro

Electrolux Professional Design & Innovation Director
Company Scientific Advisor

Introduction

Before starting the dissertation, it is essential to introduce the premise of the thesis to understand and frame the situation entirely.

Research Context

This PhD was born from the cooperation between three main actors: the “Università Iuav di Venezia”, “Electrolux Professional”, and the thesis’ author, whom, from now on, we will call “researcher”. The collaboration started in February 2018 when the researcher was selected for an internship at Electrolux Professional while studying at Iuav University to complete his master’s degree. During the trainee, the researcher supported a new function inside the design department focused on promoting design as an innovation actor in the organisation using design thinking practices. After almost one and a half years of collaboration, the organisation decides to finance a PhD scholarship at the Iuav university to study and delve into the design thinking topic. The scholarship sponsored an industrial PhD: a training course that involves the student in academic and working activities to develop a research project that finds direct application in the organisation. The researcher won the scholarship and, in October 2019, started the PhD thesis with the working title: “Design Thinking and Return on Investment (ROI).”

Acknowledging the dual nature of this thesis is paramount to understanding the research’s limitations and advantages. The industrial nature of the PhD and the covid global sanitary situation profoundly influenced the research. Firstly, the strict relationship between the research context and the researcher’s work inevitably influenced each other. Despite the effort to reduce biases, the Electrolux Professional work influenced the researcher’s perspective. Contrarily, the design department’s work adapted to the feedback elicited by the research. Acknowledging this aspect of the industrial PhD nature is crucial to look at the findings appropriately. Secondly, the sanitary situation from February 2020 to June 2022 reduced the time in the office from eight to hundred per cent, forcing the researcher to be creative, changing and adapting its methods and planned activity to the new situation. Finally, the double role of academic researcher and design practitioner sometimes hindered the thesis’s smooth development. The growing responsibility of the researcher in the organisation alternately blocked the research work for months, which, especially at the end of the third year, became complicated.

However, this relationship did not have only downsides. On the bright side, the practice prophetically strengthened the research. Although some operational activities did not directly affect the thesis, they positively shaped the researcher's global understanding of design thinking and innovative organisational dynamics. Moreover, the five years of practice in the organisation was a unique opportunity to learn a job and accumulate thousands of hours of precious experience. Finally, seeing the direct impact of their work on a complex system such as an organisation is priceless.

Keywords Definition

Managing the differences between the academic and practitioners world has been a complex part of the thesis. Especially the jargon utilised and the metal frame are distant and reconciling them in the thesis work is not a walk in the park.

The academic approach is based on clear-cut definitions and technical labels. On the contrary, practitioner jargon is vaguer and inconsistent, full of obscure acronyms. Sometimes, the clarity might be compromised when translating the practitioner's vocabulary into an academic one. Therefore, despite the effort, sometimes the glossary definition is not perfectly stated, and some ambiguity could emerge. Moreover, the English language used did not always help. Sometimes Italian bicker with English, and some complex concepts could seem odd. In the following lines, three of the most crucial keywords of the thesis are briefly discussed to prevent some possible incomprehension.

First, "design thinking". It is a label that goes beyond its literal meaning. Without trivialising it, it is impossible to state a unique definition for this keyword. Indeed, its interpretation is the objective of the first chapter of this thesis. Still, generically speaking, we can state that design thinking is a label assigned to a vast phenomenon that assumes different meanings in different times and contexts. Thus, it is always essential to understand the diffuse meaning adopted in a shared social context to avoid misunderstanding.

Second, "innovation". This keyword has a more precise definition. In this thesis, innovation is any invention in use that reaches the market. Thus, two elements make a solution an innovation: its degree of novelty and market success. Still, in Electrolux Professional, this term is not always used in this sense. In the organisation, innovation is an overused word that is lightly used to indicate any idea, project, or feature with a certain degree of potential innovation. The thesis tried to respect the main differences between “innovation” and “potential innovation”. Still, sometimes these contradictions have been complex to avoid.

Finally, “design”. Defining design is not up to this thesis. As for design thinking, its plurality of meanings makes it complex to frame. However, for this thesis, it is helpful to acknowledge the similarities and differences between design and design thinking. In Electrolux Professional, the two topics partially overlap, but they are not the same, especially at the beginning of the adoption of the term. In Electrolux Professional, design thinking is a methodology that surrounds a set of practices employed by designers and non-designer to support and foster innovation in the organisation. For instance, participatory workshops and user research are probably the most well-known activities associated with design thinking. Still, over time, a growing awareness enlarged the design team’s meaning broadening its conceptualisation to entire practices. From this perspective, there are a few differences between design and design thinking. Even if there are no clear-cut boundaries, we can say that design thinking practices resemble the main characteristics of the design ones. Still, the design does not necessarily do the same with design thinking.

The definitions of the keywords are essential to state the meaning of a concept. However, they quickly change over time for personal usefulness or convenience. In Electrolux Professional, the words design, design thinking and innovation usually mingled. What is important is not necessarily the label but the concept, the knowledge and the credibility generated by the actions and facts the label leverage.

Research Contributions

Finally, before starting with the dissertation, hear a short introduction of the thesis’s contents and contributions. The essay is divided into four chapters.

The first chapter discusses the meanings the design thinking label assumed over different times and contexts. It narrates the primary facts and implications of design thinking, historically reconstructing the events identified by analysing the design thinking literature in the design and management disciplines. This chapter gives an updated and extensive overview of what design thinking was and is in its different meanings. In the second chapter, the dissertation focusses on Electrolux Professional context. Firstly, the innovation ecosystem analysis from a historical and technical perspective explored the company's innovation ambition, supporting the development of an innovation strategy. Secondly, the design department's history reconstruction pinpointed the influence of design thinking on the design and the organisation. Finally, an in-depth analysis of the adoption, legitimisation and shortcomings of design thinking identified its meaning for Electrolux Professional. In the third chapter, the thesis focused on the assessment topic. Still, the lack of a proper reference structure for the evaluation prompted the researcher to develop a framework to explore the contextual characteristics of design thinking. To facilitate it, the researcher designed a tool that investigates the practitioners' practices and perceived impacts. Finally, the fourth chapter analyses the Electrolux Professional mapping the design thinking practices through the framework lens. Three models were defined and discussed through three exemplificative case studies that summarise the characteristical elements of design thinking in Electrolux Professional. Finally, the models and the innovation strategy were exploited to define an evaluation system aimed at assessing the design thinking impact on innovation. The monitoring system has already been designed. Still, no data has been collected yet.

From the very beginning, this thesis aimed to assess the impact of design thinking on Electrolux Professional. However, in the evaluative attempts, the researcher was confronted with several obstacles that addressed the research toward a growing number of propaedeutic subjects. Pursuing those answers, the thesis becomes more focused on exploring the intercorrelation between design, design thinking and innovation than purely concentrating on evaluation. Still, the assessment process gained traction just before the end, and a first evaluation system is under implementation. From the original focus on the ROI, the journey was long and is not yet finished. Still, the contributions along the way are plenty, while we are confidently waiting for the first results of the design thinking evaluation.

1. Design Thinking Phenomenon

This chapter discusses the development of the design thinking phenomenon between the design and management disciplines. The literature review analysis shows that the label assumed different meanings in different contexts and times. Design thinking was born in the design discipline as a field of research that studies design attitudes. Then it moves toward the management discipline, becoming a practice capable of influencing the whole organisation. This chapter examines this evolution in detail to define the research standpoint on design thinking.

1.1 Methodology

This paragraph resumes the methodology adopted to review the design thinking literature. The process followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher, Liberati, Tetzlaff, & Altman, 2009) to analyse the literature and run a meta-analysis study. Firstly, a preliminary assessment of the current literature reviews has been conducted to explore the existing knowledge about design thinking (Figure 1.1). However, the partially unsatisfying results prompted the researcher to deepen the inquiry. Thus secondly, the researcher ran a systematic literature review, combining as input the reference analysis of the four literature reviews included from the previous analysis (372 contents) with an additional time-constrained database search (586 contents). At the end of the process, 452 items were analysed for eligibility and 136 were included for the qualitative synthesis (Figure 1.2).

Review of the Literature Reviews

The systematic literature review process started by collecting existing literature reviews on the topic to understand the current knowledge about design thinking and the main events that characterised the phenomenon.

The researcher identified[1] 105 records[2] that were screened[3], removing duplicates, excluding unfitting elements and discarding unavailable full-text journals.[4] This process narrowed the items selected to 10 records (Table 1.1). Then, each article was assessed for eligibility[5], collecting

1 The researcher used academic electronic databases and informal methods to identify the design and management literature. The academic database selected were: IEEE Xplore, Sage, ScienceDirect, Springer, Taylor & Francis and Wiley, together with an informal method as Google scholars. After several tentative explorations, the more suited queries identified were: “design thinking” paired with “literature” or “review”, searched in the title and the abstract, with no other specific filters applied to the search.

2 The researcher identified 101 records through database searching and 4 through Google Scholar.

3 Only one researcher runs the items screening of the abstracts.

4 Firstly, the researcher removed the duplicate records. Secondly, he eliminated the contents unsuitable for the research scope by reading the abstract and looking at the methodology to assess the work quality. Thirdly he discarded the items that he could not collect the full text.

5 The reviews were clustered by arguments, creating a synthetic categorisation. The researcher identified three papers (Micheli, Wilner, Bhatti, Mura, & Beverland, 2019; Razzouk & Shute, 2012; Schweitzer, Groeger, & Sobel, 2016) underlined the phenomenon’s characteristics, looking at the literature for the specific design thinking attitudes. Three records (Park

and analysing the selected items into a database. After this analysis, only four papers focused on the historical reconstruction of design thinking were included in the qualitative synthesis[6]. Indeed, only those records addressed the review's goal: understand the design thinking phenomenon. While the other two groups did not critically argue the design thinking developments, focusing mainly on an analytical and detached screening of processes and characteristics.

Finally, the four studies included in the qualitative synthesis were analysed[7] again. Still, the articles struggled to create a clear picture of the phenomenon. Only Johansson-Sköldberg, Woodilla, and Çetinkaya (2013) considered and argued a holistic perspective on design thinking. The others explicitly or implicitly considered only one side of the topic or surfaced the existing correlations shallowly. For these reasons, the researcher chose to iterate the review process to deepen the design thinking subject.

Reference Analysis and Literature Review

The review revealed divergent views about design thinking. A shared label definition did not exist: the term has a plurality of meanings depending on the context of its adoption. Only Johansson-Sköldberg, Woodilla, and Çetinkaya (2013) identified these differences. However, the paper's publishing year could not consider the more recent evolution of the design thinking landscape. For these reasons, the researcher chose to deepen more into the topic, especially considering the co-evolution of the phenomenon within the design and management disciplines.

The identification process adopted two strategies. Firstly cross analysed the references of the four papers included in the previous review work (F. Baker & Moukhliss, 2020; Johansson Sköldberg et al., 2013; Micheli et al., 2019; Russo, 2016)[8]. The references collected through reference analysis amounted to 424 records, which arrived at 372 after the

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& McKilligan, 2018; Schallmo & Williams, 2018; Waidelich, Richter, Kölmel, & Bulander, 2018) collected and compared the design thinking processes and methods. Finally, four of them (F. Baker & Moukhliss, 2020; F. W. Baker & Moukhliss, 2020; Johansson Sköldberg, Woodilla, & Çetinkaya, 2013; Micheli et al., 2019; Russo, 2016) focused on reconstructing the historical events that characterised the design thinking journey.

6 The final selection considered only one of Baker and Moukhliss's articles because they were based on the same review work.

7 The researcher read them, reported the critical considerations, synthesised the contents, and combined the findings to highlight convergent or divergent opinions.

8 The selection considered the reviews' focus, the perspective adopted, and the publish date to collect the broadest and most diverse bibliography items.

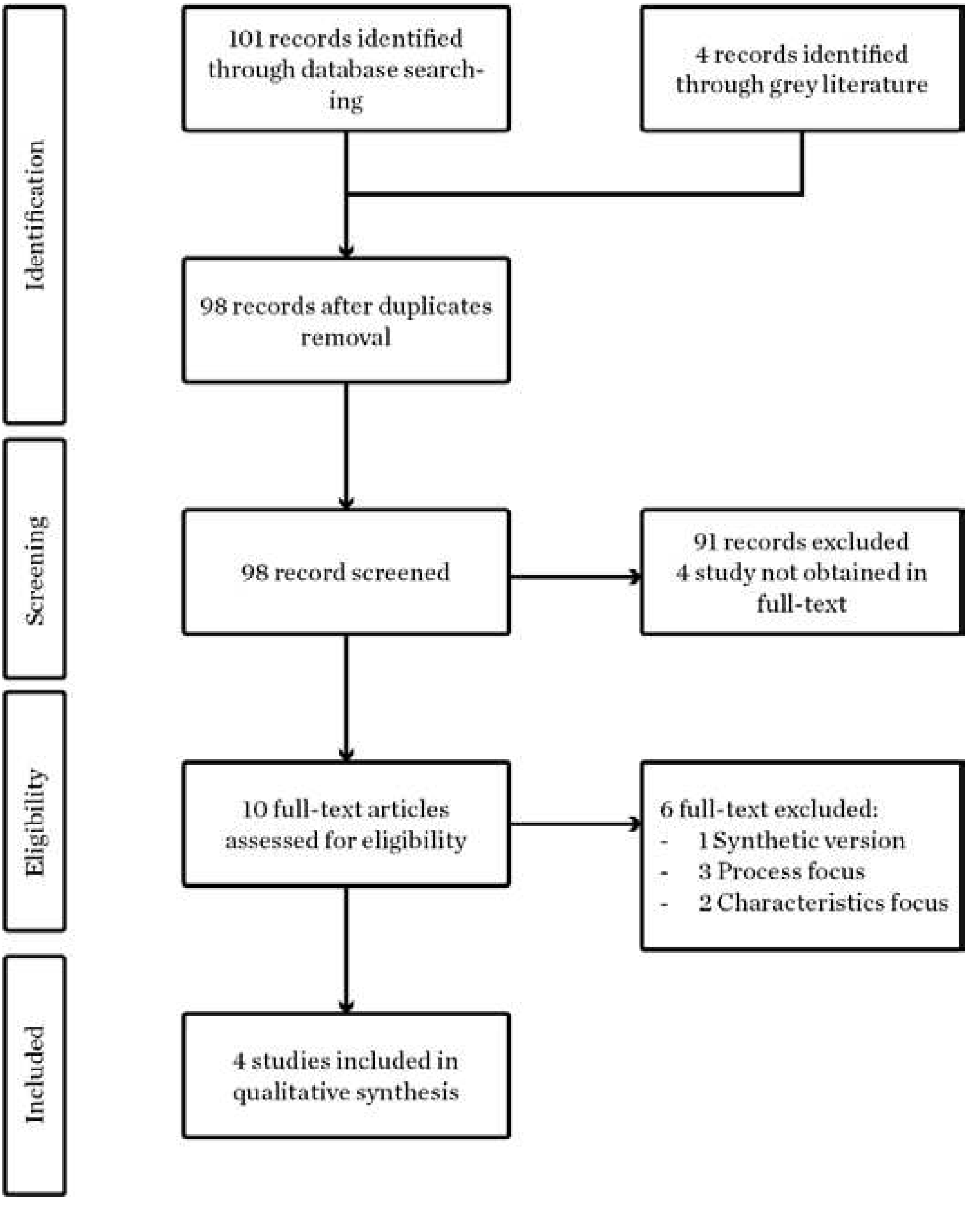

Figure 1.1 PRISMA process flowchart: review of the literature reviews.

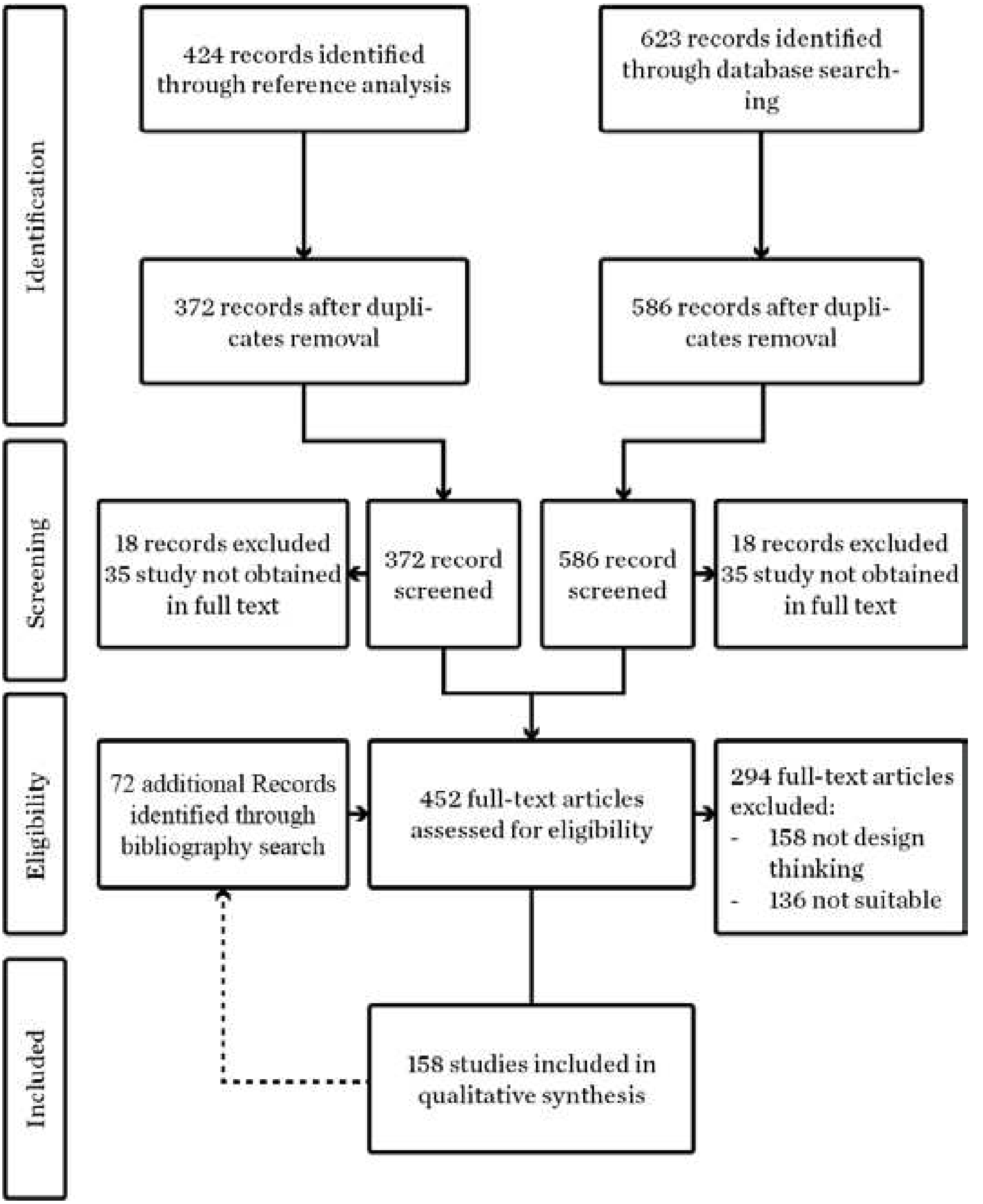

Figure 1.2 PRISMA process flowchart: reference analysis and literature review.

duplicate removal. Secondly, since the references' time laps considered were unbalanced toward the past, the researcher ran an additional database search focused on the recent literature on the topic[9]. The database search identified 623 items, which arrived at 586 after the duplicate removal. Then, in the screening process,[10] the items identified by the reference analysis and the database search narrowed the first cluster to 319 items and the second one to 61. Overall, 380 items arrived at the eligibility phase (Figure 1.3).

In the eligibility phase, the researcher chronologically assessed[11] each element, analysing the contents, pinpointing the primary contributions, and discarding the others. Still, this process highlighted some recurring missing elements that prompted the inclusion of 72 more items in the index. After this examination, the researcher excluded from the next phase 294 items, dividing them into two clusters. The first collected 158 elements that did not primarily focus on design thinking. The second resembled 136 contents that do not substantially influence the phenomenon by offering new contributions or points of view[12]. Finally, the elements considered adequate for inclusion in the meta-analysis phase were 158.

9 The researcher ran the searches on the 19-20th of June 2020. The academic database selected were: IEEE Xplore, Sage, Science Direct, Springer, Taylor & Francis and Wiley and JSTOR. The suitest query identified was: "design thinking", searched in the title and the abstract and filtered by time frame, considering the items from 2018 to 2020.

10 In the screened phase, the researcher analysed the items by reading their abstracts and excluding the elements that did not primarily embrace the design or management perspective. Firstly, the researcher included all the items in a private database. Secondly, he read the abstract and rapidly assessed the text structure, excluding the elements that did not belong to the design or management realms. Thirdly, he discarded the records with the full text unavailable.

11 In the first stage, the researcher indexed all the literature demography in a private online database. The researcher used a personal database to index the items over eight factors: the title and subtitle; the author/s; the publication information; the pages; the date; the item typology; a link to access the content; and the reference to the source. In the second stage, the researcher analysed the contributions by reading and underling the contents to judge their relevance and cluster them by topic. In the third stage, the cross-check examination of the bibliography highlighted some recurring missing elements. Indeed, several books and papers were recurrently cited, especially in the first phase of the design thinking process. Thus, they have been implemented in the literature demography.

12 The selection filter considers the historical period, context and importance of the contents on the macro-evolution of the phenomenon. This review does not aim to analyse all the possible discourses the design thinking phenomenon initiated and its consequences.

Bibliography	Category	Perspective
Razzouk, R., & Shute, V. (2012). What Is Design Thinking and Why Is It Important? Review of Educational Research, 82, 330–348.	Characteristics	Design
Johansson-Sköldberg, U., Woodilla, J., & Çetinkaya, M. (2013). Design Thinking: Past, Present and Possible Futures. Creativity and Innovation Management, 22, 121–146.	History	Design & Management
Russo, S. D. (2016). Understanding the behavior of design thinking in complex environments. Swinburne University of Technology.	History	Design
Schweitzer, J., Groeger, L., & Sobel, L. (2016). The Design Thinking Mind-set: An Assessment of What We Know and What We See in Prac-tice. Journal of Design, Business & Society, 2, 71–94.	Characteristics	Management
Park, H., & McKilligan, S. (2018). A Systematic Literature Review for Human-Computer Interaction and Design Thinking Process Integration. In A. Marcus & W. Wang (Eds.), Design, User Experience, and Usability: Theory and Practice (pp. 725–740). Cham: Springer International Pub-lishing.	Process	Design
Waidelich, L., Richter, A., Kölmel, B., & Bulander, R. (2018). Design Thinking Process Model Review. 2018 IEEE International Conference on Engineering, Technology and Innovation (ICE/ITMC), 1–9.	Process	Design
Schallmo, D., Williams, C., & Klaus. (2018, July 8). An Integrated Design Thinking Approach-Literature Review, Basic Principles and Roadmap for Design Thinking.	Process	Design
Micheli, P., Wilner, S. J. S., Bhatti, S. H., Mura, M., & Beverland, M. B. (2019). Doing Design Thinking: Conceptual Review, Synthesis, and Research Agenda. Journal of Product Innovation Management, 36, 124–148.	Characteristics	Management
Baker, F., & Moukhliss, S. (2020). Context and Implications Document for: Concretising Design Thinking: A Content Analysis of Systematic and Extended Literature Reviews on Design Thinking and Human-Centred Design. Review of Education, 8, 334–339.	History	Design
Baker, F. W., & Moukhliss, S. (2020). Concretising Design Thinking: A Content Analysis of Systematic and Extended Literature Reviews on Design Thinking and Human-Centred Design. Review of Education, 8, 305–333.	History	Design

Table 1.1 Selected literature reviews for eligibility: underlined the elements included for the meta-analysis.

Meta-Analysis & Design Map

The meta-analysis considered only the studies included for the qualitative synthesis to determine the vertical and horizontal cross-correlations between the content analysed.

In the first phase, the selected elements were indexed in a "vertical analysis" database. Each item was identified chronologically, specifying: the title, subtitle, authors' name, publication media, publication date, and typology[13] and belonging realm[14]. In the second phase, the researcher analysed the literature vertically, chronologically reading and underling each paper to pinpoint critical topics and isolate some key quotes. Then, those statements were reported in another database, preparing them for horizontal analysis. In the third phase, the contents collected were analysed in a horizontal database, using the tags as a compass to organise and cluster the recurrent topics (Figure 1.4)[15].

The horizontal analysis highlighted three primary historical periods: from 1960 to 1980, when the design thinking concept was in its embryonic state in the design realm; from 1980 to 2000, when the design thinking concept developed mainly in the design discipline; from 2000 to 2020 where the design thinking concept rose and spread worldwide in the organizational context. The researcher organised the literature contents within these timespans, labelling them by topics. For each period, the data are partially recurring and partially new. In any case, we can see an evolution of the subject over the years. These similarities and differences are discussed and presented in the remaining part of the chapter.

13 The item could belong to the design or the management realm.

14 The item could be a book, a book section, a journal article or a web article.

15 The map breaches' length is proportionate to the number of papers that discusses the topic.

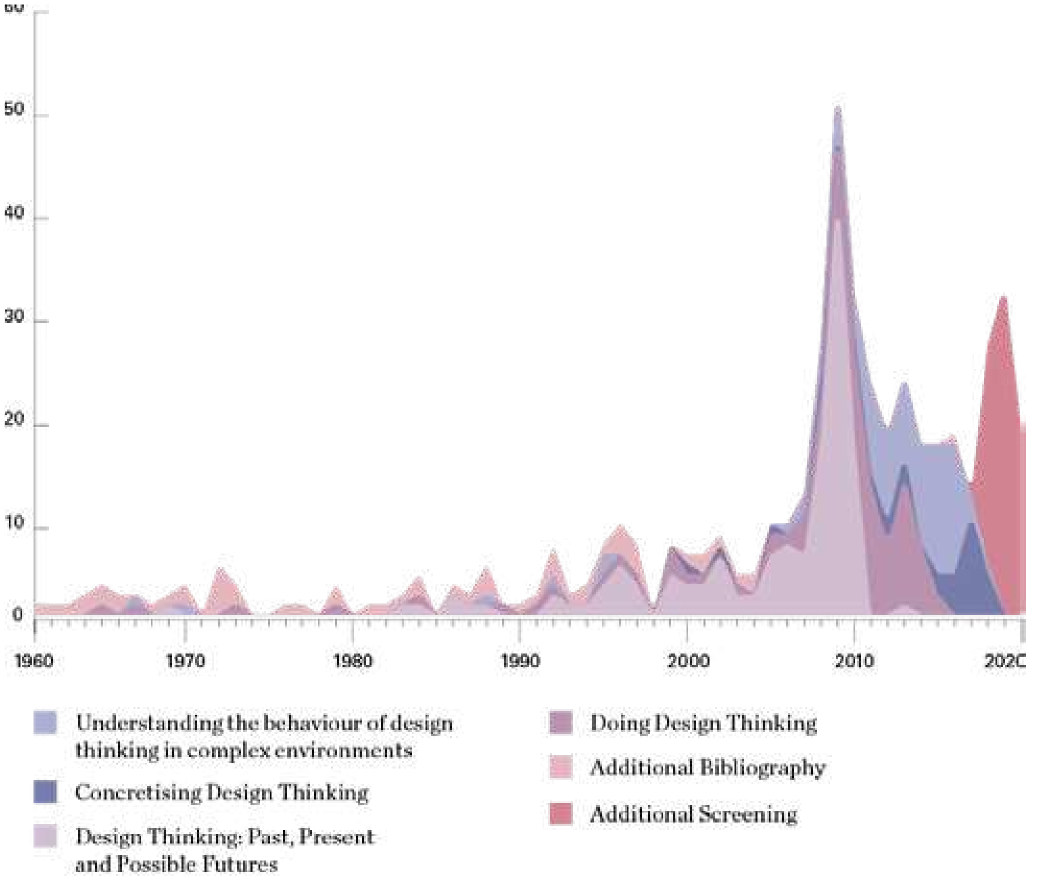

Figure 1.3 Literature demography per sources (eligibility phase): number of item identified per year.

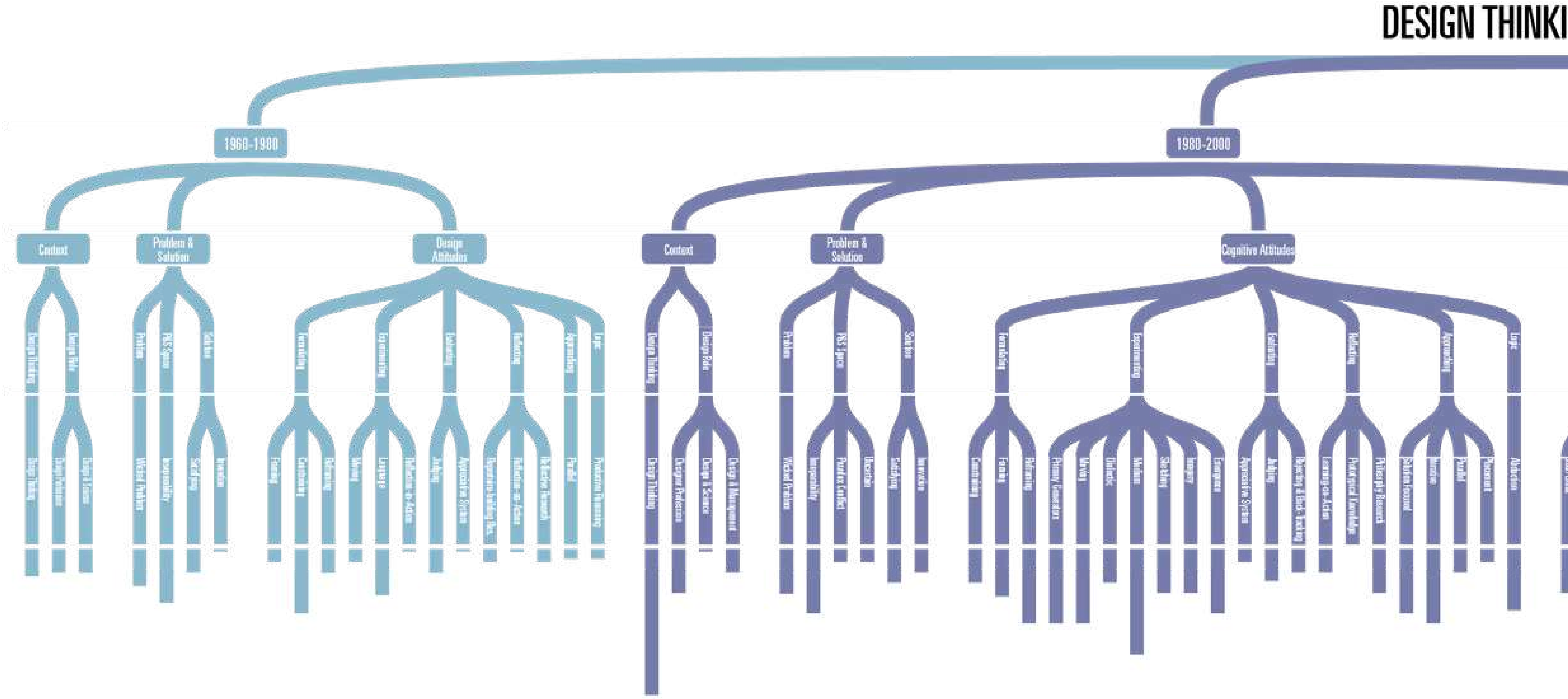

Figure 1.4 Horizontal cluster analysis topic map. Tree-view chart, topic frequency pinpointed by the bar chart length.

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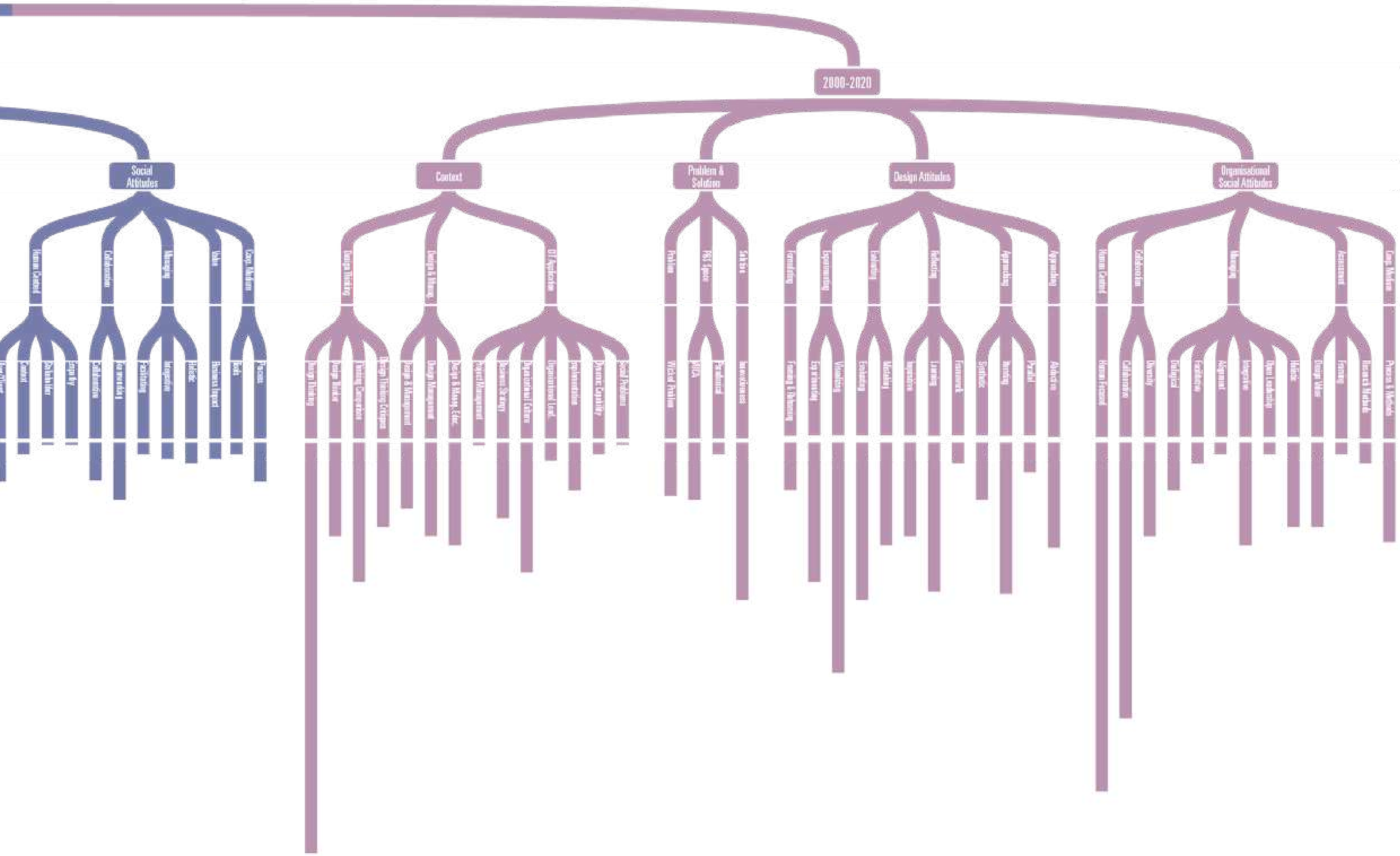

1.2 Design Thinking Perspectives

The analysis of the literature reviews proposed different interpretations of the evolution of the design thinking phenomenon. We can identify a design (F. W. Baker & Moukhliss, 2020; Russo, 2016) and managerial (Micheli et al., 2019) interpretation of the phenomenon (Figure 1.5). While the selected review mainly endorses only one of the two perspectives, only one adopts a more holistic viewpoint, acknowledging both (Johansson Sköldberg et al., 2013). This paragraph analysed the holistic, design and management perspectives to discuss the most suitable frame for the thesis's inquiry.

Holistic Perspective

In the article of Johansson Sköldberg, Woodilla, & Çetinkaya (2013), they compared the two perspectives, considering a wide variety of literature, such as academic journals, business and social media and books. The article postulated the existence of two major design thinking discourses: designerly thinking and design thinking. The "designerly way of thinking" refers to the academic works that reflect on the non-verbal competencies of the designer. "Design Thinking" refers to the discourse where design practice and competence are used beyond the design context, becoming a way of describing a designer's methods in management discourse.

Within the designerly thinking discourse, the authors identified five main sub-discourses. Herbert Simon (H. Simon, 1969) described design as an activity that creates something new, differentiating it from the sciences that deal with the existing reality. Donald Schön (1983) pictured the designer practice as a relationship between creation and reflection upon the creation that allows re-creation. Richard Buchanan (1992) presented designers' way of thinking as a process of dealing with wicked problems (Rittel & Webber, 1973). Lawson (1980) and Cross (1982) revealed what designers do during designing. Finally, Krippendorff (2005) defined designers' work as a matter of creating meaning.

Similarly, the authors identified three main sub-discourses for the design thinking side. Firstly, IDEO's practical experience cooperating with the Stanford d.school program boosted a design interest in the innovation discourse. Tim Brown (2009) labelled the concept as design thinking, providing compelling stories to help everyone use IDEO's methods to

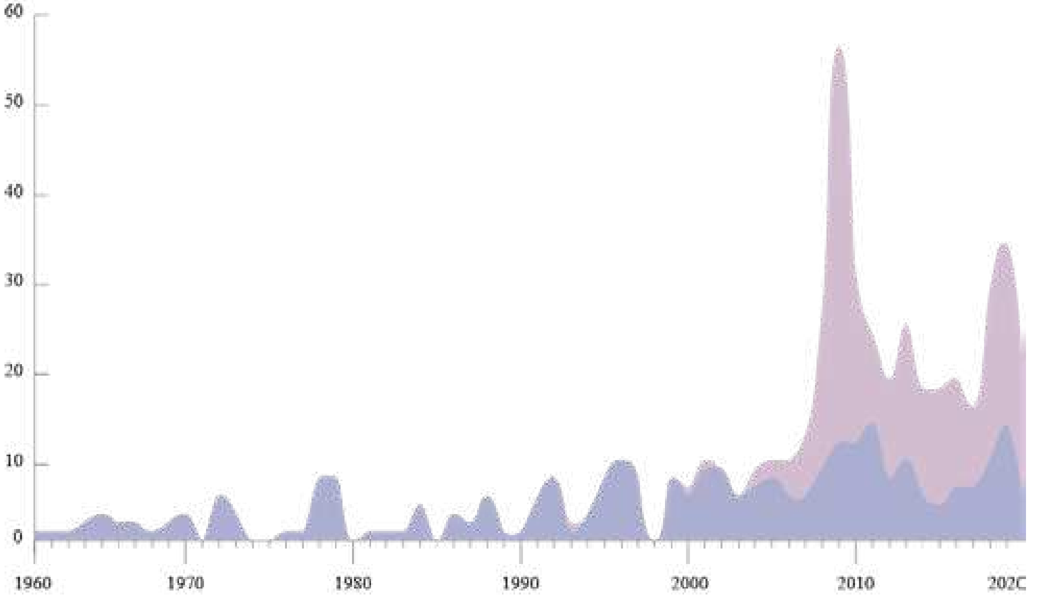

Figure 1.5 Literature demography per sources: design vs management literature.

innovate. Secondly, Martin's (2009) Design thinking discourse is an ongoing cycle of generating ideas (abduction), predicting consequences (deduction), testing, and generalizing (induction). From this perspective, design thinking became a way to approach indeterminate organizational problems, a necessary skill for managers and a component of their education. Finally, Boland and Collopy (2004) use the concept of design thinking to point towards cognitive characteristics. They developed a theory of the design attitude for managers, stating that managing is very similar to designing in more general aspects.

The article's conclusion compared the two discourses proposing some interesting considerations. They observed that both discourses referred to a design practice still far from standardisation. The "designerly" discourses are more scholarly than the "design thinking" ones. Design thinking literature has a managerial and business audience and does not have strict references and relationships with other texts[16]. Finally, the authors believe that design thinking does not have a unique meaning, and we should not look for one. Instead, we look for where and how the concept is used in different theoretical and practical situations and what meaning is given to it.

16 Therefore, it can not be taken as the foundation for further research.

Design Perspective

Two primary studies (F. W. Baker & Moukhliss, 2020; Russo, 2016) reviewed the design thinking literature from a design perspective. In both, the authors explicitly decided to consider only the design literature on the topic, acknowledging the other side but describing it briefly.

In the first chapter of the thesis, Di Russo discussed the design thinking literature, organising the storytelling focusing on the main contributors. As Johansson Sköldberg, Woodilla, & Çetinkaya, she cited Simon, Schön, Rittel and Weber, Buchanan, Lawson and Cross as some of the most prominent design thinking authors, giving a coherent interpretation of their contribution to the topic. In addition, she suggested the work of Archer as another critical author. Indeed, in the academic literature, he first used the label "design thinking" (Archer, 1965) and "designerly way of thinking" (Archer, 1979), strongly influencing the work of Cross (B. Archer, 1979a).

More recently, Baker and Moukhliss's review (2020) analysed the design and management literature, primarily considering the design perspective. The article explicitly assumed that design thinking and human-centred design concepts are similar enough to be considered synonymous. This assumption precluded other possible interpretations of the phenomenon, especially from the management side. From that standpoint, they used a google trend analysis to show how the design thinking label is much more common than the human-centred design one, in plain language. Then, they noted how design thinking triggered different discussions within different pools of literature, especially in Architecture, design, business and education. Finally, an extensive reference analysis determined the main shared works cited belonging to nine primary authors. Among the authors already mentioned, they highlighted three other relevant names: Dorst (2001), Liedtka (2015), and Lockwood (2010).

Management Perspective

In "Doing Design Thinking" (Micheli et al., 2019), the authors discussed the design thinking management perspective, approaching the review analytically. They identified a vast pool of literature from design and business journals and magazines[17] to analyse the frequency of the content in the dataset. The authors calculated the most frequent design thinking definition, process descriptions, attributes, tools and methods.

17 They considered six management and business journals/magazines and two design journals.

However, the initial collection selected considered mainly business and management sources, with a timeframe biased toward the managerial perspective.

Another interesting result was the dataset cluster analysis, which defined five scholarly perspectives on design thinking. The first emphasised interdisciplinary collaboration and the importance of work within and across functional groups. The second focuses on reclaiming design thinking as the designer's domain[18]. The third concentrates on design thinking and problem-solving resilience, highlighting the tolerance for ambiguity and failure, evincing an emphasis on organizational culture. The fourth emphasises seeing and reflecting upon the whole, pointing out the ability to visualize and a gestalt view of problems. Finally, the last cluster focuses on individual designers' thinking, discussing how to educate professional designers and design thinkers to leverage these skills.

Discussion

The four selected reviews describe design thinking in different ways. As this paragraph suggests, only one work intensely discusses the correlation between the two views. The others focused more on a single side of the story.

Di Russo adopted a design perspective explicitly and considered mainly the design authors. Baker and Moukhliss looked at design and management literature, but their initial assumption precluded any other kind of meaning interpretation. Micheli, Wilner, Bhatti, Mura, and Beverland screened a vast pool of literature, but their analysis was biased toward the management and business dataset identified at the beginning. Only Johansson Sköldberg, Woodilla, and Çetinkaya faced both perspectives, breaking this duality to get out of the realm's divergences and proposing a plurality of meanings. This view, shared by other authors (Kimbell, 2009; Mansoori & Lackéus, 2019), helped academics and practitioners better interpret the different contexts where designers and managers use the design thinking label.

This thesis adopted the Johansson Sköldberg, Woodilla, & Çetinkaya interpretation of design thinking, acknowledging the plurality of meaning the label assumed within the design and management discourses. However, their review work considered only a constrained time

18 Primarily written by no management authors, they tend to advance critical views on the conceptualization of design thinking typically expressed in management discourse.

frame (from 1960 to 2010). On the one hand, the review work date the design thinking origin in the late 50s, mainly neglecting[19] the previous European research heritage initiated by Gestalten psychology under the productive thinking label (Whertimer 1945)[20]. On the other hand, the article's publication date can not consider the last decade of literature developments.

For this reason, the researcher decided to update their work, building upon their meaning interpretation but enlarging the research to a broader scope in time. Although acknowledging the interconnection between design thinking and productive thinking, the researcher chose not to directly consider those seminal works not to dilute the focus on design thinking. Still, consistent additional literature research deepened into the latest evolutions of the phenomenon.

Thus, The literature review described in the following paragraphs aims to describe and offer a critical understanding of the main design thinking events, looking for the primary design thinking meanings within the two perspectives, especially considering the latest developments.

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19 Besides the literature mainly overlooked to refer to productive thinking research directly, some authors (March 1976, Lawson 1980, Rowe 1987) reminded this seminal work.

20 Max Wertheimer (1880–1943) was a pioneer of psychology. His book Productive Thinking, written in New York during his exile years (1933-1943), was published in 1945, and it became one of the milestones of the booming research on "creativity." At the book's centre are the concepts of insight and understanding in the human thought processes involved in creative problem-solving (Sarris, 2020). Insightful problem-solving was considered by Gestalt psychologists to be associated with productive, as opposed to re-productive, thinking. Productive thinking is characterized by shifts in perspective which allow the problem solver to consider new, sometimes transformational, approaches. Re-productive thinking, on the other hand, involves the application of familiar, routine procedures (Cunningham, MacGregor,).

1.3 Generation Game

From the design perspective, design thinking heritage is traditionally rooted back to the late 1950s to the early 1980s, in terms of what is broadly accepted today as the “generation game” (Bousbaci, 2008; Nigel Cross, 1981). Even if some seminal work on creative thinking could be dated back to the Gestalt study about productive thinking (Whertimer 1945), the topic emerged and started to be discussed in the design realm through a series of opposite movements that took turns in what their participants described as first-, second-, and third-generation design methods. At the end of this “game”, the rational problem-solving paradigm was put alongside the reflective one, opening up to the design thinking discourses.

First-Generation Design Methods

Held in London in September 1962, the Conference on Design Methods ushered in the method movements, aiming to define a design process based on objectivity and rationality. The first generation tried to shift from the designer’s romantic, intuitive, and artistic design model to a logical and rational one (Bousbaci, 2008). Their authors employed novel, scientific, and computational methods to address the complexity of the post-Second World War problems, taking inspiration from civilian developments such as operations research and management decision-making techniques (Nigel Cross, 2001b, pp. 49–50). With these tools, the movement attempted to describe the design as a rational problem-solving process (Nigel Cross, 1999a; Dorst & Dijkhuis, 1995) governed by scientific and mathematical language.

Alexander (1964) was one of the key proponents of this movement. In the first part of his book, the architect described the design culture’s paradigmatic shift: from unselfconscious practice to a self-conscious one. The first repeated the traditional building paradigms, imitating and correcting them; the second, according to specific rules, taught the form-making process academically. However, the lack of logical clarity in academic education and the rising complexity of the designers’ problems drove Alexander to suggest new analytical tools to ease and rationalise the design process. He proposed an extremist analysis-synthesis method to decompose the design problem and recompose it in a suitable solution, explaining the process ratio academically through a sequence of mathematical formulas.

Similarly, Archer (1964) suggested a similar but less severe design method. Partially derived from his design work experience, he described a systematic approach to the design practice, considering the main design phases and even the relationship with other professions. As Alexander, Archer underlined the shift from an artistic to a scientific approach and the consequent repercussions on the designers' activity:

> "In the face of this situation, there has been a worldwide shift in emphasis from the sculptural to the technological. Ways have had to be found to incorporate knowledge of ergonomics, cybernetics, marketing, and management science into design thinking." (B. Archer, 1964, p. 1).

In this sentence, which well represented the first-generation intentions, we can probably find the first use of the term design thinking to indicate the designers' way of thinking. Nevertheless, in contrast to the prescriptive method of Alexander, Archer proposed a systematic process more interested in giving suggestions than a rational appearance to the practice.

Probably the most emblematic work of that period was "the Science of Artificial", where Simon proposed to discover and teach a science of design: "a body of intellectually tough, analytic, partly formalisable, partly empirical, teachable doctrine about the design process" (Simon, 1969, p. 138). Nobel prize for economics and holistic man of science, Simon established design as a rational problem-solving process (Nigel Cross, 1999a; Dorst & Dijkhuis, 1995), highly influencing the design thinking discussion. With this new paradigm, he introduced several concepts in the design discourse, offering a coherent, rational description of the design activity. For instance, the "bounded rationality" concept describes the human incapacity to deal with the world in all its complexity (H. Simon, 1969, p. 44), defining the nature of the designer's situation. The "ill-structured problem" concept suggested the inherent indefiniteness of the designers' problems, underlining the importance of creating a representation of a proper problem space (H. Simon, 1969, pp. 105–108). The "satisficing" process described the nature of the designers' creative activity. Indeed, compared to optimising, satisficing entails that different solutions can fulfil a given problem (H. Simon, 1969, p. 119). Or the "heuristic searches" concept, namely the "rules of thumb" approaches that designers apply to find a satisficing solution given an ill-structured problem context (H.

Simon, 1969, pp. 27–28).

With his book, Simon marked the transition from a purely logical view of design to acknowledging the designers' limited cognitive capacity to face uncertainty with pure rationality. Despite this shift, the rational and positivistic paradigm is still strongly present. Still, the growing gap between this view and the emerging research evidence turned the discussion toward the second and third-generation methods, more interested in understanding the design characteristics instead of trying to shape them in rational terms.

Second- Third-Generation Design Methods

In the 1970s, the social and cultural climate[21] and the lack of success in applying the first-generation methods prompted even the movement pioneers to react to their initial propositions[22]. In this context, the second and third-generation methods emerged almost simultaneously (Bousbaci, 2008), addressing the discussion in the opposite direction.

The second-generation method emerged (Rittel, 1972), trying to get closer to the practice concerns by fostering a more participative and argumentative process[23]. Catalyser of the academic discussion was the common ground generated by a shared design problem definition. Simon (H. Simon, 1969; H. A. Simon, 1973) introduced the topic of the ill-defined problem in the design discussion opposing it to the well-defined ones, borrowing the label from cognitive science (Reitman, 1965). Still, only in 1973 Rittel and Webber unveiled the wicked nature of the design problems[24]. Their paper (Rittel & Webber, 1973) made ten assertions about the design problem's characteristic nature, stressing the design situation's inherent

21 Such as the campus revolutions, the radical political movements and the general rejection of conservative value

22 For instance, Cross (2001, p. 50) recalled Alexanders' reaction: "I've disassociated myself from the field... There is so littlein what is called "design methods" that has anything useful to say about how to design buildings that I never even read the literature anymore... I would say forget it, forget the whole thing."

23 Rittel highlighted four main characteristics of the second-generation methods. First, design methods maximise participation in the design process to activate as much knowledge as possible. Second, the argumentative structure of the design process contraposes pros and cons to different viewpoints to decide in favour or against various positions. Third, the design problem can get consistently expanded, as if the issue at hand was the symptom of a broader problem. Fourth, the process is not linear; designers can not list criteria in advance because every step into the solution raises new questions that inform new criteria.

24 They used the term wicked to highlight the design problem's malignant, vicious, tricky, and aggressive nature.

uncertainty and indeterminacy[25]. This description offered a common framework upon which a growing number of empirical studies undermine the foundation of the rational problem-solving paradigm, paving the way to the reflective one.

In the third-generation design methods, design scholars and researchers began to empirically study design, accumulating knowledge about the designers' cognitive behaviours as they occurred in the traditional ways of their practice.

Several studies (Akin, 1979; Archer, 1979; Hillier & Musgrove, 1972) openly denied design as a sequence of well-defined consequent activities (Rittel, 1984), considering the problem definition and the solution identification activities interdependent, simultaneously occurring during all the design process. Hillier and Musgrove (1972) observed a conjecture-analysis process rather than an analysis-synthesis one. In this view, conjectures occurred early in the process, while the primary purpose of the analysis was to test the assumptions' validity.

Other observations (Eastman, 1970; Levin, 1966) deny a deterministic logic in the constraints definition, observing a designer's attitude to make discretion decisions about the criteria to consider. Hillier and Musgrove defined them as internal constraints[26] (1972), the requirements designers generate and redefine (Akin, 1979; Krauss & Myer, 1973) during the design process to make the problem situation manageable. Building on these conclusions, Darke (1979) suggested the concept of primary generators, a set of discretional and adjustable criteria defined early in the process that guided the designers' conjecture-analysis process since its initial phases.

Supporting this conclusion, Lawson (1979) discovered that

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25 The ten assertions are: (1) There is no definitive formulation of a wicked problem; (2) Wicked problems have no stopping rule; (3) Solutions to wicked problems are not true-or-false, but good-or-bad; (4) There is no immediate and no ultimate test of a solution to a wicked problem; (5) Every solution to a wicked problem is a "one-shot operation"; because there is no opportunity to learn by trial-and-error, every attempt counts significantly; (6) Wicked problems do not have an enumerable (or an exhaustively describable) set of potential solutions, nor is there a well-described set of permissible operations that may be incorporated into the plan; (7) Every wicked problem is essentially unique; (8) Every wicked problem can be considered to be a symptom of another problem; (9) The existence of a discrepancy representing a wicked problem can be explained in numerous ways. The choice of explanation determines the nature of the problem's resolution; (10) The planner has no right to be wrong. (Rittel & Webber, 1973, pp. 161–167)

26 Hillier and Musgrove (1972) differentiated between external constraints, determined by the inherent essence of the problem, and internal constraints, expression of the designer's interpretation of the situation.

despite a control group that did not have any preference, fifth-year architecture students use solution-focus strategies for problem-solving, while fifth-year science students prefer problem-focus techniques[27]. On the one hand, these conclusions supported the generator-conjecture-analysis model. On the other hand, they suggested that students learn these strategies during their studies, acquiring new skills in their education path. Similarly, March (1976) reflected on the logic of design, borrowing Peirce's abductive logic concept to suggest that designers mainly use productive logic capable of creating and injecting new values in the process. While deduction predicts and induction evaluates, the designer's abductions produce something new.

Finally, other studies focused on the importance of the representation medium for problem-solving (Eastman, 1970). The essential design language is modelling, a medium comparable with but diverse from notation language. Modelling has a vocabulary and syntax that can be conveyed through different media, such as drawings, diagrams, physical representations, gestures, and algorithms (B. Archer, 1979a, 1979b).

This first wave of research shed light on the nature of the designers' practice underlining some divergences between the rational problem-solving paradigm and the practice reality. In this transitional movement, the growing awareness o the nature of design elicited a discussion about the differences between the design and science disciplines. The design thinking discourse arose in this discussion, and the label assumed its first clear meaning.

The Rise of Design Thinking and the Reflective Turn

In the 1980s, thanks to the emergence of different design journals,[28] plenty of studies and experiments started to explore the essence of the design activity, spreading and supporting the belief in a distinct designerly way of thinking. Indeed, the design thinking label slowly assumed an explicit acknowledgement in this period.

In 1979, Archer first expressed his belief in a designerly way of thinking and communicating, different from scientific and scholarly methods of inquiry (B. Archer, 1979b, pp. 1–2). The same year, Archer

27 On the contrary, first-year science and design students did not reveal specific attitudes.

28 11 Design Studies in 1979, Design Issues in 1984, Research in Engineering Design in 1989, the Journal of Engineering Design and the Journal of Design Management in 1990, Languages of Design in 1993, and the Design Journal in 1997 (Cross, 2001, p. 50)

opened the first of the three articles in Design Studies, aiming to establish design as a coherent discipline of study (B. Archer, 1979a). Last of these articles, Cross sustained Archer's view proposing a distinct designerly way of knowing (Nigel Cross, 1982). In this important article, he summarised the insights of previous research identifying the distinctive aspects that define design practices.[29] Another substantial contribution came from Lawson's book "how designers think" (Bryan Lawson, 1980), first published in 1980 and integrated over three re-editions until 2005; it tried to collect and popularise the studies that characterise the unique way the designers think and act. These outcomes supported the conviction that design practice has a solid and appropriate intellectual culture, different from the sciences and the arts (Nigel Cross, 2001b, p. 53). The rising concept of the "designerly way of thinking," Designerly way of knowing", and finally "design thinking" turned out to be a pivoting point for the emancipation of design from other cultures[30], rising in design scholars the awarness of a design distinctiveness.

This discussion arrived at its climax with Donald Schön (1983). He openly challenged the positivistic view of Simon with a constructivist one, proposing to search for an epistemology of practice implicit in the uncertain, unstable, unique, and value-conflicting practitioners' process (Cross, 2001, pp. 53–54). In the reflective practitioner (Schön, 1983), Schön analysed different practitioners facing a context base situation to understand the standard pattern of strategies they employed. As in the third-generation methods, he aimed to understand and describe their reflective practice rather than supplant them with a predetermined methodology.

Schön criticised the technical rationality perspective, which acknowledges professions as problem-solving because it denies the problem-setting activity: the process of interactively naming the things we will attend and frame[31] the context in which we will attend to them, namely the conditions necessary to exercise technical expertise (Schön, 1983, pp. 47–49). In Schön's view, the practitioner

29 He identified five distinctive aspects of designerly ways of knowing: designers tackle 'ill-defined' problems; their mode of problem-solving is solution-focused; their manner of thinking is 'constructive'; they use 'codes' that translate abstract requirements into concrete objects; they use these codes to both 'read' and 'write' in 'object languages' (Cross, 1982, p. 226).

30 The design discipline realised that design practice has a solid and appropriate intellectual culture. It does not need to swamp design research with other cultures imported from the sciences or the arts. (Cross, 2001, p. 53)

31 The naming and framing process recalls the criteria selection process observed in different studies (Akin, 1979; Archer, 1979; Hillier & Musgrove, 1972).

that reflect-in-action becomes a researcher in the practice context. He is not dependent on the categories of established theory and technique but constructs a new theory of the unique case (Schön, 1983, p. 76). He does not separate thinking from doing; reflection-in-action consists of moving experiments in conversation with the situation. At each move, the case back talks to the practitioner, informing the global experimentation until the possible reframing of the problem[32] (Schön, 1983, pp. 84–99). The evaluation of the frame experiment is grounded in the practitioner's appreciative system and judged in a threefold way: in therm of the desirability of their consequences judged in categories drawn from the normative design domains, in terms of their conformity to or violation of implications set up by earlier moves, and in term of his appreciation of the new problems or potentials they have created (Schön, 1983, p. 106). Thus reflection-in-action can proceed, even in situations of uncertainty or uniqueness.

As suggested by Dorst and Dijkhuis (1995, p. 274): "the reflective paradigm has a close link between the content and process components of design decisions. Taking the action (move) as the "unit for studying design" also gets us much closer to the activity of design as experienced by designers." This view helped scholars position their research on a broad framework of analysis. Globally, this turn helped find an alternative to the previous paradigm. Nevertheless, the reflective paradigm did not take over rational problem-solving; instead, both survived and sometimes combined in the design thinking discourses[33].

32 With the moving experiments and the situation back talks, the reflective-in-action framework complies with the observation of Hillier and Musgrove (1972) and their conjecture-analysis model.

33 Dorst and Dijkhuis described in which context the two paradigms aremore suited for describing design thinking: "Describing design as a rational problem-solving process is particularly apt in situations where the problem is fairly clear-cut, and the designer has strategies that he/she can follow while solving them. Describing design as a process of reflection-in-action works particularly well in the conceptual stage of the design process, where the designer has no standard strategies to follow and is proposing and trying out problem/solution structures" (Dorst & Dijkhuis, 1995, p. 274).

1.4 Designerly Thinking

Between the 1980s and 1990s, the design thinking label slowly assumed a common acknowledgement in the design community. The first wave of studies explored the individual designers' cognition and the social dimension of design. In this discourse, design thinking became the label describing the designers' cognitive and social characteristical approach. In parallel, different authors observed similar patterns outside the design realm. Here, design thinking became a collaborative intellectual approach shared by many disciplines and humans at different ability levels. This openness voluntarily or involuntarily involved other fields in the discussion triggering a translation of the label toward other realms.

Cognitive and Social Characteristics

The first widespread use of the design thinking label is probably due to Rowe's (1987) homonymous book title, where he resumed the latest research advancements in the generation game discourses, offering the public a detailed portrait of design thinking. His principal aim was to account for the underlying structure and focus of inquiry associated with those relatively private moments of design. The book's first part reported some protocol analysis[34] studies about some architects' work, illustrating their activity by the design thinking framework. In this description, Simon's rational problem-solving paradigm and Schön's reflective practice combine and complete each other in an extensive description of design thinking characteristics.[35]

While Rowe did not explicitly define the design thinking label, since 1992, a sequence of symposiums[36] (Table 1.2) marked the peace of the

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34 The protocol analysis is a psychological research method that elicits verbal reports from research participants. Protocol analysis is used to study thinking in cognitive psychology (Crutcher, 1994), cognitive science (Simon & Kaplan, 1989), and behaviour analysis ('Protocol Analysis', 2020)

35 Among the other topics, Rowe moves from Simon's concept of bounded rationality and satisfaction to introduce the difference between well-defined, ill-defined and wicked problems. Then, he introduced the designer's heuristic reasoning, combining it with the framing and reframing activity described by Schön. All these topics would become some of the pillars of the design thinking discussion.

36 The symposium series originated from a proposal by Norbert Roozenburg, and Nigel Cross made together within the faculty of Industrial Design Engineering at the Delft

Year	Location	Organisers	Focus
1991	Delf	Roozenburg; Cross; Dorst	Design cognition and computational modelling of design processes
1992	Delf	Dorst; Christiaans	Studies with a shared dataset experiment of individual designers and team
1996	Istanbul	Akin	Descriptive design models
1999	Cambridge	Goldschmidt	The role of representations in design thinking
2001	Delf	Lloyd; Christiaans	Designing within its broad social context
2003	Sydney	Edmonds; Cross	Design expertise and the nature and the nurture of expert performance in design
2007	London	Lloyd; McDonnell	Studies with a common dataset of teamwork
2010	Sydney	Dorst	Linking design thinking to other disciplines and fields.
2012	Newcastle	Rodgers	Analysed different responses to the given design task
2014	Indiana	Adams	Education
2016	Denmark	Christensen	Studies with a shared dataset tracking design meetings over three months

Table 1.2 Design thinking research symposiums list.

evolution of the "designerly way of thinking" discussion. In the first one, Cross defined design thinking as:

> "Design thinking - the cognitive processes that are manifested in design action - has become recognized as a key area of research for understanding the development of design capability in individuals and for the improvment of design practice and design education" (Nigel Cross, 1992, p. 1).

From that standpoint, several explorative studies widened and sometimes deepened the design thinking research (Coyne, 1988; Waldron & Waldron, 1988; Zeng & Cheng, 1991) quickly becoming the label describing a complex and sometimes irregular array of cognitive processes, strategies and approaches characteristical of the designers' way of acting and thinking.

However, in light of this review, it is interesting to highlight another development that sparked the discussion beyond the designers'

University of Technology in 1990. The proposal was to hold a small international workshop meeting on 'Research in Design Thinking' that would bring together some of the early work in progress at that time in design cognition and computational modelling of design processes. Kees Dorst joined the planning activity, and together with other researchers, they ran the first meeting in Delft in May 1991 (Nigel Cross, 2018).

individual cognition. Indeed, in the 90s, some concerns (Bryan Lawson, 1980) highlighted the limitation of studying design thinking in a lab, denying its social and context-dependent attitudes. Bucciarelli, Goldschmidt and Schön raised this argument in 1987, questioning the appropriate unit of action to study design. They noted: “Is it the individual designer and what goes on in his head? Is it design as a social process?” (Goldschmidt, Bucciarelli, & Schon, 1987, pp. 60–61).

Trying to address this question, Dorst and Christiaans, in the second symposium of design thinking research, collected a standard set of data[37] that different researchers analysed and studied. Goldschmidt (1995) moved her observations by comparing the same design task at the individual and team levels[38]. Peng (1994) focused on the importance of the modelling medium for the team[39]. Similarly, Lawson explored the role of design in the designer-client relationship in an actual practice context (Bryan Lawson & Pilling, 1996)[40]. Finally, taking stock of this conversation, Cross (1995) suggested that design thinking studies have to broaden their boundaries, addressing design as a technical, cognitive and social process.

In 1999 Goldschmidt opened a new symposium in Cambridge focused on the role of representations in design thinking. Building on early observations about visual thinking[41] (Goldschmidt, 1994) and creative emergence[42] (Nigel Cross, 1997), authors like Brereton and McGarry[43] (Brereton & McGarry, 2000) and especially Oxman (1999, 2002) deep-dived into the cognition behind the relationship between sketching and

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37 They realised a video-recorded experiment with individuals and teamwork designers from the XEROX Paolo Alto Research Center.

38 She found out that team participants do not resemble different aspects of the individual designer but rather that the individual designer is a unitary system that resembles the team. In this view, an individual designer moves like a team of one, asking and answering all the questions by him/herself.

39 She observed that representations orchestrated the communication among people, moving from a private to a social act modelling medium creates a shared workspace where different domain design expressions combine and integrate.

40 He observed a lack of appropriate communication and a failure to engage the client in the process at the right level and at the right time.

41 She suggested that visual thinking is the process of production of thought via visual imagery that is frequently found in creative thinking or problem-solving. She observed that

42 He confirmed Goldschmidt’s observations about the dialogical relationship between sketches and creativity, identifying three ways for new moves to emerge: combination, mutation and analogy.

43 They focused on the role of the object in supporting the designers’ thinking. They found that designers heavily depended upon references to physical objects and their gesturing. Moreover, they frequently used fast rough prototypes that balanced ambiguity and actual representativeness.

creativity[44]. These studies started to reflect on the mystery behind the creative act, rooting and explaining their findings in the cognitive sciences. These observations suggested that the creative leap is not a matter of fixing the problem and searching for a satisfactory solution. Instead, it is a constant co-evolution between the problem space framing and the solution space exploration (Dorst & Cross, 2001). Sketches and other modelling mediums facilitate this process triggering imagery and the emergence of creative thinking. In light of these findings, design creativity analogically resembles building a creative bridge between the problem and solution space instead of a blinking flash of creativity that make the practitioner leap to the final solution (Nigel Cross, 1997).

With the new millennium, the research focused on studying the designers' real work in context. The protocol analysis method gave way to in-depth interviews (Bryan Lawson, 1980) to explore the design process of highly experienced and well-known designers. Anticipated by the work of Roy (1993) with James Dyson, this approach aimed to investigate the actual context of design with all its contingent implications. Mainly Lawson (1994) and Cross (2001, 2008, 2011) studied the work of expert practitioners in their field,[45] collecting several clues that confirmed, questioned and sometimes increased the knowledge about the designerly way of thinking, contextualising them through real-world case studies.

However, after its initial sprint, the design thinking research and the symposium events became less frequent, and the discussion lost its pace. Overall in this first period, design thinking could be considered an academic field of research that prompted design scholars to study the designer's cognitive and social characteristical attitudes (Figure 1.8.1).

Human Intelligence

Supported by the design thinking cognitive and social research, rising evidence suggested these characteristical approaches were not unique to designers. On the contrary, these traits are commonly shared by other professions and, by extension, by the whole human being with different levels of expertise.

44 She used Schön's seeing-moving-seeing model to map the cognitive relationships and variables occurring in this process. Building up Goldschmidt's concept of visual thinking, she broadened and deepened the cognitive variables in place. Noteworthy, she identifies the emergence process as the medium for designers to conceptualize during the design process. The dialogue between ambiguous sketches and their perception triggers visual memory to recall stored information that visual imagery can interpret and reformulate differently.

45 Design expert in the field of engineering, industrial design and architecture.

Already in the generation game period, some clues addressed this belief. Firstly Simon (1969), trying to establish the science of artificial highlighted the shared aim among several practical professions.

> Everyone designs who devises courses of action aimed at changing existing situations into preferred ones. [...] Design, so construed, is the core of all professional training; it is the principal mark that distinguishes the professions from the sciences. [...] Schools of engineering, as well as schools of architecture, business, education, law, and medicine, are all centrally concerned with the process of design. (H. Simon, 1969, p. 111)

Similarly, Schön (1983), in the Reflective Practitioners, observing architects, psychologists, and managers at work, noted a shared reflective way of working, each of which declined in their specific application context.

In the design thinking community, this belief, driven by the analysis of designers at work, found similar results. Lawson's (1979) comparison study between architectural and science students first pointed out that exist different ability levels in using design thinking strategies[46]. A few years later, he further developed the concept, suggesting that design thinking is a form of thinking and, thus, a set of cognitive skills people can acquire and develop (Bryan Lawson, 2005, p. 303). Following this consideration, Cross (1990) tried to show that design ability is a multi-faceted cognitive skill everyone possesses. He observed that design knowledge is not exclusive to professionals; even schoolchildren of all ages display an inherent design ability. In this paper, he advocated for design abilities as a natural form of intelligence, pointing out its intrinsic values in education. Indeed, conventional education, still divided between the two cultures of the Arts and the Sciences, tends to neglect the Technological culture, centred on design ability, with its things to know, ways of knowing them, and finding out about them (Table 1.3).

Accommodating Cross's vision, Buchanon (1992) recognised design thinking as the new liberal art of the technological culture, suggesting it should not be only a professional component of technical education but a core discipline for every liberally educated man. For him, the emergence of design thinking is essential to connect and integrate valuable knowledge among professions. The challenge is to gain a deeper understanding of design thinking so that more cooperation and mutual benefit are possible between

46 In his famous experiment, five-year architecture students showed a marked design-oriented attitude compared to first-year students who did not display any specific difference from non-architectural students.

	Arts	Science	Technology
Field of Work	Human experience	The natural world	The artificial world
Range of value	Subjectivity, imagination, commitment, and concern for justice	Objectivity, rationality, neutrality, and concern for truth	Practicality, ingenuity, empathy, and concern for appropriateness
Type of Skills	Criticism, analogy, evaluation	Experiment, classification, analysis	Modelling, pattern forming, synthesis

Table 1.3 Cross's (1982) comparison of the three cultures.

those applying design thinking to remarkably different problems and subject matters[47]. Still, there is a profound gap among design thinking professions. Reporting some observations in an organisational context, he argued:

> "[...] there is persistent confusion about the different modes of argumentation employed by the various design professions. For example, industrial design, engineering, and marketing each employ the discipline of design thinking, yet their arguments are often framed in sharply different logical modalities. [...] Because of these modal differences in approaching design problems, three of the most important professions of design thinking are often regarded as bitter opponents in the design enterprise, irreconcilably distant from each other" (Richard Buchanan, 1992a, p. 20).

In Buchanon's view, a common discipline of design thinking could root a shared culture among design professions beyond the inherent contextual differences in the design's products or subject matter.

In this discussion, design thinking assumed a new dimension. It is no more a scientific discussion about design's cognitive and social characteristics; instead, it takes advantage of these findings to suggest a broader goal. It represents a standard pool of knowledge and skills that make up a transversal language for the subjects involved in designing. In this view, design thinking crosses the boundaries of a canonic design discipline, opening the concept to the other realms that work in the technological culture (Figure 1.8.2).

47 For Buchanon, the wicked-problems approach (Rittel & Webber, 1973) suggests a fundamental indeterminacy in all design problems, implying no ideal conditions or limits. This point prompted the author to wonder why design problems are indeterminate and wicked. He suggested that design problems are "indeterminate" and "wicked" because the design has no particular subject matter apart from what a designer perceives it to be. The subject matter of design is potentially universal because design thinking may be applied to any area of human experience. Therefore, in the application process, the designer must discover or invent a particular subject out of the problems and issues of specific circumstances (Buchanan, 1992, p. 17).

Design as a Practice

Between 2000 and 2008, the cognitive and social discussion about design thinking slowed down, while in disciplines such as management and practitioners of business and design, the label started to take hold. Indeed, the term moved away from its original context, gradually losing any apparent reference to the scientific discussion.

In response to these events, in 2010, the design thinking symposium started again, reflecting on the impacts of the new situation. Dorst (2010) tried to reorder the pieces of the design thinking puzzle in a framework to ease and systematise the fragmented insights collected by the designerly thinking discussion over the years. With a different approach, Badke-Schaub, Roozenberg, Cardoso (Roozenberg, Cardoso, & Badke-Schaub, 2010) critiqued the "new" design thinking concept[48], acknowledging that the "traditional" discussion probably overlooked some critical aspects of the designerly way of thinking[49].

Probably only Kimbel's work (2009, 2011, 2012) tried to reconnect the two discussions under the practice lens[50] with a discrete success. She proposed to rethink design thinking as-a-practice and in-practice. This perspective offered a new standpoint for design thinking research in the design discipline.[51] In Kimbell's view, design-as-a-practice reframed the design thinking object of study away from the cognitive and social investigation, considering the practice the unit of analysis.

> "Design-as-practice mobilizes a way of thinking about the work of designing that acknowledges that design practices are habitual, possibly rule-governed, often shared, routinized, conscious or unconscious, and that they are embodied and situated. [...] It acknowledges the work done by professional designers in their practices, but also opens up design to others, such as managers and employees in organizations during design processes, and also customers, end-users and other stakeholders who

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48 For the lack of grounded empirical studies and poor clarity in the description of the concept.

49 Aspects such as the role of emotion in design, the role of interdisciplinary.

50 In her papers, she adopted Reckwitz's definition, in which practice is "a routinized type of behaviour which consists of several elements, interconnected to one another". Kimbel's design thinking view emphasizes three aspects of the practice theory: firstly, practice theory considers technologies and structure in a situated and distributed way; secondly, practice theory pays attention to the role of objects in their construction; Finally, in practice theory, knowledge is a social accomplishment situated in the ongoing routines of bodily and mental activities.

51 The practice lens emphasises the designer's role in creating the practice's outcome, allowing artefacts to be active actors of the procedure. It adopts a practice view level, pushing away the individual and group cognitive level that failed to account for the situated nature design. Finally, it avoids difficulties associated with the word "thinking".

> through their practices also take part in design" (Kimbell, 2009, pp. 10–11).

To complete this view, Kimbell placed beside the design-as-a-practice concept the design-in-practice that foregrounds the incomplete nature of designing.

> "When the designers have finished their work, and the engineers and manufacturers have finished theirs, and the marketers and retailers have finished theirs, and the customer or end-user has bought a product or started using a service artifact, the activity of designing is still not over. Through engagement with a product or service over time and space, the user or stakeholder continues to be involved in constituting what a design is" (Kimbell, 2012, p. 135).

With these two concepts, the author suggested how design-as-practice and designs-in-practice might be used as analytical devices in design research. This work proposes a fruitful way to account for what goes on within the design, moving beyond the classical protocol analysis and the interview methods. Thinking of design as a practice, Kimbell considered designers, other professions, users, artefacts and all the contextual factors a fundamental part of the research, moving toward the new disciplines involved in the design thinking discussion.

Beyond the effort and the intention, the cognitive, the social, and the practice discourse struggled to open an honest and productive conversation with the other design thinking communities. The vocabulary (Herrmann & Goldschmidt, 2013), the research methods and especially the perspectives and aim from which they observed the design thinking phenomenon differed. In the design discussion, design thinking is a subject of inquiry. Its journey began by focusing on the designers' cognitive and social characteristics. Then open up its boundaries to other disciplines. Finally, it changed its standpoint by acknowledging design as a practice to study. In all these research dimensions, knowledge was acquired from different viewpoints and sometimes used in other disciplines. Still, within this meaning, design thinking is inside the design discipline, focused on studying the design activity with different methods and perspectives (Figure 1.8.1).

1.5 Design Thinking

At the beginning of the new century, the design thinking label emerged from its native context, assuming different meanings. Firstly, management scholars looked at design thinking as a possible answer to the rising request for innovation and a complementary approach to their analytical decision attitude. Secondly, IDEO sizing this nascent opportunity, suggested an easily applicable "design thinking" method for innovation. Thanks to the success of this methodology, the label rapidly spread worldwide in the business literature. Design management discipline takes advantage of this success to advocate for renewed design management leadership in innovation.

However, the sudden hype of the term trivialised the original concept emptying it of any clear meaning. Inevitably many critiques from the design and management side sparked the debate around design thinking. After the buzz, the label coexisted in different communities without a shared agreement on the meaning. Nevertheless, many studies still explore the potential of design thinking approaches in organisational contexts.

Managing as Designing

From the managerial perspective, design thinking presents less defined boundaries. The management-related discourses generally look at the consequences of the designerly way of thinking applied to the organisational context. This point of view implies setting aside the micro view of designers' cognition, zooming out at the macro level, where the repercussions of the designerly way of acting influence teams and organisations (Kimbell, 2012).

Despite some early explorations (Smith & Browne, 1993), this perspective rose in the academic management discussion at the beginning of the new century. Especially two circumstances nurture the adoption of the design thinking label. In North America, a debate about the relevance of MBA programs to practitioners undermined some pillars of business education (Dunne & Martin, 2006; Heiman & Burnett, 2007; Mozota, 2008; Patnaik & Patnaik, 2009b). Parallelly, a renewed competitive landscape raised the bar of the market requests for innovation, hindering the standard organizational structure (Beckman & Barry, 2007; Johansson & Woodilla, 2009; C. L. Owen, 2006). In this context, management scholars found in design thinking research an allay to address these challenges.

Before design thinking, design was far to be a dominant concept for management. In academic literature, Liedtka suggested that design fell in disfavour after the influential work of Henry Mintzberg[52] that associated design labels with outmoded approaches to strategy. Similarly. in organisational practice, to cite Brown words:

> " [...] design has been treated as a downstream step in the development process—the point where designers, who have played no earlier role in the substantive work of innovation, come along and put a beautiful wrapper around the idea" (Brown, 2008).

Management scholars tried to overturn the design perception, leveraging design thinking research to suggest the potentiality of design in management. The first authors to connect these fields moved their proposition from Simon's suggestion about the centrality of design skills to management (R. Boland & Collopy, 2004; R. Buchanan, 2004; Liedtka, 2000). Indeed, Simon's undisputed reputation in both filed was the perfect starting point for a revived alliance between the disciplines.

Building on those foundations, Western Reserve University professors Boland and Collopy (2004) published the book Managing as Designing, collecting several contributions about the topic from the design and management realms. The book's authors proposed the "managing as designing" concept by observing the work of Frank Owen Gehry during some workshop activities. The scholars identified two distinctive attitudes. The design attitude is concerned with finding the best answer possible, given the team's skills, time, and resources, and takes for granted that it will require the invention of new alternatives. The decision attitude, in contrast, is predominant in management practice and education, solving problems by making rational choices among various options. However, The decision attitude has a central weakness: It assumes that good design work has already produced the best possible alternatives from which the managers are to choose. Thus, Bolland and Collopy called for a self-assessment in management practice and education, recommending the importance of a design attitude for best business decisions.

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52 He defined the "design school" as a hierarchical, top-down approach ill-structured for facing real challenges in an uncertain context (Liedtka, 2000, pp. 7–8).

> "Today the pendulum has once again swung too far and is in need of correction. An emphasis on quantitative methods and analytic techniques is fine, as long as you are already dealing with your best ideas about the situation you face and the alternatives open to you. But the more turbulent and chaotic the environment of business becomes, the less likely that is to be true. In those conditions, something else is needed—something that will help put better ideas and alternatives on the table for analytic consideration and quantitative assessment. We propose that a design attitude toward problem solving can do that" (R. J. Boland & Collopy, 2004, p. 16).

Similarly, Roger Martin, Dean of the Rotterdam School of Business, used design thinking to sustain the MBA programs' reform (Dunne & Martin, 2006), proposing that design thinking could balance the organisational tendency toward analytical thinking with more intuitive thinking (R. L. Martin, 2009a). Indeed, Martin's role in an academic context, his work as a strategy consultant, and his interest in cognitive processes (R. L. Martin, 2007) placed him in the perfect position to be receptive to design thinking. Martine moved his arguments from Pirce's abductive logic, suggesting design way of thinking is mainly abductive and, therefore, creative. Indeed, design thinking balancing deduction and induction with abduction tend to have an inherently explorative nature. In his writing, he usually refers to March's seminal work (1991) on organisational behaviour about exploration and exploitation. Exploration engages in search, experimentation, and variation, while exploitation enhances productivity and efficiency through choice, execution, and variance reduction. Both activities are essential for organizational learning and prosperity, but they entail contradictions that must be managed[53] (Lavie, Stettner, & Tushman, 2010).

In Martin's view, design thinking is getting fundamental in business precisely because, in the average organisation, there is a marked imbalance toward exploitation.

> "Most businesses, in terms of strategy, structure, process and culture, have tended to favor exploitation and reliable replication of a proven success formula in the present (a reliability orientation) over exploration

53 "The trade-offs between exploration and exploitation are various. Compared to returns from exploitation, returns from exploration are less certain, more remote in time, and more distant from the locus of action (March, 1991). Nevertheless, organizations must invest in discovery of new knowledge and market opportunities in order to secure future economic gains. [...] Even though at any given moment exploration and exploitation are at odds, over time exploration generates opportunities that the organization can later exploit. In turn, exploitation can produce income that can be then invested in future exploration" (Lavie, Stettner, & Tushman, 2010, p. 116).

and search for a new formula that might be more relevant in the future (a validity orientation)" (R. Martin, 2010a, p. 41).

Thus, design thinking could re-balance the organisational exploration-exploitation activities, becoming an abductive-centric engine for creative exploration that help companies run ideas faster through the knowledge funnel[54].

Both Bolland and Collopy's managing as designing and Martin's design thinking have similarities: they referred to different attitudes/ways of thinking between design and management; They highlighted management unbalance toward a decision attitude or exploitation approach; they suggested a reform of MBA programs to balance the two perspectives; both of them used mainly academic medium55; neither of them proposed specific methods out of their work. Thus, in this context, design thinking could be considered an attitude and a way of thinking different and integrative from the standard managerial approach and a proposition supporting the reformative discussion about management education (Figure 1.8.4).

Innovation Methodology

In the first decade of the new century, design thinking label diffusion grew exponentially, thanks to the adoption of the term by IDEO[56] and the Stanford d.school education program[57]. Indeed, first Tom Kelley (2001, 2005),[58] with his two books about innovation and creativity and then Tim Brown (2008, 2009),[59] that publicly adopted the term design thinking to define the IDEO's methodology, captured the business practitioners'

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54 For Martin, organisations create value by moving and operating knowledge throughout a funnel. Exploration moves across the knowledge stages from the initial mystery to the heuristic to the algorithm discovering new value. Exploitation operates within each knowledge stage, concreting the value.

55 Martin wrote a famous book, released interviews, and wrote articles in business magazines. However, he also wrote several papers. Collopy even wrote web articles on Fast Company.

56 IDEO is a design and consulting firm founded in 1991 by merging David Kelley Design (founded by David Kelly), Moggridge Associates and ID Two (Founded by Bill Moggridge), and Matrix Product Design (founded by Mike Nuttall. Today IDEO has nine branches and is one of the biggest design consult agencies in the world ('IDEO', 2021).

57 Hasso Plattner Institute of Design at Standford, commonly known as the d.school, was founded in 2004 by Davide Kelley and other professors, thanks to Hasso Platner's contribution (co-founder of SAP SE, a German multinational software company). The program integrates business, law, medicine, social sciences and humanities into more traditional engineering and product design education ('Hasso Plattner Institute of Design', 2021).

58 Brother of David Kelly (co-founder of IDEO),

59 CEO of IDEO until 2019.

audience through compelling and accessible literature, spreading design thinking to the general public.

If in the managing as designing perspective design thinking concept was partially rooted in the designerly way of thinking literature, Stanford and IDEO's design thinking seemed to represent a well-fitting name of its specific practice with no direct correlation with the scientific discourse (Johansson-Sköldberg et al., 2013, p. 128). Indeed, during an interview (Camacho, 2016), David Kelley[60] recalled the partial randomness behind the label origin, sustaining the distinctiveness of IDEO meaning from the academic one.

> "It depends on who you think came up with the term "design thinking" [...] it doesn't matter to me. In our minds, it's a method for how to come up with ideas. [...] For us at the d.school, we think of ourselves as "ground zero" for design thinking. We started using the term in our world because our students were saying, "I'm not an expert in anything" . I said, "Yes, you are expert at design methodology, at how you routinely come up with ideas." I said that for many years ... and then one year I started saying randomly, "No, you're experts at a way of thinking, you're experts at design thinking." I said "a way of thinking," and then they changed to say "design thinking" and that caught on for some reason. All those years I said "You're experts at design methodology," nobody paid attention. They didn't take it as a new idea or a novel idea. They didn't believe it. For some reason, the words "design thinking" resonated with them. [...] Then it took off. Tim Brown wrote his book Change By Design after that, so now we have a period in which we are getting to the same point where we are with design. Everyone means something slightly different by the term. I guess this is OK. It doesn't bother me, but I hear people using design thinking to mean something quite different from what I mean. There are many words in the English language that people use, and they all mean something different by the same words" (Camacho, 2016, pp. 88–89).

Nevertheless, there are several correlations in the content with the designerly thinking discourse. Indeed, the methods and approaches that belong to the design culture are implicitly connected. Digging into Stanford's design program story, some significant turning points emerged. Firstly, Arnold, with his studies about creativity[61] and then McKim, who focused on human-centred design,[62] traced the path since Kelley's

60 Co-founder of IDEO and the d.school program at Standford University.

61 John Arnold moved to Stanford in 1957, founding the design division in the mechanical engineering department. He mainly worked on the topic o innovation, based on psychology, creative thinking and innovation ('John E. Arnold', 2020).

62 Robert McKim was a mechanical engineering professor who founded Stanford's

d.school, which transformed the program into a multidisciplinary course where different disciplines collaborate in complex challenges using design-driven methodologies (Camacho, 2016).

Thanks to these influences, design thinking arose from a strict and entangled relationship between Stanford's design program developments and IDEO's practical experience. In this view, design thinking is a discipline that uses the designer's sensibility and methods to match people's needs with what is technologically feasible and what a viable business strategy can convert into customer value and market opportunity (Brown, 2008, 2009a). This definition pointed out the two main milestones of Stanford and IDEO's design thinking: the importance of empathy to understand people's needs and use them as the creative engine for innovation; and the collaborative approach to creativity, capable of balancing different expertise and values in a standard process.

Moving from this general description, IDEO and the d.schol program developed several processes over the years (Waidelich, Richter, Kölmel, & Bulander, 2018), widely spreading and affirming this design thinking meaning as the most predominant in the practitioners' world. This success caused both positive and negative effects. On the one hand, its success spread worldwide a design thinking process that became increasingly trivialised and over-simplified.[63] On the other hand, IDEO should be credited for effectively leveraging design methodologies in the business context. Indeed, despite the "managing as designing" discourse on the academic side, IDEO proved in practice the potential role of design as a strategic asset for innovation. In this popular context, design thinking resembles a set of processes, tools and approaches IDEO and the d.school foster worldwide through its influence. This meaning codified design thinking as a replicable way of working that led companies to innovation (Figure 1.8.5).

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human-centred product design program in 1958. He was David Kelley's predecessor at the direction of the design program ('Robert H. McKim Product Design Achievement Award | Mechanical Engineering', n.d.).

63 If in the beginning, design thinking was described metaphorically more as an iterative system of spaces rather than a predefined series of orderly steps to follow (Brown, 2008), in compliance with the finding of the designerly way of thinking discourse. The urgency to simplify the process for a fast application and implementable to business people led to trivialising some concepts, suggesting the erroneous idea that design thinking gave magical results just by following predetermined steps.

Design Management

Between 2005 and 2010, the term "design" became the new buzzword in the business world, favouring the "design in business" trend and promoting design as a qualified partner for innovation and management. In this context, the design management discipline jumped into the design thinking conversation, determined to leverage design leadership in the organisational realm.

However, it took a long time since design thinking revamped design in the business context. Since its origins in 1960, design management has been concerned with deploying available resources to help the company achieve its product development and manufacturing process objectives. Then, especially in countries where manufacturing now plays a significantly lower role, design management moved closer to marketing and branding, working on experiences and services (Cooper, Junginger, & Lockwood, 2009). In these contexts, management's perception of the design remained closely connected with the project-based outcome they produced[64].

Nevertheless, in the new century, the increasing collaborations between business and design schools[65] nurtured by the "managing as designing" discourse, and the success of IDEO design thinking methodology, strengthen the role of design in organisations, fostering a receptive and collaborative context. Here, design thinking helped shift the focus from design as a project-based outcome to design as a knowledge-based practice[66] capable of affecting business decision-making through a repeatable methodology (Mozota, 2008).

Lockwood, PhD in design management and curator of the Design Management Review, sustained this argument, opening the dialogue on design thinking at the conference of Paris in 2009[67].

64 Aware of this bias, in the 2008 DMI Education Conference, design management practitioners and scholars debated the right way to overturn this misperception, highlighting some shared concerns, such as: explaining the values and roles of design; defining what design means for organisations; communicating the design's roles; creating the space for design to assume and fulfil this role.

65 New collaborative courses, from Toronto and Stanford to INSEAD, Politecnico di Milano, Université Paris X, and Essen.

66 In a knowledge-based approach, designers can synthesise several disciplines' methods and pieces of knowledge within valuable concepts and forms to support brand, innovation, strategy and management decisions.

67 The conference, "Design Thinking; New Challenges for Designers, Managers, and Organisations, " collected a paper representing empirical research, theory building, and case studies published in the Design Management Journal.

> “The concept of design thinking is now taking hold in management and is paving the way for design to address new problems in the organization. With that, design thinking frees design activities from the product and allows design thinking to be applied outside the traditional realms of design and to different kinds of problems (those of organization, strategy, mission, and so on). (Cooper et al., 2009, p. 49)”

In this view, design management changed its course from “designing as managing” to “managing as designing”.[68] In these contexts, design thinking and design activities became integral to most aspects of the organisation, applying a methodology to inquire into a wide range of organisational problems (Junginger, 2009, p. 25). In this framework, the design management scope concerns the ongoing management and leadership of design organisation, processes, operations, projects, and outputs. While design thinking, which is primarily an innovation process, became the fuzzy frontend to carry on management activities, pursue design strategy and achieve design leadership. Indeed, design strategy sets the direction and roadmap, and design leadership focuses on integrating design into the organisation. Both can be viewed as outputs of effective design thinking and design management (Lockwood, 2009).

Design management discourse unknowledge previous academic discussions on the topic, but it focuses on different aspects. Even if both the “managing as designing” and “design management” perspectives looked at the effects of design thinking on the organisational context, the first assumed a management perspective. In contrast, the second adopted the design viewpoint. Compared to IDEO’s design thinking, it did not focus on supplying practical suggestions or new methodology. Still, it tried to explore the potential of design thinking for designers in the organisational realm, engaging both in the academic discussion and in the more accessible practitioner literature.

Design management’s design thinking does not overtake the different nuances of design or design management. Still, it emerged as an integrative practice that shifted the organisational’s perspective on design, supporting and enlarging the design influence across the organisation (Figure 1.8.6).

68 The first use of the term managing as designing came from the homonymous book of Boland and Collopy. The use of these neologisms underlined the passage from developing and designing a product that followed a structured process derived from a management approach to one that derived from the designerly way of approaching the activity.

Success & Critiques

At the end of the first decade of the twenty-one century, the design thinking phenomenon arrived at its tipping point (Figure 1.3) with a granular label diffusion in the academic and practitioner management literature.[69]

In 2007, Bill Breen (2007) was one of the first to foresee that design thinking was entering the common vernacular. At that time, a Google search returned 141 million results. Today,[70] the exact search gave back almost tenfold the results, arriving at 1.390 million contents. This progression can be displayed by tracking the "design thinking" keyword in Google Trends. The result highlighted a constant growth in the label's popularity from 2010 till late 2020, when it reached a certain stability (Figure 1.6).

Indeed, the high concentration of publications[71] in 2008 probably kicked off this trend, boosting the hype around design in business. Books, business magazines, and web articles spread a concise and sometimes simplified picture of design thinking, whereas IDEO and Standford's arguments prevailed over the other.[72] Additional clues about the general public's perception of design thinking can be found in the Google query and the topic people usually most associate with the label (Table 1.4). Indeed, the frequent label association with IDEO and Stanford confirmed that design thinking was mainly framed as an "innovation methodology".

In a Fast Company web article, Collopy (2009) pictured the reaction to the unexpected diffusion of the design concept in management and business literature. He noted that a Google search for design thinking terms associated with management or business gave back mostly blogs in which designers struggled to make sense of this phenomenon and attempt to characterise design thinking. In this mainstream view, design thinking concerns: emphasising customers to unveil their needs, thinking creatively about new ideas in teamwork to synthesise different knowhow in a concept that addresses people's needs, roughly representing by sketches

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69 For instance: Fast Company, Business Week, Harvard Business Review, and Fortune.

70 The research scanned the design thinking trend on google from 01/01/2004 to 31/12/2020.

71 Virtually all the primary design thinking authors published their books in that period. Brown published "Change by Design"(Brown, 2009); Martin published "The Design of Business" (R. L. Martin, 2009); Verganti published "Design Driven Innovation" (Verganti, 2009); Lockwood published "Design Thinking"(Lockwood, 2009a); Liedtka published "Designing for Growth" (Liedtka & Ogilvie, 2011).

72 This view probably prevailed, thanks to several conditions. The success of the books of Kelley and Brown. The successful examples of IDEO consultancies, such as with PNG. The Stanford d.school academic support. A plain and accessible language. A complete media coverage.

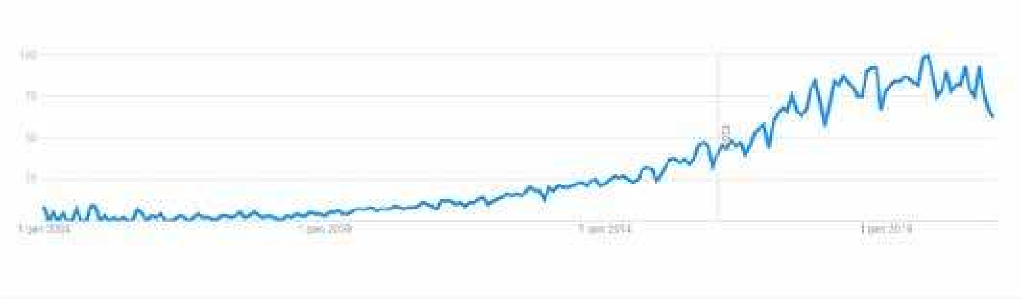

Figure 1.6 Google Trend research outcome using the “Design Thinking” keyword.

Correlated Topics	Query Associated
Design (Topic)	Design Thinking
Discipline (Education)	Design
IDEO (Topic)	Thinking
Thinking (Topic)	Design thinking process
IDEO (Consultancy)	Design Process
Innovation (Topic)	What is design thinking
Entrepreneurship (Topic)	What is design
Standford University (Education)	Ideo
Methodology (Education)	Innovation
Agile Methodology (Topic)	Ideo design thinking

Table 1.4 Google trend top ten ranking topics and query correlated with “Design Thinking”.

and prototypes the concepts and testing them with customers. These steps required a human-centred, creative, iterative and practical approach that drives innovation (Brown, 2008).

This label diffusion tended to simplify the topic, cutting the academic root of design thinking and morphing the term into a buzzword (Breen & Breen, 2007). Vague and emptied of specific meaning, the label was used indiscriminately in several contexts and disciplines, facing incomprehension and misunderstandings. In this situation, design thinking received strong critiques both from the design and management world.

From the design side, Norman (2010) tried to make a point about this phenomenon. He called design thinking a useful myth: a myth because it is nothing more than what creative people in all disciplines have always done;[73] useful because he found that the perpetuation of the myth also has justifiable reasons to exist. Firstly, it served the design consultant well in selling their performances. Secondly and more critically, it forced companies to view design as more than a pretty face: something applicable to any organisational problem.[74]

From the designerly thinking discourse, the first clear step toward management design thinking arrived in 2010 with the eight symposia on design thinking. Dorst admitted the design research community's difficulties and shyness in efficiently communicating their findings outside the design research community. Therefore he tried to summarise the nature of design thinking, opening the discussion to the other disciplines (Dorst, 2010). Roozenberg, Cardoso and Badke-Schaub (2010) attempted to compare the two discourses, distinguishing and comparing the traditional and new design thinking approaches. They summarised:

> "[...] we can state that Brown's (2009) 'new' design thinking approach presents a prescriptive or even idealistic view, which is ultimately formulated at a rather low resolution level. The instructions are not empirically nor theoretically supported; they are a generalization of his own experiences packed in a kind of popularized management problem solving approach" (Roozenberg et al., 2010).

The lack of empirical investigation or evaluation prompted the designerly thinking discussion to deny the scientific value of management design thinking, taking the distances from it.

From the management side, rising rumours about the failure to adopt design thinking fractured the growing enthusiasm. Oster (2008) observed that even if some companies implemented design thinking with spectacular gains, many more companies that invested resources in design thinking abandoned the concept after no positive results. Similarly, Nussbaum (2011), an earlier adopter of the idea, vehemently claimed the failure of design thinking. He suggested that the good ideas about design thinking came to fall over its process standardisation. Indeed, by-the-book methodologies often delivered by consultancies demonstrated a shallow success rate that at least led to incremental innovation.

Other critiques came in contraposition to different kinds of

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73 He did not refer to previous research from the design academic perspective, but it concluded similarly to the "human Intelligence" discourse.

74 For instance: organizational structure, factory floors, supply-chain management, business models, and customer interactions.

thinking. As design thinking grew in success, business thinking (Merholz, 2009), critical thinking (Barratt & Barratt, 2009), and hybrid thinking (Patnaik & Patnaik, 2009a) proposed themself as valid alternatives or integrations. These propositions suggested overtaking the design-business thinking dichotomy to explore other ways of thinking. This call for collaboration is at odds with the design thinking collaborative soul emphasised by almost all the meanings the label assumed. This concern and several other arguments discussed in the paragraph highlighted an apparent misalignment about what design thinking means for the opposing parties. The more the label gets out of the design field, the more it changes its original meaning creating confusion and critiques. As Collopy (2009) suggested, probably the misunderstanding is even at the linguistic level. While those close to design topics might immediately get what it means to design thinking, it is perhaps not what folks conjure up when they first hear the label.

To sum up, the success of design thinking caused a buzz around the label that had different repercussions. It blurred the concept causing linguistic misunderstandings. It oversimplified the meaning spreading unprecise assumptions. It engaged companies in something they were hardly prepared for. Despite the results, it attracts consultants wishful to capitalise on the new business trend. In short, it highlights several weak spots. However, more than the fragility of the contents behind the label, they pointed out weaknesses in the concept's use, diffusion, and adoption. This buzz, which gradually returned within the normal range in the following decade, prompted a new maturity level in the design thinking discussion that scholars tried to address with renewed methods and intentions.

1.6 Organisational Implications

While in the first ten years, the management discourse mainly looked at the design thinking research to speculate about meanings and implications for the discipline. After the buzz and critiques, the discourse moved toward a more grounded approach, focused on exploring the organisational implications of design thinking.

In the second decade of the twenty-one century, management design thinking discussion reorganised itself, setting off diverse empirical research to inquiry: the best practices adopted to implement and legitimise design thinking in companies; the synergic relation among design thinking, strategy and product development; the influences of design thinking on organisational culture; and the capabilities design thinking could empower in the social dimension of organisations.

Implementation

After the low success rate and scarce innovative results, several authors described design thinking as a fad and a buzzword. Some authors reacted to these critiques by exploring the reasons behind these failures. In this line of research, management scholars studied the successful and unsuccessful implementation cases, describing the mistakes and the best practices adopted in trying to legitimise design thinking.

Observing P&G's[75] design thinking implementations, Leavy (2010) and Martin (2011) studied the recipe for its success. Leavy identified seven critical ingredients that make the design thinking P&G integration successful[76]. We can identify the use of a top-down and bottom-up approach to legitimise design thinking through theoretical lessons made practical

75 Procter & Gamble (P&G) is an American multinational consumer goods corporation specialised in a wide range of personal health, personal care and hygiene products.

76 First, the CEO's commitment to design thinking allowed the company to experiment with this approach. Second, its ability to build momentum, using concrete results to demonstrate the effectiveness of design thinking. Third, it employed the best-experienced design talents to support the transformation. Fourth, it allowed designers to sit in on the business team, where their creativity could directly influence the company strategy. Fifth, it built long-term relations with design agencies like IDEO, continuously improving and updating their practices. Sixth, it organised a few-day immersion in design thinking for the CEO and the Global Leadership Team, spreading the approach upstairs through practical activities. Finally, it developed a program called "Designworks," crafted to bring direct experience to its employees worldwide.

by actions. This program, designed with Martin, helped enrol and train an increasing number of managers that become catalysers of cultural change. Altogether, these ingredients sparked the methods and attitudes in the organisation, transforming and preparing P&G's DNA to design thinking.

Similarly, Rauth, Carlgren and Elmquist (2014), building upon Suchman's (Suchman, 1995) legitimacy framework,[77] tried to understand how companies incorporated design thinking by inquiry into several firms' reality. They found that companies that successfully implemented design thinking mashed up the terms and methods with the organizational culture to fit the specific context instead of adopting an off-the-shelf package. They convinced stakeholders by involving them in projects and workshops instead of lecturing them. They created ambassador networks that supported and advocated design thinking in organisation. Finally, they created physical spaces where stakeholders can experience design thinking and feel the new-way of working.

Following this direction, an explorative study by Dunne (Dunne, 2018) classified his finding to model the possible implementation strategies organisations could adopt to integrate design thinking. Noteworthy in his work is the classification of the organizational form that design thinking programs could assume. He noted that sometimes it takes a centralized structure, in which an identifiable, discrete design lab develops early-stage ideas for implementation. Sometimes it is distributed, spreading the design program across the operating divisions. Sometimes it is hybrid, where a relatively small centralized team acts as a focal unit for design supporting design programs across the organization. Finally, sometimes it is collaborative, where organizations share facilities, ideas, and technology with other non-competing organizations. Each model has its advantages and risks. In his paper, Dunne argued:

> "The optimal form for design thinking in an organization depends on its purpose for disruptive innovation, a program would benefit from working outside the day-to-day business of the organization, and hence a central lab at an offsite location would be most appropriate. On the other hand, a design program undertaken for cultural change should not be too far from the cultural centre: a distributed model in which design is spread across departments would be more effective here" (Dunne, 2018, p. 13).

77 Legitimacy can be defined as the "generalized perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions" (Suchman, 1995, p. 574).

Despite these models, Dunne's work confirmed that a suitable culture is a prerequisite for legitimising design thinking. Indeed, organisations' culture is usually so far from the design thinking attitude that a senior-level champion has to take ownership and accountabilities for the program to mitigate these differences. Due to this need, a critical vicious circle sometimes jeopardized the program's legitimacy. Since the program needs to demonstrate results quickly while stakeholders' attention is still present, many programs take on "low-hanging fruit", overwhelming design thinking activity of incrementalism that leave little time for more revolutionary innovation. Poor levels of innovation caused critiques that undermined the company's trust in the program.

Through this line of research, authors from different discourses tried to answer the growing critiques on design thinking. Adopting an explorative grounded approach, they dig into the reasons behind the failures and successes of design thinking. To sum up, their finding suggested an entangled net of variables affecting the correct adoption of design thinking in a specific community. Rising evidence suggests that failed legitimisation of design thinking strongly depends on cultural aspects and misinterpretations of the concept. This awareness prompted scholars to rethink design thinking more as a cultural aspect to implement than an innovative methodology to apply. Within this meaning, the research moves over three pathways: design thinking as a strategic way of thinking, design thinking as a reformative cultural aspect, and design thinking as a social technology.

Strategy

Few touchpoints between design thinking and strategy happened over history. Indeed, historically, strategy discourse was an executive subject focused on long-term goals, resource allocation, and decision-making that evolved parallel to design. However, within the new century, a renewed conciliatory context emerged.

Retracing design and strategy's discourse history,[78] Johansson and Woodilla (2009) found that in the new millennium, firms strategic view, compromised by an economic and competitive landscape, adopted a new

78 Strategic discourses generally acknowledge their roots in the discourse of military orders in the ancient world. The foundation of strategic management is frequently traced to Chandler (1962) and Anshoff (1965). Michael Porter (1990) that continues to be recognized as a, if not the¸ leading authority on business strategy, further developed Anshoff's analytic view within the managerial discourse. A more process-oriented view of the strategy was introduced by Mintzberg (1994).

reconstructionist worldview, in which the actions and beliefs of industry players can reconstruct market boundaries and industries. The milestone of this strategic approach is called Blue Ocean Strategies. Kim and Mauborgne (2015) argued that a company could create its blue ocean rather than competing within the existing industry or trying to steal customers from rivals in the “red ocean”. This uncontested market space makes competition irrelevant. This strategic competitive advantage required more the creation of new pathways than the application of structured rules that inherently brought closer to competition. In this pro-active and humanistic ground, strategy came closer to innovation and the creative attitude of design thinking, allowing unprecedented synergistic dialogue.

In a forerunner paper, Liedtka (2000) pinpointed the strict relationship between the two discourses. She noted as strategic thinking is naturally adductive and open to creative thinking. It is hypothesis-driven and therefore oriented toward the experimentation of new possibilities. It is opportunistic toward upcoming new strategies, learning and changing in response to the action. It is dialectical because it must mediate between the constraints and opportunities identified through an ever-evolving discussion. Finally, it is inquiring- and value-driven because it focuses on inventing new possibilities rather than discovering something already in place. Together, these characteristics highlighted the strong commonalities between strategy and design thinking, offering management scholars a new metaphor to reflect on.

Over the following years, several lines of research explored the role design thinking could have in strategy construction. By summing up the management literature, a shared pattern of insights emerge. Scholars seem to agree on the importance of setting aside time for an exploration phase that allows new opportunities to arise (Liedtka & Kaplan, 2019; Mahmoud Jouini, Midler, & Silberzahn, 2016). The ability to prototype strategies to learn in action, iteratively testing them by trial and error to minimise the risk of big a failure and understand in advance what is worth commercialising (Holloway, 2009; Liedtka & Kaplan, 2019; Mahmoud-Jouini et al., 2016). The emergent link between project management and firm strategizing replaced project management within the broader concept of knowledge creation through a multi-project portfolio (Liedtka & Kaplan, 2019; Mahmoud-Jouini et al., 2016). Finally, the importance of stakeholders’ mobilisation to build the political context in which the project can develop and scale (Liedtka & Kaplan, 2019; Mahmoud-Jouini et al., 2016).

In these studies, the cultural collision between design and management discourse prompted design thinking and strategy one toward the other. On the one hand, design thinking reached a new application level, moving from product and communication to business strategy issues. On the other hand, strategy explored new methods that prompted it to dirty its hands with concrete actions that prove its strategies in practice through a collaborative process. In contemporary organisational management strategy making, "new product development" and design-oriented approaches got closer, hybridising and cooperating in the overall effort to reach new degrees of innovation.

Culture

Early management design thinking studies focused mainly on identifying the tools and methods to solve management problems. Recent research examined how the implementation of design thinking might relate to organizational-level constructs, such as organizational culture. Implementation discussion highlighted the importance of a suitable corporate culture to allow design thinking to express its potential. Conversely, a cultural debate recognised design thinking as a transformational force supporting this cultural shift.

Already in the first decade of the twenty century, authors like Burney (2006), Oster (2008), and Lockwood (2009) foresaw the importance of the design thinking cultural aspects, pinpointing its potential agency:

> "Design thinking is more than a methodology. Design is a cultural way of thinking. It's important to understand its power, commit to evolving your culture, even restructuring the company, resourcing and rewarding those who practise design thinking. (Burney, 2006)"

Indeed, by experiencing design thinking practices, companies' cultures must face values that usually contrast with the standard organisational' ones. The organisations are prompted to change and balance their original attitude from this coexistence and hybridisation. In this regard, the ability to influence people's agency becomes a crucial feature of design thinking. It was no more about putting design into corporate culture and adapting it to the company's needs. It was about putting corporate culture into design (Lockwood, 2009).

According to Elsbach and Stiglian (2018) three main insights emerged from these studies. Firstly, the effective use of design thinking tools profoundly affected organizations, helping develop and support an innovative-oriented culture. Secondly, organizational cultures influenced (both positively and negatively) the efficacy of design thinking. Thus, cultures defined by values, norms, and assumptions different from design thinking threaten its successful implementation[79]. Thirdly, adopting design thinking tools produced physical artefacts and emotional experiences in those who use them. By reflecting on these experiences, organizational members understand why and how design thinking was effectively used, creating an instrumental link between design thinking tools and corporate cultures.

In one of the few contributions to this discourse from the design side, Buchanon (2015) stressed the close link between design, experience, and culture, suggesting that design is a potential enabler of cultural change. Recovering his previous line of research on the four orders of design[80] (Richard Buchanan, 1992b) and some early intuition on the possible role of design in organisations (R. Buchanan, 2004), he described the evolution of design within the management practice:

> "Typically, it emerges gradually, beginning with the tactical problems of designing products and services. Then, it is turned inward, toward organizational problems of operations. Finally, it is elevated to address the problems of vision and strategy that are at the guiding core of organizations, relating the organization to the external world. (Richard Buchanan, 2015, p. 16) "

In this escalation,[81] the design increased awareness and brought it closer to the organisational aspects. In Buchanan's view, design methods usually employed in products, communication artefacts or services may be applied to an organization system. Here, the role of design is to create the environments within which human experience can move forward and reach satisfaction. In Buchanan's view, design thinking is a powerful way

79 Since design thinking attitudes contradict the traditional organisational mindset in most cases, hard work on culture is required to achieve long-term innovation success.

80 It is a matrix of the arts of design thinking and the problems toward which those arts have been applied. The four orders demonstrate the evolution of the design professions from graphic and industrial design to interaction design and, then, to the design of systems, environments and organizations that is the hallmark of the current design movement.

81 Sabrine Junginger described a similar evolution pattern (Junginger, 2009) and other papers that expanded her seminal research (Cooper, Junginger, & Lockwood, 2009; Westcott et al., 2013). Sabrine got a P.hD in design and Buchanon was his supervisor.

to reform the experience. Thus, as with other artificial artefacts, design can affect an organisation's environment and culture by shaping individuals' experiences, thoughts, and behaviours.

Design thinking applied to the organisational level aims to innovate and act as a powerful cultural transformation agent. In the last decade, the design thinking management view acknowledges this intertwined dual nature. The design's cultural heritage sparked new values in companies, but more importantly, it offered a method to spread and integrate them through valuable and practical actions.

Dynamic Capabilities

In many ways, the design thinking discussion in the management realm could be seen as a response to the rising uncertainty in the global competitive market that challenged standard companies' configuration. The design thinking cultural change was one of the latest answers in the search for building organisations capable of reacting to uncertainty with innovation. Recently, a promising line of research has been trying to link design thinking with the concept of dynamic capabilities to explore the potential role design could have in quickly adapting the company to unpredictable, chaotic events.

In his seminal work, Teece defined dynamic capabilities as:

> "The firm's ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments. Dynamic capabilities thus reflect an organization's ability to achieve new and innovative forms of competitive advantage given path dependencies and market positions" (Teece et al., 1997, p. 516).

In this context, dynamic capabilities facilitate an organization's ongoing ability to address environmental change by continually reconfiguring its competencies. They enable firms to adapt, dynamically building new organizational and strategic routines in response to market reconfigurations and emerging user needs.

Rosensweig (2011) suggested that design could become a dynamic capability for an organisation by developing a model describing how design thinking support design in this journey. The model proposes three primary components. Firstly, the interaction of the design process within the organization. Design thinking[82] incorporating characteristics such as

82 For Rosensweig, design thinking is the mental discipline the designers develops as part

iteration, knowing-in-action, inquisitiveness, action orientation and collaboration represents a fundamental skills-set for an organisation willing to adapt to change. Secondly, the design management function should integrate and establish the design process and values in the company. As noted in the cultural discourse, design thinking must be supported and combined at the strategic level in the company by a function with diffused capabilities to generate value. Thirdly, the design management function should capitalize on design as a dynamic capability to protect and support organizations against competition and sustain its competitive advantage in the marketplace (Rosensweig, 2011, p. 18). In Rosensweig's view, design function, design management, and design thinking should work together with business functions to develop dynamic capabilities that allow the organisation to adapt to the uncertain modern market.

However, Rosensweig did not discuss the design thinking relationship with the dynamic capability framework in detail. On the contrary, Liedtka (2020), building upon her previous explorative study on the impacts of design thinking (Liedtka, 2017), tried to accommodate her finding through the dynamic capability framework to give a precise overview of the two approaches. She identified three sets of core dynamic capabilities that Teece related to innovation and adaptation: sensing (seeing opportunities), seizing (making choices), and reconfiguring or transforming (executing choices). Building upon these three capabilities, Liedtka designed a framework (Table 1.5) that correlates them with five design thinking practices. In conclusion of her observations, Liedtka argued that design thinking seems to act in the organisation as a social technology,[83] a shared process capable of creating and altering the experiences of people involved in innovation. She noted:

> "Focusing on the social technology lens cues us to innovation as a shared process and ties it to human emotions and the complex ways people intersect and solutions emerge. It pays attention to the personal journeys of innovators and how they and their relationships are personally impacted during the innovation process. In doing so, DT offers tools and processes to foster enhanced learning, collaboration, and productivity among the human beings who produce innovation" (Liedtka, 2020, p. 54).

of the training.

83 Social technology is a way of using human, intellectual and digital resources in order to influence social processes ('Social Technology', 2021).

This perspective stressed the social impact of design thinking without denying its process orientation. It shapes the transformative cultural power described by other authors by proposing a model to frame it. The dynamic capabilities concept is founded in individual capabilities, but to be relevant to an organisation should be extended as much as possible to the community. Even if design thinking is about personal abilities and mindset at its root, only the collective integration of this attitude could grant a real company advantage. The design department and design management play a central role in this integration. However, the likelihood of failure is high without leadership support and willingness to transform the company culture.

In the last decade, design thinking research in organisational contexts seems to describe design thinking practices with a strong cultural agency that acts as a social technology in the organisation. Design thinking is still seen as a methodology but in a more holistic term. It is an iterative and highly flexible process that supports innovation by shaping the organisational social dynamics. In doing so, it influences the cultural values that, in turn, it favour its integration amplifying its potential impact. At the end of the twenty-first century's second decade, design thinking discourse appears better rooted in empirical studies, redefining itself and giving away from the initial buzz. In this context, design thinking is a methodological approach that could influence the company culture, building capabilities and shaping the social interactions needed to settle a sustainable environment for innovation (Figure 1.8.7).

DT Practice	Sensing	Seizing	Transforming
The practice of develop-ing a deep empathic un-derstanding of the user's needs and context.	Provides the user-driven criteria for ideation and encourages the refram-ing of the problem.	Aligns stakeholders on the same pool of knowl-edge, which addresses them toward agreeing on the ideas to pursue.	Builds the team's emo-tional engagement that drives focused and fast development.
The practice of including diverse perspectives.	Expands the team's repertories and knowl-edge, broadening the possibility of identifying additional insights and solutions.	Brings diversity into the conversation, leveraging it productively.	Builds local capabili-ties to solve problems and enlarge access to re-sources.
The practice of cre-ating multiple possi-bility-based solutions made tangible through prototyping and then winnowed through realworld interaction and experimentation.	Encourages a possibility-inspired mindset.	Creates an action orien-tation process that emphasises prototyping, forcing abstract thinking to concrete actions.	Encourages self-identi-fied champions to emerge naturally.
The practice of dialogue base conversations that focus on problem defini-tion and the emergence of a new solution.	Allows emergent solu-tions to challenge the status quo and engage diverse stakeholders in the conversation.	Focuses on surfacing tac-it assumptions, en-hanc-ing innovators' ability to choose wisely.	Builds trust, facilitates the development and produces commitment across the project stake-holders.
The practice of a sup-porting infrastructure with processes, tools, and mindsets.	Facilitates the involve-ment of other stakehold-ers, not part of the core team but who could still contribute.	Increases psychological safety over the creative process, structuring it in activity-focused phases.	Identifies the supporting team and invites ownership and engage-ment in implementing the strategy.

Table 1.5 Liedtka's design thinking and dynamic capability framework summary.

1.7 Innovation

Design thinking owns part of its success in the management discourse to the rising request for innovation, but what is innovation? This thesis does not aim to dig deep into the root of the innovation literature and all its branching. Still, a brief introduction to the topic in correlation to design is summarised in this paragraph.

Theory, Methods and Tools

Innovation has its own story rooted in business and technology literature that, like strategy discourse, tended to collide with design thinking at the beginning of the new century. In their research, Johansson and Woodilla (2009) found that the innovation concept is a multifaced keyword used in several academic discourses at different levels.

Within the academy, the discourse rise from the economic side was thanks to Schumpeter (1934)[84], who observed that innovation and entrepreneurship drive economic development forward. Under this lens, innovation is any invention in use that has reached the market. Following World War II, innovation discourse got traction even in technical universities. This discourse aims to codify product and service innovations' sources, goals, measures, and diffusion. However, over time, the discussion became less theoretical and more normative, aiming at understanding the process of making an invention into an innovation[85].

Within the new millennium, organisational hunger for innovation sets the perfect stage for different innovation methodologies to flourish. Design thinking was one of the answers to this emerging need. Nevertheless, other approaches have been developed in the academic and professional world.

Similarly to design thinking, some methods focus on a design-driven approach. For instance, we can cite the work of Verganti (2009, 2016) in the innovation of meaning or Celanschi (2007) in the design culture of innovation. Kristiansen's "LEGO serious play" (2014) method, which exploits Lego bricks as a medium to support creative

84 Schumpeter distinguishes between incremental, radical and disruptive innovations, paving the way for Christensen (1997; 2003; 2011) and other authors' research.

85 An invention refers to something new that was discovered. Meanwhile, innovation entails the successful introduction of the invention to the market.

thinking. Another suitable method is the "Design Sprint" by Knapp (2016), which describes a polished process to arrive at innovative solutions in an agile and quick way. Or the "Jobs to be done" practice (Ulwick, 2016) that propose human-centred methods to solve the very root problems of the customers.

From another viewpoint, several authors seem to focus on collaboration and openness. Chesbrough (2006) developed the "open innovation" approach. With roots in computer science and R&D practices, this discourse avoids the logic of an internally oriented, centralized approach to product development and instead brings external ideas into play. Von Hippel (1988, 2006, 2017) propose an open-sourced approach to innovation that directly involves "lead users"[86] as co-producers in the innovation process. Similarly, Howe (2009), in his book "Crowdsourcing", spread the homonymous neologism to the general public, strengthening the connection between innovation and collaboration.

Other authors seem to focus on the efficiency of processes and manufacturing. In his book "Lean Six Sigma" (2005), George Michael described a process improvement approach that takes a clue from the Kaizen philosophy (Imai, 2012), combining the lean production concept with quality control. Following this path, in more humanistic terms, the agile concept takes relevance in the organisation, especially after the publication of the manifest for agile development ('Manifesto for Agile Software Development', 2001). Agile management aims at requirements discovery and solution improvement through the collaborative effort of self-organizing and cross-functional teams.

Other methods look at innovation from an entrepreneurial perspective. In the book "The lean startup" (2011), Ries takes a clue from the startup world to set up a well-recognised process for developing innovative ideas and bringing them to the market. Kim and Mauborgne propose the already cited blue ocean strategy (2005) from a business strategy perspective. Finally, Osterwalder's work (2010, 2013, 2014) is worth citing because it combined the design visualisation capability with the business-oriented topic, presenting a set of methods and tools to support company innovation.

These are only some of the methods and approaches that broadly spread in organisational cultures over the new millennium's first decade.

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86 Lead users are people who, due to their unique attitude and context, are set in the best position to face the market's future needs and therefore be well positioned to benefit significantly by obtaining a solution to their needs.

Together they compose a mix of theory, methods and practical tools to face the innovation challenge. In that decade, the design, business and technical cultures moved in the same direction bringing their contribution to the organisational innovation discussion from their perspective. However, analysing them from a human cognitive perspective, they seem to have several instances in common. They start moving from one central hypothesis. Then, they iteratively explore the idea by concretising and testing it to acquire as much new learning as possible. In this way, the idea increases its likelihood of success in the market, becoming a fully-fledged innovation.

If we go back to the design thinking origins, some clues about the reasons for these similarities could be traced back to the inherent human way of facing complex creative problems. Indeed, as discussed in the "human intelligence" paragraph, in the 90s, scholars found that design thinking cognitive strategies occur in every human being. Thus, even from distant cultural and disciplinary standpoints, the mental processes behind the theory, processes, methods and tools resemble the same structure. They are all base on shared "natural" human cognitive ability. Differences in methods and tools probably are due to discipline and sub-discipline inclination toward a more scientific or humanistic culture. However, the cognitive paths and methods have more similarities than differences.

This conclusion should not be misinterpreted. Not all the approaches discussed are equal and have the same efficacy. Still, they are coherent. They have the same aim and a shared cognitive process language that makes them compatible and combinable in everyday organisational practice.

Design and Innovation

Even if design thinking and design-led approaches were mainly introduced in the management discussion due to their innovativeness potential, few talks about innovation took hold in the design realm until the new century. Designerly thinking discussions, aiming to explore the designers' cognitive and social aspects, seldom employed innovation as a research keyword. Some early research observed that design practices produce novel, unexpected solutions (Nigel Cross, 1990), arguing the importance of creativity and imagination in the process (Goldschmidt, 1991; Bryan Lawson, 1980, 1980). However, the design thinking discourses placed much more emphasis on innovation (Herrmann & Goldschmidt, 2013) than the designerly thinking ones.

Discussing the "managing as designing" concept, Boland and

Collopy (2004) found that precisely innovation was one of the main distinguished aspects between management (decision) and design attitude. While the first, focusing on analytical capabilities, was not prepared to produce inventions, the second was the source of that inventiveness; and, therefore, a powerful tool to create new value. Martin (2009) further clarifies this distinction by leading the discussion to the logical level. He suggested that design thinking is far more abductive than management thinking which is mainly deductive and inductive. Especially abductive logic fosters innovation by framing the discussion on what might be possible (Dunne & Martin, 2006) and then exploring the hypothesis's consequences. Similarly, in IDEO's design thinking discourse, design becomes the catalyst for innovation productivity in organisations (Brown, 2007). Indeed, design thinking and its process, increase the rate at which good ideas are generated and brought to market, influencing where, how, and what innovate.

This attention to innovation came along within a broader business trend at the beginning of the new century. The rising market and business competitiveness and the global complexity jeopardized standard company strategy found in the innovation a driver to further business growth (Lockwood, 2009). This generalised concept prompted nearly every company to strive for innovation, raising it to the buzzword status (C. L. Owen, 2006). One answer to this urge was precisely design thinking, with its way of facing challenges through an innovative lens. However, the attempt to structure design-like approaches into an innovation process raised some of the most robust critiques.

Verganti, together with Norman (2013), the father of the Human Centred Design (HCD) philosophy, argued how HCD and, by affinity, design thinking rarely led to radical innovation. They argued that HCD is suited to incremental innovation, while radical innovations are mainly driven by technological changes or shifting meaning. Indeed, the HCD process unwittingly restricts the potential solutions to incremental innovations because, by its very nature, it focuses on things people already know. On the contrary, radical innovation often results from the dreams of inventors, engineers, and others who have an inner vision of what might be possible or from a deliberate shift in meaning. In this case, the predominant frame is disrupted, offering a perceivable discontinuity from the past.[87]

87 Dahlin and Behrens suggest three criteria for identifying an innovation as radical: the invention must be novel and dissimilar from prior inventions; the invention must be unique; the invention must be adopted and influence the content of future inventions. The first two criteria define radicalness; the third the success. Indeed, the third criterion only occurs if the

This framing and reframing capabilities are usually far from design thinking discourse that, especially in the first decade, prevalently focuses on the HCD principles of design. IDEO and Standford's design thinking clearly had such a slant in their work. After their mediatic success, organisations tried to mirror their methods, transferring the HCD philosophy to innovation. The attention toward people's needs induced companies to exactly pursue people's desires, putting little attention on critical reasoning about what they were doing. In this sense, the most popular design thinking discourse failed[88] to effectively transfer to the general public the design strategies that, more than others, convey disruptive thinking.

On the contrary, in the designerly thinking discourse, the authors put much more emphasis on these strategies. For instance, the ability to frame and reframe a situation is one of innovation's most powerful thinking strategies. Moving from Schön (1983), several authors (Nigel Cross, 2008; Dorst & Cross, 2001; Goldschmidt et al., 1987; Bryan Lawson, 1980; Oxman, 2002; Rowe, 1987) adopt these labels, extending and deepening the inquiry on this field. Among all, Dorst (2006, 2010) noted an interesting correlation between the paradoxical nature of the design's problem, the adoption of framing strategies, and the identification of innovative solutions.

> " "Paradox" is used here in the sense of a complex statement that consists of two or more conflicting statements. In the initial state of the paradoxical problem situation, all the statements that make up the paradox are true or valid, but they cannot be combined. A paradox, a real opposition of views, standpoints, or requirements, thus requires a redefinition of the problematic situation in order to create a solution." (Dorst, 2006, p. 14)

The paradoxical opposition of views and standpoints required the redefinition of the paradox to get solved. In this sense, framing and reframing strategies foster inventive design solutions. This capability does not come from a processual activity but from the individual or group expertise in breaking the current paradoxes. The importance of this capability, which is probably where business innovation and design thinking are more intimately linked, is perhaps still underestimated in popular "design thinking" discourses.

In the second decade of the century, the management movement

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sociological, market, and cultural forces align appropriately.

88 IDEO and Stanford's design thinking highlighted the importance of interpreting people's and society's needs behind their first expressions toward a more disruptive reconceptualisation of the problem context. However, the message had no broad appeal to the general public, probably because it required high design expertise.

tried to incorporate design thinking more as a cultural aspect than a structured process. This discourse suggested that the values and capabilities of design thinking practices spread through their practical manifestations could support people's inclination to act in favour of innovation. The process was not only a means to innovation but a vehicle to transmit and build up the right mindset in the organisation. Here, the cultural meaning sees design thinking as an insightful inspiration to organise the company's innovation culture.

Innovation is a fuzzy word that means different things to different people. Even design thinking seems to have the same trait. Looking at the two terms together, inevitably, different interpretations emerge that sometimes lead to unmet expectations. If design thinking is considered an HCD process, probably, it will not lead to disruptive innovation. If design thinking is viewed as a capability to frame and reframe the paradoxical situation, there are higher chances of finding inventive solutions to complex problems[89]. If design thinking is considered a cultural aspect, probably, it will not directly lead to rapid innovations, but it will help support the proper context where innovation can flourish. Using just a label and expecting the desired result to materialise is silly. The label should follow the actions that should drive the right results. An excellent example of clarity is the Advance Design[90] (Cenlanschi, Celi 2011) movement that took hold in Italy in parallel and with many touchpoints in common with the design thinking discussion. Instead of using a generalised label such as design thinking, they choose the keyword advanced precisely because the focus of value creation has slowly been shifting away from the physical product, the object, toward the creation of value that begins long before the product design process. In this view, Advance Design act as a mediator and orchestra director of this new constellation, generating value for all stakeholders far in advance of the New Product development process starts.

Defining the label and the contextual meaning of design thinking should help set innovation expectations. Design Thinking could lead and support innovation, but it is not a magic formula for extraordinary

89 Using framing and reframing strategies to face paradoxical problems favours the invention of the original solution. Inventions that are not innovative till they realise market success. These strategies are not easily accessible to organisations without the proper expertise.

90 Advanced design is a practice that imagines future perspectives by envisioning future products and processes. It mainly deals with extensive projects—extended in time, space, uncertainty, and complexity. As a branch of design, it covers primarily the front end of innovation and looks for solutions in complex innovation processes using design-related tools and practices (Celi, 2010, p. 33).

innovative results. All approaches and methods are based on people's capabilities and dependent on their context of adoption. Not considering this variable in the equation is dangerous. However, setting the right expectation, involving the right expertise and preparing a correct context design thinking can be a powerful approach to innovation.

Conclusion

This chapter shows that design thinking assumed different meanings in different times and contexts (Figure 1.7). As Johansson-Sköldberg, Woodilla, & Çetinkaya (2013) suggested, two main design thinking discourses could be identified: designerly thinking (from the design perspective) and design thinking (from the management perspective). However, even within the same discourse, the label acquired different meanings over the evolution of the discussions (Figure 1.8).

The designerly thinking discourse started as an academic field of research aimed to inquire into the designers' cognitive and social characteristical attitudes (Figure 1.8.1). From this research, some authors similarly concluded that the strategies under examination were more than pure designer characteristics. They are skills that every human being possess with different levels of expertise (Figure 1.8.2). Finally, more recently, the management discourse influenced the designerly thinking discussion that moved the research unit from the designers' attitude to the design practice, acknowledging design thinking as a routinised context-depended set of procedures that involved several stakeholders (Figure 1.8.3).

The design thinking discourse in the management real could be split into two phases. In the first one, several meanings coexist almost simultaneously, with innovation as the common denominator. We observed: the academic management perspective that sees design thinking as a complementary attitude for managers to achieve innovation (Figure 1.8.4); the practitioners' viewpoint, with IDEO that adopted the label to describe its innovation methodology (Figure 1.8.5); and the design management view, which sees design thinking as a practice that enhances design influence across the organisation (Figure 1.8.6). In the second phase, after the buzz around design thinking, we noted a more mature evolution of the meaning. Several management papers studied the companies that adopted design thinking to understand its organisational implications. They observed design thinking implementation, its influence on strategy making, its cultural agency and its role as a dynamic capability. Finally, recently, Liedtka

(2020), combining different findings, identified design thinking as a social technology: a practice that, through its methods and tools, has a strong agency on the organisational processes, dynamics, and culture (Figure 1.8.7).

Although through different conclusions and times, both discourses arrived at a similar perspective, but from different viewpoints. The design sees design thinking as a set of cognitive and social skills that designers employ with a high level of expertise to manage their everyday practices. Practices that are not restricted to designers but consider the involvement of different stakeholders (Figure 1.8.3). The management sees design thinking as a practice that, through its methods and tools, facilitates the development of novel ideas and strategies and, through the same process, brings values that have an agency on the organisational culture (Figure 1.8.7). They are the same phenomenon, but one discourse observes it from the designers' perspective, and the other form an organisational one.

Separately, they offered a limited prospect of the phenomenon, but together they could give a comprehensive view of the role of design thinking in innovation. Indeed, the designerly thinking discourse seems to deepen how designers employ their skills to find novel solutions to complex problems. They do not directly look at innovation but at invention. The design thinking one seems to deepen the role of design thinking in spreading ideas in the organisation, involving stakeholders to collaborate, and building a supportive culture. The management perspective looks at the organisational factor that increases the likelihood of an invention arriving in the market and becoming a real innovation. The first discourse studies the mechanisms to come up with an invention, while the second analyses the factors that transform it into an innovation. They look at the phenomenon from different viewpoints, but both are essential, especially if we aim to understand the design thinking impacts on innovation.

For the remaining part of the thesis, the researcher acknowledges the existence of different design thinking meanings. They should not be considered static perspectives in which one meaning excludes the other. Instead, they are more like dynamic stratifications that evolve in the people that use the design thinking label. We can not understand and evaluate design thinking in a specific context without knowing the primary meanings for the organisation and the people that employ it. For this reason, before moving to the evaluation topic, the second chapter focuses on the organisational system of Electrolux Professional to contextualise the design thinking and innovation topics in the actual setting of the thesis.

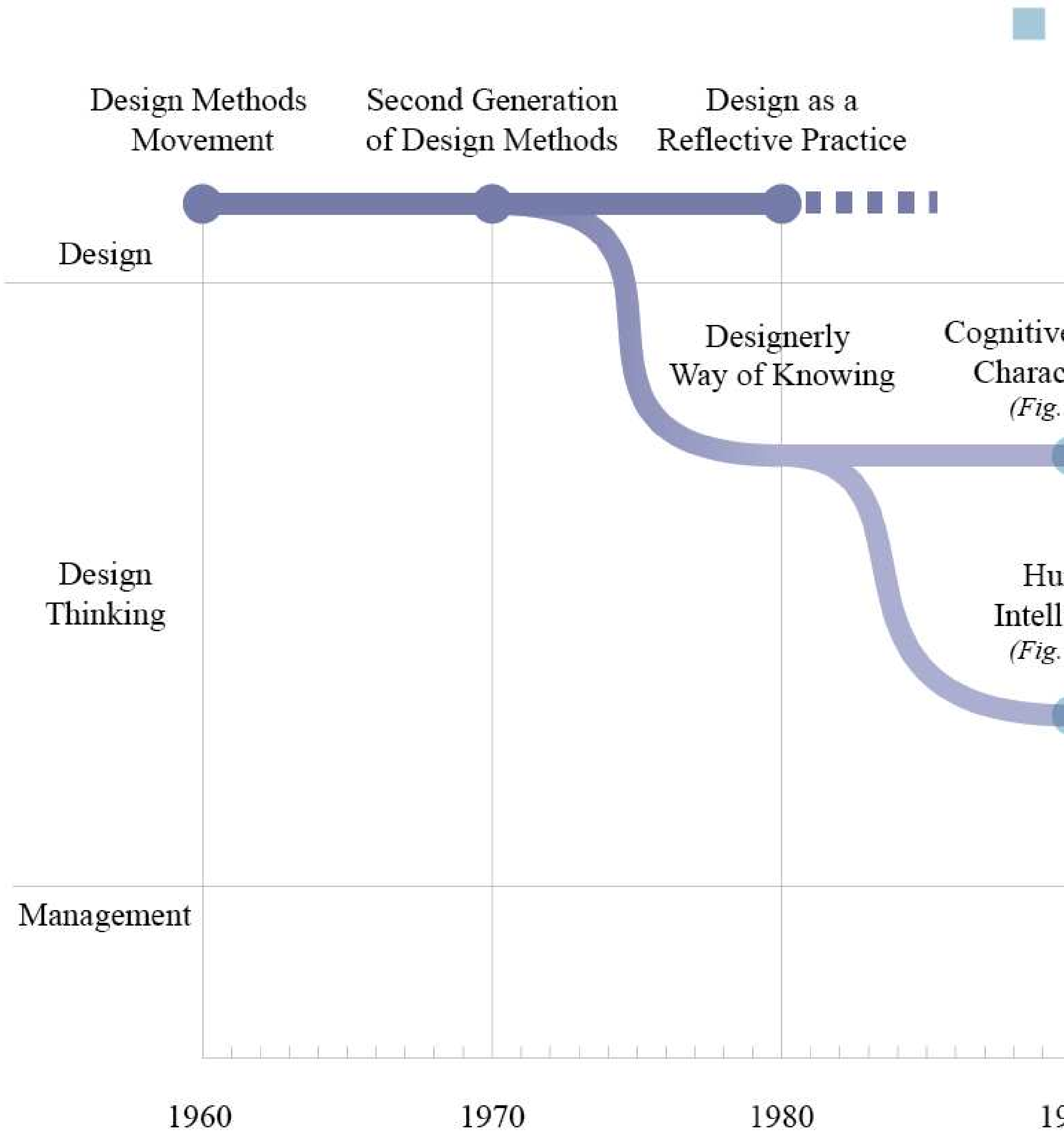
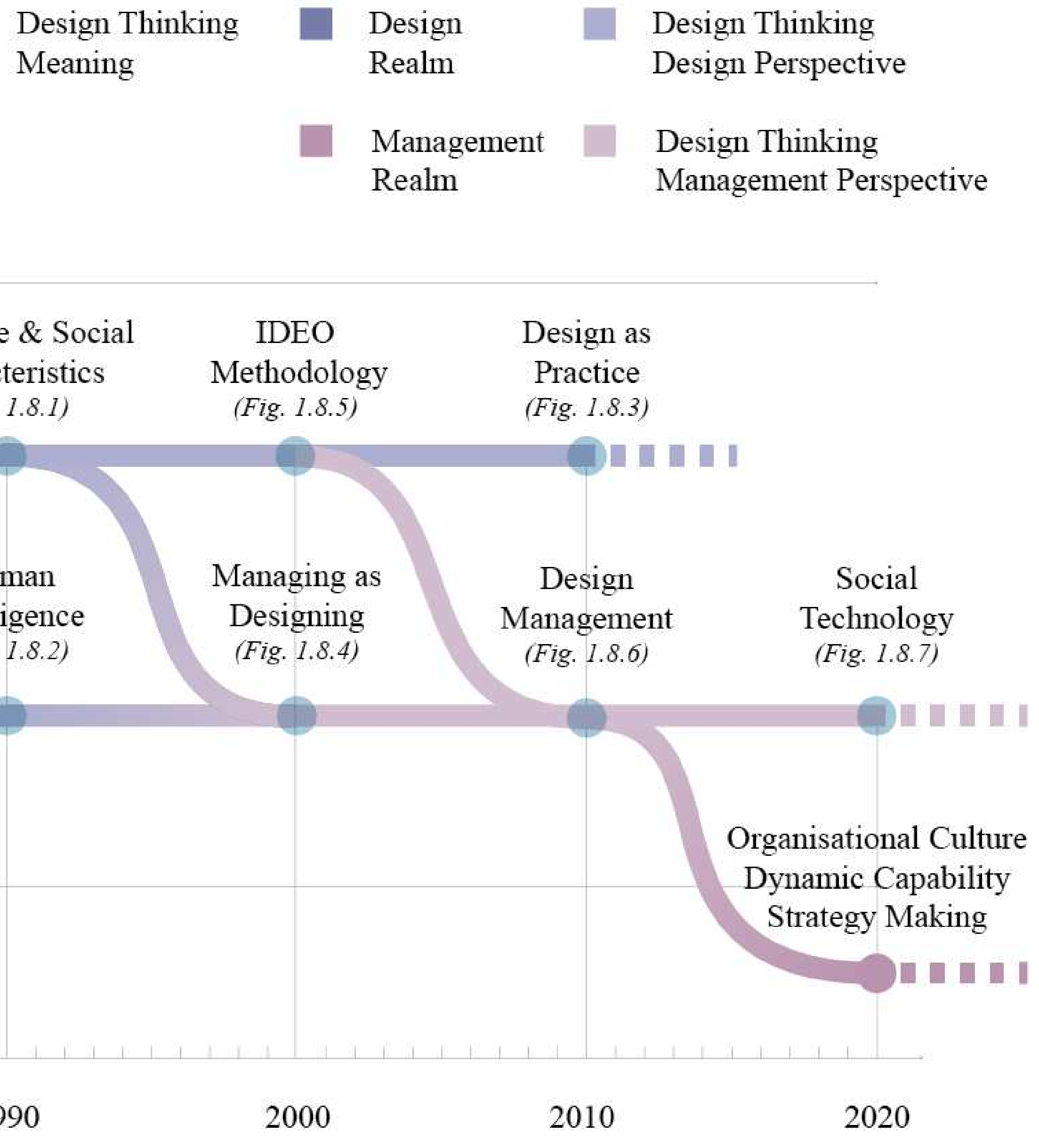


Figure 1.7 Design thinking journey map.



Design Thinking
Meaning
Design
Realm
Design Thinking
Design Perspective
Management
Realm
Design Thinking
Management Perspective
e & Social
teristics
1.8.1)
IDEO
Methodology
(Fig. 1.8.5)
Design as
Practice
(Fig. 1.8.3)
man
igence
1.8.2)
Managing as
Designing
(Fig. 1.8.4)
Design
Management
(Fig. 1.8.6)
Social
Technology
(Fig. 1.8.7)
Organisational Culture
Dynamic Capability
Strategy Making
990
2000
2010
2020

Design Thinking Meaning Evolution in the Design Discipline

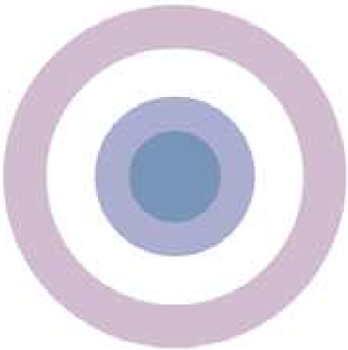


Fig. 1.8.1
Design thinking is the designers' cognitive & social characteristics
Design thinking is inside the design discipline that is the object of its study

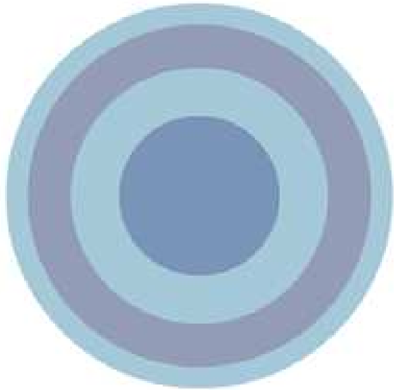


Fig. 1.8 .2
Design thinking is a form of human intelligence/skills/liberal art
Design thinking crosses over the design boundaries

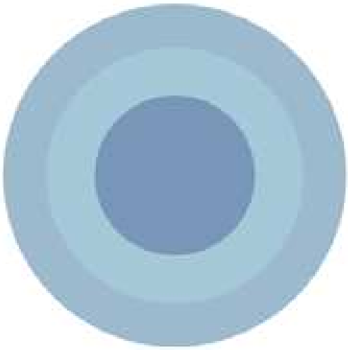


Fig. 1.8.3
Design thinking is a collaborative practice
Design thinking acknowledge multiple srakeholders in the practice

Figure 1.8 Design thinking meanings map

Design Thinking Meaning Evolution in the Management Discipline

Design Discipline Realms

Management Discipline Realms

Design Thinking

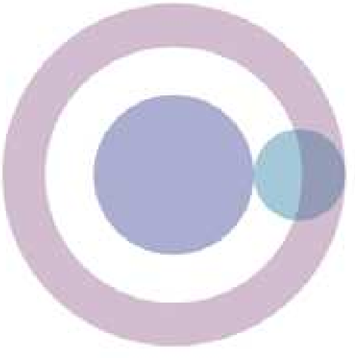


Fig. 1.8.4
Design thinking is a complementary attitude for managers
Design thinking moves management toward design

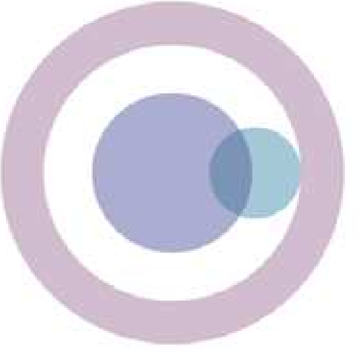


Fig. 1.8.5
Design thinking is the name for IDEO's methodology for innovation
Design thinking moves design toward management

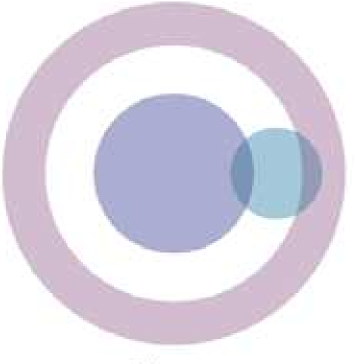


Fig. 1.8.6
Design thinking is a practice that enhances design management
Design thinking connects design with management

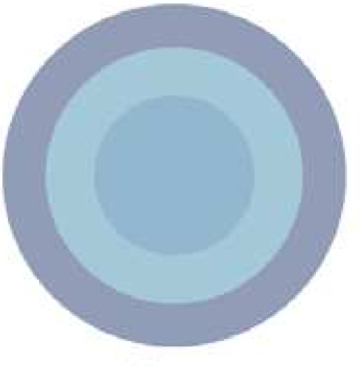


Fig. 1.8.7
Design thinking is a social technology for the organisation
Design thinking is an agent for the organisational change

2. Electrolux Professional Design & Innovation Context

This chapter introduces the research context describing the relationship among Electrolux Professional, innovation, design, and design thinking. After an introductory paragraph explaining the methodology and the methods adopted for this chapter, the text discusses the Electrolux Professional history, focusing on the evolution of its innovation context. The dissertation then illustrates the current company's innovation perception, synthesising the research results in a framework that points out complaints and suggestions about innovation. Finally, the chapter focuses on the Electrolux Professional design journey and the role design thinking played in this story.

2.1 Methodology

This paragraph briefly introduces the methodology selected for this chapter. The selection of the innovation audit methodology led to a broad survey submitted to the organisation and thirty-two interviews with the key innovation stakeholder. Furthermore, five discussions delved into the design and design thinking topic to deepen the research's actual context.

Innovation Audit

The research aimed to study the Electrolux Professional design and innovation context. The inquiry combined two main goals: understanding the overall context and using that knowledge to develop the company's innovation strategy. Indeed, a new competence called Innovation Hub strived to assess the organisation to redefine the company's innovation ambitions. Thanks to these mutual needs, a specific research team[91] was assembled. However, due to tight company constraints[92], the team involved a management scholar[93] from Politecnico of Milan to converge on a methodology rapidly. The decision fall on the innovation audit methodology (V. Chiesa, Coughlan, & Voss, 1996). The process adopts a two-layer approach: a rapid quantitative assessment of innovation to identify the gaps between current and required performance; and in-depth qualitative research, surfacing the reasons behind those shortages and possible enforcement.

Method Selection

Following Chiesa's methodological approach, the team designed the quantitative and qualitative methods more suited for the Electrolux Professional purpose. Firstly, the team tried identifying a simple and ready-available quantitative way to assess the innovation ecosystem.

91 The research team included a PhD student and two Electrolux Professional company practitioners involved in the innovation hub team.

92 The specific research planning activity started in July 2020, and Electrolux Professional expected the auditing process to be delivered by the year's end.

93 Claudio Dell'Era is an associate Professor in Design Strategy at the School of Management and Director of the Observatory "Design Thinking for Business" of the School of Management.at Politecnico di Milano.

Secondly, a qualitative semi-structured interview approach was designed to deepen the first findings and look for possible strategies to improve Electrolux Professional innovation.

Quantitative Method

The first step of the innovation audit methodology focuses on the company's innovation context assessment by a quantitative method. However, in contrast with Chiesa's procedure, the researcher did not use a scorecard for the evaluation (V. Chiesa et al., 1996, p. 113).

Thus, a lean literature review study was run to identify a valuable alternative, adopting the PRISMA model described in the first chapter to support the decision (Moher et al., 2009). The identification process[94] pinpointed more than eight thousand results. Therefore, the team narrowed them down by time-lapse[95] and topic[96] filters, considering only the first hundred papers sorted by relevance by the search engines. At the end of the process[97], the researcher screened the papers assessing their abstracts to narrow the eligible number of records to 23 items (Table 2.1). After reading the literature, were immediately discarded eight elements because they were irrelevant to the research purpose. The others were clustered into three main groups: "context", "method/methodology", and "tool/framework". Among the six "tool/framework" papers, the researcher included for the qualitative synthesis the Innovation Quotient Survey (Rao & Weintraub, 2013) because it approached the innovation topic holistically and used an easy-to-submit format. Furthermore, the Innovation Quotient's researchers developed an extensive study to validate and refine the tool (Danks, Rao, & Allen, 2017a, 2017b).

The "Innovation Quotient Survey" is a tool that assesses an organisation's innovation context by surveying the employees[98] on a linear scale from one to five. It aims to determine the organisation's " innovation quotient" by calculating the average responses to the questionnaire. The questions are organised hierarchically; each building block, factor, and element correspond to a defined number of questions. The average of the underlying level makes the result of the overhead value. Following

94 The researcher questioned different database engines with several tentative queries to identify the relevant literature. After several searches, the most suited one identified was: Innovation AND culture AND (analysis OR assessment OR assess OR measurement OR measure).

95 Consider the elements between 2000 to 2020.

96 The topic selected were: Management, innovation, business, organisational behaviour.

97 The 800 items considered become 746 after the duplicate removal.

98 Employees could take the survey voluntarily, and no answer was mandatory.

the order of the survey's structure, we find the result of the innovation quotient,[99] the six building blocks,[100] the 18 factors[101] and the 54 elements (Table 2.2). Each of the sentence questions represents a characteristical element for successful innovation. Overall, they aimed to capture a holistic picture of the innovation ecosystem of an organisation.

Bibliography	**Category**
Aiman-Smith, L., Goodrich, N., Roberts, D., & Scinta, J. (2005). Assessing Your Organization's Potential for Value Innovation. Research-Technology Management, 48(2), 37–42.	Tool/Framework
Adams, R., Bessant, J., & Phelps, R. (2006). Innovation management measurement: A review. International Journal of Management Reviews, 8(1), 21–47.	Context
Dobni, C. B. (2008). Measuring innovation culture in organizations: The development of a generalized innovation culture construct using exploratory factor analysis. European Journal of Innovation Management, 11(4), 539–559.	Tool/Framework
Wang, B. (2008). The Measurement and Evaluation on Organizational Innovation Culture in Chinese Academy of Sciences. 2008 ISECS International Colloquium on Computing, Communication, Control, and Management, 3, 380–385.	Not Relevant
Balsano, T. J., Goodrich, N. E., Lee, R. K., Miley, J. W., Morse, T. F., & Roberts, D. A. (2008). Identify Your Innovation Enablers and Inhibitors. Research-Technology Management, 51(6), 23–33.	Tool/Framework
Dalton, M. A. (2009). What's Constraining Your Innovation? Research-Technology Management, 52(5), 52–64.	Method/ Methodology
Xie Yumin. (2011). A research on the evaluation of enterprise innovation system. MSIE 2011, 607–611.	Not Relevant
Goldasteh, P., Nadali, A., & Khalilinezhad, M. (2011). Innovation Culture Assessment by a Fuzzy Expert System (Case Study: An Iranian IT Company). 2011 International Conference on Information Management, Innovation Management and Industrial Engineering, 3, 530–533.	Not Relevant
Assess Innovation Readiness. (2013). In Innovation Engine (pp. 37–55). John Wiley & Sons, Ltd.	Method/ Methodology
Büschgens, T., Bausch, A., & Balkin, D. B. (2013). Organizational Culture and Innovation: A Meta-Analytic Review. Journal of Product Innovation Management, 30(4), 763–781.	Context
Rao, J., & Weintraub, J. R. (2013). What is Your Company's Innovation Quotient? (SSRN Scholarly Paper ID 1987866; MIT Sloan Management Review, pp. 29–34). Social Science Research Network.	Tool/Framework
Hogan, S. J., & Coote, L. V. (2014). Organizational culture, innovation, and performance: A test of Schein's model. Journal of Business Research, 67(8), 1609–1621.	Tool/Framework
Holt, D. T., & Daspit, J. J. (2015). Diagnosing Innovation Readiness in Family Firms. California Management Review, 58(1), 82–96. JSTOR.	Not Relevant

99 The innovation quotient score is returned by the average of the six building block.

100 Each building block score is returned by the average of the three factors under the building block.

101 Each factor score is returned by the average of the three elements grouped under the factor.

Bibliography	**Category**
Sidhu, I., Goubet, J.-E., & Xia, Y. (2016). Measurement of Innovation Mindset A Method and Tool within the Berkeley Innovation Index Framework. 2016 International Conference on Engineering, Technology and Innovation/IEEE International Technology Management Conference (ICE/ITMC), 1–10.	Tool/Framework
Danks, S., Rao, J., & Allen, J. M. (2017). Measuring Culture of Innovation: A Validation Study of the Innovation Quotient Instrument (Part One). Performance Improvement Quarterly, 29(4), 427–454.	Context
Danks, S., Rao, J., & Allen, J. M. (2017). Measuring Culture of Innovation: A Validation Study of the Innovation Quotient Instrument (Part 2). Performance Improvement Quarterly, 30(1), 29–53.	Context
Status and Concerns about Innovation Measurement. (2017). In The Value of Innovation (pp. 19–34). John Wiley & Sons, Ltd.	Not Relevant
Aligning Innovation Projects to the Organization. (2017). In The Value of Innovation (pp. 81–106). John Wiley & Sons, Ltd.	Method/ Methodology
Tian, M., Deng, P., Zhang, Y., & Salmador, M. P. (2018). How does culture influence innovation? A systematic literature review. Management Decision, 56(5), 1088–1107.	Context
Kievit, P. J., Oomes, J., Schoorl, M., & Bartels, P. (2018). The missing link: Toward an assessment of innovation capacity in health care organizations. International Journal of Quality Innovation, 4(1), 3.	Not Relevant
Osorio, F., Dupont, L., Camargo, M., Palominos, P., Peña, J. I., & Alfaro, M. (2019). Design and management of innovation laboratories: Toward a performance assessment tool. Creativity and Innovation Management, 28(1), 82–100.	Not Relevant
Chutivongse, N., & Gerdsri, N. (2019). Creating an innovative organization: Analytical approach to develop a strategic roadmap guiding organizational development. Journal of Modelling in Management, 15(1), 50–88.	Method/ Methodology
Tomasova, D. (2020). Analysis and assessment of innovative culture development. African Journal of Science, Technology, Innovation and Development, 0(0), 1–13.	Not Relevant

Table 2.1 Selected literature reviews for eligibility: underlined the elements included.

Building Block	Factor	Element	Question
Values	Enterprenurial	Hungry	We have a burning desire to explore opportunities and to create new things.
		Ambiguity	We have a healthy appetite and tolerance for ambiguity when pursuing new opportunities.
		Action-Oriented	We avoid analysis paralysis when we identify new opportunities by exhibiting a bias towards action.
	Creativity	Imagination	We encourage new ways of thinking and solu-tions from diverse perspectives.
		Autonomy	Our workplace provides us the freedom to pursue new opportunities.
		Playful	We take delight in being spontaneous and are not afraid to laugh at ourselves.
	Learning	Curiosity	We are good at asking questions in the pursuit of the unknown.
		Experiment	We are constantly experimenting in our innovation efforts.
		Failure	We are not afraid to fail, and we treat failure as a learning opportunity.
Behaviours	Energise	Inspire	Our leaders inspire us with a vision for the future and articulation of opportunities for the organization.
		Challenge	Our leaders frequently challenge us to think and act entrepreneurially.
		Model	Our leaders model the right innovation behaviors for others to follow.
	Engage	Coach	Our leaders devote time to coach and provide feedback in our innovation efforts.
		Initiative	In our organization, people at all levels proactively take initiative to innovate.
		Support	Our leaders provide support to project team members during both successes and failures.
	Enable	Influence	Our leaders use appropriate influence strategies to help us navigate around organizational obstacles.
		Adapt	Our leaders are able to modify and change course of action when needed.
		Grit	Our leaders persist in following opportunities even in the face of adversity.

Building Block	Factor	Element	Question
Climate	Collaboration	Community	We have a community that speaks a common lan-guage about innovation.
		Diversity	We appreciate, respect and leverage the differ-enc-es that exist within our community.
		Teamwork-ing	We work well together in teams to capture op-por-tunities.
	Safety	Trust	We are consistent in actually doing the things that we say we value.
		Integrity	We question decisions and actions that are in-con-sistent with our values.
		Openness	We are able to freely voice our opinions, even about unconventional or controversial ideas.
	Simplicity	No bureau-cracy	We minimize rules, policies, bureaucracy and rigid-ity to simplify our workplace.
		Accounta-bility	People take responsibility for their own actions and avoid blaming others.
		Decision Making	Our people know exactly how to get started and move initiatives through the organization.
Resources	People	Champions	We have committed leaders who are willing to be champions of innovation.
		Experts	We have access to innovation experts who can support our projects.
		Talent	We have the internal talent to succeed in our in-no-vation projects.
	System	Selection	We have the right recruiting and hiring systems in place to support a culture of innovation.
		Communica-tion	We have good collaboration tools to support our innovation efforts.
		Ecosystem	We are good at leveraging our relationships with suppliers and vendors to pursue innovation.
	Projects	Time	We give people dedicated time to pursue new opportunities.
		Money	We have dedicated finances to pursue new op-por-tunities.
		Space	We have dedicated physical and/or virtual space to pursue new opportunities.

Building Block	Factor	Element	Question
Process	Ideate	Generate	We systematically generate ideas from a vast and diverse set of sources.
		Filter	We methodically filter and refine ideas to identify the most promising opportunities.
		Prioritize	We select opportunities based on a clearly ar-ticu-lated risk portfolio.
	Shape	Prototype	We move promising opportunities quickly into prototyping.
		Iterate	We have effective feedback loops between our organization and the voice of the customer.
		Fail Smart	We quickly stop projects based on predefined failure criteria.
	Capture	Flexibility	Our processes are tailored to be flexible and con-text-based rather than control-and bureaucra-cy-based.
		Launch	We quickly go to market with the most promising opportunities.
		Scale	We rapidly allocate resources to scale initiatives that show market promise.
Success	External	Customers	Our customers think of us as an innovative or-gan-ization.
		Competitors	Our innovation performance is much better than other firms in our industry.
		Financial	Our innovation efforts have led us to better fi-nan-cial performance than others in our industry.
	Enterprise	Purpose	We treat innovation as a long-term strategy rather than a short-term fix.
		Discipline	We have a deliberate, comprehensive and dis-ci-plined approach to innovation.
		Capabilities	Our innovation projects have helped our organi-za-tion develop new capabilities that we did not have three years ago.
	Individual	Satisfaction	I am satisfied with my level of participation in our innovation initiatives.
		Growth	We deliberately stretch and build our people's com-petencies by their participation in new initia-tives.
		Reward	We reward people for participating in potentially risky opportunities, irrespective of the outcome.

Table 2.2 Innovation Quotient questions

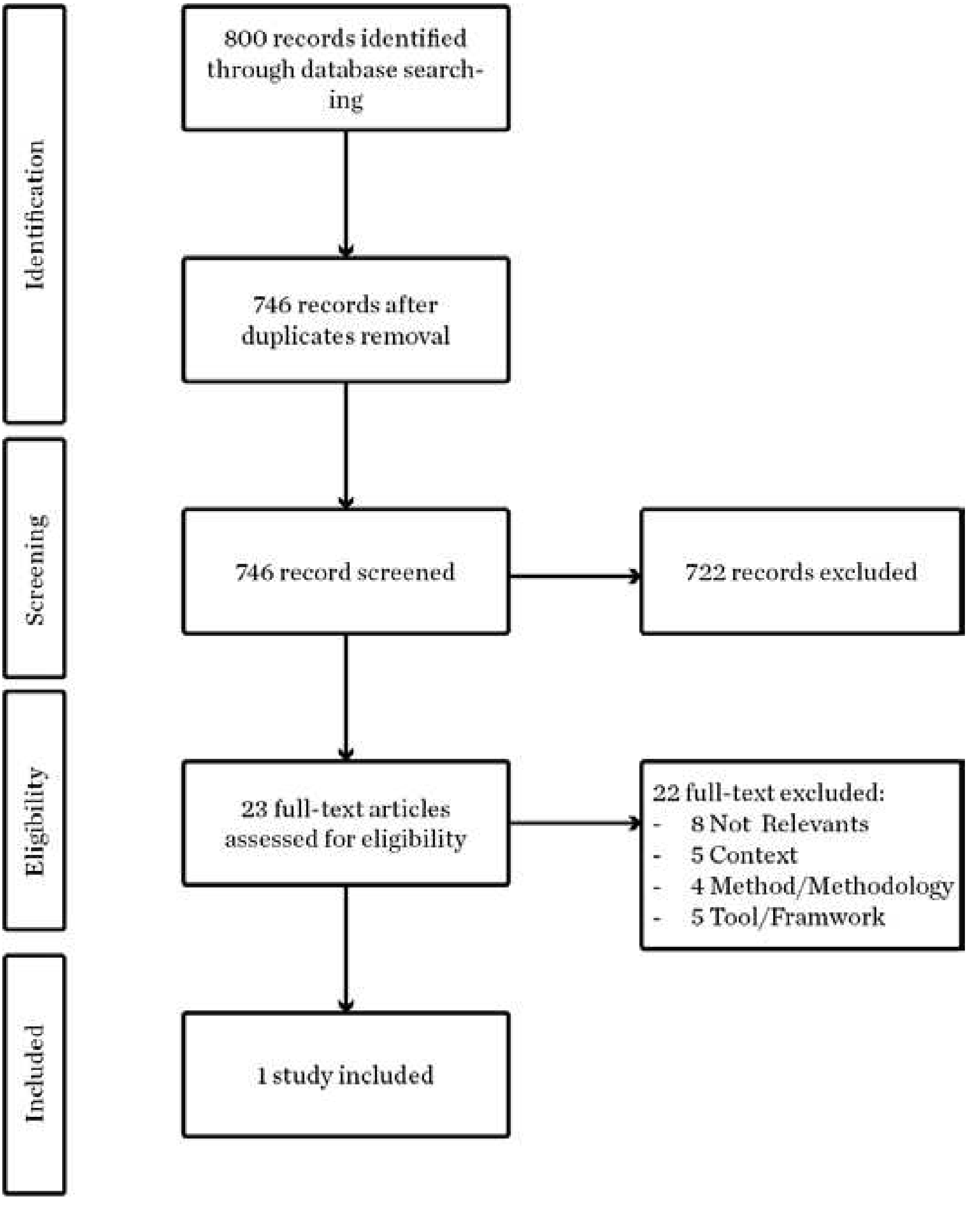


Figure 2.1 PRISMA process flowchart: literature review.

Qualitative Method

The second phase of the audit focused on identifying the motivations and possible actions to improve the innovation ecosystem. For this purpose, the researcher developed a thirteen-question format (Table 2.3) to interview the main stakeholders involved in innovation.

The interview had three sections: the first investigated the innovation's state of the art, highlighting the lesson learnt and what hinders the company from innovating. Furthermore, two questions were asked to define the current and the aspired company's innovation level on a linear scale from one to five to compare the quantitative result with the qualitative one. The second section questioned the firm's aspiration for innovation, surfacing the ingredients and the challenges the company will face. Finally, the third focused on the actions the company could undertake to reach their aspirations. On average, the interviews ran through the Microsoft Team Platform[102] took an average of one hour to be completed.

The sample was thirty-two people, ranging from the Company CEO to all the executives and some directors. The executives represent all company functions,[103] while the directors' selection considers the involvement in the innovation process, therefore focusing on the R&D and P&M departments. The geographical sample highly represents the organisation's dislocation, mainly established in Italy and Sweden.

Questions
What does innovation mean to you?
How important is innovation in our business? (from one to five)
How innovative is our company currently? (from one to five)
What have we learnt from past experiences in innovation (Positive and Negative)?
Could you tell me three things that are hindering us from innovating?
What do you think are the most important ingredients for successful innovation
Considering the different innovation strategies (incremental, disruptive, low-end), what is your perspective about these approaches in our context?
Which are the key challenges we will face (internal and external)?
How could Innovation Hub have a more significant impact on our company and our customers?
Which are the key activities you would suggest Innovation Hub focus on?
Which KPIs and objectives do you consider more viable to measure innovation?

102 Due to the Covid-19 world sanitary situation.

103 Global Operation, Research and Development (R&D), Business Development, Finance, Product and marketing (P&M), Commercial Organization Europe/Americas/APAC/MEA, Human Resources, IT and Communications.

Questions
If we have to focus our innovation effort on a specific technology, business or trend, based on your experience and knowledge, where would you concentrate the effort of Innovation Hub?
Any curiosities or questions you would like to discuss regarding innovation and Innovation Hub?

Table 2.3 Executive interview questions.

Data Collection & Analysis

The research team ran innovation audit data collection and analysis over five months, from September 2021 to January 2021. The researchers first submitted the innovation quotient survey, analysing the data to inform the qualitative data collection. Secondly, they run the interview with the executive team analysing the qualitative data to get the information for defining the organisational innovation strategy.

Innovation Quotient Survey

The team submitted the Innovation Quotient Survey (Rao & Weintraub, 2013) over two months, from September to October 2020. The inquiry was open to all the employees of Electrolux Professional through an online survey run through the Microsoft Form tool. None of the 54 questions was mandatory. Still, the response was satisfying. Overall the research team collected 101 responses, with an average response of 98 answers per question.

In addition to the innovation quotient, the team submitted three preliminary questions to track the respondent sample about the geographical location, the working function and the operating segment. The geographic sample (Figure 2.2) was relatively homogeneous, focused mainly on Italy and Europe, with few North American responses and almost no one in Asia[104]. The working function sample (Figure 2.3) focused on Global Operation (GO) and Research and Development (R&D) departments. In this case, the response was unproportionate. The R&D department's response was higher than the other group functions. Finally, the operating segment sample (Figure 2.4) is relatively balanced between Laundry and Food and Beverage.

Considering these variables, the team calculated the average score (Table 2.4) of the elements, factors and building blocks, analysing the results in light of the sample variables. The team compared the data

104 This correlation was consistent with the employees' distribution for regions.

variance between geography, functions and segments. Still, the few minor differences in the results make the researchers agree to use only the comprehensive data set together for the final analysis. Nevertheless, the GO and R&D answer prevalence could not be denied. It represents a piece of information: evidence of higher involvement and interest in the topic.

In conclusion, the researcher visualised the selected data through a radar map (Figure 2.5) because it easily captures the overall score and the details of the innovation quotient survey. This configuration gave the researcher a readable picture of the company innovation ecosystem's current status, helping them clarify the qualitative inquiry direction and sustaining its conclusions.

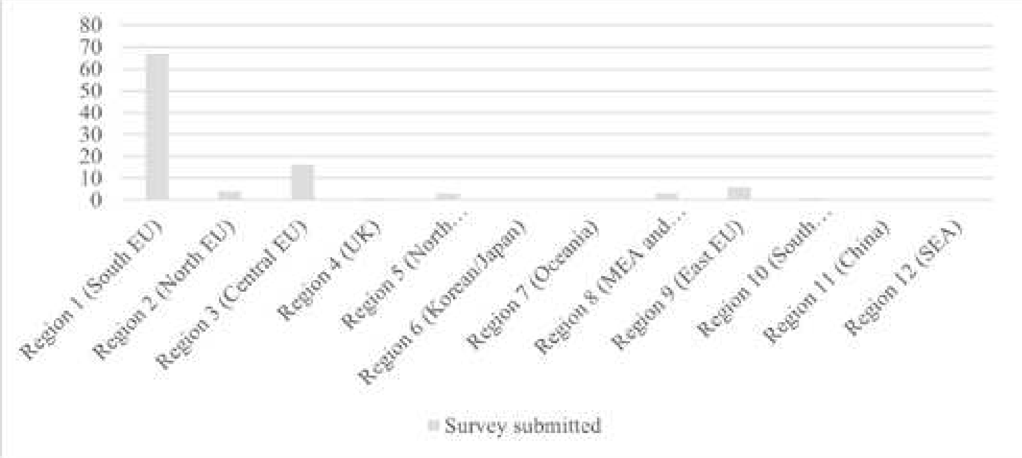


Figure 2.2 Geographical sample.

Figure 2.3 Working function sample.

Figure 2.4 Segment Sample.

Building blocks	**Factors**	**Elements**	**Element Score**	**Factor Average**	**Building Block Average**
Value	Entrepreneurial	Hungry	3.16	2.98	2.91
		Ambiguity	3.14		
		Action-Oriented	2.66		
	Creativity	Imagination	2.92	3.01	
		Autonomy	2.72		
		Playful	2.62		
	Learning	Curiosity	2.67	2.76	
		Experiment	2.89		
		Failure	2.62		
Behaviour	Energize	Inspire	2.67	2.98	2.73
		Challenge	2.89		
		Model	2.62		
	Engage	Coach	2.52	3.00	
		Initiative	2.51		
		Support	3.05		
	Enable	Influence	2.62	2.78	
		Adapt	2.89		
		Grit	2.84		
Working Environment	Collaboration	Community	2.49	3.12	2.89
		Diversity	3.67		
		Teamworking	3.19		
	Safety	Trust	2.91	3.13	
		Integrity	3.24		
		Openness	3.24		
	Simplicity	No bureaucracy	2.03	2.43	
		Accountability	2.76		
		Decision Making	2.51		
Resources	People	Champions	2.66	3.12	2.73
		Experts	2.55		
		Talent	3.32		
	Systems	Selection	2.66	3.13	
		Communication	2.96		
		Ecosystem	2.75		
	Projects	Time	2.45	2.56	
		Money	2.54		
		Space	2.70		

Building blocks	Factors	Elements	Element Score	Factor Average	Building Block Average
Processes	Ideate	Generate	2.68	2.77	2.56
		Filter	2.77		
		Prioritize	2.84		
	Shape	Prototype	2.52	2.61	
		Iterate	2.56		
		Fail Smart	2.74		
	Capture	Flexibility	2.08	2.30	
		Launch	2.28		
		Scale	2.54		
Success	External	Customers	3.03	2.72	2.72
		Competitors	2.42		
		Financial	2.72		
	Enterprise	Purpose	2.83	2.78	
		Discipline	2.60		
		Capabilities	2.93		
	Individual	Satisfaction	2.80	2.64	
		Growth	2.79		
		Reward	2.34		

Table 2.4 Innovation quotient results.

Innovation Quotient

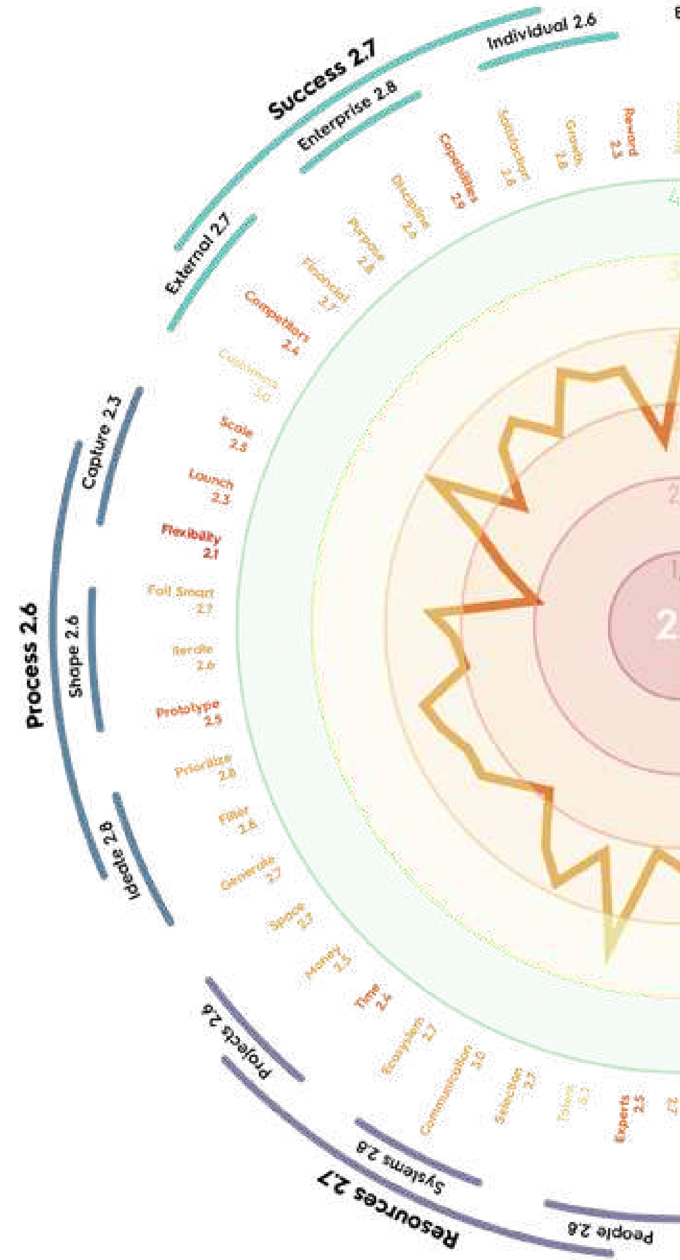
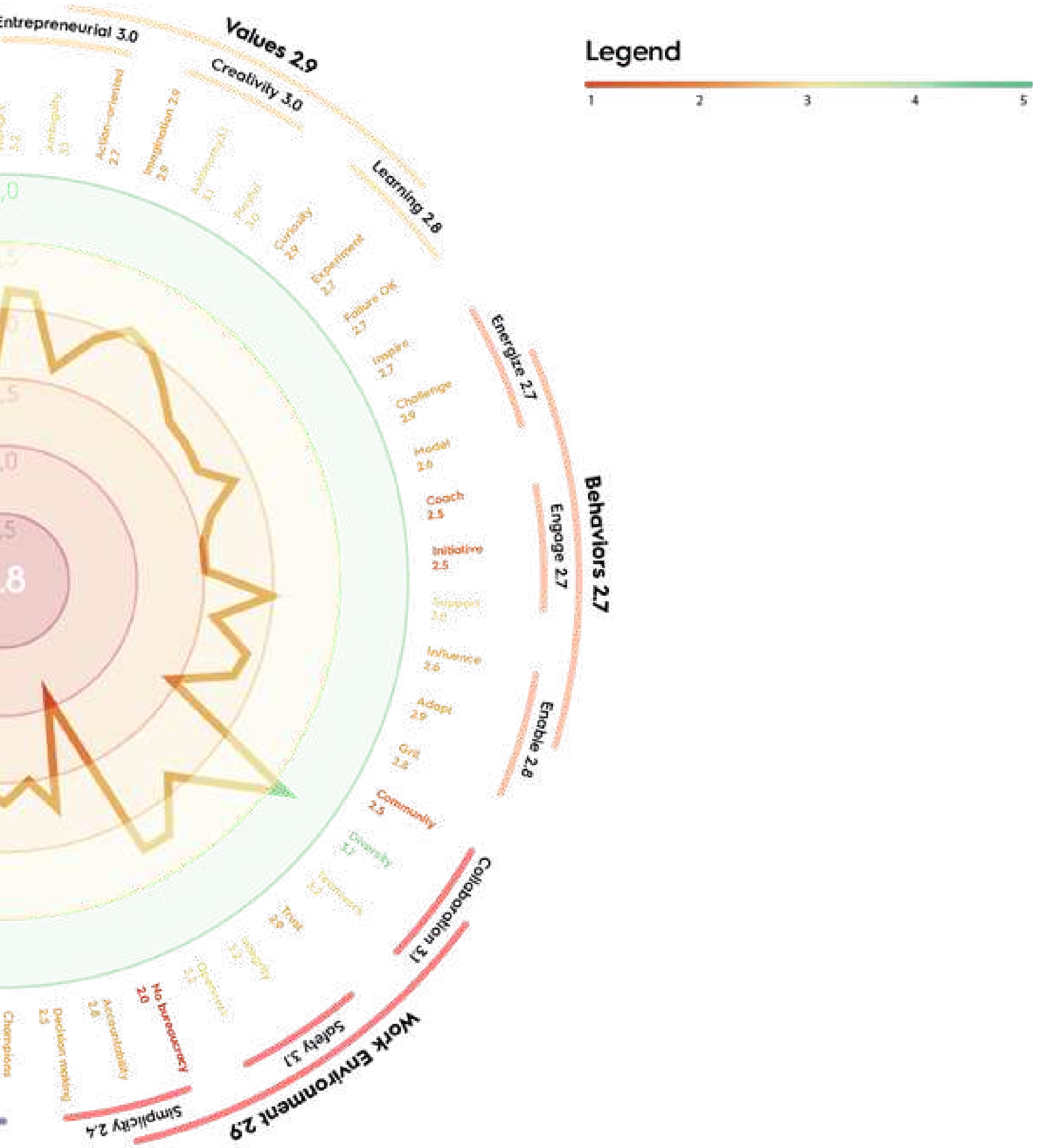


Figure 2.5 Innovation quotient visual summary.


Entrepreneurial 3.0
Values 2.9
Creativity 3.0
Learning 2.8
Energize 2.7
Behaviors 2.7
Engage 2.7
Enable 2.8
Collaboration 3.1
Safety 3.1
Work Environment 2.9
Simplicity 2.4
Action-oriented 2.7
Imagination 2.9
Curiosity 2.9
Experiment 2.7
Failure OK 2.7
Inspire 2.7
Challenge 2.9
Model 2.6
Coach 2.5
Initiative 2.5
Influence 2.6
Adapt 2.9
Grit 2.8
Community 2.5
Diversity 3.1
Trust 2.9
No bureaucracy 2.0
Accountability 2.6
Decision making 2.5
Champions
Legend
1
2
3
4
5

Executive Interviews

The researchers performed the thirty-two interview over three months, collecting qualitative data and analysing them vertically and horizontally to arrange them in a framework representing the company innovation context.

Each semi-structured interview was done in a team of three people. An interviewer specialised in following the inquiry line-up, and two listeners focused on collecting first impression notes. All the sessions were video-recorded through the Microsoft Team application and reviewed by one researcher to transcribe the interview internally. Then, first, the description was made available to the team of reviewers to check their notes according to the report singularly. Second, a debrief meeting to discuss the findings converged and combined the single perspectives in a common viewpoint. The final result of this vertical analysis consisted of an insight bullet-point summary for each interview.

Subsequently, the team analysed the data horizontally, looking for common patterns. The researcher collected similar findings in a dedicated database, grouping them using a labelling approach to cluster the insights in a three-level hierarchical structure. Then each topic highlighted was weighted by calculating the topic frequency (Table 2.5 and Table 2.6). After several iterations, five main subjects emerged, supported by the interviews' topic frequency data. In the same direction, the insights' sub-clusterisation resulted in two categories: problems that affect the topic and possible solutions. Finally, the researcher combined those data into a visual representation of the qualitative interviews (Figure 2.6), displaying the main Electrolux Professional concerns about innovation and possible actions to solve them. All with visual feedback about the frequency of the insight described.

Due to the topic's corporate confidentiality, the interviews' transcriptions were not reported in the thesis appendix. They were treated as personal interviews conducted informally to support the thesis argument. In the "innovation framework" paragraph, the researcher did not directly make any personal reference to the single interviewee. Instead, the information was treated as aggregated data and discussed, focusing more on their general insights than the intrinsic quality of the source.

Cluster	Frequency	Number of Interviewees
Focus	100%	32
Human-Centricity	99%	31
Process	99%	31
Community	93%	29
Culture	96%	30

Table 2.5 Topics cluster frequency.

Cluster	Sub-cluster	Frequency	Number of Interviewees
Focus	Innovation Focus	61%	19
	Product Centricity	45%	14
	Innovation Vision	20%	6
Human Centricity	Customer Understanding	77%	25
	Trend Scouting	29%	9
	Technology Centred	16%	5
Process	Lack of Time, Slow and Delay	51%	16
	Bring Innovation to the Market	40%	13
	Complexity and Bureaucracy	16%	5
	Innovation Ownership	16%	5
Community	Not Invented Here Bias	38%	12
	Inside-out Perspective	26%	8
	Working in Silos	13%	4
	No Innovation Feedback	13%	4
Culture	Risk Aversion	26%	8
	Expecting Short Payback	23%	7
	Traditional Habits	16%	5
	Few Innovation Competences	10%	3
	No Failure Culture	6%	2

Table 2.6 Concerns sub-cluster frequency.

Cluster Lev. 1	Cluster Lev. 2	Cluster Lev. 3	Frequency	Number of Interviewees
Focus	Innovation Ambition	Familiar Incremental Innovation	55%	17
		All types of Innovation	35%	11
		Different Innovation Paths	23%	7
		EP Position Requires Innovation	23%	7
		Innovation Vision	16%	5
	Innovation Priority	Sustainability	45%	14
		Digitalisation	41%	13
		Service & Business Model	29%	9
		Chain	16%	5
		Leverage Synergies	16%	5
Human Centricity	Customer Understanding	Listen to Customers	23%	7
		Insight Collection Process	16%	5
		Customer Innovation day	6%	2
		Customer Data Mining	6%	2
	Trend Scanning	Monitoring Changing Society	16%	5
		Big Data Trend Understanding	3%	1
		Customer Trend survey	3%	1
Process	Manage Innovation	Coordinate & Facilitate Process	32%	10
		Define the Innovation Rules	26%	8
		Innovation Accountability	13%	4
		Delegation Process	13%	4
	Lean Innovation Process	Evaluate, Prioritise, and Select	32%	10
		Quick Customer Testing	29%	9
		Start Small and Scale-up	19%	6
	Innovation Speed	Act as an independent Function	26%	8
		Minimise Bureaucracy	23%	7
		Be Proactive, Agile & fast	16%	5
		Allow Time for Innovation	13%	4
Community	Cross-Collaboration	Involve Everybody	39%	12
		Collaboration	29%	9
		Horizontal Integration	19%	6
	Spread Innovation	Spread Best Practice	29%	9
		Build Internal Consensus	16%	5
	External Collaboration	Grow External Alliances	25%	8
		Acquire Outside Capability	19%	6
		Working with Startups	6%	2

Cluster Lev. 1	Cluster Lev. 2	Cluster Lev. 3	Frequency	Number of Interviewees
Culture	Learning from Failure	Learning by Failing	32%	10
		Fail as Early as possible	10%	3
	Risk-taking	Sustain Investment	23%	7
		Different Metrics	6%	2
		Decisions with Less Information	6%	2
	Cultural Change Catalyst	Nudge Cultural Change	19%	6
		Cultural Hacks	6%	2
		Teach new Skills	6%	2

Table 2.7 Suggestions sub-cluster frequency.

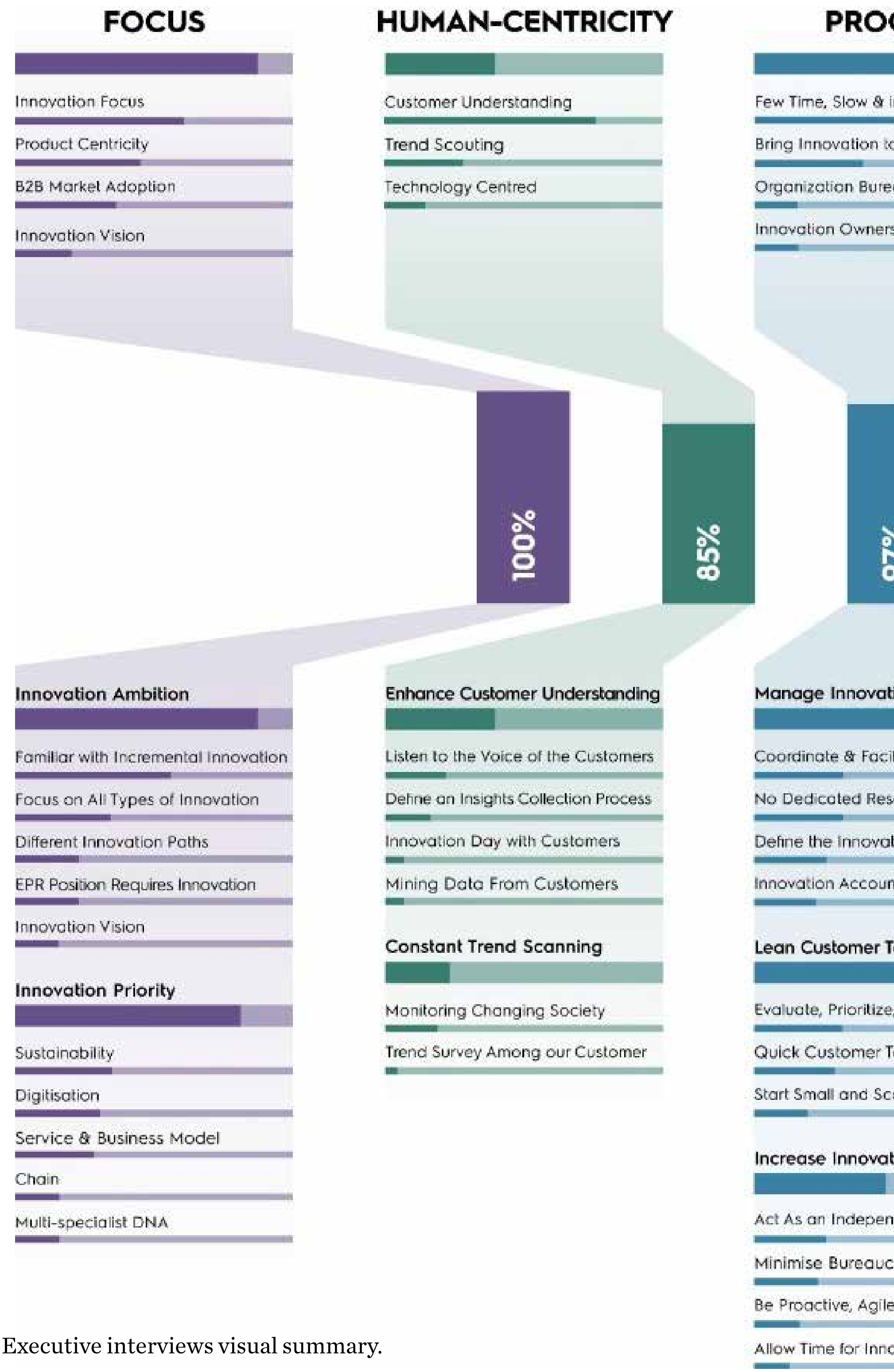
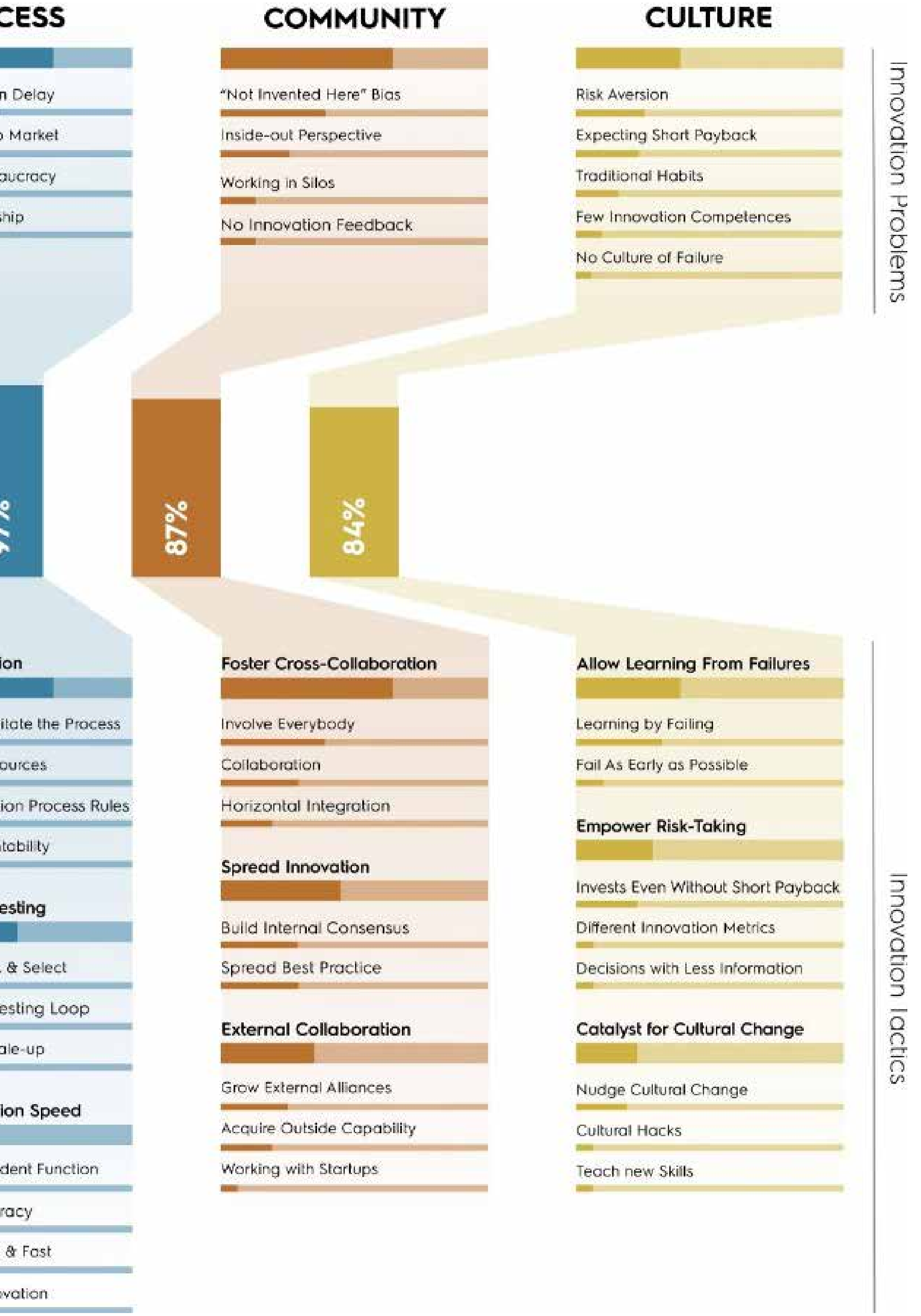


Figure 2.6 Executive interviews visual summary.



CESS
COMMUNITY
CULTURE
n Delay
Market
aucracy
hip
"Not Invented Here" Bias
Inside-out Perspective
Working in Silos
No Innovation Feedback
Risk Aversion
Expecting Short Payback
Traditional Habits
Few Innovation Competences
No Culture of Failure
Innovation Problems
87%
84%
ion
itate the Process
ources
ion Process Rules
tability
esting
& Select
esting Loop
ale-up
ion Speed
dent Function
racy
& Fast
vation
Foster Cross-Collaboration
Involve Everybody
Collaboration
Horizontal Integration
Spread Innovation
Build Internal Consensus
Spread Best Practice
External Collaboration
Grow External Alliances
Acquire Outside Capability
Working with Startups
Allow Learning From Failures
Learning by Failing
Fail As Early as Possible
Empower Risk-Taking
Invests Even Without Short Payback
Different Innovation Metrics
Decisions with Less Information
Catalyst for Cultural Change
Nudge Cultural Change
Cultural Hacks
Teach new Skills
Innovation Tactics

Design & Design Thinking Interviews

After assessing the Electrolux Professional ecosystem, the researcher deepened the design and design thinking subjects to point out the relationships and interconnections between innovation, design and design thinking through additional in-depth interviews with key design department figures.

Design Interviews

After the innovation audit process, the researcher decided to understand the interconnections between innovation and design. Thus, he scheduled and ran five in-depth interviews to surface the department's journey over the Electrolux Professional history and its relationship with the innovation and design thinking topics.

For this purpose, the research was split into two streams. The first focused on the design department's role developed over the years and its relationship with the innovation process. The second regarded the design thinking practices, perceived shortcomings, and assessment attempts. The researcher designed an interview format for each stream to dig into the interviewees' know-how (Table 2.7 and Table 2.8). The first set of interviews counted 12 open questions and took an average of one hour to be completed, while the second was composed of 17 and took one hour and a half. All of them ran through the Microsoft Team Platform due to the covid sanitary emergency.

The samples were of three people for the first stream and two for the second one. In the first one, the interviewees were the current and the previous head of the design department and the innovation hub[105] manager. In the second one, the interviewees were again the current head of the design department and the innovation hub manager because they are the main characters that adopted and spread design thinking in the organisation.

105 The innovation hub is a new concept developed in 2020 within the design function to support the organisation in innovation. Its origin and development are discussed over the course of this chapter.

Questions
When did you join the company, and what were your role and responsibilities?
How did your role develop over the years?
How did the design role develop over the years?
Which were the main events that articulate this journey?
What was the relationship between design and innovation along this path?
Does the design role impact the company's innovation output? How?
What do you think was the perception outside the design department?
What is the current design role?
What is the current relationship with innovation? Do you perceive any impact?
Which were the key elements that brought the design to this position?
What do you think is the current perception outside the design department?
Which will be the design department's direction from now on?

Table 2.8 Design thinking interview questions.

Questions
What is design thinking for you?
What does design thinking represent for your work?
When did you start to adopt this label? Why?
What was the company's reaction to design thinking?
How are you used to explaining the concept to them?
How did design thinking spread over the company?
Why did it come from design?
How is design thinking integrated into the design?
What is the design thinking relationship with the other functions?
How are you trying to legitimise design thinking in the company?
Did design thinking help the design department achieve its current role? How?
Did you find any side effects or shortcomings in design thinking? Which ones?
Did design thinking impact the innovation ecosystem till now? How? Why?
Have you ever tried to assess the design thinking impacts? How? Why?
Do you think it will be valuable? Why?
Which will be the design thinking future of Electrolux Professional? Innovation Hub?
Do you think the label will last longing in Electrolux Professional? Why? Alternatives?

Table 2.9 Design thinking interview questions.

Design Thinking Interviews

The researcher ran the semistructured interviews during March 2021. He first interviewed the head of the design department, the innovation hub manager and the previous design director about the Electrolux Professional design department journey. Then, he asked the design director and innovation hub manager again about the role of design thinking in this story.

The researcher ran each interview singularly, leading the questioning process and taking notes simultaneously. He recorded and transcribed each dialogue and then compared it with the observations collected during the interviews. By the end of the review process, for each interview, the researcher pointed out the central insights preparing them for the horizontal analysis.

The researcher approached the first three interviews with a historical approach, analysing the findings chronologically. He reconstructed the events, sorting them on a timeline on the x-axis[106] and dividing them by category on the y-axis (Figure 2.7).[107] Then, he connected the insights pointing out the influences and the relationship among the items. However, this analysis pinpointed gaps in the information collected. Therefore, the researcher ran one more additional focus group with the interviewees to close the highlighted gaps and verify the high-level reconstruction validity of the events.

Similarly, the researcher analysed the insights from the two interviews on design thinking, comparing the two perspectives through an affinity map[108] (Figure 2.8). The visual tool supported the information analysis by highlighting the main topics, their interconnections and the convergencies and divergencies of opinions in the interviewees.

106 The events journey started in 1969 until 2021.

107 The orange line underlines the main events in the design journey. The pink line represents the design of functional reporting. The green line points out the role of design in the company. The blue line shows the relationship with innovation. The yellow line identifies the pivoting project and activity for the design. The grey line describes the interviewees' key assumptions.

108 In the affinity map, we can see the main topics discussed in red in the interviews. In yellow are the summarised insights suggested by the design department director, and in green are the insights from the innovation hub manager. The arrow describes the correlations among the topics.

Even in this case, the interviews' complete transcriptions were not reported in the thesis appendix due to the topic's corporate confidentiality. However, since these interviews are more qualitative and less sensitive, the organisation decided to allow the interviewees' direct citations. Thus, the interviews were treated as personal communication and cited in the "design journey" and "design thinking" paragraphs, highlighting the source's name and the interview's date.

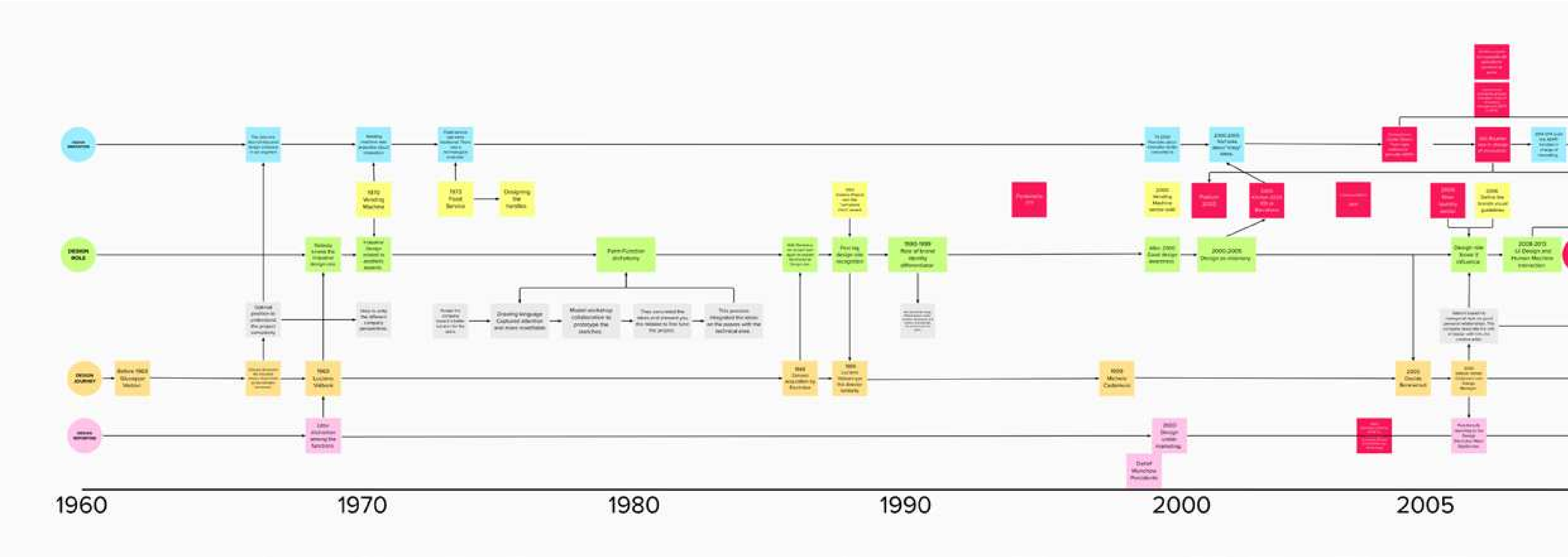
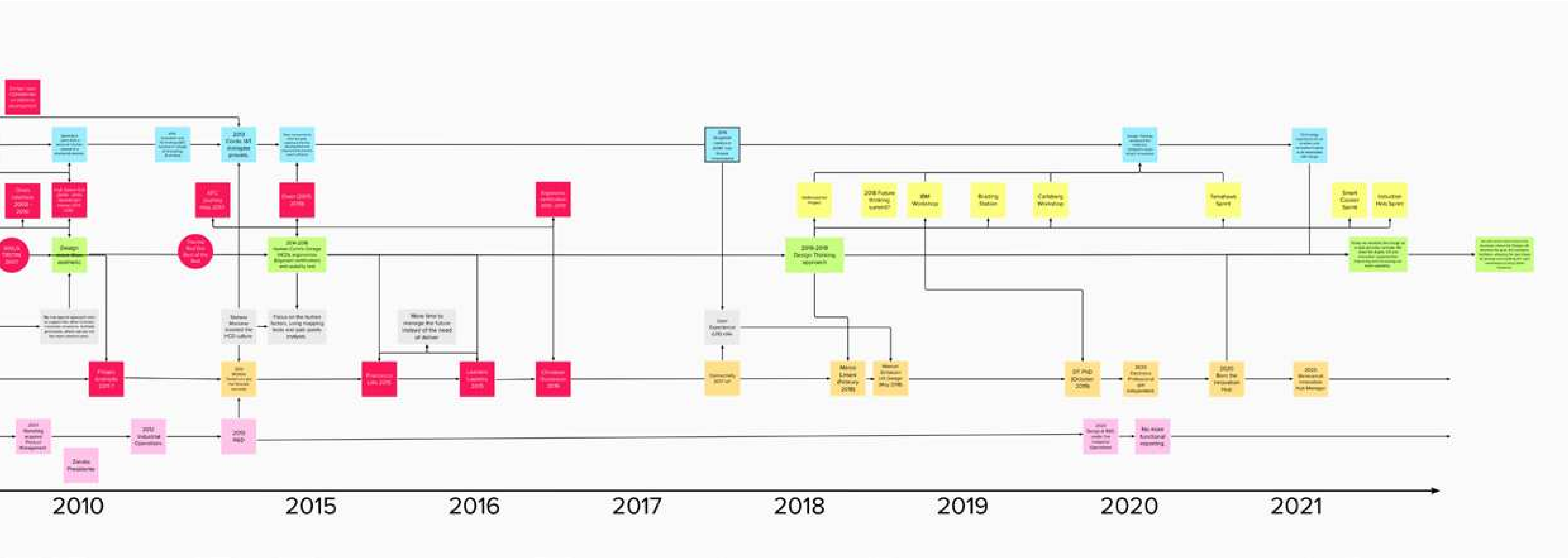


Figure 2.7 Design journey map.



2010
2015
2016
2017
2018
2019
2020
2021
More time to manage the future instead of the need of deliver
2018-2019 Design Thinking approach
IBM Workshop
Carlsberg Workshop
No more functional reporting

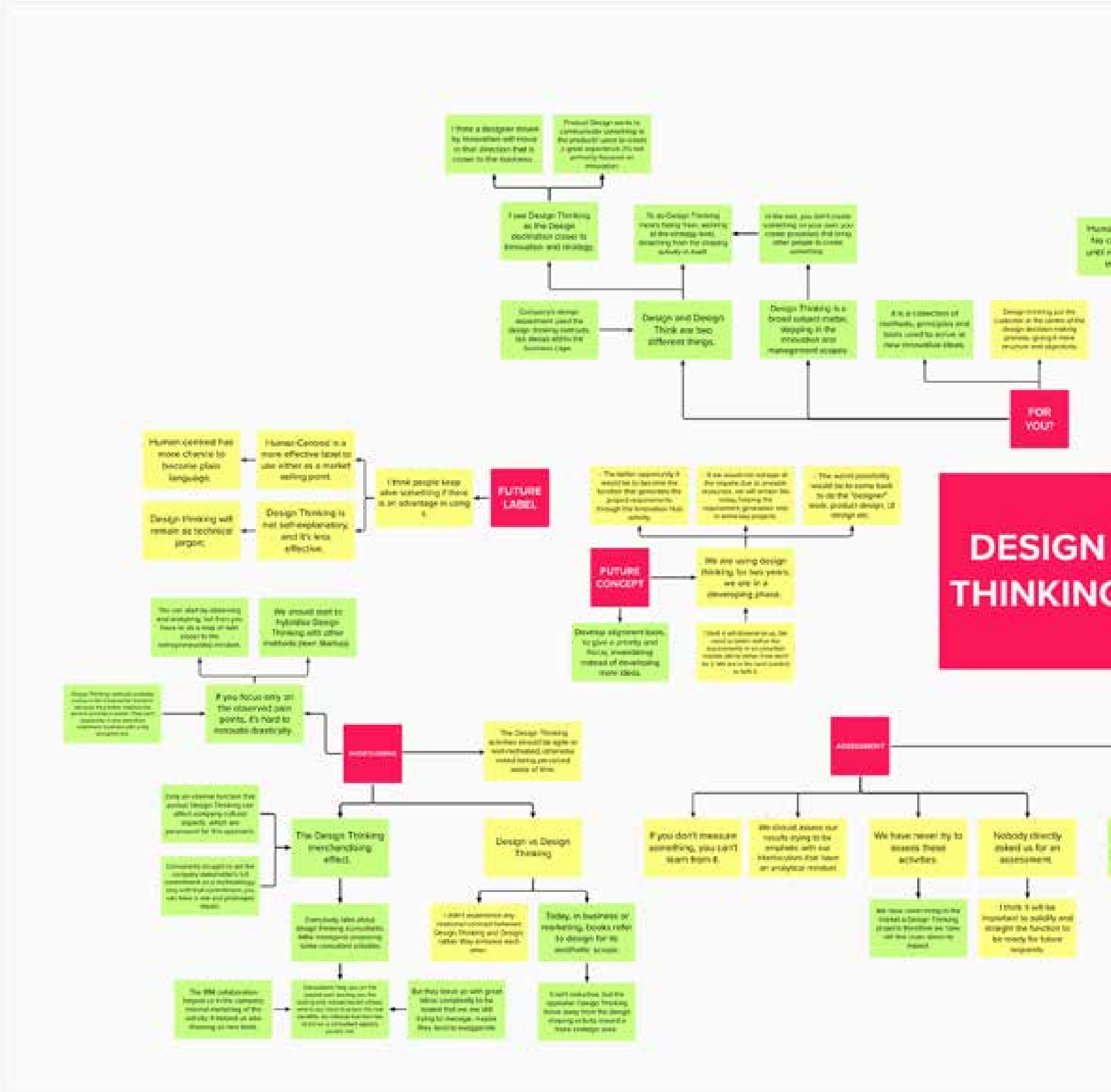
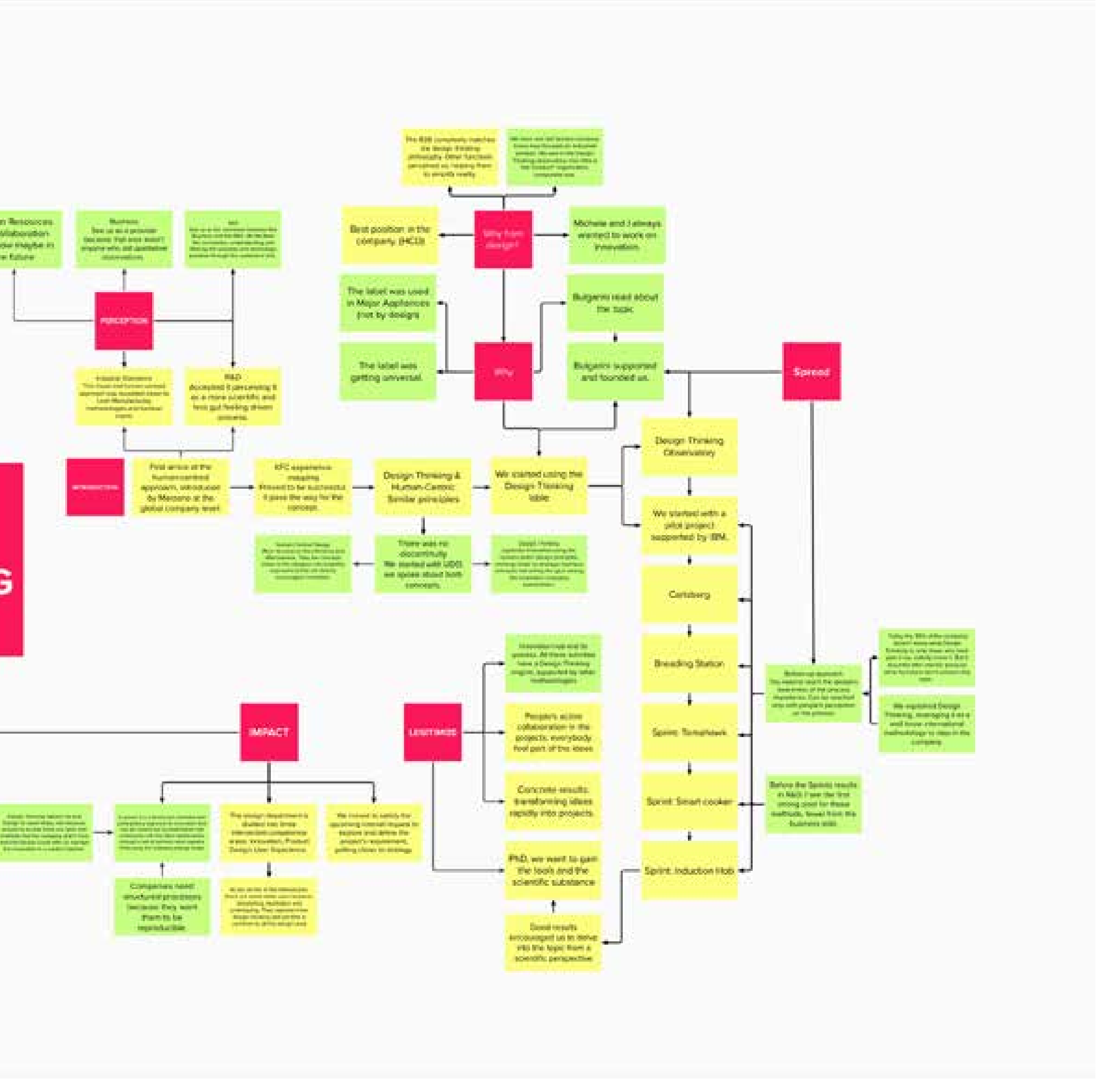


Figure 2.8 Design thinking affinity map.



Why
Spread
IMPACT
Best position in the company (HCD)
The label was getting universal.
Bulgarini read about the topic
Bulgarini supported and founded us.
Design Thinking Observatory
Design Thinking & Human-Centric Similar principles
We started using the Design Thinking table
We started with a pilot project supported by IBM.
Carlsberg
Breeding Station
Sprint: Smart cooker
Sprint: Induction Hob
Concrete results: transforming ideas rapidly into projects.
Companies need structured processes because they want them to be reproducible

2.2 Electrolux Professional

This paragraph sets the context of the company's history. Firstly, it introduces the events that led Electrolux Professional to its international dimension. Then, it examines the evolution of the innovation discussion, pointing out the primary organisational shifts over this process. Finally, it argues the stakeholders' perspective on the meaning of innovation, its importance for the company's success and their aspirations.

Brief History

Electrolux Professional is a Sweden business-to-business (B2B) multinational company that produces professional appliances for the hospitality sector. Since the 20th of March 2020, Electrolux Professional has been an independent company, but the journey that brought this firm to that point was full of events. Before 2020, Electrolux Professional was a relatively small internal division of Electrolux: a multinational Sweden company settled in Stockholm that produces and commercialises a broad range of domestic appliances. However, if we look back again, the company's heritage lies in the Zanussi Grandi Impianti, another professional division of the multinational company Zanussi that produced domestic appliances until Electrolux's acquisition in 1984.

Axel Wenner-Gren (Fig 2.09) officially founded Electrolux in 1919 by commercialising vacuum cleaners. In the following years, an aggressive acquisition policy expanded its product range to refrigerators, dishwashing machines and freezers until it became a multinational firm. Similarly, in Italy, Antonio Zanussi (Fig 2.10) founded the Zanussi in 1916, initially producing a standard wood-burning kitchen and then expanding its business to the professional kitchen area in 1934 ('Zanussi', 2021). After successfully introducing the first gas burners, Zanussi differentiated its range by manufacturing refrigerators, dishwashers, and televisions, adopting an acquisition policy similar to the Electrolux one. However, in 1968 Lino Zanussi, Antonio's son and CEO of the company died in an air accident with the executive team. From that point, Lamberto Mazza overtook Lino, and the company started a vast expansion policy in Italy and Europe. On

Figure 2.9 Axel Wenner-Gren with its degree from the Berlin School of Business (Berlin handelsakademie) in 1902.

Figure 2.10 Antonio Zanussi, Portrait in Gregoris's studio with one of the most beautiful wood-burning kitchens of the 30s.

the B2B side, Zanussi built a Spain facility to produce and commercialise large kitchen plants and established a vending machine company in Italy. At the beginning of the 80s, Zanussi started its relentless decline after an initial exponential expansion due to a wrong acquisition policy and an adverse economic condition. Finally, in 1984, Electrolux acquired Zanussi, and Zanussi Grandi Impianti became Electrolux Professional (Fig 2.11).

In the following years, Electrolux Professional enlarge its business in different directions. For instance, in 1998, it acquired Alpeninox, expanding its business in the refrigeration sector. In 2006 it introduced the laundry sector in Ljungby (Sweden), and later in 2018, it acquired Schneidereit, a fast-growing laundry rental business in Germany. In 2015 increase the dishwashing segment in China bought Veetsan. In 2017 Electrolux Professional expanded its business into the beverage sector, acquiring first Grindmaster in the US, then SPM Drink System in Italy and, more recently, Unic in France.

Finally, in 2019, the excellent market result and high return for the investor convinced the Electrolux board of directors to approve the professional division separation. In 2020 the change became official with the stock exchange listing in the Stockholm Nasdaq, which set off Electrolux Professional as a separate organisation.

Innovation Story

The innovation discourse in Electrolux Professional started to mature at the beginning of the new century due to the rising competition challenge. Over the years, innovation accountability moved from developing a dedicated technology-based competence to today's reorganisation in Open Innovation and Innovation Hub.

From 1970 to 2000, the interviewee perceived innovation as a spontaneous and unstructured process. There were few or no talks around innovation but rather a general attitude toward investigating new possibilities. This inclination came from people's intuition and the company's willingness to believe and pursue new ideas. Indeed, inside the company, there was no significant distinction among functions or heavy hierarchical structure. Employees were free to propose and try to realise new solutions beyond the official company's product pipeline. This approach was predominant in the vending machine segment, where the previous design department director described a lively experimental environment that, over the years, produced different innovative products.[109] On the contrary, the food service segment was more traditional, where technological evolutions brought new functionalities to the products, but the range remained almost the same (L.Valboni, personal communication, March 19, 2021).

The research did not highlight a clear and shared reason behind the innovation shift of importance. However, within the new century, two main factors spot the organisational attention toward innovation. Firstly, the traditional mindset that affected Electrolux Professional and the overall B2B hospitality business was changing. The global pace of change accelerated the hospitality competition, challenging the professional customers' traditional mindset, which is more oriented toward reliable solutions than new and risky innovations. Consequently, even the competition

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109 The most prominent was the Domino project, which won the Compass D'oro award in 1989. Other products were cited by Valboni but without any specific reference point. For instance: a hexagonal vending machine for the emerging open space offices; or a free water dispenser for the hotels, which allowed customers to offer their users free water, increasing their satisfaction and lowering the overall water logistic expenses.

Dagens industri • Fredag 16 nov 1984 7

Största utlandsaffären: Lux har köpt Zanussi

Werthén i går: ”Vi är lättade”

ROM

Electrolux har köpt Zanussi.

Det är innehållet i den kommuniké som de båda företagen skrev på torsdagseftermiddagen för att ge ut efter ett sista möte med Italiens industriminister sent på kvällen.

Köpet är det största som ett svenskt företag gjort utomlands. Electrolux betalar 1,25 miljarder kronor

DI / Italien
Titti Nylander

Bankerna ger efter

Figure 2.11 Electrolux brought Zanussi. Frm the Swedish daily Dagens Industri on November 16, 1984.

that historically was far behind Electrolux Professional became stronger, increasing the company's motivation to develop a structured discourse around innovation.

One of the first concrete signals in favour of innovation arrived in 2003 when Electrolux Professional's CEO[110] officially designated Udo Bauman,[111] a brilliant mechanical engineer, to explore new innovative opportunities, sustaining him personally. In 2005 Electrolux Group built the Global Connectivity and Technology centre (GCNT) to boost technological innovation, pressing its professional division to develop a similar

110 Münchow overtake Zoppas as CEO of Electrolux Professional in 2000.

111 Interviewees recalled Bauman as an entrepreneurial spirit capable of moving ideas forward on a parallel path involving the right colleagues in its journey.

competence. Thus, a few years later, Omero Tuzzi, head of the electronic engineering department, formed a small technological competence centre. The joint effort of the competence centre, Bauman's dedication, and the CEO's direct sponsorship create the right conditions in the company to explore new potential innovative ideas. Starting from 2003, the Molteni Podium kitchen,[112] in 2005, the first Libero Point line[113] and, finally, in 2008, the SpeeDelight[114] projects (Figure 2.12; Figure 2.13; Figure 2.14; Figure 2.15; Figure 2.16) sparked a creative atmosphere inside the company.

Nevertheless, the organisation struggled to gain consistent positive results. The Air-o-Speed Oven[115] had potential, but the company failed to commercialise it successfully. Gran Cousine[116] did not pass the market test, not finding the proper channels, and the self-cleaning robot[117] had technical and safety issues that blocked it during the development phase (Figure 2.17; Figure 2.18; Figure 2.19; Figure 2.20; Figure 2.21). In those ten years, the interviewees' general perception was that the company faced the innovation challenge with the right ingredients but in a poorly structured manner (M. Cadamuro, personal communication, March 4, 2021).

In 2010, with the arrival of Zanata as the new CEO and Corda as the new head of R&D, the competence centre enlarged its scope, becoming the Innovation and Technology (I&T) function. In a few years, Bauman

---

112 Molteni is an Electrolux Professional brand that produces handmade professional kitchens in the north of France. Its historical aesthetic and indisputable quality made the brand one of the most iconic in the professional world, used by many Michelin-star chefs worldwide. The Podium version tried to challenge the classic iconic form, creating a mediatic success but with little economic returns.

113 The Libero Point is a stand-alone modular kitchen that chefs can use everywhere: in hotels, show-cooking performances, and all the front customer situations. This product is highly flexible and customisable depending on the type of cuisine. The product had a good market impact and is still in production. The picture refers to the newest version of the same product.

114 The Speedlight is an innovative high-speed cooking appliance that uses infrared and microwave technology to heat a meal in a few seconds. Thanks to the technology patents and its new typology, it is considered by the interviewee the most successful Electrolux Professional innovation. The picture refers to the newest version of the same product.

115 The Air-o-Speed Owen was an innovative solution that used multi-heating technologies to reduce cooking time. However, the low reliability, the wrong sales commercialisation and the company's impatience toward a fart return on the investment prompted it to recall the product from the market.

116 Grand cousin was a semi-professional kitchen designed in collaboration with Electrolux Major Appliances. It has domestic customers but an overall quality that resembles the performance and reliability of professional appliances. However, the lack of the right channel and the market segment competition caused it to fail in the market.

117 The cleaning robot was an internal experiment thought to clean an oven's cavity automatically. However, the product was unreliable and dangerous. Therefore it was blocked during the developing phase.

Figure 2.12 Molteni Podium (2003), first prototype.

Figure 2.13 Molteni Podium (2003) show-cooking event.

Figure 2.14 Libero Point (2003), first prototype.

Figure 2.15 Libero Point (2005), final product.

retired, and Furlanetto[118] overtook him, leading the company's innovation effort in a technological direction. On the one hand, he created the Research Hub forming strong and valuable alliances with different universities on the technical side. However, on the other hand, the overreliance on internal development and technology slows the innovation inertia foreclosing many possible innovative opportunities to the organisation. Therefore, in 2018, Bulgaroni, the new head of R&D, restructured the I&T function as Advance Development (ADNT), bringing it back to its previous role of competence centre. Simultaneously, for the first time, he suggested the design function to collaborate with ADNT to support the technological push with a human-centric innovation perspective. However, due to organisational and personal motivations, the cooperation between the two functions never took off (M. Cadamuro, personal communication, March 4, 2021).

Finally, in 2020, with the company separation and reorganisation, the design was officially put in charge of pursuing innovation, supported by the ADNT as an innovation enabler. In 2021 the company reorganised its innovation function around two competencies: Open Innovation[119] and Innovation Hub. The first one focused on fostering innovation outside by collaborating with universities, companies and startups. The second one specialised in the internal innovation management of new ideas and projects.

Innovation Meaning

The word innovation in the Electrolux Professional context has different meanings and interpretations. During the innovation audit, the first question asked to all the interviewees was: What does innovation mean to you? However, as expected, there was not a univocal clear answer. A common interpretation of innovation lies in its Latin lexicon root innovatio, derived from the verb innovare, namely to introduce (something) new. For all the interviewees, the word innovation refers to the act of introducing something new. Still, despite this shared view, its meaning seems to differ depending on the stakeholders' interpretation.

Considering the frequency of the answers (Table 2.10), we can observe that the most shared meaning attributed to innovation is: creating value for the customers by making their life easier[120]. However, during

118 The R&D Director of the oven category initially became I&T and then ADNT director since he left the company in 2020.

119 he "Research Hub" manager became the "open innovation" manager, broadening its previous university focus to all the company's external relationships with innovation.

120 This definition of innovation is influenced even by the Electrolux Professional mission.

Figure 2.16 SpeeDelight Mokeup (2008).

Figure 2.17 Air-o-Speed (2003).

Figure 2.18 Grand Cousine sketch of the contxt (2017).

Figure 2.19 Grand Cousine (2017), Wok Induction Hob.

the interviews, others meanings emerged. Innovation means producing a competitive advantage and winning the competition. Innovation is a marketing tool for others stakeholders, giving visibility and making noise in the market. It has a business perspective for others because it generates value by producing salable benefits. Finally, some interviewees highlighted a relationship between innovation and the company culture, pinpointing the importance of having the proper mindset embedded in the organisation's DNA to be innovative.

At first gaze, these perspectives seem to reflect the organisation's departmental division with the business functions that see innovation as a value for the business, marketing as a tool for getting visibility and human resources see it as a cultural aspect. Still, the data do not suggest an apparent correlation between the stakeholders' roles and their answers. Nevertheless, this is an indicator of the holistic and broad impact associated with innovation at any level of the organisation.

The vast network of meaning that innovation assumes and its interconnections with many company aspects suggest its solid long-term implications for the sustainable success of Electrolux Professional. Another clue in this direction came from the considerations expressed during the interviews. Some stakeholders underlined as the premium market position of Electrolux Professional requires innovation to offer the customers something more to stay competitive in the market. Thus, innovation is paramount in justifying the higher market price of the company and sustaining its profitable growth.

However, the data collected in the audit suggested that the company has a higher ambition about innovation. The Innovation Quotient Survey's final score was 2.8 out of 5, following the 2.9 scores expressed by the executives' interviews result (Table 2.11). This result proves a good alignment between the leadership and the employees' perception of today's innovation level. Still, the company executives' innovation ambition is higher. The qualitative research spotted an innovation aspiration of 4.4 out of five, pointing out a clear gap between the ambition and the current level.

Identified the goal and expectations of the executive stakeholders, the following paragraph discusses the other findings collected in the innovation audit, analysing the interviewees' concerns and suggestions about innovation.

Indeed, it states: making Electrolux Professional's customers' work-life easier, more profitable and truly sustainable every day.

Figure 2.20 Automatic Cleaning Robot (2004), Main Body.

Figure 2.21 Automatic Cleaning Robot (2004), Trolley.

Cluster	Frequency	Number of Interviewees
Innovation as Customer Value Creation	58%	19
Innovation as Competitive Advantage	39%	12
Innovation as Marketing Tool	32%	10
Innovation as Company Business Tool	29%	9
Innovation as Company Culture	26%	8

Table 2.10 Innovation meanings for Electrolux Professional.

Method	Question	Score (from 1 to 5)
Innovation quotient survey	Overall data average	2.8
Executive interviews	How innovative is our company currently?	2.9
Executive interviews	How important is innovation in our business?	4.4

Table 2.11 Innovation status and ambition.

2.3 Innovation Framework

This paragraph discusses the central insights of the innovation audit research. It introduces the key findings dividing them into primary clusters: concerns and suggestions. For each group, the paragraph narration follows the main topic discussed during the interviews. Finally, the insights were summarised into a framework that became the theoretical foundation of the organisational innovation strategy.

Concerns

The innovation audit highlighted several stakeholders' concerns. Analysing them by frequency (Table 2.6), the researcher identified five main areas of improvement, where the interviewees focused their attention.

Focus

Electrolux Professional is a multi-brand company that manufactures many different products for the hospitality segments. Its multi-specialist character makes the organisational capability to decide on what to focus on paramount, especially considering a competition landscape made of product specialists that can spend their innovation effort toward fewer directions. Indeed, the company's limited energies and willingness to innovate over the entire range made the focus topic the most common concern among the interviewees. The organisation struggle to decide where to focus its limited energies and compete against a competition that is becoming stronger and stronger.

Another frequent element pointed out is the product-centricity topic. Electrolux professionals is a technology, and engineering-driven company focused on product development. However, even in this traditional market, business opportunities move away from products toward service, digital and business model innovation. Moving from a product-centric approach to a service one is a complex issue that requires a collective effort from the whole organisation, not only innovation.

Finally, a lack of a clear strategic vision about innovation worsens decision-making. Indeed, without an official and clear view of the company's strategic direction, personal opinions sometimes take over, increasing the likelihood of inefficient resource allocation.

Human-Centricity

Since 2013, Electrolux Professional has been embracing a human-centred culture. First introduced at the global level by Stefano Marzano, the design department fostered this approach in the following years until today. Nevertheless, understanding what the customer and the market want is still a big concern for the interviewees. In a B2B global market, the human-centred perspective is perceived as fundamental to considering all the stakeholders'[121] needs during development. The challenge of customers' understanding is to surface the internal assumptions and dig deeper into the human aspects to capture the implicit unmet customers' needs.

Another aspect highlighted in this context is trend scouting. Understanding the present customer situation is essential, but it is not enough. Grasping the nascent trends gives a prospect about future directions, which is critical, especially for long-term innovation. Innovation must consider present and future needs to undertake the right direction and react to world changes.

In conclusion, the interviewees seemed to react to the technology-driven approach that took over in the last decades, which tended to neglect innovation's human and business aspects. Therefore, the interviewees suggested a more balanced interaction among technology, human and business perspectives in innovation.

Process

After the first unstructured period, the innovation and development process in Electrolux Professional became highly defined and integrated into the company practices. On the one hand, process structuring is critical to organising people's work in a reproducible way. Still, on the other hand, it should be able to remain agile and flexible, not block innovation.

The data from the innovation quotient survey pointed out a critical unbalance around this topic. The flexibility element scored 2.1 out of 5, revealing that the company processes are not flexible and context-based. In the same direction, another piece of evidence is that the no bureaucracy element, with a score of 1.5 out of 5, showed a workplace's rigidity caused by rules and policies. In support of this concern, the complexity and bureaucracy topics received considerable attention even in the executives'

121 For instance: buyers, dealers, consultants, users, constructors, investors, technicians, and service partners.

debate. The proper process to support innovation should leverage creativity, flexibility and adaptability and not weigh down people with bureaucratic activities that slow down the innovation inertia.

Following this consideration, the speed of innovation seems to be another concern for the organisation. Bureaucracy, day-to-day work, and competitors' catch-up activities do not leave time for innovation, slowing the process and causing delays. Especially unclear requirements in the development process seem to be an urgent topic for the stakeholders involved. On one side, continuous priority changes produce frustration and delay in the technical function focused on developing the solution. On the other, defining project specifications clearly at the beginning of the project is getting complex due to market uncertainty. This paradoxical situation creates contrasting positions between the business and technical functions that further slow down the process.

Another aspect of the process highlighted in the interviews is the difficulty in bringing innovation to the market. Interviewees complain about the lack of consistency, commitment and accountability in transforming innovation into a business success. Indeed, developing a potential innovative project does not ensure commercial achievements. Only the correct business model, requirements, marketing activities, and distribution increase the product's likelihood of success in the market, making an invention a true innovation. In these terms, innovation projects need long-term ownership. R&D, P&M and sales employees need to feel accountable for innovation taking responsibility and sustaining it daily, even over complicated situations.

Community

Electrolux Professional is a multi-specialist brand working in different segments and countries, with two central R&D locations.[122] Despite its range, the R&D dimension is limited, and it struggles to work on several projects simultaneously. Nevertheless, interviewees pointed out that some attitudes worsen this situation.

The research data showed that the company's innovation process struggles to be open to external opportunities. Some stakeholders noted the presence of the "not invented here" bias[123] and a diffuse pride

122 One in Italy, in Vallenoncello (PO), develop the food and beverage sectors. The other one is in Sweden, in Ljungby, which develop the laundry sector.

123 The tendency to avoid using or buying something from external origins ('Not Invented Here', 2021)

in the R&D department. These attitudes led the organisation to develop projects mainly through internal resources, aggravating the situation and underestimating the potential benefit of outside partnerships. Moreover, there is an inclination to stick too long with ideas that are not promising. Instead of abandoning them and moving forward, ideas crowd around in the innovation pipeline, lowering the overall process speed.

Another criticality pointed out was the communication around innovation. Both the survey[124] and the interviewees underlined this topic. The time devoted to coaching, providing feedback and follow-up about innovation seems insufficient. The executive stakeholders and the organisation do not always know what is happening in the innovation labs. Communication is an urgent and unsolved topic for innovation. Indeed, on the one hand, it seems to be an organisational matter. On the other hand, it is historically devoted to secrecy due to intellectual property patents or its strategic role as a competitive advantage.

Finally, both the survey and the interviews highlighted community compartmentation in silos. The survey output score of 2.5 identifies a misalignment in the innovation community. Similarly, the interviews suggested a silos division that does not allow departments to collaborate synergically on innovation. The company seemed to lack a cohesive force that combined the different functions around a shared and organised innovation effort.

Culture

The right culture is fundamental to setting the suitable condition for innovation. As discussed in the previous chapter, the culture in an organisation enormously increases innovation potential. Still, it is challenging to influence and even more complex to change.

In this direction, the risk-taking capability was a central topic for the interviewees. They perceived that the company was unwilling to take risks, looking for generalised commitment and data-driven approaches instead of facing a leap of faith in the innovation uncertainty. Innovation is inherently a risk because there is always a certain degree of uncertainty about its results. Nobody has done it before. Therefore, there are no data to make precise forecasts.

Even after the product launch, organisations need bravery to

124 The survey score of 2.5 out of 5 showed a light flow in the coaching element. The coaching element states: our leaders devote time to coach and provide feedback in our innovation efforts.

sustain their choices. Indeed, innovation payback is highly uncertain and sometimes requires time and pivoting actions to be realised. In these terms, companies that make decisions based mainly on costs and payback hinder innovation. Moreover, the innovation risk relentlessly led to failures. Therefore, the readiness to accept them is another essential cultural component for an organisation willing to innovate. Accepting defeat and allowing employees to risk and fail are two components of the same fundamental cultural value.

Finally, others aspects pointed out about innovation concerned the company habits. Some people seem to have a fixed mindset that does not allow out-of-the-box thinking. In general, some interviews touched upon the empowerment topic, suggesting a lack of a supportive culture capable of leveraging the innovation resources capabilities.

Suggestions

The interviewees proposed several possible tactics to address the concerns highlighted in the previous paragraph. Analysing their frequency (Table 2.7) and considering the affinity to the five concern topics, the researcher identified 13 possible tactics where the interviewees focused their attention.

Innovation Ambition

As we have seen, innovation means different things to different people. In the same way, when the researcher asked the interviewees which should be the company's preferred innovation outcome, the opinion diverged.

Most of the sample agreed that all types of innovation[125] are valuable and worth pursuing. However, some considered the company already familiar and skilled in producing incrementalisms but far from disruptive innovation. The product development process already brings forward innovative ideas in the generation plan, but the more disruptive concepts could not emerge from that process. Stakeholders believe that different innovation outcomes belong to different streams. Incremental innovation should be the core and essential result of the product development process, while disruptive innovation is rare and requires a different path.

A practical solution suggested facing this topic could be the definition of a clear innovation vision and strategy. A plan with actionable

125 The main typology we discussed were: incremental innovation, disruptive innovation, and product improvement innovation.

objectives could help the right team engage their energies on the right innovation streams and get more focus on their work.

Innovation Priority

The company's decision-making capability to focus on clear priorities was the most heartfelt concern highlighted by the interviewees. A possible answer to this issue was reducing the decision complexity by using the global company strategy as a compass. The sample did not always refer directly to the company strategy as the needle for decision-making. Still, the suggestions supplied give back a picture similar to the company strategy statement.

First of all, sustainability collected a higher frequency rate, confirming the paramount importance of this topic, especially considering the Electrolux global group vision. Secondly, digital transformation seemed mandatory and with a high potential impact. Indeed, cross-category connectivity and IoT solutions could improve the stakeholder's experience by granting a unique competitive advantage against the product specialist competition. In this direction, these types of innovation should leverage the company's multi-specialist DNA by innovating synergically over the entire range. Thirdly, interviewees pointed out the importance of moving beyond product innovation and focusing on new business models, services and internal processes. Finally, the chains segment seemed a priority. Thanks to the global chain trend, their unique needs and significant volumes, winning a contract in this segment could make a difference for the organisation.

Customer Understanding

Constant customer interactions are essential to get the most from the human-centred approach. Still, supporting the company's decisions is necessary to provide insightful customer information that could address the decision-makers focus.

About his topic, the stakeholders underlined two main tactics. Firstly, interviewees perceived few and non-distributed customer interactions during the development process, especially considering the range of stakeholders and geography the company aims to supply its solutions. Secondly, they proposed to define a structured insight collection process. Building a customer feedback loop seems essential to collect early customer insights to inform the design phase and test the solutions again with them before moving on into the development.

Other possible suggestions dealt with the customers' involvement in participatory activities. For instance, the company could organise an innovation day with critical partners to discuss possible synergic innovation directions. Or, more pragmatically, it could engage them to test ideas. Another possibility could be to define a survey format that questions the Electrolux Professional visitors about their market habits to collect fresh recurring insights from the market. Finally, some interviewees proposed a different digital strategy. They advise using the connected appliances in the market to collect data to capture deep customer needs and habits. However, they highlighted as new skills and competencies are required to read and exploit this information.

Trend Scanning

Scouting the most relevant trend is another company strategy to have a forecasted view of the future situation. When the organisation collect customers' information, the picture that emerges is about the present. Current data should be projected in the future to get the proper perspective and supports wise decisions.

For the interviewees, monitoring and forecasting the changing society and analysing the related opportunity for Electrolux Professional is the core of the trend scanning activities. Possible approaches to trend scanning are big-data trend screening and analysis or customer trend surveys. Still, stakeholders did not highlight many possible tactics about this topic. Indeed, it was the less frequently named one.

Manage Innovation

Innovation is a team activity, especially in organisations. The more people are diverse and connected, and the more innovation tends to flourish. However, this collaboration is not magic. Innovation management helps to set and amplify these conditions.

One possible strategy to manage this is by orchestrating and pushing ideas over a defined process. Interviewees suggested that the role of the innovation team is to coordinate ideas by nudging people to commit to them and bring ideas forward. In these terms, management activities should facilitate the innovation discussion by supporting and mediating decisions over the process.

Another debated argument focused on the rules of innovation. Some stakeholders pointed out the importance of defining the "innovation rules of the game" to give order to the process and accountability to the people involved. On the contrary, others highlighted the risk of normalising innovation into a standard procedure with bureaucratic rules that block innovation. This apparent contradiction seemed critical. Still, possible compromises exist. For instance, rules could allow mistakes instead of condemning or avoiding them at any cost. Namely, the process could be structured but flexible, and the rules could allow and not deny behaviours.

Finally, another management aspect to consider is accountability. People, especially management and leadership, need to be accountable for innovative ideas to generate the proper ownership to transform ideas into a project until their realisation. The innovation team will never have the internal forces to innovate by itself. A collective effort is needed. Thus people should be accountable for innovation, even if it is not part of their daily work activity.

Lean Innovation Process

The innovation process should be fast and able to manage ideas toward a decision-making process that selects the best opportunity. However, how does this process happen?

Three suggestions emerged from the audit about the process definition. The first recommendation deals with creating a funnel process to evaluate, prioritise and select the more promising ideas. Interviewees paid particular attention to the selection method to adopt over the process, asking for a shared approach to filter ideas considering the business payback, people needs, and technology issues. The development of this process seemed especially valuable to face the company focus problems. Indeed, picking ideas with more potential and parking or distracting the others helps the company not dilute its focus everywhere.

The second and third points focus on customer relationships with the process. Firstly interviewees suggested that customers should validate ideas by testing them through prototype interaction. This iterative process establishes a learning loop that collects information about the idea potential supporting the decision-making process. Secondly, another strategy is involving customers during the development. Especially those from the B2B chain segment can become potential partners in the ideas, helping the development by testing prototypes. Furthermore, the early involvement of customers could generate commitment, trust, and responsibility toward the solution favouring a future adoption.

The Paramount for this process is its fast and iterative nature that works only if the ideas can start small and scale up rapidly. In the beginning, prototyping meant making sketches or paper mockups to evaluate ideas, and then iteration-by-iteration prototypes became real functional solutions capable of triggering more valuable feedback.

Innovation Speed

To answer to the exponential acceleration of the market change, organisations attempt to speed up their internal innovation processes by reducing and eliminating all unnecessary, but companies do not change overnight.

Interviewees suggested imagining innovation as an independent function capable of making quick company decisions. This idea of a company inside a company came from two main reasons. On the one hand, it should not have a specific department location because innovation does not belong to any particular function. It is a collective effort to introduce novel ideas in the market. On the other hand, it should operate outside the typical product development flows. Using an analogy suggested by an interviewee, it should move as a speedboat that helps the company supertanker travel the fast lane of innovation. For this reason, it must be quick and agile to immediately seize the opportunities when the innovation's sliding door is still open.

To achieve this rapidity, organisations must minimise bureaucracy and challenge their orthodoxies to reorganise everyday work to allow people to spend time on innovation outside their day-to-day activities. For instance, the company could define a specific day or percentage of time for innovation activities. Or by saving time by delegating part of the internal activities outside the organisation.

Cross-Collaboration

Working together is essential to breaking the silos culture and establishing the proper condition for innovation. Interviewees suggested three aspects to foster a better cross-collaboration culture.

First, engagement seems fundamental to making everybody proactive toward innovation and creating a positive attitude of fun, confidence, and trust. Collaboration needs a gluing force capable of keeping together different departments and functions and coordinating collaborative activities. If these conditions are suited, cross-collaboration could enable a cross-fertilization process that enhances innovation potential. Moreover, involving the whole team in the discussion since its initial phase increases the chance of finding ideas' sponsors and promoters.

A second topic highlighted is horizontal integration. Interviewees want to avoid silos compartmentation in innovation, strongly encouraging the adoption of a team organisation based on ideas and projects instead of hierarchical functions. These small teams based on competencies should overtake the organizational structure and find time to collaborate on innovation.

Finally, innovation should be open. Everybody should be involved in innovation activities, enabling the potential of collective intelligence. Thus, establishing a climate of openness is essential. Innovation should not build an ivory tower but create a transparent environment where people can raise their voices and bring ideas to the global discussion.

Spread Innovation

In answering the communication issue, the interviewees come out with different inputs about possible strategies to spread innovation over the organisation.

For instance, sharing small achievements, best practices, and even failure stories could help involve and engage people in an innovation community. A continuous feedback loop should update the organisation on innovation activities, advocating the innovation result to grow the community and the stakeholders' commitment to innovation.

Still, communication is essential to promote activities to the organisation's leadership. Proper self-communication is a powerful tool to "sell" new ideas to the company, gaining consensus and building awareness. Indeed, without senior management buy-in, innovation will run out of resources and die.

Leadership accountability is indispensable for innovation, but it is not enough. The top-down process should be combined with a bottom-up one that fosters and proves its impact daily. In this regard, the goal is to ensure leadership approval by increasing the company's innovation ambassadors capable of spreading the innovation values over the organisation.

External Collaboration

In response to the company's close inclination toward external opportunities, interviewees suggested establishing a seamless open culture inside and outside the organisation.

For instance, by growing a network of alliances with other companies, businesses or universities, the innovation team could cross-fertilise the organisation with new inspirations from a broader audience of speaking partners, allowing a natural exchange of processes, methods and ideas. Or, by setting up some cross-development partnerships, the organisation could improve and update the internal know-how and capabilities and reduce the development of internal effort. Finally, some recommendations deal with the startup topic, suggesting looking at them for possible investment and as a means for assimilating their cultural spirit.

Learning from Failure

Without failure, innovation can not exist. Therefore, a proper culture of failure is a prerequisite to empowering people's ability to innovate.

Interviewees suggested two approaches to foster this cultural aspect. The first one leverage the basic idea that innovation has a high rate of failure. Thus, a safe environment must be set up to experiment and make mistakes. Indeed, failing under the right conditions is always a learning occasion, one of the pivoting points toward successful innovations.

The second one focused on the suitable condition to fail. Failing as early as possible rapidly discard low-potential projects, increasing the global likelihood of innovation. Indeed, failing at the beginning of the process is not very costly for the organisation. There is time to reshape the ideas with little effort ad risk. While waiting for the end of the process to fail is very dangerous for a project because the time and energy invested are much higher.

Risk-Taking

Many cultural concerns revolve around the complex topic of risk. Interviewees shyly proposed suggestions to empower a risk-taking culture in the organisation.

The first piece of advice deals with a shift in the company mindset. The risk of potential innovative activities should consider the likelihood that a long or even no payback is guaranteed. It should be a strategic investment out of the typical investment flow or within a dedicated non-returnable budget. Setting this mindset is fundamental. Otherwise, the stakeholders would hardly risk the company's money.

A more concrete suggestion on this topic is about the assessment metrics. Evaluating innovation using standard parameters such as the Earnings Before Interest and Taxes (EBIT) tends to nip in the bud at too many innovative ideas. Companies must consider adopting new metrics. Still, there are no standard metrics for innovation.

Besides metrics, stakeholders have to accept that innovation is inherently risky. Taking risks means making important decisions with little information. Innovation processes can only unveil the outcome uncertainty partially, but, in the end, the decision-makers have to embrace a certain amount of entrepreneurial risk. Innovation will always be strongly hindered if the company is not ready to take risks.

Cultural Change Catalyst

Interviewees pointed out many cultural aspects that affect innovation, suggesting the necessity for a catalyst force to trigger this culture change.

The innovation team should act as facilitators of this cultural shift for the stakeholders. They must prompt people's mindsets to change by encouraging them to work differently. To achieve this transition, the team should leverage a positive, engaging and trusting climate that empowers people to get out of their comfort zone, nudging them toward new cultural values.

Some interviewees' advice focused on possible training activities to enforce this catalysation process. While others suggested a more action-based approach based on small daily base "cultural hacks" that help early adopters actively get in touch with innovation, experience its cultural values, absorb them, and spread them in the organisation.

Framework & Strategy

In Electrolux Professional, the innovation topic is usually metaphorically associated with the blind men and elephant's parable ('Blind Men and an Elephant, 2021).

It is a story of a group of blind men who try to understand what the elephant is like by touching it. Each blind man feels a different part of the elephant's body and describes it based on their limited experience. The parable's moral is that humans tend to claim absolute truth based on their narrow, subjective experience as they ignore other people's limited, personal experiences that may be equally true.

Similarly, the innovation audit research tried to unveil the company's innovation blindness by listening to various perspectives to put together a holistic overview of the topic. This data supports the development of a framework (Figure 2.6) that synthesises the insights collected, weighting and giving priorities to them. The topic frequency analysis (Table 2.5) pinpointed five main pillars[126], divided into two main areas: concerns and suggestions,[127] each with its sub-clusters. Fundamentally, the framework is a composition of different viewpoints that give a readable

126 The pillars are: Focus, Human Centricity, Process, Community, Culture.

127 The concerns cluster have only one level of information. In contrast, the suggestion cluster has two levels.

overview of the situated organisation's interpretation of innovation. To resume the blind man's metaphor, we can imagine that all the elements described worked synergically in defining the unique innovation elephant perception of Electrolux Professional.

This model is one possible representation of the research outcome. Still, more than collecting information about innovation, this research had a second and more critical aim. It supported the company in developing its innovation strategy, simplifying and making more applicable the knowledge acquired during the study (Figure 2.22). As in the framework, the Electrolux Professional innovation strategy is divided into five primary pillars: focus, human centricity, process, community and culture.

Regarding the focus topic, the team used two factors as a compass to prioritise the innovation company efforts. Firstly it set three main drivers of innovation: sustainability, digitalisation and chains. In this term, Electrolux Innovation's ideas must leverage sustainable solutions and digital improvements, especially for high-volume chain segments. Secondly, The innovation effort should mainly focus on identifying new company opportunities, limiting the time invested in supporting more incremental initiatives connected to the company's generation plan.

Human centricity should remain a strategic priority for innovation. Customer discovery, understanding and testing activity should lead innovation efforts, leveraging a human-centred culture in the organisation. Together with customer research, even trend analysis should be pursued to give inspirational forecasting of the future.

Another part of the strategy is about the process. Two guidelines address the innovation team effort on this topic. Firstly the creation of a high-level approach to defining the ideas' stage through the overall process. In this concern, a funnel process should be managed to grant ideas focus and prioritisation. Secondly, the team should implement and manage a more action-oriented process that moves the ideas through the funnel. The iterative phase identified for this process has been named discovery, envisioning and testing[128].

The community pillar aims to promote the creation and development of an extensive innovation community inside and outside the

128 The discovery phase indicates the research activity aimed at collecting new information about customers or stakeholders. The envisioning stage represents an exploration activity to develop and concretise an idea into a sketch, mockup or prototype. The testing phase pointed to the validating activity to collect additional information about the designed hypothesis.

Figure 2.22 Electrolux Professional innovation strategy (figure developed by the organisation based on the executive interviews visual summary).

organisation. The innovation team should create new external alliances and involve the highest number of colleagues in the innovation conversation to share, discuss, and cultivate new ideas. Finally, the innovation team should become the first's catalysers of an innovation culture capable of nurturing new values and skills in the organisation.

The innovation strategy creation was a pivoting point for the innovation team. It gave direction to the new-born function and credibility in the eye of the executive leaders, who felt involved and considered in the innovation strategy making. If this was the first step of the design function, enlarging its responsibility toward the innovation world. Still, the design department takes a long journey to reach this point. The following paragraph describes the primary events that marked the design department's path toward innovation.

2.4 Design Journey

This paragraph reconstructs the design department story inside Electrolux Professional, highlighting its role over the years and the main events that characterised the journey. The narrative follows four periods (Figure 2.23). From 1969 to 2000, it recalled the organisation's design awareness. From 2000 to 2013, it told the design turning point toward a more scientific approach. From 2013 to 2020, it discussed human-centred design diffusion. Finally, the last part debates the recent company shifts in connection with the design department's involvement in innovation.

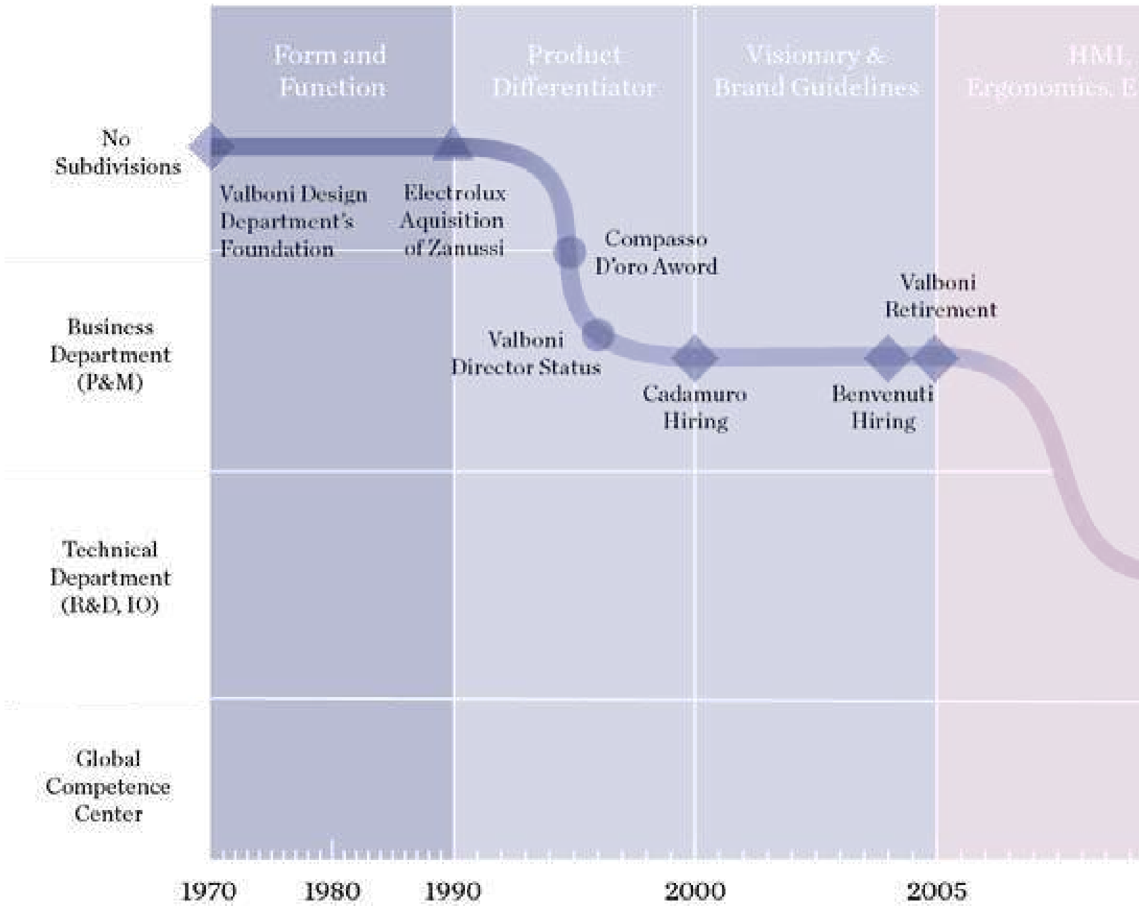
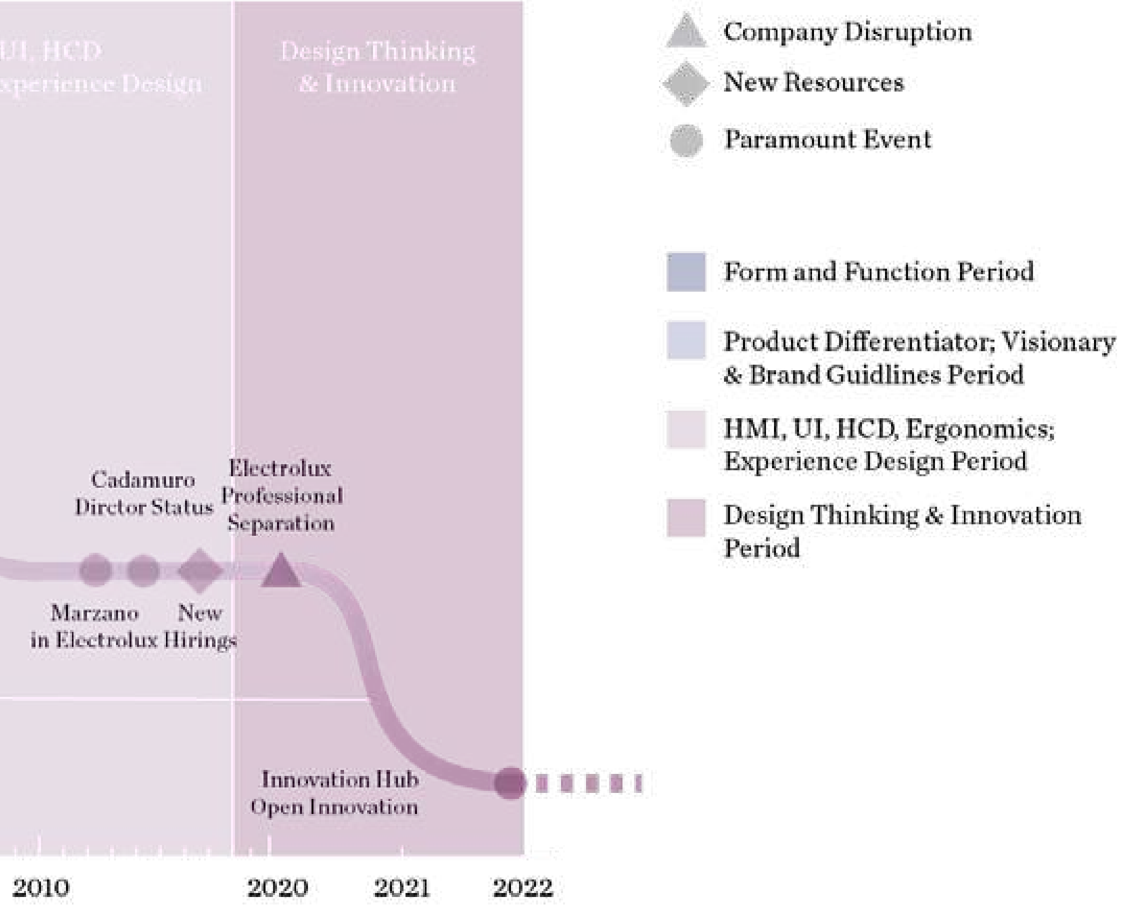


Figure 2.23 Design Department Journey Map.



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Innovation Hub
Open Innovation
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2020
2021
2022
Company Disruption
New Resources
Paramount Event
Form and Function Period
Product Differentiator; Visionary
& Brand Guidlines Period
HMI, UI, HCD, Ergonomics;
Experience Design Period
Design Thinking & Innovation
Period

Design Awareness (1969-2000)

The design journey in Electrolux Professional started in the December of 1969 when Luciano Valboni arrived in Pordenone, a small city in the northeast of Italy. After his Industrial Design studies in Florence, he joined Zanussi Grandi Impianti, the company's name before the Electrolux acquisition of Zanussi. Before 1970, a mechanical engineer called Giuseppe Vedovi was in charge of the formal aspects of the products when the company, taking cues from the Olivetti framework, reorganised the company structure, setting up an internal industrial design function (L. Valboni, personal communication, March 19, 2021).

Valboni started work in 1970 in the vending machine segment in Bergamo and, in 1973, began to take over Vendovi in the food service area. He described these first years of his career as a process of mutual understanding, where he got used to the organisation dynamics, and the company started to figure out the design potential. The design was an unknown matter in that period, especially in a professional B2B context, but this forerunner decision had significant repercussions on the organisation. On the one hand, implementing an internal design function gave the company a competitive advantage that lasted for decades. On the other hand, the design position inside the company dynamics led its role closer to management and functional aspects (L. Valboni, personal communication, March 19, 2021).

Valboni described his design activity with the form-function concept. He did not perceive it as a dichotomy but as one the result of the other. His design approach exploited his sketching ability to combine some functional drivers (such as ease of use, maintenance, and ergonomics) into the product's final form. Especially this artistic attitude let him capture the company's attention. He used it to gather feedback on the ideas and quickly modify them according to the company's suggestions. Then, he translated the bidimensional sketches into tridimensional prototypes to validate the concept by pointing out critical elements and collecting new feedback. Finally, the technical area used the prototype as a bridge to translate the paper idea into the final functional solution. In this process, the core of the design activity was developing the dialogue between the sketching and modelling medium. Giving the form to the concept informed the team on possible functional issues, converging and mediating different company perspectives in an iterative fine-tuning process (L. Valboni, personal communication, March 19, 2021).

Figure 2.24 Luciano Valboni, Domino - Hot and cold beverage dispencer Domino espresso - Espresso Caffè module (promotional advertisment), 1988-'96, Zanussi Grandi Impianti - Electrolux Zanussi Vending (1984 -'99).

In 1988 Electrolux acquired Zanussi and Zanussi Grandi Impianti became Electrolux Professional. From then on, Luciano's effort to spread design awareness over the organisation assumed a new international dimension. If under Zanussi, the factories were mainly in Italy and Spain, with Electrolux, the new context included factories in France, Swiserald, Germany and Sweden. On the one hand, the mutual understanding work needed to start again with the additional linguistic barriers, requiring recursive travels that became complex to manage. On the other hand, the Sweden culture positively influenced the organisation toward a less hierarchic and trust-oriented approach (L. Valboni, personal communication, March 19, 2021).

The tipping point in 1998 arrived with the Domino project (Fig 2.24; Fig 2.25), which won the Compasso d'Oro award, the first significant design recognition. The project was a modular set of automatic drink dispensers for the hotel's breakfast that used the technology of the coffee machine to integrate all the breakfast drinking in a compact, manageable, cleanable, and highly hygienic solution. Before, hotels had only automatic

Figure 2.25 Luciano Valboni, Domino - Hot and cold beverage dispencer (from the left) Domino espresso - Espresso Caffè module / Domino mattino - Soluble module / Domino percolato - Modulo Percolato in Caraffe, 1988-'96, Zanussi Grandi Impianti - Electrolux Zanussi Vending (1984 -'99).

coffee machines, while the other drinks[129] were too cheap to get dispensed through an automatic appliance. Domino took advantage of the coffee machine technology, integrating the other beverages in a unique solution. The final result was a good-looking appliance with a user interface easy-to-use compared to the market offer. Finally, during all the award selection phases, the company support and Tomas Maldonado's strong appreciation influenced the result in favour of Domino (L. Valboni, personal communication, March 19, 2021).

Because of this award, the company's acknowledgement of the design role proliferated. Valboni got the director seniority the same year, levelling the design status to the other functions. The director status granted Valboni and the design role more bargaining power on the project decision and access to more strategic information. Furthermore, after many trainees, in 1999, Michele Cadamuro Joined Electrolux Professional, becoming the first designer collaborator Luciano has ever had in thirty years of his career.

To sum up, the design role at the beginning of the journey was

129 Such as milk, juices and tea.

unknown, mainly related to aesthetic aspects. Over the years, a step-by-step process of working and showing results grew design awareness in the company. The most significant step in this process was the Compasso d'Oro award that triggered first the director seniority and, some years later, the design team extension.

Design Reconfiguration (2000–2013)

In 1999 Michele Cadamuro was twenty-three when he arrived in Pordenone after his Industrial Design studies at Università Iuav di Venezia. He described the first years of his career as an activity of brand identity differentiation. After the Electrolux acquisition, a new expansion policy led the company to increase its brand portfolio, owning more than twenty different brands. Indeed, despite various R&D departments around the globe, Electrolux Professional has only a design function settled in Pordenone composed by Cadamuro and Valboni that had to manage the entire design activity of the organisation. In those years, their efforts focused on the brands' differentiation of the aesthetic aspects, associating design activity with a tool to communicate different brand identities.

In 2000 the company framework became more structured, and the design moved under the marketing department. Before this change of position, the design director reported directly to Zoppas, the company's CEO, who played a "family-run" presidential role more involved in pragmatic aspects such as the final aesthetic outcome. However, after his transitional period, Electrolux influenced its professional division by introducing Münchow as the new CEO, who shaped Electrolux Professional in Electrolux's image and likeness. The design function that worked mainly as a communicator and differentiator moved under the marketing function, assuming a role strictly connected to that function (M. Cadamuro, personal communication, March 4, 2021).

From 2000 to 2005, the design role began to reduce its product differentiator effort, proving that design could also be visionary. After Münchow's reorganisation, the company downsized its brand portfolio to five brands, reducing the design customisation effort that overwhelmed its activities. These savings allowed the design to focus on new scenarios. A significant initiative was the Kitchen 2025 project: an envisioning activity in collaboration with Barcelona's Istituto Europeo di Design (IED) (Figure 2.26). Through this project, the design proved its innovative capabilities to the company by producing futuristic concepts. The outcome was naive

Fig. 2.26 Project Kitchen 2025, IED Concept (2001).

and disconnected from reality, but it proved that design could suggest a direction to the organisation (M. Cadamuro, personal communication, March 4, 2021).

In 2005 Davide Benvenuti joined the company, and the following year, Luciano Valboni retired, giving away to Michele Cadamuro, that became the new design manager. This event was another pivoting point for the design journey because a new e different approach to design took over the previous one, marking the way to the current design conceptualisation.

On the one hand, Valboni believed he had left Cadamuro and the design department in a solid position, with an overall good design awareness and a promising new leading role (L. Valboni, personal communication, March 19, 2021). On the other hand, Michele did not deny Luciano's vision but pointed out how the design achievements in the company were strongly associated with his figure. Valboni based his managerial style on personal relationships developed over the 30 years of his career, thanks to his charm and artistic attitude. When Cadamuro overtook him, design influence dropped, losing the director status and getting a functional reporting to the Electrolux Design Director[130]. From then on, Michele's

130 The relationship between Electrolux and Electrolux Professional design department helped Cadamuro to reaffirm the design status. Firstly, the relationship with a giant Design Group (two hundred designers, thirty managers, and ten directors) influenced the Professional engineering culture, strengthening their position and reaching tools and processes they could not access. Secondly, Electrolux's organizational culture influenced the

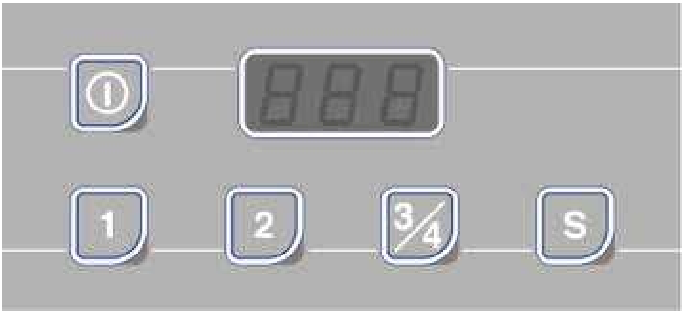

Figure 2.27 Analogic SpeeDelight User Interface (2005).

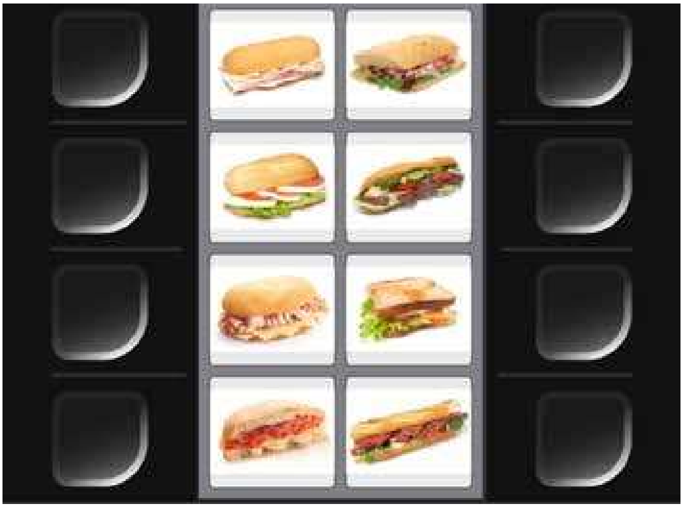

Figure 2.28 DIgital SpeeDelight User Interface (2008).

managerial work used a bottom-up approach to substitute the previous design perception with a more scientific and human one (M. Cadamuro, personal communication, March 4, 2021).

From 2006 to 2013, the design function moves under different departments, approaching the digital user interface and the human-machine interaction (HMI) topics. In 2007, the marketing department acquired the product management function, and the design got involved in the concept phase. Here, the differentiator activity became more strategic, working on

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Professional division, favouring a more "data-driven" approach. Thirdly, the interactive dialogue with the Electrolux design leaders supported Michele and the team's cultural and technical growth.

the instruction definition of the company brand guidelines (M. Cadamuro, personal communication, March 4, 2021). In 2008, the touchscreen technology adopted in the new oven and the SpeeDelight[131] projects allowed the design function to work on the iconographic field for the first time, supporting an external agency in the user interface development (Figure 2.27; Figure 2.28). After the oven project, in 2011, Filippo Andriollo joined Electrolux Professional as a design consultant to help the team in the new user interaction development activity.

In 2012 a new company reorganisation settled design under the industrial operations, bringing design close to manufacturing processes. Finally, in 2013, it moved under the R&D department that before was under the industrial operation. The new design location allowed the team to face the upcoming SpeeDelight display project from a new perspective. This activity introduced the team to the HMI role, designing the icons and the interaction. Moreover, they ran a usability test to validate the interface for the first time, proving to the R&D that the design could support the development with helpful tools. With its criteria, roles, and tests, the HMI work was the first step in Cadamuro's view, moving away from the aesthetic scope in a new "scientific" direction (M. Cadamuro, personal communication, March 4, 2021).

The second important step arrived in 2013 when Stefano Marzano became global design director, moving from Philips to Electrolux. He leveraged the Human Centred Design (HCD) culture to raise the design function position to the executive level. This approach found opponents and supporters in the company. However, even if his intention finally did not realise, Marzano strengthened the overall design role in the organisation, empowering Cadamuro. Indeed, Marzano found great support in the Electrolux Professional design team that embraced the HCD direction, perceiving it as the natural consequence of the path undertaken. Stefano introduced the User Experience (UX) design topic, using mapping tools to visualise the user interactions with the appliances and examining users through pain point analysis. This humanistic and systematic approach sustained Cadamuro's managerial personal direction. Indeed, this approach took away from the designer's concept as the leading creative actor favouring a design role supporting other functions, capable of moderate situations and facilitating processes (M. Cadamuro, personal communication, March 4, 2021). In 2013, thanks to the renewed global design perception

131 First called High-Speed Grill

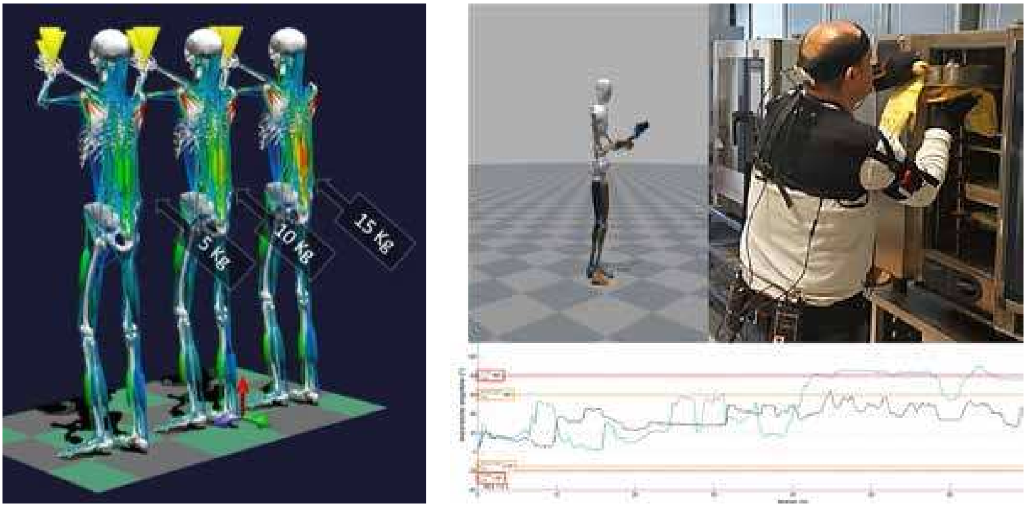


Figure 2.29 Skyline Oven Ergonomic Analysis (2018).

and the re-established design influence, Cadamuro got the director seniority opening to the HCD and then the Design Thinking chapters.

Human-Centred Design (2013-2020)

After Marzano's departure, the Electrolux Professional design team spread the HCD culture in the organisation, opening to the ergonomics topic. In 2015, the new director seniority acquired by Cadamuro and the new Skyline Oven project set the right conditions to enlarge the design team. In 2015 Francesco Lillo and Leandro La Pietra joined the design team, giving more time to Cadamuro and Benvenuti to manage the design function (D. Benvenuti, personal communication, March 4 2021). These new conditions allowed Michele to focus on the emerging ergonomics topic. After the success of the usability test, the design team broadened the ergonomics scope to human biomechanical interaction and perception. Indeed, this topic perfectly embraces the human-centred design culture and the scientific course undertaken. Thanks to Ergocert, an ergonomic consultant provider, the design function took responsibility for ergonomics, acquiring a new team element in Sweden. Christe Gustavsson decided to join the design team, moving away from the laundry R&D department and assuming responsibility for ergonomics. Over the years, Ergocert and Electrolux Professional collaboration straightened, and in 2019 they developed an international certification that granted a unique competitive

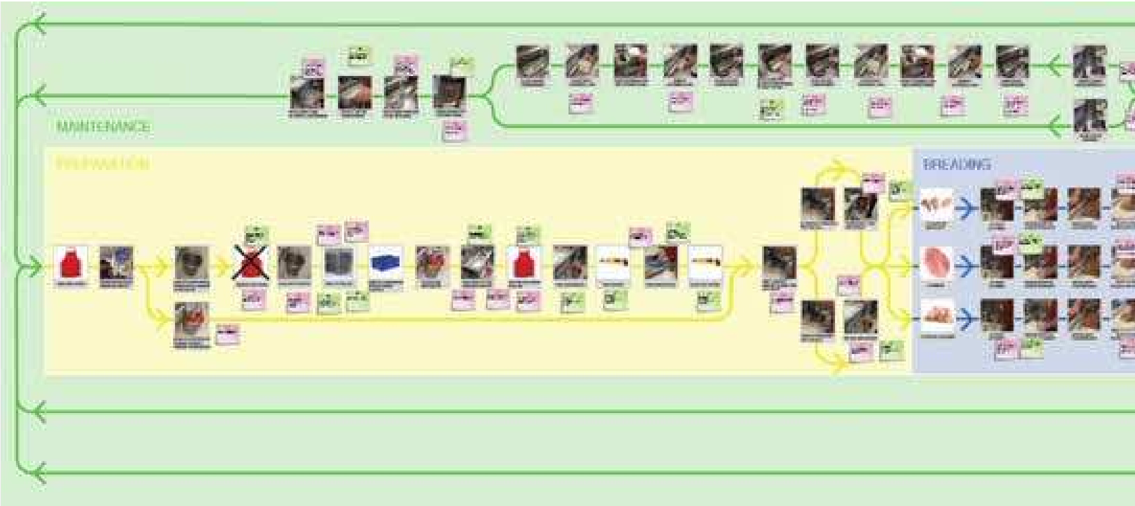
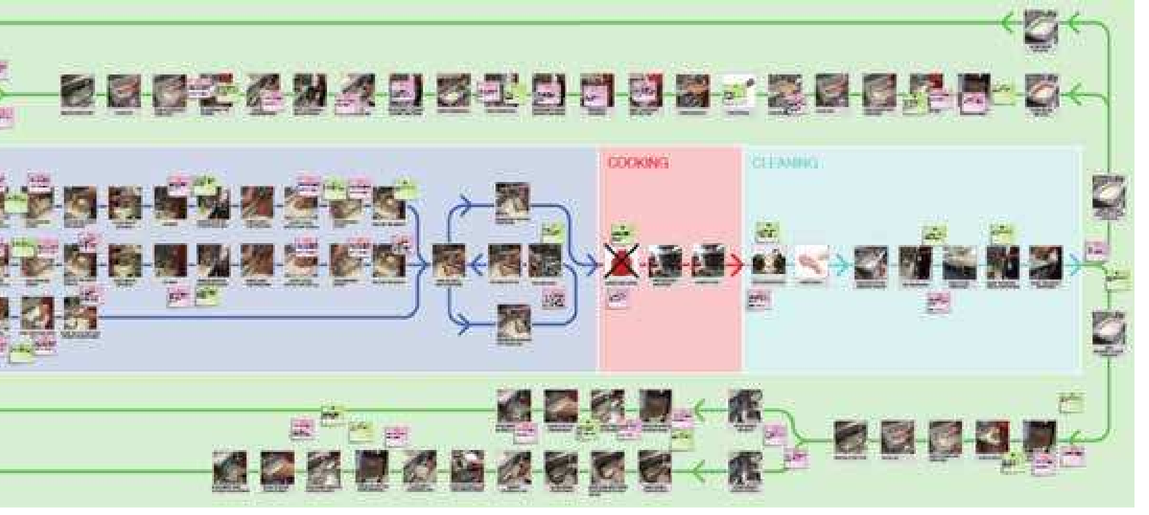


Figure 2.30 KFC kitchen workflow Analysis (2013).

advantage to the company, especially considering the topic's importance for the B2B sector processes (M. Cadamuro, personal communication, March 4, 2021) (Figure 2.28).

Another step forward in the human-centred design direction was the experience design work. Marzano introduced this topic in collaboration with the Kentucky Fried Chicken (KFC) chain in 2013. On that occasion, the design team worked as a strategic KFC partner mapping the kitchen workflows in its facilities and identifying the main pain point of their operators. This user experience analysis suggested the design of a new kitchen breading station tailor-made for KFC's needs. This activity helped Electrolux Professional win an important customer against the competition, giving the organisation additional evidence about the design's potential (D. Benvenuti, personal communication, March 4 2021) (Figure 2.30).

In the last five years, the design function rapidly increases its dimension taking responsibility for many design aspects. Among the others, two topics assume a critical size. On the one hand, the company's digital transformation offers the design function the possibility to enlarge its team again, hiring Manuel Grifalconi, a senior digital user experience designer (M. Cadamuro, personal communication, March 4, 2021). On the other hand, Benvenuti assumed the responsibility to develop the Experience Design competence, expanding the HCD horizons to the



design thinking topic. Marco Limani joined Benvenuti as a trainee to support him, forming a new competence called User Discovery and Experience Innovation (UDEI) (D. Benvenuti, personal communication, March 4 2021).

In 2018, the UDEI competence adopted the design thinking concept in a ware-washing project, convincing the stakeholders to test the approach as a pilot initiative. For the first time, the company run an extensive preliminary discovery[132] phase first-hand, interviewing customers all over Europe. Completed the research activity, the UDEI team started collaborating with IBM[133] to develop a design thinking generative workshop based on the research's information collected. In the middle of 2018, IBM and UDEI ran a two-days workshop involving all the project stakeholders and the Electrolux design team from Sweden (Figure 2.31; Figure 2.32). Over these two activities days, the participant aligned on the customer research analysed the information together, co-created new ideas, selected the most promising ones and developed low-fidelity prototypes[134] (D. Benvenuti, personal communication, March 4 2021). This pilot project paves the way for new design thinking activities, opening the design function to the other two activities: user research and co-generative workshop facilitation.

From 2019 to 2020, the UDEI team introduced the design thinking approach in

132 The first phase of the design thinking process described in the double diamond process

133 International Business Machine (IBM) has a consulting division that works specifically on supporting other companies with design thinking activities.

134 The workshop was an engagement and alignment activity to develop new ideas. Afterwards, ideas were refined, selected and prototyped in a more structured way.

almost all the new projects, initially observing a neutral curiosity about the process and, in the end, an overall good acceptance and approval. In 2019 the UDEI team[135] ran a product improvement activity at the KFC Station,[136] proving the process flexibility and scalability (D. Benvenuti, personal communication, March 4 2021). In the middle of 2019, Electrolux Professional collaboration with Carlsberg offered another opportunity for a co-generative workshop on a beverage project.[137] Here the design thinking activity worked as a bridge to involve a partner and stimulate the discussion over possible future collaborations (M. Cadamuro, personal communication, March 4, 2021). In 2020 the global Covid sanitary situation became the right occasion for experimenting with new collaborative online approaches. In the high-speed cooking project, the team used the Design Sprint (Knapp, 2016) workshop format and an online collaborative platform[138] to develop and run a three-half-day online workshop. The method showed promising results thanks to its speed and pragmatism, becoming a new company standard. Indeed, in 2021, an high productivity cooking project[139] and the hob project adopted the online Design Sprint approach with success and approval (D. Benvenuti, personal communication, March 4 2021).

Design and Innovation (2029-2022)

In 2020, Electrolux Professional split from Electrolux, causing significant company reorganisations. Changes whose repercussions could not yet be evaluated clearly. The Design department and the R&D moved firstly under Industrial Operations. Then, one year later, the company department where localised per business area and the design and innovation function got under a new-born Innovation and Operation Competence Centre (IOCC), becoming one of the few transversal functions of the company.[140] In this new position, the innovation function assumed a

135 The team got another colleague: Franca Menghi, a post-graduate trainee. During that period, Marco Limani collaborated two days per week to let him get the master's graduation.

136 The project name was changed due to confidential restrictions.

137 The project name was hidden due to confidential restrictions.

138 The team used MURAL as collaborative online tool.

139 The discovery phase started in 2019; then, the sanitary situation events blocked the project until 2021

140 The organisation was divided into five business areas: food Europe, Food Asia, Food America, Laundry and beverage. Each with its own Business and Technical department. The Transversal functions such as design, innovation, customer care and advanced development were grouped under a global competence centre.

Figure 2.31 Werewashing Workshop Material (2018).

Figure 2.32 Werewashing Workshop, Team Picture (2018).

new configuration. The design department becomes the Design and Innovation Department, with Davide Benvenuti as the Innovation Hub manager and Viktoria Ross[141] as Open Innovation Manager. These functions, placed side-by-side, redefined the previous configuration, where a technology-centred team guided the innovation effort (M. Cadamuro, personal communication, March 4, 2021). Under the new framework, the innovation hub focused on managing the company's ideas and making them real.[142] At the same time, the open innovation activity fosters external collaborations with universities,[143] startups, and external partners. This company reconfiguration place design as one of the leading innovation contributors in the organisational discussion, moving design into a new arena (D. Benvenuti, personal communication, March 4 2021).

To sum up, the design in Electrolux Professional overtook its first meaning of style provider[144] sizing the emergent company opportunities and increasing the team capability (Cadamuro, 2021). Following this path, design moved from the form-function concept to the human-centred design until the design thinking and innovation topics. The design touched on different subject matters toward this journey: from the more usual aesthetic and technological issues to the emergent management and business ones (D. Benvenuti, personal communication, March 4 2021). The interviewees' prevision about the future of the design department is still uncertain and dependent on many factors.[145] Still, if the design ability to foresee and seize new opportunities remains the same, the design role will probably be ready to change again and adapt to the upcoming situations (M. Cadamuro, personal communication, March 4, 2021).

141 Viktoria Roos was in charge of the Research Hub activity collaboration with universities and PhD students.

142 Once an idea becomes a project, it moves under product development or the advanced development process.

143 University collaboration and PhD scholarships are still under the Research Hub, which is strictly connected with the open innovation function.

144 During its path, the design department develops new competencies. Still, do not deny the previous roles. It puts them side by side with the new ones but does not overtake them

145 Cadamuro and Benvenuti described an uncertain future for the design department position and roles.

2.5 Design Thinking

The design department's journey led design toward innovation. Design thinking seemed to have played a decisive role in this process, legitimising and sustaining the design initiatives. This paragraph explores and discusses the relationships between design, design thinking and innovation to summarise the meanings the label assumed in Electrolux Professional context.

Implementation

If we want to understand the meaning of design thinking in the Electrolux Professional context, we can not entirely split the concept from the Human Centred Design (HCD) one.

Since Marzano's introduction in 2014, the design department has become a strong supporter and promulgator of the HCD values. In 2018, when the UDEI function introduced design thinking to support its innovation purpose, the team combined design thinking with the HCD principles integrating more than distinguishing the two concepts.

> "There was no discontinuity between human-centred and design thinking. Indeed, when we started with the User Experience and Experience Innovation competence, we spoke about both concepts. Human-Centred Design focuses more on the efficiency and effectiveness of human-machine interaction. Design Thinking looks for innovation using human-centric design principles, working closer to a strategy and business" (D. Benvenuti, personal communication, March 11 2021).

This synergic relationship is essential to understand why the department moved toward the design thinking concept and emerged from the design department. Indeed, the shared values between HCD and design thinking put the department in the best position to adopt this approach. Still, design adoption of design thinking should not be taken for granted. Many large corporations adopted design thinking mainly outside the design boundaries.[146]

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146 For instance, Electrolux Major Appliances started to use the label before Electrolux Professional within the innovation function that had few relationships with the design

> “It was easy because we were in the proper position. We were still pushing the human-centric approach over the company. The education and personal predisposition of Davide and me played an important role. We recognised ourselves on the design thinking principles; therefore, we adopted and spread them throughout the company. Two designers more familiar with design-as-style would probably leave this concept to others” (M. Cadamuro, personal communication, March 11, 2021).

The interviewees did not clearly understand why the label took hold in 2018. Still, they had the perception to hear it from different directions simultaneously: in magazines and books, in conversations with the colleagues of Electrolux Major Appliances, and even internally discussing with the head of R&D.[147] They felt that the label diffusion was about to reach its internal tipping point. Thus, thanks to their willingness to influence the company’s innovation dialogue, they started to adopt it, reading and becoming as knowledgeable as possible about it. Finally, as we saw in the design journey paragraph, the dishwashing project was the first pilot embracing the design thinking approach, becoming the Electrolux Professional icebreaker.

> “The label was getting universal. Bulgarini spoke about those topics because he read about them in Harvard Business Review and Fortune magazine. He let us work with IBM, which supported us in the ware-washing project. Then, we size the opportunity of becoming the owner of this approach in the company” (D. Benvenuti, personal communication, March 11 2021).

Legitimisation

Design thinking in Electrolux Professional seems to spread over the organisation mainly through a bottom-up approach. However, leadership support and acceptance were essential to reach an acceptable legitimisation.

When the design thinking label and concept stuck in the design department community, the head of R&D support and encouragement in applying this approach was essential. First, he left Benvenuti time to

department and more with the marketing one (D. Benvenuti, personal communication, March 11 2021).

147 In 2018 Bulgaroni was the R&D head. He left the company in 2020 after Electrolux Professional division from the Electrolux. Marceca took over him in 2020.

pursue these activities in the organisation, founding courses[148] and internships. Secondly, he invested in the Design Thinking Observatory,[149] where the team participated in many didactic activities and networked with some consultant experts.

> "Bulgaroni supported us with some funds for the IBM collaboration and the Design Thinking Observatory participation, but we had mostly a bottom-up approach. It is complex because you have to prove its benefits, hoping the interlocutor is receptive. To grow, we need to bring evidence of the Design Thinking value to gain new methodology ambassadors" (D. Benvenuti, personal communication, March 11 2021).

Despite this first significant nudge, the interviewees agreed on describing the design thinking legitimisation process as a bottom-up approach, made of small but incremental actions that got concrete results. The first big step in this process was the warewashing pilot project, where a log and structured process involved IBM[150] as a consultant partner to help the internal design team to get more credibility. This collaboration led to a vast generative workshop involving many important company stakeholders who experienced these approaches. Similar experiences enlarge the stakeholders' support around design thinking in the following months, pushing the bottom-up legitimisation approach over the company. Indeed, the importance of this approach lies in the people's awareness that can be reached only through their participation and involvement.

> "Leadership support is fundamental, but it is not enough. You also need to create awareness in colleagues about the process's importance, making them believe it is useful. This awareness cannot be achieved only by a top-down approach but requires them to experience the process and let them judge its value. This process takes a long time and effort. But it is fundamental to have a long-term consensus" (M. Cadamuro, personal communication, March 11, 2021).

Another big step further arrived during the covid sanitary emergency. Inspired by the Sprint methodology (Knapp, 2016) and thanks to some online collaborative tools,[151] the team developed and led online

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148 Some online courses developed by IDEO.

149 An observatory managed by the Polimi that connects the university and the researchers with a community of corporations and consultants.

150 IBM contat was gained through the Design Thinking Obsevatory network.

151 We used MIRO and MURAL ad virtual spaces of collaboration.

workshops with unexpectedly good results and reactions. The workshop's ease of use and speed allowed by the digital environment proved and persuaded the company about its value, rapidly becoming a standard company practice. For the first time, there was a strong push for these methods from the R&D community that found them extremely helpful in aligning the product requirements early in the project.

> "We explained Design Thinking, leveraging it as a well know international methodology to step into the company. We adopted the tools, with a clear reference to the human-centric approach, to prove its value. However, only after the Design Sprints results, I saw the first strong push for these methods from the R&D side. Fewer from the business side, but we are only at the beginning of the journey" (D. Benvenuti, personal communication, March 11 2021).

Indeed, R&D accepted design thinking as a more scientific and less gut-feeling-driven process (M. Cadamuro, personal communication, March 11, 2021). Moreover, R&D saw it as a facilitator and a connector that understood and filtered the business and technology priorities aligning them through a customers' lent. On the contrary, the business side seemed less eager toward this approach. However, they perceived design and design thinking as valuable resources supporting their strategic decisions (D. Benvenuti, personal communication, March 11 2021).

Shortcomings

Design thinking approaches positively impact the organisation and the design role in the innovation realm. Still, the interviewees pinpointed even some shortcomings in its application and results.

The first significant concern about design thinking could be traced back to its application purpose. Sometimes, design thinking seems to suffer from the "merchandising effect". A mechanism that leads many consultant agencies to exploit the design thinking fame to sell their services. On the one hand, this effect advantaged the diffusion of the concept by spreading it in plain language. Still, on the other hand, it made design thinking a buzzword everybody uses.

> "Everybody talks about design thinking, proposing some consultant activities, but we saw the side effect of these approaches. Consultants help you with the easiest part: the emphasis, idea generation or prioritisation. However, they leave you with the last and more difficult part (the testing phase and the

> market launch), where you have to prove the real benefits. The IBM collaboration helped us in the company's internal activity marketing, showing us new tools. However, they leave us with many high-level ideas that must be tested. We are still trying to manage the complexity created" (D. Benvenuti, personal communication, March 11 2021).

Consultants usually adopt design thinking to help companies with the easiest part of the innovative path, leaving the internal functions to deal with the riskiest ones, when failures happen. Indeed, consultancy usually results in a one-spot activity struggling to gain the right level of commitment to affect the company on an organisational scale.

> "Only an internal function that pursues design thinking can affect company cultural aspects, which are paramount for this approach. Consultants struggle to get the company stakeholder's full engagement on the methodology. Only with the right commitment you can have a real and prolonged impact on the organisation" (D. Benvenuti, personal communication, March 11 2021).

The second concern about design thinking focuses on the innovativeness degree this approach can aspire to achieve. As Norman and Verganti (2013) pointed out, design thinking practices oriented toward rigorous human-centred processes will unlikely arrive at a breakthrough new idea. They finely work for product improvement or development projects but not for the next disruptive company solution. For this kind of innovation, the company need an entrepreneurial mindset where the critical stakeholders take brave decisions. Here design thinking can help, but it is insufficient.

> "Focusing only on the observed pain points makes it hard to leap on something drastically new. To focus on more disruptive ideas, we should start hybridising design thinking with other methods (lean Startup). You can begin by observing and analysing, but then you must take a leap of faith closer to the entrepreneurship mindset. Design Thinking methods probably evolve in the incremental direction because they better address the service provider's needs. They can't jeopardise their customers' business with a big, disruptive bet in one shot" (D. Benvenuti, personal communication, March 11 2021).

Impact and Assessment

More than just shortcoming, the interviewees observed even some indisputable benefit design thinking bring to their daily work. The most significant impact perceived concerns the different role design assumed after the adoption of design thinking.

Before, the design department could not influence the project requirements and explore innovative opportunities. Thanks to design thinking and its structured, inclusive and participatory approach to innovation, small teams can carry out diverse activities by collaborating with the project stakeholders through a flexible explorative method.

> "Design thinking proves it is a structured, inclusive and participatory approach to innovation that can be carried out by small teams collaborating with the other stakeholders through ad-hock tools capable of focusing the company energy better. Companies need structured processes because they want them to be reproducible. Still, they have to be agile and flexible" (D. Benvenuti, personal communication, March 11 2021).

This way of working, diverse from the previous stage-gate waterfall process, helped the company focus its energy more effectively without the limitation of a linear approach. This impact move design form satisfies the upcoming company requests to explore and define the projects' requirements, getting closer to the company strategy.

> "Usually, the company's design department used the design thinking methods but always within the business cage[152]. To apply design thinking means being freer: working at the strategy level. Moreover, you must detach from the shaping activity and assume the human, business and technology perspective" (D. Benvenuti, personal communication, March 11 2021).

Simultaneously, it proved that the design with these tools and methods could support some management activities through the skills and approaches inherent in design thinking. Indeed, even if the design department had different competence areas[153] at its intersection, a set of design

152 With this term, the interviewee means the business processes and rules that usually manage the organisational innovation flow. It represents a cage for innovation because it does not allow innovation to move away from the standard predefined company paths.

153 The design department is divided into three intersected competence areas: Innovation, Product Design, User Experience.

thinking skills[154] joined them all.

> "The design department is divided into three intersected competence areas: Innovation, Product Design, and User Experience. Some skills are at the centre of the intersection: user research, storytelling, facilitation and prototyping. They represent the design thinking skill-set common to all the design areas" (M. Cadamuro, personal communication, March 11, 2021).

These skills help design generally manage its daily work within the organisation or in any context of multi-stakeholder activities. However, specifically in the innovation management context, it can become the foundation for a modern approach to innovation.

Besides this generic but valuable macro-impact, the company and the design department never assessed the design thinking. This lack of evaluation lay partially because the company never asked for an assessment and partway because the design thinking projects' had still not yet given a clear market outcome. Nevertheless, the interviewees described the design thinking assessment as a crucial future element for the complete legitimisation of this approach in the organisation.

> "We should assess our results by trying to be emphatic with our interlocutors that are not designers. They have an analytical mindset: what are the input and the output? It will be valuable when we ask for more resources, and our personal credibility will not be enough. We will need evidence and, therefore, need to be ready" (M. Cadamuro, personal communication, March 11, 2021).

Electrolux Professional's Design Thinking

What is design thinking for Electrolux Professional? What will be the future of the concept and the label in this context? These were the first and last interview questions and the crucial element to clarify before the next chapter's discussion. As illustrated previously, design thinking meant different things for different people in different times and contexts, and in Electrolux Professional, this makes no difference. Design thinking in this specific context has some common roots but not a clear, shared meaning.

In the Electrolux Professional's design thinking conceptualisation, the HCD influence is strongly present. As described in the previous

154 The skills Cadamuro hilighted were user research, storytelling, facilitation and prototyping.

paragraphs, design thinking has embedded the HCD values to some extent. Therefore, even if the interviewees did not overlap the two labels, they described a seamless transition from one concept to the other.

> "The organisation's decision-making process was highly uncertain. Decisions were based on hierarchy, consensus-building networks, personal relationships and opinions. Human-centred design first and Design thinking then puts the customer at the centre of the design decision-making process, giving it more structure and objectivity" (M. Cadamuro, personal communication, March 11, 2021).

Another significant influence in the Electrolux Professional's design thinking lay in IDEO's view. Indeed, the design department's first design thinking experience derived from the IDEO's courses and literature. This path prompted Electrolux Professional to perceive design thinking primarily as a methodology and a set of tools for innovation.

> "Design thinking is a collection of methods, principles and tools used to arrive at new innovative ideas. In some way is the design approach to innovation" (D. Benvenuti, personal communication, March 11 2021).

However, in some parts of the discussion, the interviewees seemed to switch from one meaning to another. Sometimes they pinpointed the strategic importance of the concept for the design department's role. Others refer more to design thinking as management practice related to innovation. In this perspective, design thinking seems to work on a different organisational scale. It did not deny design thinking as an "innovation methodology", but it tried to act at the managerial level getting closer to the "managing as designing" and "design management" meanings[155].

> "Design Thinking place itself in a broad subject matter, stepping into the innovation and management scopes. Ultimately, you do not create something alone. You develop processes that bring other people to create something. This process is manager work; probably every other manager should be able to do this" (D. Benvenuti, personal communication, March 11 2021).

In this conceptualisation, design thinking reassembles the "managing as designing" view, where the core of design thinking practice

155 Let's see the design thinking paragraph in the first chapter.

lies in creating a process that leads other colleagues toward an improved innovation journey.

In Electrolux Professional, design thinking seems to have a multi-level meaning stratification. It is a human-centred innovation methodology, getting closer to IDEO's meaning. Still, they display a certain degree of awareness even toward the "managing as designing" and "design management" meanings. Indeed design thinking seems even to represent a set of activities that support a collaborative, participative approach to managing creative situations and a tool to leverage the design department's role in the organisation. On the contrary, there is almost no evidence of a "designerly thinking" term interpretation, nor as a "social technology".

> The design thinking label is not self-explanatory and is less effective than others like HCD. Electrolux Professional will probably survive mainly as technical jargon unless of a top executive commitment on the label. However, the approaches, methods, and tools are necessary for the organisation. Maybe it will not be the design to use these approaches in the future. Perhaps business and management will use them to orchestrate the company's innovation effort. However, the interview perception is that designers are still privileged actors to participate in the innovation dialogue that design thinking is leveraging (M. Cadamuro, personal communication, March 11, 2021).

Conclusion

The analysis of Electrolux Professional shows the importance of the context for correctly interpreting a complex phenomenon such as design thinking. The organisation's unique story, business, and people who work on them uniquely shaped the practice and the consequent concept.

Electrolux Professional is in a phase of reorganisation and profound change. The repercussions on the organisation are not yet clear. However, the design department seems to get out of this shift with a new opportunity to size. Innovation is a fundamental topic for any company, and we saw that Electrolux Professionals have a grand ambition. The design department faces an excellent opportunity to shape the new-born innovation structure by fostering design thinking methods, approaches and values to innovation. The extended design journey prepared and influenced the design team in this process, but the design thinking concept with its different meanings strongly supported the team in this process. It gives a recognised and functional methodology for innovation, an approach to managing people collaboratively through a creative process, and a powerful tool to sustain this role by proving its value in practice.

However, the Electrolux Professional journey and situation are not the same everywhere. We would probably find similarities and contradictions if we compared different design thinking practices in their context. They are not insurmountable because common traits exist. Still, without specifying the unique context and acknowledging the plurality of possible meanings behind the label, we will obtain only half-truths about design thinking. This chapter does not want to sustain the diversity and the uniqueness of design thinking for its own sake. Otherwise, we will obtain only unrelated and unstructured practices that can not suggest or support other practitioners facing their design thinking interpretation. However, we can neither ignore the differences.

Meanings are not static but living entities like the people and the practices that they underlie. In Electrolux Professional, we can already perceive the enlargement and stratification of the design thinking meanings. Increasing the organisation's awareness about the possible role design thinking can have is essential to exploit the concept's full potential. Meanwhile, understanding the actual awareness level of the concept help set the expectation and trace a plan about how to define and spread the most proper design thinking interpretation in the organisation. For this purpose, the researcher designed a simple and easy-to-apply assessment tool to capture the actual status of awareness of the design thinking in a situated context. We can assess the design thinking meanings using a scorecard to map the level of awareness in the organisation.

For instance, in Figure 2.33, we can see the Electrolux Professional scorecard, where the primary design thinking meanings[156] has been assessed by scoring their level of awareness. We can observe a slight level of understanding about the designerly thinking's meanings. Cadamuro observed that design thinking represents a shared set of skills for different design areas. At the same time, Benvenuti suggests design as a collaborative practice. Still, they are only personal or internal to the design department's interpretations of the label. Outside the design department, for the most, design thinking is meant as methodology, a tool for innovation. From the managerial perspective, other personal interpretations refer to "design as a management practice" or as a "method to improve the

156 The seven meanings refer to the ones identified in the first chapter (Fig.1.8)

design leadership”. Still, they are not diffused outside the department, and probably neither in the entire design team. In conclusion, design thinking awareness in Electrolux Professional is meanly bounded to the design department with diversified interpretations but with an evident prevalence toward the innovation methodology meaning.

The evaluation of design thinking meanings in a specific context is a valuable starting point to define the boundaries of design thinking and observe the phenomenon from the correct perspective. Still, this is not enough for a sufficient assessment. Even the practical differences should be framed to understand the plurality of practices under the design thinking meaning. In this regard, the following chapters focus on defining a framework and a connected tool capable of assessing and studying the practices related to design thinking. Design thinking needs a flexible framework first to determine its blurred boundaries. Secondly, to evaluate and improve its approaches and methods in an open but coherent discussion.

Design Discipline Realms

Management Discipline Realms

Design Thinking

	Meaning	Not Aware	Department Awareness	Cross-Department Awareness	Organisation Awareness
Designerly Thinking (Design)	**Cognitive & social characteristics** Design thinking is a set of skills and strategies of designers.		X		
	Human Intelligence Design thinking is a set of skills and strategies everybody posses at different levels of expertise.	X			
	Design-as-Practice Design thinking is a practice that involves multiple stakeholders in the design process.		X		
Design Thinking (Management)	**Managing as Designing** Design thinking is a managerial practice for managing innovation.		X		
	Innovation Methodology Design thinking is a set of processes, methods and tools for innovation.			X	
	Design Management Design thinking is a practice that enhances design management and leadership.		X		
	Social Technology Design thinking is an agent for organisational change.	X			

Figure 2.33 Design thinking's meanings scorecard: the Electrolux Professional example.

3. Assessment Framework & Tool

In the previous chapters, the thesis focuses on studying and defining the two research subjects: the design thinking phenomenon and Electrolux Professional. This chapter shifts the focus to the core topic of the thesis: the design thinking assessment.

In this chapter, the literature review of the existing assessment practices did not highlight any satisfactory approach for the design thinking evaluation. To fill this gap, the researcher developed a coherent and flexible framework to explore the different design thinking practices and their correlated impacts. The following sections describe the primary steps of the framework evolution. Its literature foundation, the creation of the correlated tool, the validating activities, and finally, the last version of the framework's description.

1 Assessment Practices

This paragraph describes the method and the main findings collected by the literature review, picturing an image of the current academic work on the design thinking assessment attempts. The literature suggested a practical value of design for organisations. However, a contextual evaluation of design thinking is still relatively unusual and underdeveloped. Fragmented methods and tools are under study, but there is no coherent discussion around this topic.

Literature Review and Meta-Analysis

The researcher ran a literature review study, adopting the PRISMA methodology described in the first chapter (Moher et al., 2009) to assess the current approaches adopted or studied to evaluate the design thinking practices (Figure 3.1).

The literature review started by collecting the existing literature on the topic. The researcher used academic electronic databases and informal methods to screen[157] the design and management literature.[158] The search identified 405 results the researcher screened, reading the abstracts and excluding unfitting elements[159] (Table 3.1).

Each article was assessed for eligibility.[160] Five of these studies generally explored the design and design thinking value. Five tried to identify the design thinking impacts on an organisation. Finally, the remaining 20 focused on methods and approaches to assess design thinking,

157 The academic database selected were: IEEE Xplore, Sage, ScienceDirect, Springer, Taylor & Francis and Wiley, together with an informal method as Google scholars. After several tentative explorations, the more suited queries identified were: "design thinking" searched in the title, paired with "impact" or "assessment" or "measurement" or "measure" or "performance" or "metrics", searched in the abstract, with no other specific filters applied to the search.

158 The researcher ran the searches on the 9/10th of March 2020.

159 Only one researcher runs the items screening of the abstracts. Firstly, the researcher excluded the contents unsuitable for the research scope. Secondly, the researcher screened the abstract again, looking at the methodology section to understand the work quality. This process narrowed the items selected to 42 elements.

160 Firstly, he collected all the selected full-text articles in a private database. Secondly, he chronologically read and underlined their fundamental parts, discarding ten resources due to their irrelevance to the topic. Thirdly, he analysed and clustered the papers by argument.

Bibliography	Focus
Design Council. (2007). The Value Of Design Factfinder report.	Value
Karhumaa, A., Piirainen, K., Elfvengren, K., & Tuominen, M. (2009). Assessment of Facilitators' Design Thinking. In L. Carriço, N. Baloian, & B. Fonseca (Eds.), Groupware: Design, Im-plementation, and Use (pp. 231–246).	Assessment
Lande, M., Sonalkar, N., Jung, M., Han, C., & Banerjee, S. (2012). Monitoring Design Thinking Through In-Situ Interventions. In H. Plattner, C. Meinel, & L. Leifer (Eds.), Design Thinking Research: Studying Co-Creation in Practice (pp. 211–226).	Assessment
Ingle, B. R. (2013). Metrics for Design Thinking. In B. R. Ingle (Ed.), Design Thinking for Entrepreneurs and Small Businesses: Putting the Power of Design to Work (pp. 127–131). Apress.	Assessment
Rae, J. (2013). What Is the Real Value of Design. DMI, 8.	Value
Jenkins, J., & Golsby Smith, T. (2013). (Im)Proving It: Designing a Measurement System that Nourishes Innovation. Design Management Review, 24(4), 40-46.	Assessment
Westcott, M., Sato, S., Mrazek, D., Wallace, R., Vanka, S., Bilson, C., & Hardin, D. (2013). The DMI Design Value Scorecard: A New Design Measurement and Management Model. Design Management Review, 24.	Value
Carlgren, L., Elmquist, M., & Rauth, I. (2014). Design Thinking: Exploring Values and Effects from an Innovation Capability Perspective. The Design Journal, 17(3), 403–423.	Impacts
Koh, J. H. L., Chai, C. S., Wong, B., & Hong, H.-Y. (2015). Developing and Evaluating Design Thinking. In J. H. L. Koh, C. S. Chai, B. Wong, & H.-Y. Hong (Eds.), Design Thinking for Edu-ca-tion: Conceptions and Applications in Teaching and Learning (pp. 109–120).	Assessment
Sr, Rosenberg N. O, Chauvet, M. C., & Kleinman, J. S. (2015). Leading for a Corporate Culture of Design Thinking. In Design Thinking (pp. 173–186). John Wiley & Sons, Ltd.	Assessment
Saggar, M., Hawthorne, G., Quintin, E.-M., Kienitz, E., Bott, N. T., Hong, D., Chien, Y.-H., Liu, N., Royalty, A., & Reiss, A. L. (2015). Developing Novel Methods to Assess Long-Term Sustainability of Creative Capacity Building and Applied Creativity. In H. Plattner, C. Meinel, & L. Leifer (Eds.), Design Thinking Research: Building Innovators (pp. 29–39). Springer Internation-al Publishing.	Assessment
Royalty, A., Ladenheim, K., & Roth, B. (2015). Assessing the Development of Design Thinking: From Training to Organizational Application. In H. Plattner, C. Meinel, & L. Leifer (Eds.), Design Thinking Research: Building Innovators (pp. 73–86). Springer International Publishing.	Assessment
Schmiedgen, J., Spille, L., Köppen, E., Rhinow, H., & Meinel, C. (2016). Measuring the Impact of Design Thinking. In H. Plattner, C. Meinel, & L. Leifer (Eds.), Design Thinking Research: Making Design Thinking Foundational (pp. 157–170). Springer International Publishing.	Assessment
Hawthorne, G., Saggar, M., Quintin, E.-M., Bott, N., Keinitz, E., Liu, N., Chien, Y.-H., Hong, D., Royalty, A., & Reiss, A. L. (2016). Designing a Creativity Assessment Tool for the Twenty-First Century: Preliminary Results and Insights from Developing a Design-Thinking Based Assessment of Creative Capacity. In H. Plattner, C. Meinel, & L. Leifer (Eds.), Design Thinking Re-search: Making Design Thinking Foundational (pp. 111–123). Springer International Publishing.	Assessment
Royalty, A., & Roth, B. (2016). Developing Design Thinking Metrics as a Driver of Creative Innovation. In H. Plattner, C. Meinel, & L. Leifer (Eds.), Design Thinking Research: Making Design Thinking Foundational (pp. 171–183). Springer International Publishing.	Assessment
Rae, J. (2016). The power and value of design continues to grow across the s&p 500. DMI, 27(4).	Value
Royalty, A., & Roth, B. (2016). Mapping and Measuring Applications of Design Thinking in Organizations. In H. Plattner, C. Meinel, & L. Leifer (Eds.), Design Thinking Research: Taking Breakthrough Innovation Home (pp. 35–47). Springer International Publishing. https://doi.org/10.1007/978-3-319-40382-3_4	Assessment

Bibliography	Focus
Rapp, K., & Stroup, C. (2016). How Can Organizations Adopt and Measure Design Thinking Process? Student Works.	Assessment
Rapp, K., & Stroup, C. (2016). How Can Organizations Adopt and Measure Design Thinking Process? Student Works.	Assessment
Zheleva, E. (2017, October 3). A Three Step Process To Start Measuring ROI of Design Think-ing. Medium. https://blog.usejournal.com/a-three-step-process-to-start-measuring-roi-of-de-sign-thinking-6b15512da864	Assessment
Liedtka, J. (2017). Evaluating the Impact of Design Thinking in Action. Academy of Man-age-ment Proceedings, 2017(1).	Impacts
Chin, D. (n.d.). Evaluating the Impact of Design Thinking in Action: Webinar Recap. Retrieved 7 February 2020, from https://blog.mural.co/designthinking-roi	Impacts
Royalty, A., & Shepard, S. (2018). Mapping and Measuring Design Thinking in Organizational Environments. In H. Plattner, C. Meinel, & L. Leifer (Eds.), Design Thinking Research: Making Distinctions: Collaboration versus Cooperation (pp. 301–312). Springer International Pub-lish-ing.	Assessment
Dosi, C., Rosati, F., & Vignoli, M. (2018). Measuring design thinking mindset. DESIGN, 1991–2002. https://doi.org/10.21278/idc.2018.0493	Assessment
Suarez-Battan, M. (n.d.). ROI of Design Thinking: A Framework to Measure Impact. MURAL. Retrieved 7 February 2020, from https://mural.co/roi/	Impacts
Benedict, S., Hugo, S., Garen, K., & Fabricio, D. (2018). The Business Value of Design.	Impacts
Forrester. (2018). The Total Economic Impact™ Of IBM's Design Thinking Practice.	Impacts
Tomlinson, M. (2018). The Impact of Design Thinking on Driving Innovation Within Large Businesses.	Assessment
Media, D. S. (2018, June 14). The ROI of Design: Measuring the Impact of Design Training. Medium. https://medium.com/forward-obsessed/the-roi-of-design-measuring-the-impact-of-design-training-ec7c2939f844	Assessment
Rivera, I. (2019, January 1). Measuring the value of design. Medium. https://medium.com/designportfolio/measuring-the-value-of-design-7a5224fe2f4c	Assessment

Table 3.1 Selected Literature reviews for eligibility: underlined the elements included in the meta-analysis.

sometimes describing experimental cases. The researcher considered adequate for the meta-analysis of 23 papers, discarding the others because they were not relevant enough for the review aim. Indeed, some items had a weak methodology structure and arrived at results of little interest to the review's goal.

After this last screening phase, 23 studies were analysed[161] and included in the qualitative synthesis. The following paragraph discusses the qualitative analysis, summarising the current knowledge identified concerning the approaches to assess the design thinking practices.

161 The researcher first reported the critical considerations vertically, summarising the key points for each resource analysed. Then, he looked at the contents horizontally to combine the findings and highlight the shared core results.

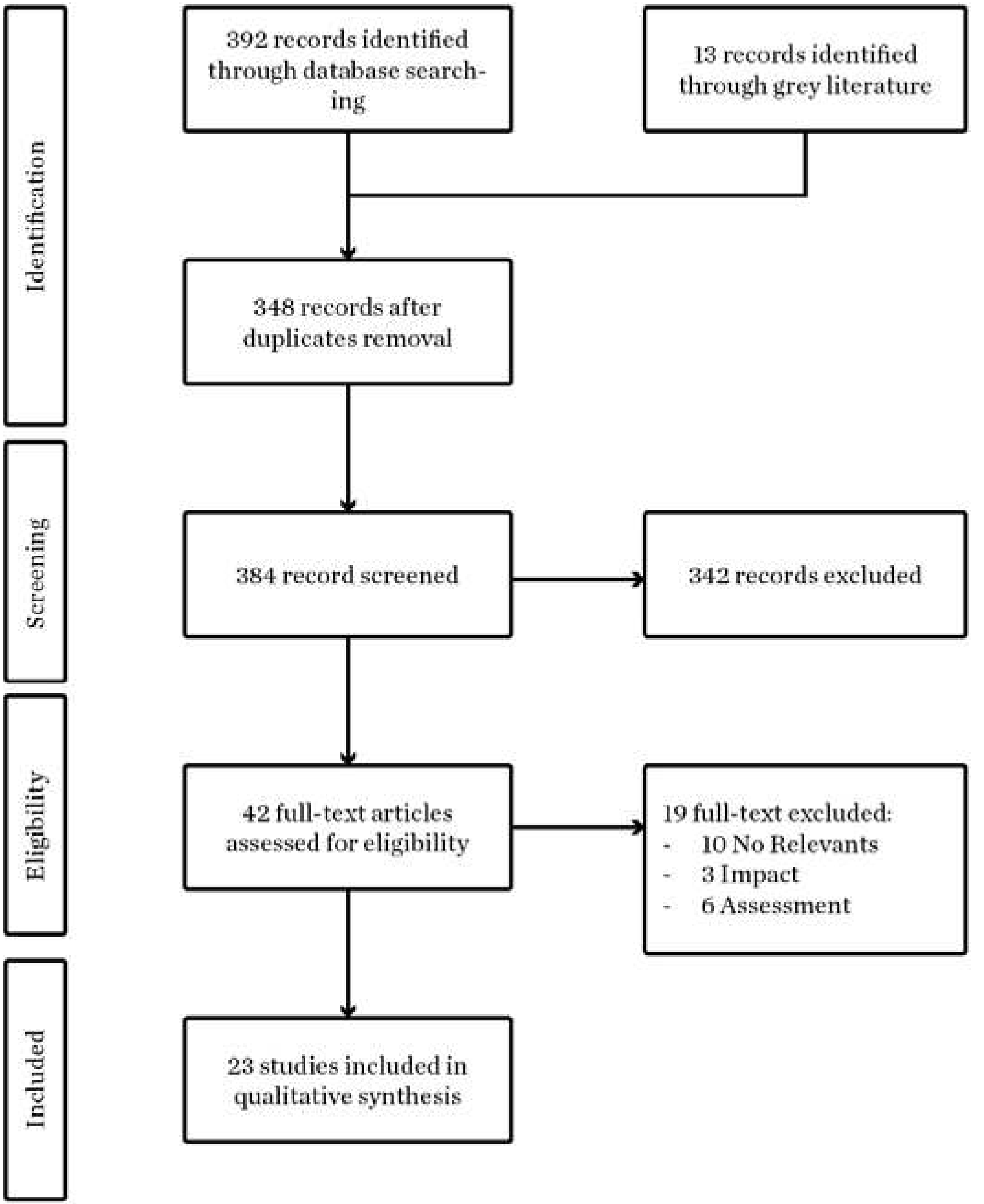

Figure 3.1 PRISMA process flowchart: literature review.

Design Value

At least three consecutive studies showed that companies that effectively integrated design into the organisational life perform better than average companies.

The first study of this kind was due to the Design Council research effort that in 2005-06 surveyed 1500 businesses and firms all over Britain (Design Council, 2007). Thanks to the data collected, the Design Council's team isolated 250 firms that outperformed the average ones using design, observing the consequent financial and performance benefit they got from it. By comparing these two groups, they found that firms in the design index outperformed the others on several measures.[162] Moreover, in 2007, additional interviews[163] strengthened the quantitative findings qualitatively investigating the role of design in the firms' processes, either directly or indirectly.

A similar result came from the Design Management Institute (DMI) (Rae, 2013), which compared US firms with a high DMI Design-centric Index with average companies. They analysed the best 500 businesses listed in the Standard & Poor index (S&P) from 2003 to 2013 in the US market, finding that while firms grew by 75% on average, the Design-Centric Index group grew by 299%. Furthermore, the article pinpointed eight ways design helped these companies: expressing the brand; solving unmet user needs; developing better customer experiences; rethinking strategy; integrating hardware with software and services; expanding the market through user understanding; reducing costs.

Finally, McKinsey confirmed this trend in another report (Benedict, Hugo, Garen, & Fabricio, 2018). They compared firms with a high McKinsey Design Index (MDI) score with industry benchmarks across three segments[164]. They found that from 2012 to 2017, the MDI group outperformed the average in revenues[165] and shareholder returns.[166]

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162 For instance, they calculated that: every £100 a design alert business spends on design increases turnover by £225; shares in design-led businesses outperform key stock market indices by 200% (data collected from 1994 to 2004); on average, design alert businesses increase their market share by 6.3% through using design (Design Council, 2007, p. 8).

163 The Design Council's team conducted telephone interviews with business managers across the UK, speaking to a total of 503 businesses with ten or more employees.

164 They based their model on three datasets: MDI's Second, third, and fourth quartiles; the S&P 500; and a McKinsey corporate database of 40,000 companies.

165 From 2012 to 2017, MDI companies increased their revenues by 10% compared to 3-6% of the benchmarks group.

166 From 2012 to 2017, MDI companies increased the total return to stakeholders by 21%

In addition, a McKinsey survey with design leaders pointed out some interesting correlations between design activities and improved financial performances. They found that the best performance comes when design: measures and drives design performance with rigour; breaks down internal walls between physical, digital, and service design; makes user-centric design everyone's responsibility; de-risks development by continually listening, testing and iterating with end-users.

Despite some datasets differences, these studies suggested the precious role of design for firms' business competitiveness. Furthermore, they partially converge on design activities that seem to trigger a business performance enhancement. However, the opaque and diverse index[167] of parameters used to select the design-centric group of firms does not allow a comprehensive understanding of what it means to be a design-led organisation. Similarly, they do not clearly state what parameters or measures to consider to assess a specific company. The vast and comparative aim of these researches offers valuable evidence about the value of design, but only a few indications on the reasons, the methods and the practical implications behind this value.

Assessment Approaches

The review revealed that exist different possible design thinking assessment approaches. However, design and even more design thinking practices usually are not inclined to get evaluated.

In 2016 a research team (Schmiedgen, Spille, Köppen, Rhinow, & Meinel, 2016) surveyed more than 400 people[168] trying to figure out more about the assessment practices the companies were actually employing. The study showed that 76% of the sample never measured the design thinking impacts. They did not assess them for three main reasons: they do not know how, do not have time, and do not have money to do it.

More details emerged from the second qualitative part of the study. Firstly, there is the butterfly effect. Namely, the difficulty in isolating

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compared to 12-16% of the benchmarks group.

167 Some clues came from the DMI index. The design-centric criteria were: the scale of design organization and deployment is an integrated function and organizational catalyst for change; growth in design-related investments and influence over time; design practices are embedded within the organizational structure; design leadership is present at senior and divisional levels; there is a senior-level commitment to design's use as an innovation resource and integrative force for positive change.

168 The international sample came from different corporate forms and sizes. It comprised design thinking managers (51%) and team members (49%).

the design thinking impacts from the many factors that could influence the project's success. Secondly, the design thinking embedded nature made it hard to measure separately from other organisational activities. Thirdly, because of the last point, it is complex to determine which level the design thinking contributed to the activity. Finally, no stand-alone design thinking Key Performance Indicators (KPI) could ease the practitioners' evaluation.

In the few cases, practitioners who tried to assess design thinking tended to use standard metrics. Six primary assessment approaches emerged from the twenty-three respondents who provided detail about the metrics adopted. (1) asking for customer feedback; taking note of design thinking activities (number of projects, training, trained people, junior coaches). (2) Tracking "immediate" results (number of transferred innovations to development, number of concepts). (3) Adopting traditional KPI (financial performance, market success, revenue of design thinking projects, ROI, sales). (4) Employing reflective measurements (questionnaires and evaluation from survey). (5) Assessing the working culture (measure motivation, effectiveness, collaboration, and engagement). (6) Finally, the researchers spotted an interesting qualitative story-based approach adopted by Intuit. They collected some metrics the company cares about but presented them through yearly story-based records that can be shared to see and understand the design thinking impact more effectively.

Even if few companies are assessing design thinking, its evaluation seems to be a high priority for design managers. In McKinsey's survey (Benedict et al., 2018), the number one priority listed among the organisation's most significant design weaknesses was the lack of employing design metrics to support analytical leadership. Some studies tried to address this issue, facing the problem from different perspectives. A research path investigated the creativity assessment topic (Hawthorne et al., 2016; Saggar et al., 2015). Another developed a self-assessment survey to evaluate the design thinking mindset (Dosi, Rosati, & Vignoli, 2018). Others focused on organisational culture (Sr, Chauvet, & Kleinman, 2015) or coaches' and trainees' evaluative sheets (Royalty, Ladenheim, & Roth, 2015).

Worth citing the work of Adam Royalty, that, with the support of other researchers, is trying to develop new methods and tools to assess design thinking activities. The principles they adopted to establish specific design thinking metrics are particularly interesting for this review. The research team found that due to design thinking contextual dependency, measurement tools for an organisation should consider the situation. Such a tool should be aligned with the organisational goals and easily capturable to be employed in work practice. Following these principles, Royalty (2016) proposed four design thinking categories of metrics: empathy, which aims to capture how close teams are to users;[169] reframing, namely the ability to identify new and valuable opportunity spaces;[170] iteration, which aims to define how robust their prototyping process is;[171] team collaboration, which aims to assess how well teams are working using design thinking.[172]

Another approach developed by Royalty (2018) focused on measuring the organization's internal design thinking strategy through ecology mapping. Building on Amabile's innovation model (1996), he draws three ecology maps, each considering one main component of the model: management practices, resources, and organisational motivation. The first maps the innovation target, tracking project duration and innovativeness[173] through a scatter plot. The second one pictures the business unit distribution, analysing the organisation's approximate percentage of design thinking activities through a pie chart. The last one visualises the employee training profile, assessing the percentage of the different category of employee trained through a column chart. Overall the three maps offered a global picture of the company design thinking strategy, its state of implementation and weak areas to improve. Moreover, in a recent paper (Royalty, Chen, Roth, & Sheppard, 2019), the aggregation of a vast amount of data collected from different organisations highlighted some valuable patterns that firms can use to benchmark their dataset.[174]

Another insightful but isolated assessment example is the Forrester analysis of IBM's design thinking Return on Investment (Forrester, 2018). This study examined the potential return on investment (ROI) enterprises may realize by engaging IBM's design thinking practice.

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169 For instance, he identified as a metric: the number of users spoken with, the number of categories of people spoken with, and days gone without interacting with a customer.

170 For instance, he assessed the opportunity by a Novel/value grid to classify the project objective.

171 For instance, he identified the metrics: the number of prototype iterations and the number of prototypes worked on in parallel.

172 No Specific metric or tool available.

173 The second version of this tool adopted Nagji and Tuff matrix (Nagji & Tuff, 2012), dividing innovation into three sectors. Core innovation optimises existing products for existing markets. Adjacent innovation expands existing business into "new to the company" business. Transformational innovation develops breakthroughs and invents things for markets that do not exist.

174 Precisely about the prototypical design thinking diffusion and the average number of design thinking training and projects per organisation.

The research team developed a financial model[175] of the design thinking impacts based on IBM's consultant practice with four companies. They aggregate these data in a composite organisation, estimating time, costs and people involved over three years. The results show a cost reduction in the project's design, development, testing, and maintenance and an increased profit from a faster time-to-market.[176] Moreover, the research team, projecting the per-project data over three years, esteemed additional value in the overall risk reduction in the project portfolio management, increased portfolio profitability, and streamlined organizational process efficiency. In the end, Forrester's assessment showed a design thinking ROI of 301%, suggesting the high economic impact of this practice.

The review of the identified assessment approaches showed that no standard design thinking metrics exist. Organisations seldom assess the design and design thinking impact. Moreover, when they did it, they usually employed collateral standard KPIs that struggled to reflect the specific and isolated effects of the practices. Some experimental tools and metrics are under study. Still, it lacks a design thinking framework capable of organising a shared and joint analysis of the design thinking impacts. Today's assessment efforts are uncoordinated and look at design thinking from various perspectives and aims. This pool of approaches seems to mirror the lack of clarity in the label definability, leading researchers to study different design thinking aspects with little consistency.

The path to developing reliable design thinking metrics seems to be only at its beginning. However, significant steps forward will be hard to archive without a clear design thinking definition and a structured picture of the relations between the practices' activities and their impacts.

Impact Models

While several studies tried to develop assessment tools and methods to capture diverse aspects of design thinking, only a few examples attempted to suggest a holistic impact model.

The first framework example identified in this review focus on the design thinking impact from an innovation capability perspective (Carlgren, Elmquist, & Rauth, 2014). The authors based their framework on an interview study of six large companies in Germany and the USA,

175 The model adopts some risk adjustment calculations and compensations.

176 Moreover, a survey identified some soft impacts. Still, they have yet to be considered for the final calculation.

adopting the innovation capability[177] perspective. Innovation capabilities research focuses mainly on organizational resources, processes, and mind-set, all governed by strategic intent. The scholars developed the structure by associating the design thinking mechanisms they observed with the three capability clusters. As a result, the framework interpretation (Table 3.2) tried to represent a holistic picture of the design thinking's impacts[178], moving beyond the best-known effects on the process.

A second framework example emerged from the case-based research[179] of Liedtka (Liedtka, 2017)[180]. She studied the impact of design thinking on some organizations that implement these practices in their routines. The data collected supported the development of a framework that correlates five primary design thinking practices to the mechanisms they trigger to the effects they generate (Table 3.3). In this structure, the practices are not silos. Each seamlessly sustains the other enabling multiple impacts on the organisation's innovation ecosystem.

For Liedtka, at its core, design thinking is a dialogue-based practice that involves a heterogeneous team in a user-centred process that leads to the envisioning and winnowing of multiple possible solutions, overall structured and facilitated through a flexible approach. Thanks to the mechanisms these practices enable, she observed that organisations improved the quality of their choices by focusing on the user needs and involving different stakeholders in constructive dialogues. It reduced the risk and cost of failure by better managing the risks of undertaking innovation and emphasising real-world feedback and testing. It enhanced the likelihood of successful implementation by engaging a broader set of stakeholders and building trust and ownership among implementers. It increased adaptability by shifting from a view of organizations and innovation as mechanistic to one that views them as a complex social

177 It is a stream of research t that argues that some companies are better positioned to exploit new ideas successfully. In other words, they have innovation capability: the firm's muscles for innovation. These studies argue that a systemic understanding of innovation that includes organizational and cultural aspects is essential instead of a narrow focus on isolated innovation activities or processes that assess just the performances of an organisation.

178 The researchers suggested a substantial impact on the organisational resources such as engagement, collaboration and leadership, and cultural aspects such as openness, optimism and risk-taking.

179 Liedtka's team used a qualitative case-based methodology, inquiring into 22 organisations and analysing their projects, the innovation team activities, and some organisational aspects.

180 Worth noting, even if not identified through this review, a recent and slightly updated version of the framework developed by Liedtka (Liedtka, 2020) reorganises the findings through a dynamic capabilities lens.

Innovation Capability	Design thinking impacts
Resources	Improve leadership skills and empathy
	More motivated and empowered
	More holistic understanding of what they are developing
	Embrace diversity and different backgrounds
	Develop an image of an attractive employer
Processes	Customer-focused
	Better understanding of problems
	Speed up the innovation process
	Cross-functional teams reduce classic function division
	Physical space for innovation unlocks team creative potential
	Prototyping as a way of learning and creating a common language
	Tool associated with DT useful outside of innovation work
	It helps employees understand why the change is needed
Mindset	Instil value: openness, empathy and optimism
	Become less averse to risk and failure
	Less short-term and output-oriented
	Senior management connection with users

Table 3.2 Design thinking framework from an innovation capabilities perspective: findings synthesis (Carlgren, Elmquist, et al., 2014).

Practices	Mechanism	Impact
1. Commitment to a deep understanding of the user's needs	• Developing user-driven criteria for ideation • Reframe problems to solve more promising one • Alignment of team member perspectives • Enhances ability to pivot • Emotional Engagement	• Improved quality of choices • Reduced risk and cost of failure • Enhanced likelihood of implementation • Increased adaptability
2. Truly heterogeneous teams	• Team expansion leads to high-order solutions • Build local capabilities to solve new problems • Broaden access to networks and pooled resources • Create alignment across differences • Enhance willingness to co-create	• Improved quality of choices • Reduced risk and cost of failure • Enhanced likelihood of implementation • Increased adaptability
3. Creation of structured and facilitated process	• Increase psychological safety • Allows involvement of key stakeholders • Help manage cognitive complexity • Incorporate coaching to improve confidence	• Improved quality of choices • Increased adaptability
4. Dialogue-based conversations	• Focusing on surfacing assumptions • Fosters team alignment and collective learning • Builds engagement ad trust • Provides a social technology for better dialogue • Allows unique solutions to emerge	• Improved quality of choices • Reduced risk and cost of failure • Enhanced likelihood of implementation • Increased adaptability • Creation of local capability sets

Practices	Mechanism	Impact
5. Multiple solutions winnowed through small bets	• Reduce visible failure and investment • Reduce cognitive biases • Allow champions to emerge • Encourage learning and action-orientation	• Reduced risk and cost of failure • Enhanced likelihood of implementation • Increased adaptability

Table 3.3 Liedtka's design thinking: findings synthesis (Liedtka, 2017).

system. Finally, it created local capabilities by defining a collection of "simple roles" that allow leaders to coordinate and encourage innovation in complex social systems while maintaining the ability to share learnings.

In both the examples described, the frameworks do not consider design thinking only as a process but as a social practice that holistically impacts the organisation. Both models focus on collaboration, diversity, engagement, leadership, customer focus and learning mechanisms. Still, the first emphasises the mindset impacts, such as openness, empathy, optimism and risk-taking tolerance. The other brings attention to the role of the process as a social technology. Nevertheless, the overall insights are quite aligned and consistent.

From the model structure point of view, Liedtka's work seems better organised due to its three-level organisation that distinguishes the mechanisms that the design thinking practices enable from the organisational impact on innovation. Instead, the innovation capability framework appears less coherent, proposing more descriptive impacts that sometimes match Liedtka's mechanisms. Defining what we mean by using the word "impact" still seems confusing and unclear. Finally, there is no integration between the impact framework and the possible valuable metrics to assess them.

Toward a design thinking framework

In summary, almost all the papers presented some clues about the positive value of design and design thinking for organisations (Benedict et al., 2018; Design Council, 2007; Rae, 2013). However, the analysis does not highlight any standard assessment approach.

Several specific embryonic procedures are under development (Royalty & Roth, 2016a, 2016b; Royalty & Shepard, 2018), but research data suggested that, at the moment, companies usually do not assess design thinking (Schmiedgen et al., 2016). Sometimes they used standard measures and metrics to capture the design thinking impacts but at the expense of precision and credibility (Benedict et al., 2018; Schmiedgen et al., 2016).

The review showed the lack of a clear definition of shared design thinking meaning and, consequently, difficulties in its assessment. Different interpretations sometimes led the assessments in opposite directions[181] opening fragmented research paths that struggled to achieve concrete applicability, especially in the practitioners' everyday work. Indeed, only two studies showed a framework (Carlgren, Elmquist, et al., 2014; Liedtka, 2017) proposing a complete picture of the organisational design thinking impact. However, even in these cases, no metrics have yet been associated with them.

We can conclude that there are two main obstacles hindering design thinking assessment. Firstly, few contextual studies still researched the correlations between design thinking and its impacts in organisational settings. Secondly, metrics impacts and practices are not dialoguing until now in a coherent structure that considers the embedded nature of design thinking. Without a cohesive framework, metrics struggle to capture the full potential of design thinking practices. Without metrics, frameworks can not prove the effects observed. From these considerations, the researcher decided to move the research toward developing a framework to comprehensively explore different design thinking practices and assess them through correlated metrics.

181 If design thinking is considered a cultural mindset, an innovation methodology.

3.2 Scaffold

This paragraph aims to set the bases for a new design thinking framework, discussing the methodology adopted and the reasons behind its development. The remaining part of the paragraph sketched the framework's three-level layout, describing the organisation of the contents in its structure.

Method

In the literature, there is little consensus on what constitutes a 'methodological framework'[182] and even less published guidance on how to develop one. This study follows three basic steps to develop the methodological framework: identifying evidence to inform the framework, developing the framework, evaluating, and refining it (McMeekin, Wu, Germeni, & Briggs, 2020).

In the first phase, the researcher identified and collected all the valuable information for the framework development by assessing the pool of literature gathered over the three previous literature reviews.[183] Initially, the identification process focused on isolating previous design thinking frameworks and process models that could guide the foundation of the new framework (Table 3.4). In the second phase, the researcher exploited the structure of some existing frameworks as the foundation to organise the content collected through the literature reviews.

Three frameworks (Carlgren, Rauth, & Elmquist, 2016; Bryan Lawson, 1980; Liedtka, 2017) were adapted and combined to build the new structure. The researcher predesigned the database tables to organise the dataset by following the new framework's themes. The information extracted from the pool of literature was reorganised through the new structure lens and grouped into new categories. This iterative categorisation process arranged the cluster and sub-cluster by affinity, amalgamating similar contents.

182 For this review, the methodology is defined as the set of methods used in a specified field. The framework is a structure of rules or ideas over something that could be built.

183 The review of the current literature review on the design thinking topic (first chapter). The aggregated reference analysis (first chapter). The review of the design thinking assessment approaches (third chapter).

Bibliography	Review Source	Focus
Park, H., & McKilligan, S. (2018). A Systematic Literature Review for Human-Computer Interaction and Design Thinking Process Inte-gra-tion. In A. Marcus & W. Wang (Eds.), Design, User Experience, and Usability: Theory and Practice (pp. 725–740). Springer Interna-tional Publishing.	First Review	Process
Waidelich, L., Richter, A., Kölmel, B., & Bulander, R. (2018). Design Thinking Process Model Review. 2018 IEEE International Confer-ence on Engineering, Technology and Innovation (ICE/ITMC), 1–9.	First Review	Process
Schallmo, D., Williams, C., & Klaus. (2018, July 8). An Integrated De-sign Thinking Approach-Literature Review, Basic Principles and Roadmap for Design Thinking.	First Review	Process
Lawson, B. (2005). How Designers Think (4 edition). Routledge.	Second Review	Cognition
Dorst, K. (2010). The Nature of Design Thinking. DAB Documents.	Second Review	Cognition
Carlgren, L., Rauth, I., & Elmquist, M. (2016). Framing Design Think-ing: The Concept in Idea and Enactment. Creativity and Innovation Management, 25(1), 38–57.	Second Review	Organisation
Liedtka, J. (2020). Putting Technology in Its Place: Design Thinking's Social Technology at Work. California Management Review, 62(2), 53–83.	Second Review	Organisation
Carlgren, L., Elmquist, M., & Rauth, I. (2014). Design Thinking: Ex-ploring Values and Effects from an Innovation Capability Per-spective. The Design Journal, 17(3), 403–423.	Third Review	Organisation
Liedtka, J. (2017). Evaluating the Impact of Design Thinking in Ac-tion. Academy of Management Proceedings., 2017 No. 1.	Third Review	Organisation

Table 3.4 Literature concerning design thinking's framework. Underlined the framework selected and used as the foundation for the new one.

In the third phase, the researcher performed iterative discussions with expert academics and practitioners experts to assess its structure.[184] Nevertheless, the topic's complexity and the contents' detail struggled to lead to clear and constructive feedback. For this reason, the researcher pivoted the evaluative approach, transforming the framework into a card tool[185] developed to validate the correlated framework and study the Electrolux professional design thinking practices.

184 The researcher had some informal preliminary discussions about the framework with the university, the Electrolux Professional supervisors, the company tutor, and in a PhD review.

185 The tool is described and presented in detail in this chapter.

Foundation

The systematic literature review in the first chapter and the shorter review on the assessment methods highlighted two main lacks. Firstly, there is no clear definition or consensus on design thinking. Some patterns of meaning emerged in the design thinking phenomenon, crystallising its meaning for a delimited circle of scholars or in the specific context and time of adoption[186]. However, there is no holistic view of how these different practices talk together. Secondly, relatively few studies explored the design thinking impact topic. Some surfaced the effects on the organisations, but almost none tried to measure them with some metrics.

For these reasons, this framework aims to be able to map, study and compare different design thinking practices through a flexible but coherent framework. On the one hand, it acknowledges the plurality of design thinking practices and meanings, suggesting design thinking as a range of possible paths instead of a predefined process. On the other hand, it offers a view of the practices' impacts on the organisational innovation ecosystem, linking them to practical actions. The framework allows the study of the design thinking practices in a specific context and their correlated perceived impacts on innovation.

The overall hierarchical structure took a clue from Liedtka's three-level framework (Liedtka, 2017). However, while she distinguished among practices, mechanisms and impacts, organising the contents around five primary practices, this framework founded and managed the contents based on five main cognitive patterns, distinguishing among attitudes, mechanisms and impacts. The attitudes level collected the characteristical behaviours the design thinkers tend to emphasise. They are cognitive and attitudinal strategies design thinkers usually adopt while designing. The mechanisms level mapped the possible paths a design thinking process could face, dividing them into five central clusters. They were practical expressions of high-end cognitive and social patterns. Finally, the level of the impact arranged the design thinking practices' effects on the organisations. They are the elements the design thinking practices influence through their introduction into an organisational setting.

186 Scholars studied design's cognitive and social aspects in the designerly thinking discourse, producing coherent but often fragmented insights. In the design thinking discourse, design practices are mainly observed in organisational contexts, observing the effects on the companies' lives.

In this composition, the framework exploits the designerly thinking discourse studies to organise the design thinking findings in a structure that combines cognitive and practical elements with their effects on an organisation. The cognitive system supplies a consistent view of what design thinking is, making it flexible and adaptable to different practices. The practical aspects make it more usable in context, suggesting and mapping the most common contextualised application pattern. This way, the overall cognitive structure makes the framework stable and usable over different practices. Instead, the mechanisms offered scholars and practitioners enough detail to study and map the practices' diversity. Finally, the impact level suggests the implications of these practices, highlighting the recurring connections between the mechanisms and their effects on the organisation.

Attitudes

In literature, there are few agreements on what exactly a design thinker is. However, after the label crossed the design discipline boundaries, several studies tried to identify and summarise the attitude and mindset of design thinkers (Dosi et al., 2018; C. L. Owen, 2006).

Almost all the studies analysed agree that a designer is not necessarily a design thinker (McCullagh, 2010, 2013; Porcini, 2009; Rosensweig, 2011). Anyone could excel in design thinking, and a great design thinker sometimes is not a designer (Porcini, 2009). Indeed, designerly thinking studies showed that even young children displayed the cognitive patterns adopted by professional designers (Cross, 1990). The discriminating factor to being a great design thinker seems to be the level of expertise in mastering those patterns of cognitive skills (Nigel Cross, 2008). As for each skill, time, practice, and complete dedication are essential to master them. For this reason, even now that design thinking has become public knowledge, good design thinkers are fundamental and still rare to find out (Rosensweig, 2011).

Designers seem more prone to stand out in design thinking for their level of expertise accumulated and attitude. Indeed, to persist in pursuing and training these skills, the right attitudes seem to facilitate and support the workout. Whether it is the attitudes supporting the training, or the training strengthening the attitude, some recurring characteristics seem to emerge from the comprehensive literature analysis. This framework level aims to map these attitudes and their influence on the underneath levels (Table 3.5).

Attitude	Description	Reference
Inquisitive	Attitude to discover as much as you can about something	(Brown, 2007; Cooper et al., 2009, p. 51; Dunne & Martin, 2006, pp. 514–515; Junginger, 2007, p. 59;70; Liedtka, 2000, pp. 20–21)
Human-Centred	Attitude to focus on human aspects, putting people at the centre of the design	(Brown, 2008; Brown & Wyatt, 2010; Buchanan, 2004, pp. 57–60; Buchanan, 2015, pp. 17–20; Camacho, 2016, pp. 90–91; Carlgren, Elmqvist, & Rauth, 2014, pp. 46–48; Carlgren, Rauth, & Elmquist, 2016; Collopy & Collopy, 2009; Dunne, 2018, pp. 6–7, 2018; Elsbach & Stigliani, 2018, pp. 11–12; 17; Hassi & Laakso, 2011; Heiman & Burnett, 2007, p. 3; Liedtka & Kaplan, 2019, pp. 3–4; Lockwood, 2010, p. 19; McCullagh, 2010, p. 39; Merholz, 2009; Norman & Verganti, 2013, pp. 88–89; Owen, 2006, p. 3; Porcini, 2009, p. 12; Sato, Lucente, Meyer, & Mrazek, 2010, p. 47; Stewart, 2011, pp. 516–517; Ward, Runcie, & Morris, 2009, pp. 81–82)
Tolerant to Uncertainty	Attitude to deal with unknown and ambiguous situations	(Nigel Cross, 1990, p. 130; Elsbach & Stigliani, 2018, pp. 7-8;12; Hassi & Laakso, 2011; Bryan Lawson, 1980, pp. 114–116; Liedtka, 2011, pp. 16–18; Liedtka, Salzman, & Azer, 2017, pp. 54–55; Mahmoud⌧Jouini et al., 2016, p. 114;146; Robbins, 2018, p. 2)
Synthetic	Attitude to mixing and inte-grating different ideas to make another whole	(Beckman & Barry, 2007, p. 27; R. J. Boland & Collopy, 2004; Collopy & Collopy, 2009a, pp. 9-10;14; Heather, 2007, pp. 72–73; Liedtka, 2000, pp. 20–23; Melles, 2011, p. 299; Porcini, 2009, p. 12, 2009, p. 12)
Collaborative	Attitude to involve people to work on a particular purpose	(Beckman & Barry, 2007, pp. 52–53; R. Buchanan, 2004, pp. 59–60; Camacho, 2016, p. 90;93;99; Collopy & Col-lopy, 2009a; Davis, 2010, p. 6536; Dunne & Martin, 2006, pp. 513-514;518-519; Dziersk & Dziersk, 2009; Hassi & Laakso, 2011; Heather, 2007, p. 72; Heiman & Burnett, 2007, pp. 2–3; Holloway, 2009, p. 51; Bryan Lawson, 1980, pp. 236-240;273; Liedtka, 2000, p. 13;18;19, 2015; Lock-wood, 2009, pp. 30–31; McCullagh, 2010, p. 38; C. Owen, 2006, pp. 24–25; C. L. Owen, 2006, p. 5; Szabo, 2010, pp. 45–46; Tischler, 2009; Ward et al., 2009, p. 83)
Dialog Oriented	Attitude to exchange opinions between opposing perspectives by critical talking	(Heiman & Burnett, 2007, p. 4; Liedtka, 2000, pp. 13; 18; 20–23; Porcini, 2009, pp. 7; 13)
Holistic	Attitude to dealing with or treating the amount of a situation	(Collopy & Collopy, 2009a; Cooper et al., 2009, pp. 48–49; Nigel Cross, 2008; Dunne & Martin, 2006, p. 518; Hassi & Laakso, 2011, p. 2011; Holloway, 2009, p. 51; Bryan Law-son, 1980, p. 121; Lockwood, 2010a, p. 19; D. Norman, 2010; C. Owen, 2006, pp. 24–26; C. L. Owen, 2006, p. 4; Porcini, 2009, p. 12)
Abductive	Attitude to think through the logic of what might be	(N. Cross, Dorst, & Roozenburg, 1992, p. 8; N. Cross et al., 1992, pp. 8; 127–130; Nigel Cross, 1982, p. 226, 1990, pp. 130–132, 1990, pp. 130–132; 136, 1997, p. 316; Dorst, 2010, pp. 132–133; 135; Dunne & Martin, 2006, pp. 513; 514, 518; Hassi & Laakso, 2011; Heather, 2007, pp. 72–73; Hillier & Musgrove, 1972, pp. 10–11; B. R. Lawson, 1979, pp. 66–67; Bryan Lawson, 1980, pp. 41–43; 138–140; 295–296; Liedtka, 2000, pp. 14–15; 17; 20; Lionel March, 2010, pp. 5–6; Roy, 1993, p. 38)

Attitude	Description	Reference
Iterative	Attitude to do smoothing again and again to improve it	(Beckman & Barry, 2007, p. 43; Brown, 2008; Dorst & Cross, 2001, p. 434; Hassi & Laakso, 2011; Heather, 2007, pp. 67; 69–70; 71–72; Heiman & Burnett, 2007, p. 3; Liedtka, 2000, pp. 22–23; Lockwood, 2009, pp. 31–36; Rosensweig, 2011, p. 18; Sato et al., 2010, p. 47; Waldron & Waldron, 1988, p. 105)
Optimist	Attitude to feel that good things are more likely to happen than bad things	(Hassi & Laakso, 2011; C. Owen, 2006, pp. 24–26; C. L. Owen, 2006, p. 4)

Table 3.5 Attitude level: framework version 1.0.

Mechanisms

In the literature, there are several design thinking practice examples (Schallmo & Williams, 2018; Waidelich et al., 2018). Their descriptions showed there is no single common practice but plenty. One differs from the other depending on its context and applicational goal. However, as the designerly thinking discourse showed, different patterns of practical expression can be traced back to a shared pattern of cognitive skills. This framework level aims to decompose the practices' mechanisms and organise them around six primary cognitive skills areas: framing & reframing, visualising & representing, experimenting & exploring, evaluating, learning, and managing.

The six main pillars took clues from Lawson's framework (Bryan Lawson, 1980), which identified five main clusters: formulating (framing & reframing), representing (visualising & representing), moving (experimenting & exploring), evaluating (evaluating), and reflecting (learning).[187] This structure can be partially found even in Carlgren, Rauth, and Elmquist's framework (Carlgren et al., 2016), where they distinguished between problem farming (framing & reframing), visualisation (visualising & representing) and experimentation (experimenting & exploring). However, they neglected the evaluation and managing cluster, associating the evaluation with the experimentation and partially associating the management topic with what they called "Diversity". Finally, they added the user focus cluster, which the other frameworks do not discuss explicitly[188]. Overall, the mechanism clusterisation around five pillars tried to mediate the existing categorisation examples by

187 Dorst (2010) proposed a slightly different version that substituted the reflecting cluster with the managing one (managing).

188 At first, the framework presented in this chapter neglected this cluster. However, during the evaluation phase (discussed at the end of this chapter), practitioners highlighted this lack. In the final versions, the framework introduced this topic.

taking as primary guide Lawson's framework.

Then, the identified cognitive skills areas allowed the literature knowledge clustering in a coherent, flexible structure (Table 3.6). This level does not aim to be prescriptive but descriptive, displaying the possible mechanisms a design thinking practice can fall into. Not all of them occur every time, not in a predefined order. The objective of this level is to build a flexible structure capable of managing the incongruences of the plurality of practices under the design thinking label. In this regard, the common cognitive root at the base of each practical expression seems to make the case. This way, different practices can be mapped and analysed to identify common patterns, critical issues and possible improvements.

This level does not aim to be all-embracing of all the likely practical facets of design thinking. It highlights the most recurring pattern of action in design thinking, detaching it from pure practice but still connecting them to an explicit action. This halfway perspective aims to get the best form of both views: detailed enough to be associable with concrete steps and abstract enough to make generalisations. Still, it is a compromise. Some mechanisms could seem too abstract. At the same time, some actions could seem too situated.

Cluster	Mechanism	Description	Reference
Framing & Reframing	Constraining the Problem	Identifying and selecting what is paramount for the project to focus on the problem context	(Akin, 1979, p. 118; Beckman & Barry, 2007, pp. 36; 61; N. Cross et al., 1992, pp. 6; 8; Nigel Cross, 1997, p. 316, 2008; Darke, 1979, pp. 38–43; Eastman, 1970, p. 30; Galle & Béla Kovács, 1996, pp. 181; 186–187; Goldschmidt et al., 1987, pp. 59; 62; Hillier & Musgrove, 1972, p. 9; Krauss & Myer, 1973; Bryan Lawson, 1980, pp. 92–94; 99–106; 194–195; 267–268; 275–276; 292–293; Levin, 1966, pp. 9–10; Liedtka, 2014a; Liedtka & Kaplan, 2019, p. 7; Rowe, 1987, pp. 18; 78–79; 96; 103; 110; Roy, 1993, p. 38; Schön, 1983, pp. 70; 170–171; 273; 311–313)
	Broadening the Problem	Introducing a new extended perspective to consider a larger problem context	(Carlgren et al., 2016; Bryan Lawson, 1980, p. 56; Lockwood, 2010a, p. 19)
	Challenging the Assump-tions	Questioning the project preconceptions to foster a higher-level result	(L. B. Archer, 1965, p. 20; Beckman & Barry, 2007, p. 36; Richard Buchanan, 1992a, pp. 10–11; Carlgren et al., 2016; Dorst, 2010, p. 134; Dorst & Cross, 2001, p. 435; Eberhard, 1970, p. 56; Bryan Law-son, 1980, pp. 197–198; Lockwood, 2010a, p. 19; Rowe, 1987, p. 96; Schön, 1983, pp. 99; 134; 140; 272)
	Reformulating the Problem	Integrating different perspectives to resolve conflicting or self-contradictory situations	(Heather, 2007, pp. 72–73; C. L. Owen, 2006, p. 5)

Cluster	Mechanism	Description	Reference
Visualising &Repre-senting	Visualising the Situation	Imaging the idea to inquiry its potential	(Cooper et al., 2009, p. 51; Junginger, 2007, p. 60; Liedtka, 2000, pp. 13; 15; Porcini, 2009, pp. 13–15)
	Making Ideas Tangible	Concertising an abstract hypothesis to make it visible	(Carlgren et al., 2016, pp. 46–48)
	Giving a Form	Representing the possi-ble solution to shape its appearance	(Heiman & Burnett, 2007, pp. 3–4)
	Understanding Complexity	Representing complex information to understand its complexity	(Hassi & Laakso, 2011; C. L. Owen, 2006, p. 4; Porcini, 2009, pp. 13–15; Sato et al., 2010, p. 47; Ward et al., 2009, p. 80)
	Communicating Information	Representing complex in-formation to communicate with immediacy	(Brown & Wyatt, 2010; Goldschmidt et al., 1987, p. 62; Heather, 2007, pp. 69–70; Hollo-way, 2009, pp. 51–53; Junginger, 2007, p. 60; Liedtka, 2000, p. 15; Peng, 1994, pp. 22–23; Porcini, 2009, pp. 13–15)
Experi-menting & Exploring	Experimenting in a Virtu-al-World	Developing ideas through a visual and mental dialogue to explore their potential	(Richard Buchanan, 1992a, p. 20; Dorst, 2010, p. 134; Goldschmidt et al., 1987, p. 62; Heather, 2007, pp. 69–70; Heiman & Burnett, 2007, p. 3; Bryan Lawson, 1980, pp. 295–296; 299–301; Liedtka, 2000, pp. 13–14; Oxman, 2002, pp. 136–137; Peng, 1994, p. 36; Schön, 1983, pp. 63; 84; 89; 99; 106–107; 150–153; 275; 278; 282, 1984, p. 132; Wylant, 2008, pp. 12–13)
	Experiment-ing in Parallel Di-rections	Developing multiple lines of thought at the same time to explore parallel possibilities	(Dorst, 2010, p. 133; Bryan Lawson, 1980, pp. 153–155; 208–219; 295–296)
	Experimenting in the Real World	Developing ideas through prototypes interaction with people to explore their potential	(Brown & Wyatt, 2010; R. Buchanan, 2004, pp. 57–60; Carlgren et al., 2016, pp. 46–48; Hassi & Laakso, 2011; Heiman & Burnett, 2007, p. 3; Holloway, 2009, pp. 51–53; Liedtka, 2011, pp. 13–15; 17–18, 2014a, 2015; Lockwood, 2010a, p. 19; Mahmoud‐Jouini et al., 2016, p. 144;146-147;149;150-152; R. L. Martin, 2011, p. 299; Melles, 2011; Porcini, 2009, pp. 13–15; Sato et al., 2010, p. 47; Schön, 1984, p. 132; H. Simon, 1969, p. 15; Stewart, 2011, p. 516; Ward et al., 2009, pp. 80–81)
	Experimenting in the Market	Developing ideas through low-risk market bets to explore their po-tential	(Carlgren et al., 2016, pp. 46–48; Gold-schmidt et al., 1987, p. 60; Heather, 2007, pp. 69–72; Liedtka, 2011, pp. 13-15;17-18, 2011, pp. 17–18, 2014a; Lockwood, 2010a, p. 19; R. L. Martin, 2011; Stewart, 2011, pp. 17–18)

Cluster	Mechanism	Description	Reference
Evaluating	Evaluating by Sense of Fit	Judging the situation through a subjective sense of fit to make reactive decisions	(L. B. Archer, 1965, p. 39; Dorst, 2010, p. 134; Goldschmidt, 2017, pp. 109–111; Hillier & Musgrove, 1972, pp. 10–11; Junginger, 2007, p. 59; Bryan Lawson, 1980, p. 64;71;81;298-299; Liedtka, 2000, pp. 13-14;17-18; Rowe, 1987, p. 94;103-104; Schön, 1983, p. 106;140;163;274-279, 1984, p. 132; Ver-ganti, 2017, pp. 100–102)
	Evaluating by Stakeholder Testing	Judging the situation through a subjective sense of fit to make reactive decisions	(Brown, 2007; R. Buchanan, 2004, pp. 57–60; B. Lawson, Bassanino, Phiri, & Worthing-ton, 2003, p. 329; Bryan Law-son, 1980, pp. 123–125, 1980, pp. 84–86; 229; 236–240; 254;255; Bryan Lawson & Pilling, 1996, pp. 83–84; 86–89)
	Evaluating by User Testing	Assessing the solution and testing it with the project's stakeholders to make shared decisions	(Beckman & Barry, 2007, p. 43; R. Bu-chanan, 2004, pp. 59–60; Holloway, 2009, pp. 51–52; Bryan Lawson, 1980, p. 64;71;78-79;298-299; Liedtka, 2011, pp. 13-15;17-18, 2015)
	Evaluating by Ideas Com-parison	Judging the solution com-paring alternative ideas to consider more directions	(Beckman & Barry, 2007, p. 43; Brown & Wyatt, 2010; Nigel Cross, 1990, p. 129; Bryan Lawson, 1980, p. 81;298-299; Liedtka, 2015, p. 2011; Mahmoud Jouini et al., 2016, pp. 151–152; Marples, 1961, p. 64; Waldron & Wal-dron, 1988, p. 104)
	Suspending Evaluation	Avoiding untimely opinions to allow the exploration of risky but possibly reword-ing lines of thought	(Dorst, 2010, p. 134; Bryan Lawson, 1980, pp. 298–299)
	Resisting to Idea Rejection	Neglecting radical refor-mulation to hang on to the significant solu-tion concept	(N. Cross et al., 1992, p. 7; Bryan Lawson, 1980, p. 47)
	Reducing Per-sonal Bias	Taking into consideration different perspectives to make in-formed decisions	(R. Buchanan, 2004; Richard Buchanan, 1992a, p. 56;59-60; Liedtka, 2000, p. 13;18;19;22-23)

Cluster	Mechanism	Description	Reference
Learning	Adopting a Framework of Value	Opting for a set of principles to address the project direction	(Richard Buchanan, 1992a, p. 13;17-19; Nigel Cross, 2008; Goldschmidt et al., 1987, p. 59; Hillier & Musgrove, 1972, p. 10;11;12;;13-14; Junginger, 2007, p. 70; Bryan Lawson, 1980, pp. 159–160; 179;188-189;194-195;275-276;295-296;299-301; Rowe, 1987, p. 18;110; Sato et al., 2010, p. 47; Schön, 1983, p. 163;215;274;277-279)
	Understanding the Users	Empathising with people's needs and contexts to acquire new knowledge	(Beckman & Barry, 2007, p. 30; Brown, 2007; Brown & Wyatt, 2010; R. Buchan-an, 2004, pp. 57–60; Nigel Cross, 1990, p. 136; Dunne & Martin, 2006, pp. 514-515;519; Dziersk & Dziersk, 2009; Els-bach & Stigliani, 2018, pp. 11-1;15-17; Hassi & Laakso, 2011; Heather, 2007, pp. 67–70; Holloway, 2009, p. 51; Junginger, 2007, pp. 59–60; Liedtka, 2011, pp. 13–16, 2011, pp. 13–16, 2014a, 2015; Lock-wood, 2009, pp. 31–36; Mahmoud-Jouini et al., 2016, p. 149;151; Merholz, 2009; Roozenberg et al., 2010)
	Learning from Failure	Experiencing failure as a means of understanding how to do better	(Collins, 2013, p. 39; Heather, 2007, pp. 72–73; Heiman & Burnett, 2007, p. 3; Ignatius, 2015; Bryan Lawson, 1980, p. 156; Liedtka, 2011, pp. 17–18; R. Martin & Euchner, 2012, p. 13; Porcini, 2009, p. 13; Ward et al., 2009, pp. 80–81)
	Learning from Collective Critique	Productively critiquing ideas and opinions to increase the common knowledge	(Brown, 2008; R. Buchanan, 2004, pp. 59–60; Heiman & Burnett, 2007, p. 4; Junginger, 2007, p. 70; Liedtka, 2014a, 2015)
	Learning from People's Ex-pe-riences	Working together to access a broader pool of expertise	(Junginger, 2007, p. 70; Liedtka, 2000, p. 18)
	Learning by Doing	Reflecting carefully on your actions to address them in the right direction	(Hassi & Laakso, 2011; Oxman, 2002, pp. 136-137;139;153-154; Schön, 1983, p. 76;84;137;140;150;152-123;272; 274-277;284; Schön & Wiggins, 1992, p. 140;143;154-155)
	Learning from Doing	Reflecting on what were your actions to improve them the next time	(Dorst, 2010, p. 134; Bryan Lawson, 1980, pp. 197-198;299-301; Oxman, 1999, pp. 107–110)
	Creating new Knowledge	Producing new knowledge from the experimentation to inform the present and future projects	(Beckman & Barry, 2007, p. 29;47;52-53; Dorst, 2010, p. 134; Hassi & Laakso, 2011; Liedtka, 2000, pp. 13–14, 2011, pp. 13–16, 2014a; Mahmoud-Jouini et al., 2016, p. 147;149;150-152; Melles, 2011, p. 299; Verganti, 2017, pp. 100–101)
	Collecting Episodic Knowledge	Accumulating experiences and visual references to foresee new possibilities	(Bryan Lawson, 1980, pp. 199–301; Ox-man, 1999, pp. 108–110, 2002, pp. 138-139;146-149;152-154;161;163; Schön, 1983, p. 63;143-146;317)

Cluster	Mechanism	Description	Reference
Managing	Facilitating	Dealing with complex situations to make them more manageable without getting directly involved	(Brown, 2007; R. Buchanan, 2004, p. 56;59-60; Heather, 2007, pp. 69–70; Heiman & Burnett, 2007, pp. 2-3;8, 2007, pp. 2-3;8; Liedtka, 2014a; McCullagh, 2010, p. 3738; Peng, 1994, p. 20;35-39;42-43)
	Mediating	Helping to negotiate a solution to reach an agreement of finding a shared solution	(Bryan Lawson, 1980, pp. 48-49;229-230;269-270; Liedtka, 2000, p. 20; Stew-art, 2011, p. 516)
	Inspiring	Involving people in the situation to make them feel they want to do something and can do it	(Brown, 2007; Porcini, 2009, pp. 13–15)
	Connecting Different Per-spectives	Translating the different company perspectives to enhance the cross-disciplinary communication	(Heiman & Burnett, 2007, pp. 2–3; C. L. Owen, 2006, p. 4;5; Porcini, 2009, p. 7;13)
	Fostering Stakeholders Participation	Involving Stakeholders as an active part of the process to achieve more consensus	(R. Buchanan, 2004, p. 56;59-60; Liedtka, 2000, p. 13;18-19;22-23, 2015)
	Fostering Users Partici-pa-tion	Involving users as an active part of the process to achieve a more compelling result	(R. Buchanan, 2004, p. 56;59-60; Liedtka, 2000, p. 13;18-19;22-23, 2015)
	Enabling Team-working	Catalyse the team's potential to improve the overall team collaborative ability	(Camacho, 2016, p. 90;93;98-99; Nigel Cross & Clayburn Cross, 1995, p. 143;170; Dunne & Martin, 2006, pp. 513-514;518-519; Goldschmidt, 1995, pp. 189-190;194;208-209; Goldschmidt et al., 1987, pp. 60–61; Kimbell, 2011, p. 288; B. Lawson et al., 2003, p. 329; Bryan Lawson, 1980, pp. 236-240;246;251;258;259;263-264;273;277-278; C. Owen, 2006, p. 5; C. L. Owen, 2006, pp. 24–25; Peng, 1994, pp. 19-20;36; Waldron & Waldron, 1988, p. 104)
	Encouraging Diversity	Involving people with different backgrounds and skills to improve the team's capability	(Carlgren et al., 2016, pp. 46–48; Dziersk & Dziersk, 2009, p. 2009; Heiman & Bur-nett, 2007, pp. 2-3;8; Holloway, 2009, p. 51; Kimbell, 2011, p. 288; Liedtka, 2014a, 2015; Liedtka et al., 2017, pp. 54–55; Lockwood, 2009, pp. 30–31; Mahmoud-Jouini et al., 2016, p. 151; Roozenberg et al., 2010; Rosensweig, 2011, p. 20; Sato et al., 2010, p. 46; Tischler, 2009, p. 2009)
	Sharing Own-ership and Accountability	Shearing or interchanging the leading activities to make teamwork flexible	(R. Buchanan, 2004, p. 56;59-60; Heiman & Burnett, 2007, p. 2)

Table 3.6 Mechanism level: framework version 1.0.

Impacts

The literature review results exposed at the beginning of this chapter concluded that few studies explored the design thinking impacts on an organisation (Carlgren, Elmquist, et al., 2014; Liedtka, 2017). The ones who began this exploration struggled to frame those effects mainly because the impacts' causes were still complex to determine and isolate from the global consequences—in short, defining the design thinking impacts is a challenge (Schmiedgen et al., 2016).

Therefore, while the other levels are founded on broad literature evidence, this has fewer supporting clues. There are no impact models and few context base studies to exploit to build a reliable framework. Moving from what is known today, the third level of this framework just drafted its contents, planning to take advantage of the underneath structure to further investigate this level during the framework development process (Table 3.7).

Impact	Description	Reference
Quality of Choices	Make better decisions	(Carlgren et al., 2016; Liedtka, 2017, 2020)
Adaptability	Change to suit uncertain conditions	(Liedtka, 2017, 2020)
Speed	Move faster the project foreword	(Carlgren et al., 2016; Liedtka, 2020)
Risk and Cost of Fail-ure	Reducing the possibility of a big failure and its consequences	(Benedict et al., 2018; Liedtka, 2017, 2020)
Empathy	Imagining what it would be like to be in the customer's situation	(Benedict et al., 2018; Carlgren et al., 2016; Liedtka, 2017, 2020)
Creative Confidence	Psychological safety to feel in control of the creative situation	(Carlgren et al., 2016; Kelley & Kelley, 2015; Liedtka, 2017, 2020)
Engagement	Encouraging people's interest in work and taking part in something	(Carlgren et al., 2016; Liedtka, 2017, 2020)
Collaboration	Working together to create or achieve the same result	(Benedict et al., 2018; Carlgren et al., 2016; Liedtka, 2017, 2020)
Networking	Bring together the right mix of people and knowledge	(Carlgren et al., 2016; Liedtka, 2017, 2020)
Communication	Ease the exchange of information between people	(Carlgren et al., 2016; Liedtka, 2017)
Likelihood of Success	Improve the chance that the solutions succeed in the market	(Liedtka, 2017, 2020)
Client Satisfaction	The solution better addresses the client's expectations	(Phillips, Phillips, Paone, Gaudet, & Mcleod, 2019)
Organisation Reputation	Affect the opinion of the company and the products it sells	(Phillips et al., 2019)

Table 3.7 Impacts level: framework version 1.0.

3.3 Tool Transition

The previous paragraph sketched the framework structure, introducing the contents' organisation and spotting the level's function. This paragraph describes the transition that leads the framework to become a tool, highlighting the motivations and the reasons behind that choice. Finally, it briefly explains the design process adopted to realise the device.

Preliminary Discussions

The preliminary informal discussions about the first framework version highlighted some difficulties in the assessment approach that hindered constructive debate around the framework and, consequently, the overall evaluation process.

The framework's first draft version was discussed with the Electrolux Professional design team and the thesis's supervisors. The framework was a digital database[189] that organises the contents by affinity on different levels. Each element has a title, a description, some tags that help the information cluster, and literature references derived from the contents. The assessment aimed firstly to validate the framework contents looking for a domain agreement. Secondly, it aimed to elicit insights from the practice about the design thinking approaches and their impacts on the organisation.

However, at the end of these first preliminary discussions, the feedback gained was weak and inconsistent, eliciting several issues in the evaluative process. On the one hand, the topic complexity and the framework format hindered the domain agreement validation. Indeed, firstly, the digital support utilised was unsuitable for triggering observation about the framework's structure because it does not give enough visual feedback about the model. Secondly, the system was static, not fostering interconnections and correlations among contents. Finally, the

189 The database was developed in the Notion website application. The structure resembles the organisation shown in tables 3.5, 3.6 and 3.7.

contents' complexity sometimes was overwhelming to digest at once by the interviewees.

On the other hand, this preliminary discussion highlighted the need for a dedicated insights collection process working in synergy with the framework: a method that should be ether validated. Indeed, firstly the interview modality poorly addressed the aim of analysing the design thinking practices and exploring their impacts on the organisation. Secondly, the discussion did not naturally elicit insights from the procedure, mainly because practitioners struggled to emphasise the framework's content with their day-to-day activities. Finally, a process was required to analyse and map the design thinking practices and the connection between mechanisms and impacts.

In conclusion, these preliminary observations showed that the framework content and structure must be more understandable to be effectively reviewed. Moreover, a reliable method to elicit insight should be developed and evaluated if the framework aims to study the design thinking practices and their impacts.

From Framework to Tool

The first preliminary informal discussions with the Electrolux Professional struggled to produce the feedback expected for the evaluation. According to this initial input, the framework and the evaluative strategy changed. Instead of passively presenting the framework structure and contents and asking for feedback about the domain agreement, the researcher translated it into a set of cards usable with a tailor-made method to assess the framework topics interactively.

The inspiration came from Kleinsmann, Valkenburg, and Sluijs's paper (2017) that described the development of a set of cards exploited to assess different design thinking practices and their correlated impacts.[190] This approach seemed to move in the direction of mitigating the complaints from the preliminary discussion. Indeed, the card format reduces the cognitive complexity of managing the framework information by synthesising it through images and a few lines of text. Moreover, the card

190 In this paper, the authors performed a literature study on design thinking that resulted in a card set of 48 design activities representing design thinking. After the card validation process run with expert design thinkers and academics, the researchers used the card set to elicit stories from 33 innovators who reflected on its innovation practice and the value of design thinking within those practices. Each card has an image and a brief description framing the card's topic, visually conveying to the users the information straightforwardly.

structure helps to trigger curious discussions and flexible correlations among the framework's contents. In these terms, the framework translated into a set of cards used in a dedicated process becomes a tool with its method of investigation.[191]

Tool Development

The tool designed to support the domain agreement process and to analyse the design thinking practices has three primary design components: the cards, the boards and a set of roles that make the tool work.

Cards design

The card (Figure 3.2) design process moves from two primary goals. Make the content topic easier and more immediate, and make the framework simpler to discuss and reflect upon. To achieve these goals, the researcher adopted some strategies. Firstly, the card tool is primarily designed to be digital. Virtual cards are usable remotely[192], easy to share and reproducible. Secondly, the framework structure and subdivision are accentuated through the representations and the colour coding. Each of the six mechanisms' groups has its background colour and recursive visual elements. Thirdly, each card has the same structure and formal elements. They have a two-dimensional representation with a common visual language that exploits analogy to suggest the card's topic, a short title framing the card's subject, and a concise description summarising the content. Finally, the inherent essence of a card format fosters flexible reasoning among the cards. Indeed, cards are easy to move, group and reorganise in diverse arrangements, making them less stable and more prone to modification.

Board design

Cards are valuable artefacts to facilitate conversations and trigger feedback about complex topics such as design thinking. However, another issue highlighted in the preliminary discussion was the difficulty for practitioners to emphasise the framework's content with their actual

191 Even if the process that transformed the framework into a tool took clues from Kleinsmann, Valkenburg, and Sluijs's article, there are still some substantial differences. Firstly the pool of literature considered is broader in terms of time and depth. Secondly, the card structure is sorted into interconnected layers organised by attitudes, mechanisms and impacts. Finally, the card design is more elaborated, exploiting visual elements to enhance the overall experience.

192 The tool evaluation started during the global Covid 19 sanitary emergency. Therefore, having a digital tool that works at a distance was mandatory.

Figure 3.2 Cards: version 1.0.

practices[193]. The framework tried to reduce the gap between the theoretical and practical levels by focusing attention on the mechanisms cards. Still, the framework can not map all the design thinking manifestations. It is a compromise representing a cluster of possible expressions partially decontextualised from the practice.

Therefore, to help practitioners contextualise them even more with their work, the researcher designed a board format (Figure 3.3) fillable with the specific contents of the practice. This way, the users can associate the abstract framework content with their work activity, helping them reflect upon their practice more abstractly. Associating a board to the card help users contextualise and generate valuable feedback for the framework evaluation and explore interesting connections between mechanisms and specific approaches.

As for the card design, the board design was iteratively fine-tuned along the playtesting process. However, its objective is to represent the chronological sequences of steps visually. Displaying some anchors that practitioners can use to recall to their mind the activity and reflect upon it through the framework lens. The board is a chart that, over the x-axis, displays chronologically the activities done and, over the y-axis, clusters the activities subgroups that can reach the level of detail needed for the exploration.

Figure 3.3 Board: version 1.0.

193 Even expert practitioners seldom have the attitude of reflecting in more abstract terms about their day-to-day practical activities.

Rule Design

The cards and the board alone are not enough to collect insights from the design thinking practices. Some roles should be defined to guarantee a standard and repeatable process of gathering data from these activities. The rules aim to design a process that facilitates the users' exploration of a design thinking practice, guiding them in choosing and associating the mechanisms and impact cards with the activity described on the boards.

There are two roles in the process: the expert and the users. The expert is a scholar or a researcher interested in studying design thinking practices in a natural context with the role of activity facilitator. The users are practitioners who work with design thinking and want to reflect upon their daily work. This process helps both: the expert to explore and map the design thinking practices and the users to reflect upon their day-to-day activities and possibly improve them.

The main rules are as follows. Before the research activity, the expert has to do some preliminary work, organising and pre-populating the workplace[194] for the experiment. Firstly, prepare the board by filling it with the actual steps of the practice the expert wants to study. Secondly, order a deck of cards for each user[195] participating in the activity. At the session's beginning, the expert has to introduce the exercise. Firstly, anticipate the timing, the general schedule of the meeting and the rules of the game. Secondly, verify that the board is correct by looking for agreement on the board's contents. Thirdly, especially if the users are new to the cards, give an overview of the cards' contents by referring to the framework structure.

During the session, the expert facilitator narrates the practice by going through the board steps and asking the users to choose the card mechanisms they associate with each step. This first part of the exercise should be run singularly to allow users to think independently about their design thinking experience[196]. At the end of the selection, the expert asks to explain their choices[197] by narrating the mental relationship they did

194 In the following examples, the expert used MURAL, a digital co-working platform for this purpose.

195 There could potentially be several users participating in the activity at once. However, the process has been tested with only two users.

196 Each user has a deck of cards and board to fill in to avoid influencing each other.

197 The order in which they share their thoughts is random and alternated if the activity is repeated.

between the activity on the board and the card selected. After these steps, the expert facilitates a discussion among the users on the card choice divergences and convergencies, finally agreeing on a shared set of cards to associate with each board's step[198]. Then, the process is repeated to trigger the same discussion around the perceived impacts observed.

After each session, the expert guides the users in a recap of the analysed practice, asking for general consideration or second thoughts. The exercise ended with an open discussion about the activity's strengths and weaknesses, eliciting possible improvements the users could implement the next time.

198 The process is repeated if the practice is divided into more than one borad.

3.4 Validation

The previous paragraph told the motivation for the transition from a framework to a tool structure, introducing the core element of the tool design. This paragraph describes in detail the framework's validation process results, describing step by step the improvements introduced and the reasons behind these choices. More than merely improving the framework, this evaluative process provided valuable clues to explore the design thinking practices and their perceived impacts on the Electrolux Professional ecosystem.

During the validation process, we can identify three primary tool versions. Indeed the accumulated awareness and maturity about the tool gained through the evaluation produced significant changes, prompting a substantial redesign of the framework structure. After the method description, each validation activity (Table 3.8) is summarised in the following paragraphs, presenting the outcomes and the improvements in appropriate files[199].

Activity	Method	Tool Version	Date
Pilot: Mechanisms	Playtesting	1.1	01/06/21
Pilot: Impacts	Playtesting	1.1	07/06/21
Warewashing: Mechanisms	Playtesting	1.2	12/08/21
Warewashing: Impacts	Playtesting	1.2	13/08/21
QSR Special Appliance	Playtesting	1.3	26/08/21
Beer Drafting	Playtesting	2.1	07/09/21
High-Speed Oven: Mechanisms	Playtesting	2.2	30/09/21
High-Speed Oven: Impacts	Playtesting	2.2	05/10/21
Horizontal Analysis	Expert Analysis	2.3	29/11/21 – 03/12/21
Academy Expert Review	Expert Analysis	3.1	07/12/21
Academy Expert Review	Expert Analysis	3.1	14/12/21
Innovation Team Review	Expert Analysis	3.2	20/12/21

Table 3.8 Validating activity list.

199 Each file contains the following elements: a brief description of the project background to which the playtesting activity refers; a table that synthesises the outcomes of the card sorting exercise; another two tables that summarise the improvements elicited during the session, considering both the domain agreement and the tool functionality.

Method

In the transition from a framework to a tool, the evaluation approach doubled its mission: it should validate the tool contents and test the tool's workflow. With this purpose in mind, the researcher defined a standard procedure to assess the device and, consequently, the framework structure, adopting different approaches: playtesting and expert analysis.

Sampling

The first issue faced by the evaluator concerned the sample of practices to analyse. The question is about what should be considered a design thinking practice and what should not. As discussed in the first chapter, design thinking does not follow a unique path. On the contrary, it has multiple meanings and interpretations. Thus, the research has to define its inquiry limits before exploring the practices in context. Within the thesis, design thinking is framed holistically as a practice.[200] Nevertheless, the analysis should first consider the contextual meaning of design thinking to make sense of the situated nature of the practices. As we have seen in chapter two, for Electrolux Professional, design thinking is mainly used by the design department to enhance innovation and the design culture and leadership within the organisation.

Thus, this evaluation considered only the design thinking practices the design team led to support innovation. The researcher limited the scope in terms of time[201], typology[202] and people[203]. The evaluation does not consider consecutive or precedent practices run by other stakeholders with other approaches. With these boundaries, the research selected eight potential[204] projects for the final analysis (Table 3.9).

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200 The set of routinized behaviours and social rules adopted to design a particular artefact in a specific context.

201 From 2018 to 2020.

202 Considered only design practices focused on innovation.

203 Consider only the practices led by the design team.

204 Still, it is not known at the beginning of the process how many playtesting iterations are needed before the playtesting scope reaches its natural conclusion. In this case, the validation process required the analysis of four projects.

Project	**Year**
Warewashing	2018
QSR Special Appliance	2019
Beer Drafting	2019
High-Speed Oven	2020
High Productivity Appliance	2021
Hobs	2021
Holding Station	2021
Robotics and Automation	2021

Table 3.9 Potential projects selected for the analysis: underlined the actual projects analysed.

Playtesting

Since the tool workflow resembles the dynamic of a game, once the prototype was elaborated correctly, playtesting became the assessment's core activity. A playtest is the process by which a game designer tests a new game for bugs and design flaws before releasing it to market—playtesting exploits early game sessions to monitor and test the possible issues that could occur during gaming. It is a procedure that plans which data to track and record during the game flow. It analyses the results to make exploratory changes and uses them to redesign the next playtesting session. This way, it is possible to test how the changes affect the game and eventually change something else (Tekinbaş & Zimmerman, 2003).

The exercises involved two expert design thinking practitioners from Electrolux Professional in eight playtesting iterations of one, up to two hours each. After each session, the researcher reviews the recorded sessions analysing the data collected to update the tool and the framework before the next iteration. These playtesting activities revealed several incongruences, triggering the reformulation and adaptation of different framework versions. The iterative process arrived at its natural conclusion when progressively fewer and fewer incongruences cropped out from the exercises, and the framework structure became stable in the Electrolux Professional context.

During each iteration, the researcher collected feedback about the session to summarise them in schematic files considering two primary criteria: the domain agreement and the tool functionality.

Domain Agreement

The domain agreement aims to evaluate the level of agreement on a specific area of knowledge, such as design thinking. Two primary aspects (Milton 2007) were considered to assess this criterion: the domain's completeness and accuracy.

At each session, the completeness was assessed by two approaches: directly, by asking the users if something was missing in the overall tool structure, and indirectly, by looking for incongruences during the tool application process[205]. In the same way, the accuracy level was assessed: directly by asking the users if the card's contents made sense to them; Indirectly by observing misinterpretation, missuses and misunderstanding of the contents.

With this method, the overall domain agreement evaluation went through two levels: explicit and implicit. The first one is more rational and focused on the know-how of the users and experts. The second one is more practical and careful about incongruence in using the contents.

Tool Functionality

The functionality parameter aims to evaluate the tool's suitability to gather insight from the design thinking practices through a dedicated process of mapping and analyse. For this purpose, the researcher designed a tool composed of digital artefacts and rules to facilitate the process. After each iteration, the researcher collected feedback about the tool components and the overall experience to assess the tool's functionality. On the one hand, the researcher looked for incongruences, redundancies and incomprehension in the tool use. On the other hand, the researcher asked for users' observations about the workflow and the content format.

Filing process

The researcher summarised the outcome of each session in appropriate files describing the results of the exercises and the most relevant insight elicited by the participants. Each file contains a short introduction of the playtesting session and five tables: one framing the project backgrounds events chronologically, two describing the mechanism and impact's playtesting results, and the remaining listing the improvements clustered by domain agreement and tool functionality.

The playtesting results tables are composed of three columns. The first one shows the phases that the practice assessed. The second one lists all the individually selected cards for each step, underlining the ones the participants finally agreed to maintain. The third column notes valuable

205 Mainly caused by the lack of suitable content to use in the mapping exercise.

insights elicited by the participants. The fourth column indicates the participants[206] who chose a specific card or expressed a comment.

The domain agreement improvements table is composed of four columns. The first one labels the adjustment based on the type of domain agreement correction done: completeness or accuracy. The second one shows the card to which the improvement refers. The third lists the issue elicited by the participants. The fourth describes the tentative correction adopted to address the problem in the next iteration. As for the previous one, the tool functionality improvement table highlights the issues and corrections. However, it does not label the items by domain agreement but by focusing on the tool components: cards, boards and rules.

Expert Analysis

The researcher started evaluating the tool and the connected framework over iterative playtesting activities with two expert designers from the Electrolux Professional team. After eight sessions analysing four design thinking practices with the Electrolux Professional practitioners, fewer insights emerged. For this reason, it was decided to interrupt the playtesting activity and explore the tool more qualitatively through expert analysis.

Initially, a depth analysis involved the researcher in analysing the data gathered during the playtesting sessions horizontally, cross-checking whether the users' card[207] interpretation was consistent despite practices and phases. This analysis showed a good level of consistency, spotting the interpretations differences that supported the tool transformation.

Finally, two sessions with an external subject matter expert[208] and a focus group with the Electrolux Professional innovation team reviewed the last version of the framework. This analysis did not reveal substantial functional concerns about the tool or the domain agreement—just some clarifications in the card logic and labelling. The satisfactory results interrupted the validation process, prompting the research to move to the next phase.

Filing process

The researcher summarised the outcome of the horizontal analysis in an appropriate file that contains a short introduction of the analysis's

206 The participants' identities were anonymous. Thus, they were named user 1 and user 2.

207 Only the cards selected that elicited clear user insights were considered for this analysis.

208 Luciano Perondi is a subject matter expert in design, design logic and game design.

background and aims and three tables: two representing the mechanism and impacts analysis results and one listing the improvements clustered by domain agreement.

The analysis results tables (Table 3.37 and Table 3.38) are composed of four columns. The first one indicates the card analysed. The second column indicates in which playtesting session the users give those interpretations. The third one lists a synthetic and paraphrased description of the user's interpretations of the card. The fourth column notes the phase in which the users give those interpretations of the card[209].

Instead, the domain agreement improvements of the horizontal analysis (Table 3.39) and the expert review (Table 3.39, Table 3.43 and Table 3.44) outcome were summarised in single tables resembling the table structure described for the playtesting filing process.

Limitations

The evaluation approach described above has some limitations. The sample of selected users and experts is not as broad as it should be to effectively validate the domain agreement outside the Electrolux Professional context. Indeed, the application of the tool only in a unique environment made the device reliable only internally—further, evaluation should be done to make the tool valid even externally. The primary reason behind this weakness lies in the industrial nature of the thesis, which has to meet the expectations and schedule of the PhD's sponsor. Indeed, the study goal[210] did not match the timing of validating the tool in a multi-context arena, leaving enough time to design the assessment infrastructure[211].

In this regard, the framework presented in this thesis should be considered a proposition, requiring further testing in different contexts to reach more reliability. While the high-level cognitive structure, based on literature evidence, should grant stability despite the contextual differences, the mechanisms' level is based on weaker insights from the

209 The single phases defined by the tools used were aggregated into three macro phases: discovery, participatory workshop, and evaluation. Indeed, one or all the steps are present in all the practices analysed, making them easier to compare horizontally.

210 Assessing the design thinking practice in Electrolux Professional.

211 Even if it is not the aim of this thesis, the researcher planned to bring forward the evaluation process, expanding it in different contexts of use, involving more users, experts and even researchers who intended to use the tool for their studies. This way, the more the device gets used, the more it could improve its reliability. Moreover, the tool functionality assessment run through the playtesting activity could be enhanced by tracking usability data. By collecting efficiency, effectiveness, and satisfaction metrics, the researcher, could set up a more analytical and structured evaluation process.

literature and the Electrolux Professional practice. Therefore, it should be considered a first proposition, subject to expansion and modification if differences in the practices emerge. Even if an effort were put into decontextualising the single mechanisms, it would inherently reflect the Electrolux Professional design thinking practices. Finally, the impact level must be regarded as the most uncertain—a prototype based on the little pre-existing literature information and the explorative studies in Electrolux Professional.

Version 1.0

The first attempts to evaluate the tool involved two Electrolux Professional design thinking practitioners over five sessions. The kick-off version of the tool mirrored the framework's structure, translating its contents into cards and evaluating them with the method described above in an iterative way. At the end of each session, key issues emerged, suggesting new developments and implementations. After this first assessment cycle, the overall evaluative strategy seemed to have the potential to achieve the desired results. Still, the basic structure of the tool required substantial modifications.

1.1 Pilot

The first pilot analysed a workshop[212] led by the design team in 2020, which aimed to design new innovative features for a high-speed cooking appliance (Table 3.10[213]). To complete this first playtesting activity, the participants required two sessions of one and a half hours. In the first one, they run the card mechanisms selection process; in the second, the impact exercise. The outcome is collected in four tables (Table 3.11, Table 3.12, Table 3.13 and Table 3.14) and two figures (Figure 3.4 and Figure 3.5), summarising the most relevant insight elicited by the participants and the resulting improvements.

212 The workshop took inspiration from the Design Sprint method (Knapp, 2016).

213 For simplicity, this first pilot only considered the workshop activity even if the practice entailed a research activity, a prototype development and a user test. A further playtesting session considering the global approach has been done and described in the following examples.

Phase	Who	When
Workshop	Design; Business; Technology	April 2020

Table 3.10 Project backgrounds 1.1.

Phase	**Mechanisms Cards**	**Insights**	**Who**
Long Term Goal	Inspiring	It must inspire workshop participants on a bold objective.	User 2
	Sharing Ownership	It allows everyone to vote on the project goal.	User 2
	Facilitating		User 1
	Visualising the Situation	It depicts the situation we will face.	User 2
		It projects the team into the future, vis-ualising the dreamable situation.	User 1
	Connecting Different Perspectives	It aligns the team to the same goal.	User 2
	Suspending the Evaluation		User 1
	Evaluating by Sense of Fit		User 1
Sprint Questions	Challenge Assumptions	It challenges the team project assump-tions.	User 2
	Broadening the Problem	It brings out all the possible problems from all the team's perspectives.	User 2
	Reducing Personal Bias	It brings the bias to the table, helping the team reduce them.	User 2
	Understanding Complexity	It helps understand the complexity caused by the different perspectives of the team.	User 2
	Learning from Collective Critique	It critiques the project through those ques-tions.	User 2
	Understanding the Users		User 1
	Inspiring		User 1
	Suspending Evaluation		User 1
Ask the Expert	Broadening the Problem	It explores all the project topics one by one.	User 2
	Understanding Complexity	It considers the whole situation	User 1
	Visualising the Situation	It gives a view of the situation through visual presentations.	User 2
	Understanding the users	It presents the user-focus perspective.	User 2
	Learning from people's experiences	It allows subject matter experts to expose their knowledge.	User 2
	Creating New Knowledge		User 2
	Encouraging Diversity		User 1
	Connecting Different Perspectives		User 1
	Fostering Users Participation		User 1

Phase	Mechanisms Cards	Insights	Who
How Might We	Understanding the users	It emphasises the problems of the previous phase reformulating them into a challenge.	User 2
	Constraining the Problem	It prompts the team to pick up specific challenges to address the solutions.	User 2
	Understanding Complexity		User 2
	Communicating Information		User 2
	Reformulating the problem		User 2
	Connecting different perspectives		User 2
	Evaluating by stakeholder testing		User 2
	Reducing personal bias		User 2
	Inspiring		User 1
	Giving a form		User 1
	Visualising the situation		User 1
	Challenging the Assumption		User 1
	Broadening the problem		User 1
	Experimenting in parallel directions		User 1
	Understanding complexity		User 2
	Communicating information		User 2
Lightning Demos	Inspiring		User 2
	Collecting episodic knowledge		User 2
Notes, Ideas, Crazy Eight; Solution Sketch	Visualising the situation		User 2
	Experimenting in Virtual -World		User 2
	Experimenting in parallel directions		User 2
	Communicating information		User 2
	Giving a form		User 2
Art Museum; Speed Critique	Evaluating by stakeholder testing		User 2
	Reducing personal bias		User 2
	Suspending Evaluation		User 2
	Learning from collective critique		User 2
	Connecting different perspectives		User 2
	Sharing ownership and accountability		User 2

Table 3.11 Mechanism cards selection results 1.1.

Phase	Impact Cards	Insights	Who
Ask the Expert	Networking		User 2
Art Museum; Speed Critique	Alignment	It is the workshop's goal to align people on shared decisions.	User 2
			User 1
Overall Impacts	Collaboration	It is a cross-impact caused by the inherent essence of the workshop.	User 2
			User 1
	Client Satisfaction	It is my hope. If the design is based on customers' needs and validation, it should grant client satisfaction.	User 2
	Speed	It increases the speed of the project due to team alignment and engagement.	User 1
	Creative Confidence		User 2
	Quality of Choices		User 2
	Risk and cost of failure	It reduces the risk by validating the re-quire-ments early in the design process.	User 2
	Engagement		User 2

Table 3.12 Impact cards selection results 1.1.

Domain Agreement	Card	Issue	Correction
Accuracy	Reformulating the problem	Misunderstanding the content	New description: Redefining the initial problem in a new meaningful perspective.
Accuracy	Quality of Choices	The title and the description are not clear	New title: Decisiveness New Description: The ability to make decisions quickly and confidently and with good results
Accuracy	Adaptability	Description error.	New description: Ability to change to suit uncertain conditions
Accuracy	Understanding the users	It is perceived more as a conse-quence of the process than a mechanism.	Move from mechanism to impact
Accuracy	Encouraging diversity	It is perceived more as a consequence of the process than a mechanism.	New title: Diversity. Move from mechanism to impact
Accuracy	Empathy	It complex to see an impact	Move it as a learning mechanism
Completeness	Adopting a framework of values	It does not fit the exercise scope	Excluded.

Domain Agreement	Card	Issue	Correction
Completeness	Learning from doing	It does not fit the exercise scope	Excluded.
Completeness	Mediating	It was not considered. Similar to facilitating	Excluded
Completeness	Build trust	The description is not clear.	Add a new card

Table 3.13 Tool's domain agreement improvements 1.1.

Functionality	Issue	Correction
Board	There is not enough space on the board to organise the card selected.	Increase the board space dedicated to the participant's card choice.
Board	Participants influence each other by choos-ing the cards in the same area. People forgot who inserted a specific card	Split the board into as many dedicated areas as the number of participants.
Board	Phase clustering is too detailed.	Ease board construction by aggregating similar phases.
Board	Some phases need to be assessed together	Cluster more phases together.
Board	Some cards are recursive over an entire activity.	Design a dedicated area in the board to insert re-cursive cards.
Board	Images are redundant.	Avoid images and simplify the board.
Board	The workshop is not an entire practice.	Divide the project into more boards, one for each practice.
Board	There is too much distance between the cards to select and the board area where to insert them.	Move the cards to select closer o the board area.
Rules	Participants influence each other by talking aloud.	The first card selection round must be made silently.
Rules	Cards can stay in more than one place.	Cards can be copied and past as many times as you need.
Rules	There is no clarity about the level of de-tail to adopt during the card selection.	Select only the more suitable card: on aver-age, two to four cards for phase.
Rules	There are no criteria in the card selection.	Choose the cards the phase is meant to ad-dress: the goal of the stage.
Rules	Tendency to add as many cards as they can.	Give a clear target: select the three most relevant cards for each phase.
Rules	People forgot who inserted a specific card	Colour coding for each user participant.
Rules	The users feel the need to select some card for the entire activity	Split the card selection exercise. Firstly make the card selection by phase, then by activity with an overall perspective.

Table 3.14 Tool's functionality improvements 1.1.

Figure 3.4 Playtesting result 1.1 (after the first session).

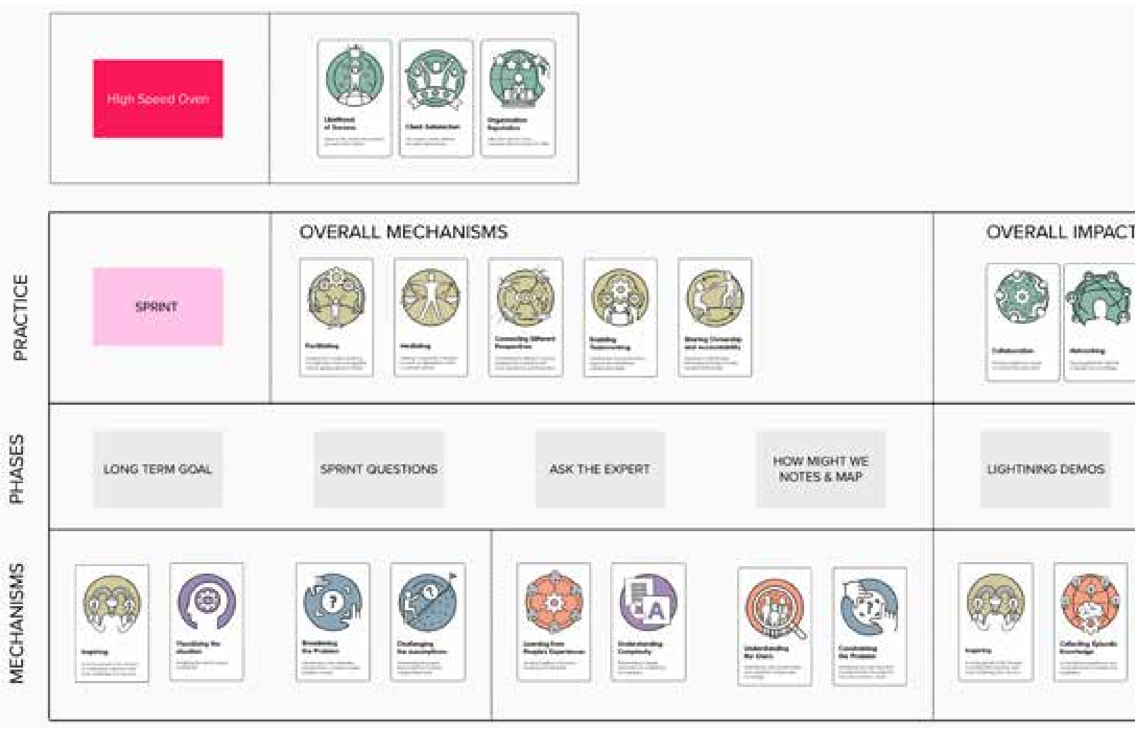


Figure 3.5 Playtesting result 1.1 (after the second session).

NOTES
IDEAS
CRAZY EIGHT
SOLUTION SKETCH
ART MUSEUM &
SEED CRITIQUE

1.2 Warewashing

The second session analysed a practice led by the design between 2018 and 2020, which aimed to design innovative features for a warewashing appliance (Table 3.15). This project was the oldest considered in this evaluation and the first one where the company involved the design department in an innovation activity. Even this second playtesting activity required two sessions of two hours to complete. In the first one, they run the card mechanisms selection process; in the second, the impact exercise. The outcome is collected in four tables (Table 3.16, Table 3.17, Table 3.18, and Table 3.19) and one figure (Figure 3.6), summarising the most relevant insight elicited by the participants and the resulting improvements.

Phase	Who	When
User Research	Design; Business	June – October 2018
Workshop	Design; Business; Technology; Consultants	October 2018
Prioritisation	Design; Business; Consultants	April – June 2019
Prototyping	Design; Technology	October – November 2019
Testing	Design; Business	April – May 2021

Table 3.15 Project backgrounds 1.2.

Phase	Mechanisms Cards	Insights	Who
User Research	Broadening the Problem	By researching, you are broadening your knowledge about the problem space.	User 2
	Understanding the User	It is precisely the aim of this phase.	User 2
	Collecting episodic Knowledge	By researching, you collect a series of episodes that happen to your users.	User 2
	Fostering User Participation	By research, you bring people on board.	User 2
	Learning by Doing	Sometimes, you try to get into your users' shoes during the research.	User 2
	Suspending Evaluation	During the research, you should adopt a beginner mindset without judging what you observe.	User 1
Cluster Analysis	Understanding Complexity	By researching, you want to understand a complex subject.	User 2 User 1
	Constraining the Problem		User 1

Phase	Mechanisms Cards	Insights	Who
Presentation; Empathy map; Journey Map; Need Selection	Evaluating by Sense of Fit	During journey mapping, you must identify the most critical journey moment by putting yourself in the users' shoes.	User 2 User 1
	Fostering User Participation	Empathy mapping lets you bring the users onboard, even if they are not physically present.	User 2 User 1
	Empathy	Empathy mapping lets you put yourself in the users' shoes and learn from that experience.	User 2
	Visualising the Situation	Journey mapping lets you visualise the whole users experience in a single representation.	User 2 User 1
	Fostering Stakeholder Participation	Journey mapping involves all stakeholders elaborating on the user knowledge collected and assimilating it.	User 2
	Creating new Knowledge		User 2
	Constraining the Problem	When selecting the primary needs, you constrain the initial problem by focusing on what is more strategic for the team.	User 2
	Reformulating the Problme	By selecting the needs, you reformulate the initial assumption framing the problem differently.	User 2
	Learning from Collective Critique		User 2
	Enabling Teamworking	An overall mechanism essential for this practice	User 1
	Learning from people's experience		User 1
Big Ideas	Communicating information		User 1
	Understanding the Users	An overall mechanism essential for this phase	User 2
	Facilitating		User 2
	Exploring in Parallel Directions	In idea generation, you experiment with different hypothesis	User 2 User 1
	Making Ideas Tangible	In idea generation, you make the ideas visible.	User 2
	Suspending Evaluation	In idea generation, you must suspend your judgment to think outside the box and propose crazy ideas.	User 2
Idea Presentation; Dot voting; Viability Feasibility Matrix; Dot Voting	Inspiring	The collective presentation of the ideas inspires the team.	User 2
	Learning from Collective Critique	In the presentation, you expose your idea to the team's critique.	User 2
	Evaluating by stakeholder testing		User 2
	Sharing Ownership and Accountability	By prioritising all together, you involve the team in the decision-making.	User 2
	Mediating		User 1
	Evaluating by Idea Comparison		User 1

Phase	Mechanisms Cards	Insights	Who
Cardboard Prototyping; Rehearsal	Give a Form	By prototyping, you gave shape to the ideas selected.	User 2
	Inspiring	In this specific case, the collaborative pro-totyp-ing activity engaged and inspired people more than resulting truly useful.	User 2
	Learning by Doing	In this specific case, there were few learnings done by doing the prototype.	User 2
	Connecting different Perspec-tives	In the collective rehearsal, you aligned all the different ideas for all the teams.	User 2
High Fidel-ity Mockup; Video	Gives a Form	By prototyping, you gave shape to the ideas selected.	User 2
	Experimenting in the Real World		User 2 User 1
	Experimenting in Virtual World		User 1
	Experimenting in the Market		User 1
	Making Ideas Tangible	By prototyping, you make the idea expe-riencea-ble for others with less friction.	User 1
	Constraining the Problem	While prototyping, you have to consider the main problems.	User 1
Interview; Business and Cus-tomer Val-ue Voting	Evaluating by Stakeholder Testing	All the project stakeholders assess the ide-as.	User 2
	Learning from Collective Critique	Interviewing the stakeholders about the ideas collects critiques from all over the organisation.	User 2 User 1
	Sharing Ownership and Ac-countability	Sharing ideas with the stakeholders makes them more accountable for the ideas.	User 2
	Fostering User Participation		User 2
	Creating new Knowledge		User 1
	Learning from Doing	Learning from what you have done.	User 1

Table 3.16 Mechanism cards selection results 1.2.

Phase	Impact Cards	Insights	Who
User Research	Creative Confidence	Doing the research and the analysis makes you feel more confident in the creative phase.	User 2
	Risk and Cost of Failure	A direct consequence of doing research. You reduce the risk of taking the wrong project directions.	User 2
	Engagement	You do not do the research alone but with other stakeholders. During this phase, you can feel people engaged in the process, part of something.	User 2
	Reduce Personal Bias	The Research reduce the bias of the team by aligning the team with a shared knowledge	User 2
	Networking	In the research, you must use your network to connect with people.	User 1
	Likelihood of Success	Research is the most critical activity to succeed.	User 1
	Empathy/ Customer Under-standing	There is not the card I would expect the research helps the team better understand the user and their context.	User 1
Workshop	Creative Confidence	Make people able to create thanks to the tools that facilitate the creative process.	User 2
		In this phase, you feel comfortable creating: you have the research knowledge and are in a safe environment where you can make mistakes.	User 1
	Engagement	You feel the energy that this participative activi-ty re-lease in the team.	User 2
		People feel engaged when they can influence the project.	User 1
	Collaboration	The participative activity with the shared mo-ment of dialogue and decision-making is done to facilitate collaboration among the team.	User 2
		It is a collaboration that enables trust by making things together.	User 1
	Alignment	The consequence of engagement and collabo-ration. At the end of the workshop, the stake-holders have a shared vision of how the project should be.	User 2
		No other tool allows you to be so aligned. This process takes into consideration all the stake-holders' opinions.	User 1
	Communication		User 2
	Networking	Bringing on board different people with different knowhow.	User 2
	Likelihood of Success	The consequences of collaboration and engage-ment.	User 2
	Speed	Even if this project was not fast, this practice speed up the overall process.	User 1

Phase	Impact Cards	Insights	Who
Internal Validation	Decisiveness	By presenting the test results, you put the company in front of a clear choice, supplying all the information the company need to make a decision.	User 2
	Risk and Cost of Failure	The risks of failure go down by prototyping the idea and testing it.	User 2
		We analytically tested the ideas and feel confident in reducing the risk of failure.	User 1
	Likelihood of Success	By reducing the risk, you increase the likelihood of success.	User 2
		You move toward the project's success by prototyping and testing an idea.	User 1
	Reducing Personal Bias	Testing ideas with people who do not participate in the workshop reduces personal preferences and biases, supplying external data.	User 2
	Alignment	Secondary impact. Testing all the ideas with several stakeholders aligned a broad audience in the same direction.	User 2
	Adaptability	Building the prototype, you know constraints and errors, and you should be ready to adopt and evolve the concept.	User 1

Table 3.17 Impact cards selection results 1.2.

Domain Agreement	Card	Issue	Correction
Accuracy	Empathy	It is not an impact but a mechanism. Empathy is not the goal but a means.	Transform the impact empathy card in mechanism one. Put it under the Experimenting & exploring cluster.
Accuracy	Empathy	The description should be more articulated.	Title: Learning From Empathisation; Description: Imagining what it would be like to be in the customers' situation
Accuracy	Visualising the situa-tion	Misunderstanding of the card as communicating information visually. It could be selected in almost all the phases	Move the card in the attitudes. Title: Visual. Description: Attitude to make sense of the situation through visualisation and representation
Accuracy	Fostering User Participation	Misunderstanding of the card	
Accuracy	Resist to Idea Rejection	Card misunderstanding. It is complex to use in these exercises. Contain several cognitive biases.	
Accuracy	Evaluating by stakeholder testing	Card misunderstanding.	Change the title: Evaluating by stakeholder? Assessment

Domain Agreement	Card	Issue	Correction
Accuracy	Giving a Form	Card misunderstanding. Understood as visualise not giving aesthetical form	
Accuracy	Learning From Doing	Card misunderstanding. It is complex to use in these exercises.	
Accuracy	Understanding the Users	Need for a mechanism that ex-presses the activity of collecting user insights. Knowledge beyond the single project, but for the organisation	New Card. Learning Mechanism. Title: Collecting customer Knowledge. Description: Empathising with people's needs and contexts to acquire new knowledge
Accuracy	Reframing the Problem Perspective	Difficult to understand.	New description: Looking at the problem from an entirely new standpoint to rethink it from its foundation
Accuracy	Collecting Episodic Knowledge	Misinterpretation: collecting insights from the field.	
Accuracy	Risk and Cost of Failure/ Likelihood of Success	They are very similar. They are two sides of the same coin.	Combine the cards
Accuracy	Risk and Cost of Failure	Unclear title.	New title: De-Risking.
Accuracy	Creative Confidence	Unclear description	New description: Empower people's creativity and psychological safety
Accuracy	Alignment	Unclear description	New description: Agree on something, sharing the same interest and aims
Completeness	Trust	Connected to collaboration but focus more on a personal level. During participative activities, you spend quality time with colleagues strengthening intimate relationships.	Add a new impact card. Title: Trust. Description: Belief that you can depend on someone or something
Completeness	Braking the Silos	Lack of impact. Collaboration partially includes breaking the silos and networking, but it does not give the same focus.	Add a new impact card. Title: Break-ing the Silos. Description: Bring together people from all across the organisation
Completeness	Encouraging Diversity	It looks redundant. Its function is present in other cards, such as enabling teamworking, connecting different perspectives, engagement, and collaboration	Discarded.
Completeness	Learning from Doing	Misleading title. It is too similar to Learning by doing	Discarded.
Completeness	Resisting idea rejection	It does not fit the exercise scope	Discarded.
Completeness	Evaluating by Ideas Comparison	It does not fit any card. Need for a new card	

Domain Agreement	Card	Issue	Correction
Completeness	Communication		
Completeness	Customer Under-standing	If empathy is a mechanism, there is a lack in the impacts of knowledge acquired during the research.	Add a new impact card. Title: Cus-tomer Understanding. Description: Collect new reusable customer knowledge
Completeness	Action Oriented		Add a new impact card. Title: Ac-tion Oriented. Description: Will-ingness to take practical action to deal with problem or solution

Table 3.18 Tool's domain agreement improvements 1.2

Functionality	Issue	Correction
Card	The "Constraining the Problem" illustra-tion was misleading, not addressing the desired meaning.	New illustration. Use the same visual lan-guage of the cluster to improve consistency.
Card	The "Reframing the Problem Perspec-tive" illustration was misleading, not address the desired meaning.	New illustration. Use the same visual lan-guage of the cluster to improve consistency.
Board	Dividing the board by single exercises sometimes is reductive. If they are close-ly connected, they will share the same mechanism cards.	Divide the board, considering some exercis-es are connected, part of the same process.
Board	No proper space to pre-select the cards. Hard to understand who choose which card.	Add a board area where each user can add the cards they pre-selected.
Board	Moving forward and backwards in the vir-tual board to copy and paste the cards is time-consuming.	Copy a card deck under each phase of the prac-tice to have an overview, and rapidly copy and paste the card when needed.
Rule	At the beginning of the exercise, it is not easy to see if the map lacks some phase. It is easier to notice it during the activity.	
Rule	I feel overwhelmed by all the cards. I feel I have to choose many cards.	Define and communicate the number of cards selectable per phase.

Table 3.19 Tool's functionality improvements 1.2.

Figure 3.6 Playtesting result 1.2.

1.3 QSR Special Appliance

The third session analysed a workshop led by design in 2018, which aimed to find an innovative answer to a specific problem identified by a multinational Quick Service Restaurant (QSR) organisation (Table 3.20). This playtesting activity required a single session of one and a half hours to complete. The outcome is collected in four tables (Table 3.34, Table 3.35, Table 3.36) and one figure (Figure 3.7), summarising the most relevant insight elicited by the participants and the resulting improvements.

Phase	Who	When
Workshop	Design; Technology	November 2018

Table 3.20 Project backgrounds 1.3.

Phase	Mechanisms Cards	Insights	Who
Presentation	Creating new Knowledge		User 1; User 2
	Understand Complexity		User 1; User 2
	Communicating Information	This phase aims to communicate information.	User 2
	Inspiring	The pictures presented may inspire participants' creativity.	User 2
Antiproblem	Empathisation		User 2; User 1
	Learning from Customers		User 2; User 1
	Inspiring	It is an ice-breaker; it is made to inspire people.	User 2; User 1
	Experimenting in a Virtual World	Even if you solve the reverse problem, you still imagine a solution. It is a creative act.	User 2
	Reframing the problem perspective	In this exercise, you turn the problem. You are doing a strong reframe of the situation.	User 2

Phase	Mechanisms Cards	Insights	Who
Five Whys	Reformulating the problem	Moving toward the exercise steps, you consider more and more aspects of the problem reformulating the team's initial frame.	User 2; User 1
	Constraining the Problem		User 2
	Creating new Knowledge		User 2
	Fostering Stakeholder Participation		User 2
	Assessing with Stakeholders		User 2
	Experimenting in Parallel Directions	You explore the problem in different directions. You broaden the problem.	User 1
	Evaluating by Sens of Fit		User 1
	Broadening the Problem	Participants give more relevance to the convergent part of the exercise than the divergent one.	User 1
Desk Research	Collecting Episodic Knowledge	Collecting more information to foster creativity	User 2
	Inspiring		User 2
	Experimenting in Parallel Direction	Searching for new information triggers your creativity. You elaborate on the information creatively.	User 1
	Connecting Different Perspectives	You connect different information from different perspectives.	User 1
Crazy Eight	Experimenting in Parallel Direction		User 2; User 1
In-depth Idea	Experimenting in a Virtual-World		User 2; User 1
	Making Ideas Tangible		User 2; User 1
	Giving a Form		User 2
Presentation	Communicating Information		User 2
$100 Priori-ti-sation	Evaluating by Ideas Comparison		User 2; User 1
	Mediating		User 2; User 1
	Inspiring	You get inspired by looking at the other participants' ideas.	User 1
	Connecting different Perspectives	You see other perspectives, and you try to connect them.	User 1
Overall Mechanisms	Enabling Teamworking		User 2
	Facilitating		User 1
	Mediating		User 2
	Connecting Different Perspectives		User 1
	Constraining the Problem		User 1

Table 3.21 Mechanism cards selection results 1.3.

Phase	Impact Cards	Insights	Who
Antiproblem	Customer Understanding	Before moving into the solution space, we made people more aware of the customers' problems.	User 2; User 1
Five Whys	Trust	In this phase, you have to trust the team. You must trust the different team experts if you do not have all the information.	User 2
	Braking the Silos	By trusting colleagues of other departments, you break the internal silos during the workshop and in the organisational life.	User 1
Desk Research; Crazy Eight; In-depth Idea	Creative Confidence	With these tools and methods, everybody can create new ideas. Even people that are not used to doing that.	User 2; User 1
	Likelihood of Success		User 1
	Communication	The workshop facilitated team communication.	User 2
Presentation; $100 Prioriti-sation	Decisiveness	The process with the final prioritisation gives the team a clear priority, easing decision-making.	User 2
	Engagement	Making people create and decide together makes people engaged in the project.	User 1
	Alignment		User 1
Overall Impacts	Trust	In participative activity, you can work with people you have never worked with. You build personal relationships with your colleagues inside and outside the workplace.	User 2; User 1
	Action Orientation	At the end of the workshop, we came out with straight-forward and easy-to-implement ideas. This Activities are fast and focus on action.	User 2; User 1
	Speed		User 2
	Collaboration	It is an inherent impact of these participative activities.	User 2

Table 3.22 Impact cards selection results 1.3.

Domain Agreement	Card	Issue	Correction
Accuracy	Experimenting in a Virtual-World	Misleading title and hard to understand from a practitioner's perspective.	New title: Experimenting by sketching
Accuracy	Experimenting in a Real-World	Misleading title and hard to understand from a practitioner's perspective.	New title: Experimenting by Prototyping
Accuracy	Evaluating by sense of fit	The word evaluation focuses on judging values, numbers or performance.	New Title: Assessing by sense of fit. The assessment focuses more on gauging the quality, value or importance.

Domain Agreement	Card	Issue	Correction
Accuracy	Evaluating by Idea Comparison	The word evaluation focuses on judging values, numbers or performance.	New Title: Assessing by idea com-par-ison. The assessment focuses more on gauging the quality, value or importance.
Accuracy	Evaluating with users	The ward user is too restrictive.	New title: Assessing by Customers' Validation. New Description: Judg-ing one or more ideas to validate them with external customers.
Accuracy/ Completeness	Learning from Customers	Learning mechanisms focus on the way we learn the means of collecting knowledge refers to something else.	Move the card under a new-born category called "Finding and Analysing". New Title: Collecting Customer knowledge"
Accuracy/ Completeness	Collecting Epi-sodic knowledge	Learning mechanisms focus on the way we learn the means of collecting knowledge refers to something else.	Move the card under a new-born category called "Finding and Analysing".
Accuracy/ Completeness	Understanding Complexity	The act of representing informa-tion to understand its complexity is generic and overused by the user.	Give the content more focus and ease its correct use. Move it under the new-born category called "Find-ing and Analysing". New title: Analysing and Synthesising. New Description: Analysing differ-ent resources to synthesise com-plex in-formation with immediacy.
Completeness	Communicating Information	Not the best collocation after the recategorisation of the cards	Move the card under a new-born category called "Finding and Analysing".
Completeness	Making Ideas Tan-gible	This card does not have a specific collocation because it is almost always involved in the design practice.	Move the card to the attitude sec-tion. Title: Visual. Description: Attitude to making sense of the situation through visualisation and representation.
Completeness	Giving a Form	There is a gap between the ex-pected use and the actual one. Difficult to distinguish between the activity of giving an aesthet-ical form and giving a shape to communicate something.	Discard the card
Completeness	Assessing with Stakeholders	In some cards, you focus on the way to assess something; on the other, who is evaluating some-thing.	Focus more on who is evaluating. Substitute this card with a new one. Title: Assessing by Criteria Analysis Description: judging one or more ideas analysing them by predefined parameters.
Completeness	Creating new Ideas	Experimenting is something that happens after the idea creation. Participants express the need for a card representing the idea mechanism creation.	New Card. Title: Creating New Ideas Description: Synthesising different insights to create new ideas.

Domain Agreement	Card	Issue	Correction
Completeness	synthetic	Overlap with the new mecha-nisms card added.	Discard the card.
Completeness	Experimenting by Virtual Tools	The sketching and prototyping categorisation missed the virtual dy-namic.	New Card. Title: Experimenting by virtual tools. Description: Developing ideas through a virtual and mental dialogue to explore potential problems and solutions
Completeness	Experimenting in the Market	The user can not use this card since the market release of the artefact they are designing.	Discard the card.
Completeness	Experimenting in Parallel Direc-tions	Mispleaded. Enlarging the prob-lem space instead of the solution space.	Discard the card.
Completeness	Mediating; Con-necting different Perspectives	The meaning and use of those cards overlap.	Keep only the mediating card. Discard the other.
Completeness	Customer Understanding; Creating new Knowledge	The customer understanding impact sounds more like a mech-anism focusing on specific knowl-edge. The knowledge creation mechanisms seem more an effect of a mechanism.	Combine the two cards as a new impact. Title: Knowledge Creation. Description: Get information & un-derstanding about something, making it a valuable & competitive asset.

Table 3.23 Tool's domain agreement improvements 1.3

Functionality	Issue	Correction
Tool	The space left for users to do the prese-lection is too small.	Braden the space dedicated to the users' preselection.
Tool	No space for the preselection of the overall mechanisms and impacts.	Design the table to leave enough space to add the cards preselected for the overall mecha-nism and impact cards.

Table 3.24 Tool's functionality improvements 1.3

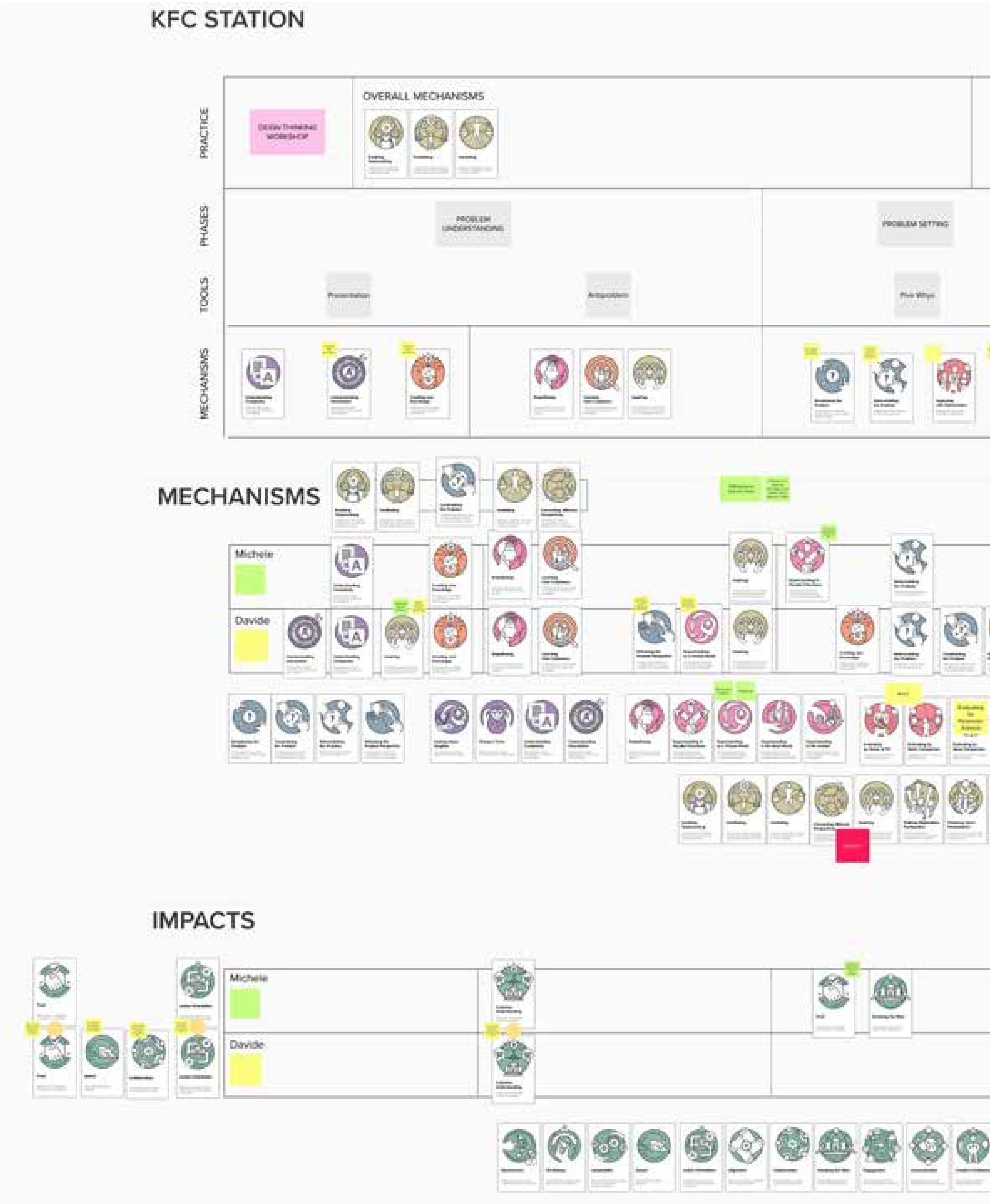


Figure 3.7 Playtesting result 1.3.


OVERALL IMPACTS
SOLUTION FINDING
SOLUTION PRIORITIZATION
Desk Research
Crazy Eight
In-depth Idea
Presentation
$100 Dollar Prioritization

Toward Version 2.0

Despite the detailed corrections described in the table above, the overall knowledge acquired over the first three playtesting activities prompted the researcher to modify the framework scaffold and, consequently, the interconnected tool. At the higher structural level, the original five skills area changed.

The “visualising and representing” mechanism cluster was integrated into the “Experimenting and Exploring” and the new “Finding and Analysing” one. Indeed, the playtesting activities highlighted a repeated inconsistent use of those cards. Compared to other mechanisms, they seem not to fit into a defined space in the design practices but seem to be involved as collateral aspects of different mechanisms. This lack of clarity prompted users to select those cards even if they did not significantly affect the practice. For these reasons, on the one hand, some cards were combined in the “creating and experimenting” pillar, where the explorative mechanisms always involved visualising or representing, whether it is a mental or physical process.

On the other hand, the mechanisms of understanding complexity and communicating moved into a new pillar called “finding and analysing”, giving a more precise collocation to those activities. This new area addressed the user’s concerns about the lack of mechanisms focused on information collection. This area included mechanisms that struggled to find a suitable position, such as “learning from customers” and “collecting episodic knowledge”. With this structure, there is a clear separation between learning and collection strategies that do not always correspond[214].

Overall, the significant changes in the skill area structure described and the plenty of minor modifications in the cards accumulated in the playtesting activities gave rise to a second tool version (Table 3.25, Table 3.26 and Table 3.27).

Attitude	**Description**
Inquisitive	Attitude to discover as much as you can about something.
Visual	Attitude to make sense of the situation through visualisation and representation.
Optimist	Attitude to feel that good things are more likely to happen than bad things.
Human-Centred	Attitude to focus on human aspects, putting people at the centre of the design.

214 For instance, it is possible doing customer research and learn something by empathising with them but even critiquing something or asking for their expert know-how.

Attitude	Description
Collaborative	Attitude to involve people to work on a particular purpose.
Dialog Oriented	Attitude to exchange opinions between opposing perspectives by critical talking.
Tolerant to Uncertainty	Attitude to deal with unknown and ambiguous situations.
Holistic	Attitude to dealing or treating the amount of a situation.
Iterative	Attitude to think through the logic of what might be.
Abductive	Attitude to do smoothing again and again to improve it.

Table 3.25 Attitude level: framework version 2.0.

Mechanism	Description	Cluster
Collecting customer knowledge	Empathising with people's needs and contexts to acquire new knowledge	Finding & Analysing
Collecting Episodic Knowledge	Accumulating experiences and visual references to foresee new possibilities.	Finding &
Analysing & Synthe-sising	Analysing different resources to synthesise complex information with immediacy.	Finding & Analysing
Communicating Information	Representing complex information to communicate with imme-diacy.	Finding & Analysing
Broadening the Prob-lem	Introducing a new extended perspective to consider a larger prob-lem context.	Framing & Reframing
Constraining the Problem	Identifying and selecting what is paramount for the project to focus on the problem context.	Framing & Reframing
Reformulating the Prob-lem	Redefining the initial problem in a new meaningful way.	Framing & Reframing
Reframing the Problem	Looking at the problem from a competently new standpoint to rethink it from its foundation.	Framing & Reframing
Creating New Ideas	Synthesising different insights to create new ideas.	Creating & Ex-perimenting
Experimenting by Sketch-ing	Developing ideas by a visual and mental dialogue to explore po-tential problems and solutions.	Creating & Ex-perimenting
Experimenting by Vir-tual Tools	Developing ideas by a virtual and mental dialogue to explore potential problems and solutions.	Creating & Ex-perimenting
Experimenting by Pro-totyping	Developing ideas by a physical and mental dialogue to explore potential problems and solutions.	Creating & Ex-perimenting
Assessing by Sense of Fit	Make a decision through a subjective sense of fit.	Evaluating
Assessing by Ideas Com-parison	Comparing two or more ideas to judge them side by side.	Evaluating
Assessing by Criteria Analysis	Judging one or more ideas by analysing them by predefined parameters.	Evaluating
Assessing by Custom-ers' Validation	Judging one or more ideas to validate them with external cus-tomers.	Evaluating
Learning from other Sources of Research	Accessing a broad pool of sources to get knowledgeable about the subject matter.	Learning

Mechanism	Description	Cluster
Learning From Empathisation	Put yourself in the customers' shies to experience their point of view.	Learning
Learning from Collective Critique	Critiquing ideas and opinions in a productive manner to increase common knowledge.	Learning
Learning by Doing	Reflecting carefully on your actions to dig into the situation and understand it.	Learning
Learning from Failure	Experiencing failure as a means to understand how to do better.	Learning
Enabling Teamworking	Catalyse the team's potential to improve the overall team collaborative ability.	Managing
Facilitating	Dealing with complex situations to make them more manageable without getting directly involved.	Managing
Mediating	Helping to negotiate a solution to reach an agreement of finding a common solution.	Managing
Inspiring	Involving people in the situation to making them feel they want to do something and can do it.	Managing
Fostering Stakeholders Participation	Involving Stakeholders as an active part of the process to achieve more consensus.	Managing
Sharing Ownership and Accountability	Shearing or interchanging the leading activities to make the teamwork flexible.	Managing

Table 3.26 Mechanism level: framework version 2.0.

Impact	Description
Decisiveness	Make decisions more quickly, confidently and with good results.
De-Risking	Reducing the possibility of a big failure and its consequences.
Adaptability	Responsively change the project direction in response to unexpected events.
Speed	Move faster the project foreword.
Action Oriented	Willingness to take practical action to deal with problems or solutions.
Collaboration	Working together to create or achieve the same result.
Breaking the Silos	Bring together people from all across the organisation.
Communication	Ease the exchange of information between people.
Alignment	Agree on something, sharing the same interest and aims.
Knowledge Creation	Get information & Understanding about something, making it a valuable & competitive asset.
Creative Confidence	Empower people's creativity and psychological safety.
Engagement	Encouraging people's interest in work and taking part in something.
Personal Bias	Not allowing personal opinions to influence your judgement in an unfair way.
Trust	Belief that you can depend on someone or something.
Customer Satisfaction	The solution better addresses the client's expectations.

Table 3.27 Impact level: framework version 2.0.

Version 2.0

After the first assessment loop, a second one involved two Electrolux Professional partitioners in evaluating the second tool's version over two more playtesting sessions. Since the incongruences in the tool application got infrequent, the expert decided to interrupt the activity and analyse the data gathered horizontally to check for inconsistencies in the tool's use. The new insights elicited by the analysis induced the researcher to rethink the tool structure and release a new, updated version.

2.1 Beer Drafting

The first session analysed a practice led by the design in 2019, which aimed to design innovative features for a beer drafting appliance (Table 3.28). For this project, Electrolux Professional worked as a consultant to co-design new solutions with a strategic partner. In particular, the participative practices involved the main stakeholders of the other organisation in supporting the creative activity. This playtesting activity required one session of two hours to complete. The outcome is collected in four tables (Table 3.29, Table 3.30, Table 3.31 and Table 3.32) and one figure (Figure 3.8), summarising the most relevant insight elicited by the participants and the resulting improvements.

Phase	Who	When
Internal Research	Design; Business; Technology	March – June 2019
Workshop	Design; Business; Technology; Partner	June 2019

Table 3.28 Project backgrounds 2.1.

Phase	Mechanisms Cards	Insights	Who
Interview	Collecting Customer Knowledge		User 2; User 1
	Collecting Episodic Knowledge	By interviewing different people, you do not collect only customer knowledge but even stakeholder knowledge inside and outside the company.	User 2
	Learning from Emphasization		User 2
	Learning from other Sources of Knowledge		User 1

Phase	Mechanisms Cards	Insights	Who
Insight Analysis	Analysing & Synthesising		User 2; User 1
	Broadening the Problem	You put together all the problems. Therefore, you enlarge the problem space.	User 2
Insight Map; Flow Map; Personas; Journey Map	Communicating Information		User 2; User 1
	Constraining the Problem		User 2; User 1
Overall Mechanisms	Customer Understanding		User 2
	Analysing & Synthesising		User 2
	Constraining the Problem		User 2
	Enabling Teamworking	Especially in this situation, collaboration and team-working with our partner were paramount from the first phases of the practice.	User 1
Presentation	Communicating Information	You explain the information to your audience, communicating with them at best.	User 2
	Inspiring	Presenting the information you collected inspires your audience, stimulating it.	User 2
	Learning from other sources of knowledge	We transfer information to the team, presenting the technological and social tend together with the insight collected.	User 1
Empathy Map; Journey Map	Constraining the Problem	You focus your attention only on a few customer insights.	User 2; User 1
	Communicating Information		
	Reformulating the Problem	The team shifted its initial perspective on the project vision by elaborating on the information collected and focusing on some.	User 2
	Learning from Emphatisation	You emphasise the personas created, elaborating the information supplied in a map.	User 2; User 1
Need Selection	Assessing by Sense of Fit	You select the most important customers' needs by emphasising the customer situation.	User 2
	Analysing and synthesising	You analyse the team's elaboration of the information and synthesise the result selecting and combining the most promising ones.	User 2
	Reframing the Problem	Selecting some needs the team to change its per-spec-tive	User 1
Big Ideas	Creating New Ideas		User 2; User 1
	Experimenting by Sketching		User 2; User 1

Phase	Mechanisms Cards	Insights	Who
Idea Presentation; Impact Feasi-bility Matrix	Communicating Infor-mation	Everyone has to present the idea to the team.	User 2
	Inspiring		User 2; User 1
	Assessing by Criteria Analysis	The team voted based on the ideas' feasibility and viability.	User 2
	Assessing by Sense of Fit		User 1
	Assessing by Idea Comparison		User 1
	Learning from Collective Critique	Everyone presented their idea discussing and integrating them collectively.	User 2; User 1
Overall Mechanisms	Enabling Teamworking		User 2
	Fostering Stakeholder Participation		User 2
	Sharing Ownership and Accountability		User 2
	Facilitating		User 1

Table 3.29 Mechanism cards selection results 2.1.

Phase	Impact Cards	Insights	Who
Interview	Knowledge Creation	I do interviews to collect knowledge that is distributed among people.	User 2; User 1
	Trust	Talking with stakeholders makes me more confident in the process and the team. You build personal relationships and bonds.	User 2
	Engagement	By interviewing stakeholders, you engage them in the project.	User 2
Insight Analysis	De-Risking	By analysing several data, you reduce the risk of making bad decisions.	User 2
	Personal Bias	It is trustable if you find a recurring insight, reducing the risk of making decisions based on personal opinions.	User 2
	Trust	You have to trust the information the stakeholders supply to you.	User 1
Insight Map; Flow Map; Personas; Journey Map	Communication	The tool we developed serves to communicate information straightforwardly.	User 2; User 1
	Personal Bias	Making decisions with a standard and trustable set of shared information reduces people's personal biases.	User 2
	Breaking the Silos	People from different company areas work together without a role and a position to defend.	User 1
Presentation	Communication	Presentation is pure communication.	User 2; User 1

Phase	Impact Cards	Insights	Who
Empathy Map; Journey Map	Collaboration	In the journey map exercise, people collaborate by integrating and combining each one's opinions.	User 2
	Breaking the Silos	It is a consequence of collaboration.	User 2
	Knowledge Creation	In the journey map exercise, you have a ream reconfiguration of the knowledge collected, synthesising it.	User 1
Need Selection	Alignment	People confront each other, understanding each one's perspectives. Finally, the team agreed on some priorities.	User 2
	De-Risking	The team reduce the risk of focusing on needs that are not paramount to the team.	User 2
	Knowledge Creation	By making decisions, you generate new knowledge for the company.	User 2
	Decisiveness	In this phase, we make the first decisions.	User 1
	Trust	We need to trust your colleges and the information they bring into the workshop	User 1
Big Ideas	Creative Confidence	The main scope of this simplified exercise is to create confidence in people about their creativity.	User 2; User 1
	Communication	People have to work to communicate their thoughts to the team.	User 2
	Engagement	The creative part is the most engaging: it is like a play activity.	User 1
Idea Presenta-tion; Impact Feasibility Matrix	Communication	Presenting the idea is inherently about innovation.	User 2
			User 1
	Personal Bias	Team decision-making balances personal opinions.	User 2
	Decisiveness	This exercise facilitates the decision making	User 2
	Alignment	Participating in the decision-making helps people find a shared agreement on the main properties.	User 2
	Trust	Maybe it is overall. You have to trust the team's competencies during decision-making.	User 1
	Action Orientation	Prioritisation makes me decide about something, forcing me to take action toward my goal.	User 1
Overall Mechanisms	Customer Satisfaction	It should be the desired result of all these activities.	User 2

Table 3.30 Impact cards selection results 2.1.

Domain Agreement	Card	Issue	Correction
Accuracy	Personal Bias	The title does not fit with the other.	Change title: Debiasing
Accuracy	Learning from other Sources of Knowledge	It is a generic concept.	New Title: Learning from Research

Domain Agreement	Card	Issue	Correction
Accuracy	Assessing cards	One evaluative card does not exclude the use of the other. They compenetrate each other.	Selecting predominant mech-anisms in the phase.
Accuracy	Collecting customer knowledge	Collecting words refers to picking something that is already available.	New Title: Finding Customer Knowledge
Accuracy	Learning from Emphasi-zation	Typo	New title: Learning from Empathiz-ing
Completeness	New Card	There is not only the collec-tion of customer knowledge but even the stakeholder's know-how.	Creating new card: Finding Stakeholder's Knowledge De-scription: Em-pathising with people's needs and context to acquire new knowledge

Table 3.31 Tool's domain agreement improvements 2.1

Functionality	Issue	Correction
Table	Users lose their focus on the exercise goal rapidly.	Organise a section in the table where the exercise steps and objectives are always visible to the users.
Table	The table division in generic project phases (Problem Understanding, problem setting, solution finding, solution prioritisation) does not fit the users' frame of mind.	
Tool	The categorisation by phase and tool does not help the users' empathising practice, nether the cataloguing of the company practice.	

Table 3.32 Tool's Functionality improvements 2.1.

Figure 3.8 Playtesting result 2.1.

OVERALL MECHANISMS
OVERALL IMPACTS

2.2 High-Speed Oven

The last session analysed focused again on the high-speed cooking appliance practice. However, despite the pilot session, this one considers the whole procedure, from the research to the testing phase (Table 3.33Table 3.10).

Even for this playtesting activity, the participants required two sessions of one hour to complete. In the first one, they run the card mechanisms selection process; in the second, the impact exercise. The outcome is collected in four tables (Table 3.34, Table 3.35 and Table 3.36) and one figure (Figure 3.9), summarising the most relevant insight elicited by the participants and the resulting improvements.

Phase	**Who**	**When**
Research	Design; Consultants	February – April 2020
Workshop	Design; Business; Technology	April 2020
Prototyping	Design; Consultants	May – June 2020
Testing	Design; Business	September – October 2020

Table 3.33 Project backgrounds 2.2.

Phase	**Mechanisms Cards**	**Insights**	**Who**
Interview; Report; Competitors Analysis	Finding Customer Knowledge	We exploit the previous research to find out the customer's knowledge needed.	User 2; User 1
	Broadening the problem	In this phase, you look for all the possible problems, diverging as much as possible.	User 2; User 1
	Collecting Episodic Knowledge	We collected the information that was spread out in the company.	User 2
	Learning from Research		User 2
	Learning from Failures	We learned from the previous workshop and the failure of that experience.	User 2
	Finding Stakeholder Knowledge		User 1
Video Analysis	Learning from Empathis-ing	Watching the video was the best way to empathise with the users during the covid sanitary emergency.	User 2
Personal Creation; Tasks Map Creation	Analysing & Synthesising		User 2
	Communicating Information		User 2

Phase	Mechanisms Cards	Insights	Who
Long-Term Goal; Sprint Questions	Inspiring	Defining a bold goal for the project had the objective of inspiring people.	User 2
	Reformulating the Perspective	You reframe the team perspective by questioning the assumptions and forcing people to consider the most challenging part of the project.	User 2
	Broadening the Problem	Considering all the tricky problems concerning the project, you enlarge the problem space.	User 1
Ask the Expert; How Might Be Note; How Might Be Map; Pick the Target	Learning from Research	In this phase, the research team transfer as much of their knowledge to the team.	User 2; User 1
	Finding Stakeholder Knowl-edge		User 2; User 1
	Finding Customer Knowl-edge		User 2
	Reformulating the Problem	People reformulated the note they took as a possible opportunity to size, shifting the team perspective.	User 2; User 1
	Broadening the Problem	People took notes of the presentation, enlarging the team project perspective.	User 2
	Reframing the Problem Perspective	People reformulated the note they took as a possible opportunity to size, shifting the team perspective.	User 2
	Analysing and Synthesising	All the information produced by the team is synthe-sised into a visual map to support the final decision.	User 2
	Constraining the Problem	After the voting session, the team chose the most relevant challenges the group would focus on in the remaining part of the workshop.	User 2
	Communicating Information		User 1
Lightning Demos; Notes; Ideas; Cra-zy Eight; Solution Sketches	Inspiring	The examples collected by the team inspire each other.	User 2
			User 1
	Learning from Research	To collect the examples, you have to do some re-search.	User 2
			User 1
	Experimenting by Sketch-ing	Taking notes of the most relevant material generated by the team, you start the experimentation process.	User 2
	Creating new Ideas	This phase lets you note down the first seed of the idea.	
	Experimenting by Sketching	During the crazy eight, you experiment with your idea by sketching them rapidly	
	Creating new Ideas	In the Solution sketches, you must represent your idea by creating it.	User 2
			User 1
	Communicating Information	You must represent your idea and communicate it to be understandable to the team.	User 2; User 1

Phase	Mechanisms Cards	Insights	Who
Art Museum; Speed Critique; Straw poll; Decisors' Vote	Assessing by Sense of Fit	Without thinking too rationally, you must vote by gut feeling in the first and second voting sessions.	User 2; User 1
	Assessing by Criteria Analysis	In the third voting session, the decision-makers must vote considering their expertise.	User 2; User 1
	Assessing by Idea Comparison	In the first voting session, you compare the ideas and vote on the part of the idea that convinced you more.	User 2; User 1
	Inspiring	Seeing all the team's ideas, you are awed and inspired by them.	User 2
	Learning from Collective Critique	People critique each other ideas building on them.	User 2
	Sharing Ownership and Accountability	The voting session is a collaborative process where they have to find a joint agreement considering the democratic vote of the team.	User 2
Overall Mechanisms	Fostering Stakeholder Participation		User 2
	Communicating Information		User 2
	Sharing Ownership and Accountability		User 2; User 1
	Facilitating		User 2
	Enabling Teamworking		User 1
	Inspiring		User 1
Sketches; 3D Modelling; VR Model	Experimenting by Sketching		User 2; User 1
	Experimenting by Virtual Tools		User 2; User 1
	Creating New Ideas		User 2
	Experimenting by Prototyping		User 1
VR Test	Assessing by Customer Validation		User 2; User 1
	Learning from Failure	There is always some part of the project you did not do best, and you can improve by learning from what the customer tells you.	User 2; User 1
	Assessing by idea comparison		User 2
	Learning from Collective Critique	You learn what is good and wrong by critically discussing your prototype with users.	User 1

Table 3.34 Mechanism cards selection results 2.2.

Phase	Impact Cards	Insights	Who
Personal Creation; Tasks Map Creation;	Communication	You increase communication by synthesising and communicating the knowledge acquired.	User 2
Overall Mech-an-isms	Knowledge Creation	During the research, you acquire new knowledge.	User 2
	Trust	By providing data from the research, the team trust the process.	User 1
Long-Term Goal; Sprint Ques-tions	Alignment	The team align on the project objective	User 2; User 1
	De-risking	You reduce the risk by highlighting the worst possible problem the project could face.	User 2
Ask the Expert; How Might Be Note; How Might Be Map; Pick the Tar-get	Braking the Silos	In this phase, each department exposes its perspective to the whole team sharing its vision.	User 2; User 1
	Creating New knowledge	Each participant builds on the knowledge exposed by other colleagues, increasing the overall project knowledge.	User 2; User 1
	Action Orientation	After evaluating the knowledge, the team makes a pragmatic decision about how to move forward.	User 2; User 1
	Debiasing	People who listen to the expert learn new things reduc-ing their assumptions.	User 2
	Alignment	In the “How might we Map”, you reach the team alignment on the most significant opportunities to ad-dress with this project.	User 2
	Decisiveness	After evaluating the knowledge, the team makes a pragmatic decision about how to move forward.	User 2
	Trust	When experts share their knowledge, you have to trust them.	User 1
Lightning Demos; Notes; Ideas; Crazy Eight; Solution Sketches	Knowledge Creation	By collecting inspirational examples, you acquire new knowledge.	User 2
	Engagement	Inspirational examples engage people.	User 2
	Speed	It is a fast way to develop new ideas. I do not know if this is a limit. Giving more time to people, would they propose better ideas?	User 2
	Creative Confidence		User 2; User 1
	Collaboration		User 1
	Breaking the Silos		User 1

Phase	Impact Cards	Insights	Who
Art Muse-um; Speed Critique; Straw poll; Decisors' Vote	Engagement		User 2; User 1
	Alignment	People get aligned on the single participant visions.	User 2; User 1
	De-risking	By sharing the decision-making process, you reduce the risk of taking the wrong direction and underestimating some aspects.	User 2; User 1
	Communication	Idea communication through images and dialogue.	User 2; User 1
	Decisiveness	At the end of the process, you must make a decision. There is no escape from not deciding.	User 2
Overall Mecha-nisms	Decisiveness		User 2; User 1
	Collaboration		User 2
	Speed		User 2
Sketches; 3D Mod-elling; VR Model	Communication	Increase communication by representing the idea	User 2; User 1
	Collaboration		User 1
	Debiasing	Good communication reduces the misleading the cus-tomer could occur in evaluating the idea.	User 2
VR Test	Knowledge Creation	Whether you make mistakes or validate the final solu-tion, you acquire precious knowledge.	User 2; User 1
	Customer Satisfaction	By testing your idea with the customers, you have more likelihood of satisficing the final customers.	User 2; User 1
	De-Risking	You reduce the risk of taking the wrong direction by testing your idea.	User 2
	Trust	By testing your idea, the team have more trust in the deci-sions made.	User 2
	Adaptability	By testing your idea, you can adapt the project base on your learnings, making the project more resilient.	User 1

Table 3.35 Impact cards selection results 2.2.

Domain Agreement	Card	Issue	Correction
Accuracy	Finding stakeholder knowl-edge; Finding Customer knowledge	Users misled the card. They got confused by the title, in-serting it in the wrong place.	Change the title of the cards: Collecting
Completeness	Reframing the problem Perspective; Reformulating the Prob	There is a little difference between the two cards.	Keep only one. Title: Reframing the Problem. Description:
Completeness	Fostering Stake-holders participation, Enabling Teamworking	There is a little difference between the two cards.	Keep only one. Title: Ena-bling Teamworking

Table 3.36 Tool's domain agreement improvements 2.2.

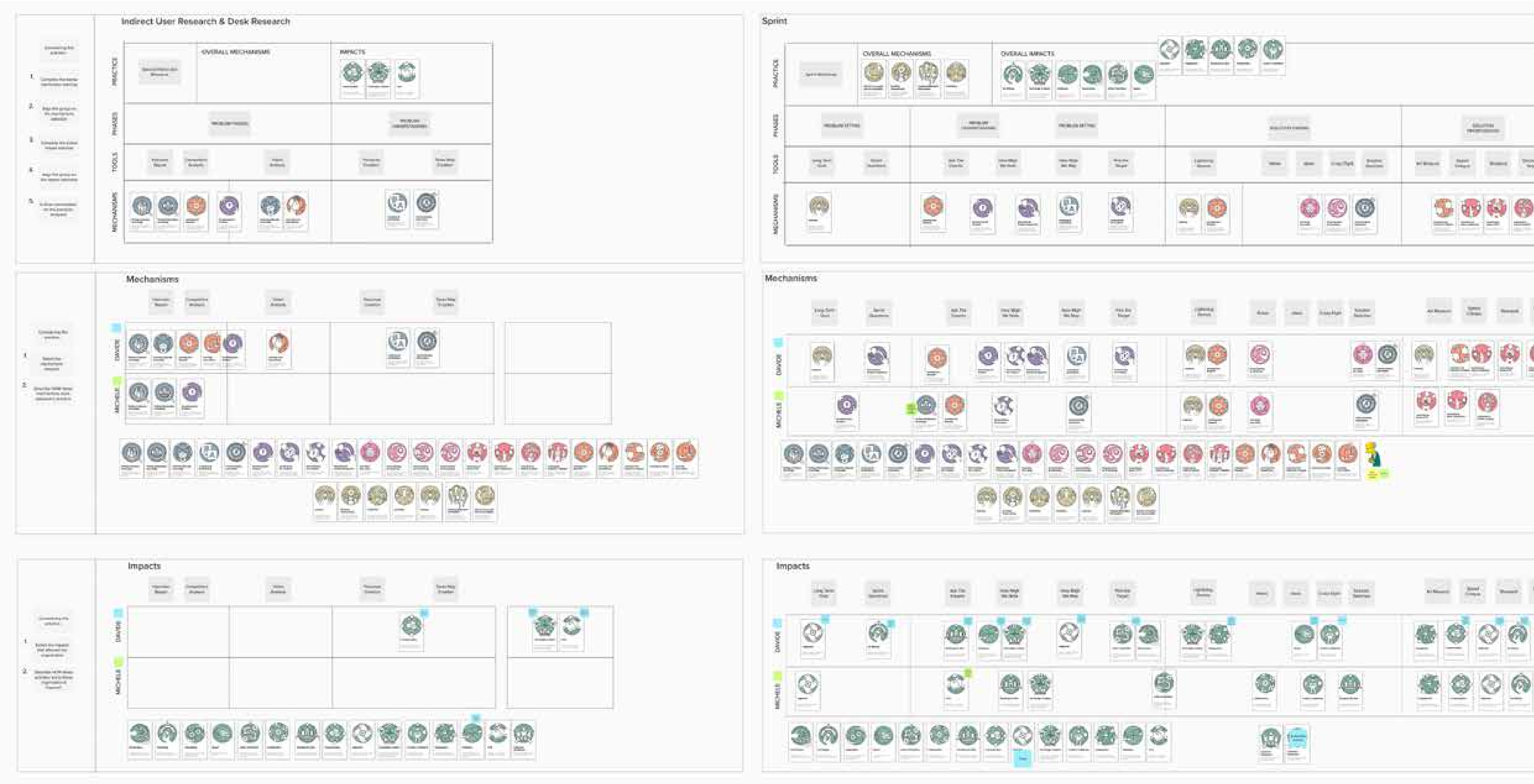
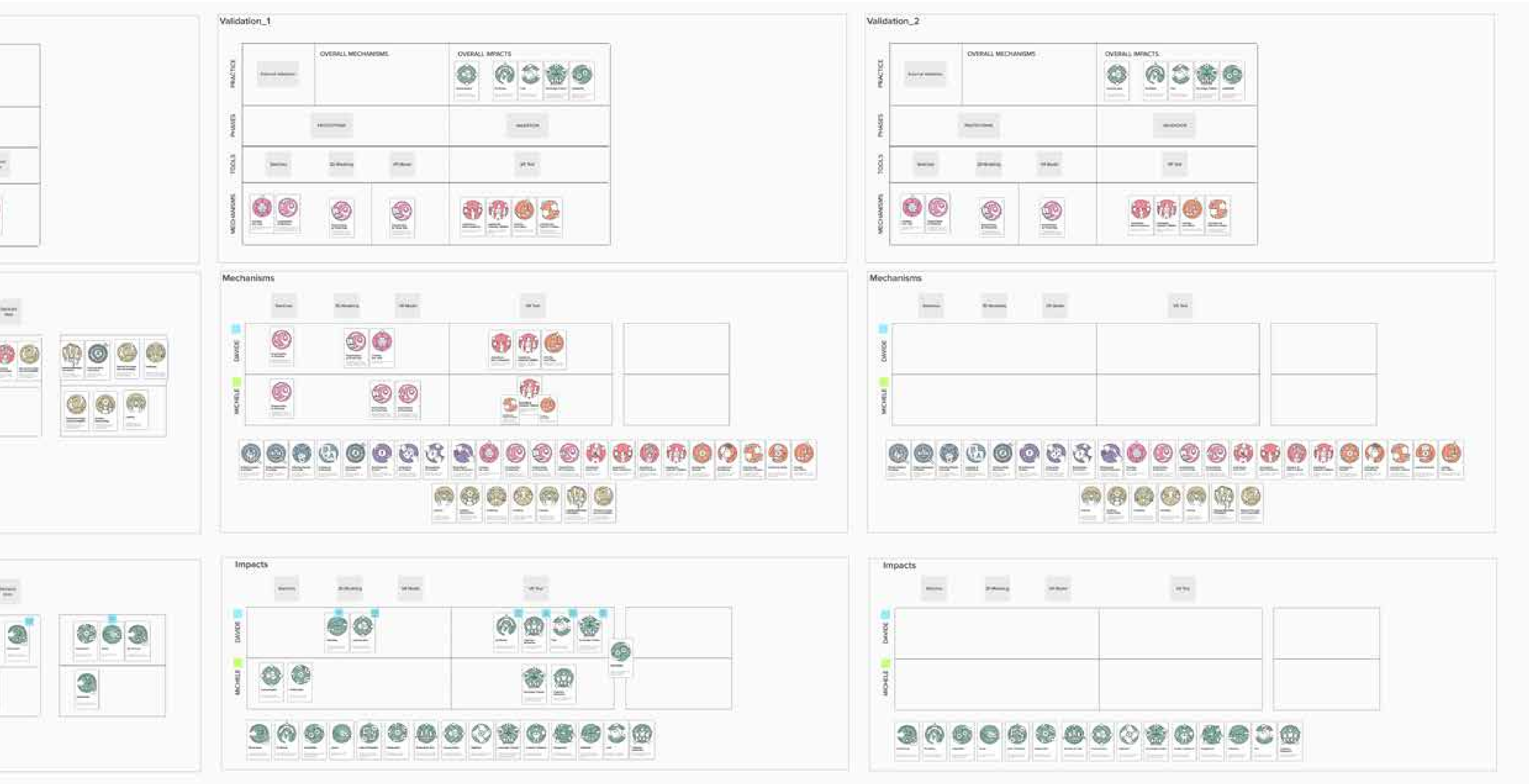


Figure 3.9 Playtesting result 2.2.



Validation_1
OVERALL MECHANISMS
OVERALL IMPACTS
PRACTICE
PHASES
TOOLS
MECHANISMS
Mechanisms
DAVIDE
MICHELE
Impacts
Validation_2
OVERALL MECHANISMS
OVERALL IMPACTS
PRACTICE
PHASES
TOOLS
MECHANISMS
Mechanisms
DAVIDE
MICHELE
Impacts

2.3 Horizontal Analysis

After the last playtesting session, the researcher analysed the overall insights collected over the playtesting sessions, clustering the insights gathered to check wheather there were inconsistencies in the domain agreement.

Table 3.37 Table 3.38 list the user-selected cards, sorting them by phase to analyse how the playtesters chose and interpreted them. The analysis shows that most cards' meanings are consistent, considering the application context and the practice adopted. However, in some cases, different meanings associated with the same card suggest a lack of specificity. Table 3.39 summarises the tool's improvements derived from the horizontal analysis.

Mechanism	Users' Interpretation	Phase	Playtesting Session
Broadening the Problem	By researching, you are broadening your knowledge about the problem space.	Research	1.2; 2.2
Finding Customers Knowledge	By researching, you collect customer knowledge.	Research	1.2; 2.1; 2.2
Finding Stakeholder Knowledge	By researching, you collect stakeholders' knowledge inside and outside the company.	Research	2..2
Learning from Empathising	By researching, you put yourself in the customers' shoes.	Research	2.2
Collecting Episodic Knowledge	By researching, you collect a series of episodes that happen to your users.	Research	1.2
Learning From Re-search	By researching, you learn from the sources you accessed.	Research	2.2
Enabling Team-working	By researching, you bring people on board.	Research	1.2; 2.1
Analysing and Synthesising	By researching, you want to understand a complex subject.	Research	1.2; 2.1; 2.2
Communicating Information	By Researching, you	Research	2.1; 2.2
Enabling Team-work-ing	During the workshop, you involve all the stakeholders in a teamwork activity.	Participatory workshop	1.2; 1.3; 2.1; 2.2
Facilitating	During the workshop, you have to make the participatory activity seamless and manageable.	Participatory workshop	1.2; 1.3; 2.1; 2.2
Mediating	During the workshop, you must help the team reach a shared agreement and solution.	Participatory workshop	1.3
Inspiring	During the workshop, you have to inspire the team to set the right atmosphere in the group.	Participatory workshop	2.2
Sharing Ownership and Accountability	During the workshop, you actively involve the team in the decision-making process.	Participatory workshop	1.2; 2.1; 2.2

Mechanism	**Users' Interpretation**	**Phase**	**Playtesting Session**
Assessing by Sense of Fit	During the workshop, you make decisions based on your gut feeling.	Participatory workshop	1.2; 1.3; 2.1; 2.2
Learning from Empathizing	During the workshop, you put yourself in the users' shoes and learn from that experience.	Participatory workshop	1.2; 1.3; 2.1
Analysing and Synthesising	You re-elaborate the information gathered during the workshop, synthesising it with the team's knowledge.	Participatory workshop	2.1; 2.2
Learning from Re-search	During the workshop, you listen to subject matter experts learning from their know-how.	Participatory workshop	2.1; 2.2
Constraining the problem	During the workshop, you identify and select the most strategic information for the team.	Participatory workshop	1.2; 1.3; 2.1; 2.2
Reformulating the Problem	During the workshop, the prioritisation of the infor-mation prompts the team to see the problem from a different perspective.	Participatory workshop	1.2; 1.3; 2.1; 2.2
Communicating Information	During the workshop, you must transfer a great amount of information to the team.	Participatory workshop	1.2; 1.3; 2.1; 2.2
Experimenting by Sketching	During the workshop, you further explore your ideas representing them through sketches.	Participatory workshop	1.2; 1.3; 2.1; 2.2
Creating New Ideas	During the workshop, you generate new ideas.	Participatory workshop	2.1; 2.2
Inspiring	During the workshop, you must provide insightful information to trigger the team's creativity.	Participatory workshop	1.2; 1.3; 2.2
Broadening the Problem	During the workshop, you build on the information given, enlarging the team project perspective.	Participatory workshop	1.3; 2.2
Collecting Episodic Knowledge	During the workshop, you collect examples that can inspire the team.	Participatory workshop	1.3; 2.2
Assessing by Criteria Analysis	During the workshop, you evaluate the team's ideas based on predetermined criteria.	Participatory workshop	2.1; 2.2
Learning by Collective Critique	During the workshop, you discuss the team's idea to integrate them collectively.	Participatory workshop	2.1; 2.2
Sharing Ownership and Accountability	By evaluating, you share the decision-making pro-cess with the team	Validation	1.2
Experimenting by Sketching	By evaluating, you further explore your ideas repre-senting them through sketches.	Validation	2.2
Experimenting by Virtual Tools	By evaluating, you further explore the ideas repre-senting them through digital tools.	Validation	1.2; 2.2
Experimenting by prototyping	By evaluating, you further explore the ideas repre-senting them through physical representations.	Validation	1.3
Assessing by Criteria Analysis	By evaluating, you judge the team's ideas based on predetermined criteria.	Validation	1.2
Assessing by Cus-tomers' Validation	By evaluating, you judge the team's ideas based on the customer's feedback.	Validation	2.2
Learning from Collective Critique	By evaluating, you discuss the team's ideas with customers to improve them.	Validation	1.2; 2.2
Learning From Failure	By evaluating, you made mistakes you can exploit to improve the ideas.	Validation	2.2

Table 3.37 Mechanism horizontal analysis 2.3.

Impact	Users' Interpretation	Phase	Playtesting Session
Breaking the Silos	DT breaks company silos, collecting trans-departmental knowledge and supplying a shared version of the situa-tion.	Research	2.1
Engagement	DT improves stakeholders' engagement, involving them early in the information collection process.	Research	2.1
Knowledge Creation	DT increases the company's knowledge by researching new customers' information.	Research	1.2; 1.3; 2.2
	DT increases the company's knowledge by collecting information from different stakeholders.	Research	2.1
De-Risking	DT reduce the project's risks, analysing and synthesising a significant amount of different sources of information.	Research	1.3; 2.1
Communica-tion	DT increases communication, developing synthetic visual tools usable by the team to learn information with immediacy.	Research	2.1; 2.2
Knowledge Creation	DT increases company Knowledge, recon-figuring the information collected in a synthetic visual tool.	Research	2.1
Speed	DT increases speed, facilitating a fast, creative process.	Participatory workshop	1.3; 2.2
Collaboration	DT fosters collaboration, involving people in teamwork activities.	Participatory workshop	1.2; 1.3; 2.1; 2.2
Breaking the Silos	DT breaks company silos, encouraging different depart-ments to cooperate.	Participatory workshop	1.3; 2.1; 2.2
Engagement	DT increases team engagement, encourag-ing everyone to participate and give their contribute	Participatory workshop	1.2; 1.3; 2.1
	DT improves team engagement, involving people in a structured, gamified creative process	Participatory workshop	2.1
Trust	DT improves trust in the project outcome, fostering stakeholders to participate in the process.	Participatory workshop	2.1
	DT improves trust among colleagues, fos-tering better people and mutual connections.	Participatory workshop	1.3
	DT improves trust among people, fostering people to share convivial experiences of collaboration.	Participatory workshop	1.2
Communica-tion	DT increases communication, allowing participants to converse in an open arena.	Participatory workshop	1.3; 2.2
Trust	DT improves trust among stakeholders, considering their know-how fundamental for the project.	Participatory workshop	2.1
Breaking the Silos	DT breaks company silos, allowing de-partments to share their know-how with the project team.	Participatory workshop	2.2
Communica-tion	DT increases communication, presenting a holistic snap-shot of the situation to the team.	Participatory workshop	2.2
Debiasing	DT reduces personal bias and prejudices, supplying the team with a shared base of knowledge.	Participatory workshop	1.3; 2.1
De-risking; Alignment	DT reduces the project's risks by analyzing with the team all the available information and defining a shared set of priorities.	Participatory workshop	2.2

Impact	Users' Interpretation	Phase	Playtesting Session
knowledge Creation; Alignment	DT increases company Knowledge, aligning participants on the main customers' problems.	Participatory workshop	1.3; 2.2
Creative Confidence	DT improves the team's creative confidence, building a safe environment where everyone is free to create.	Participatory workshop	1.2; 1.3; 2.1; 2.2
Knowledge Creation	DT increases company knowledge, creating and experimenting with new ideas.	Participatory workshop	2.1
Communication	DT effectively communicates the ideas, avoiding misunderstanding.	Participatory workshop	2.1; 2.2
Debiasing	DT reduces personal bias, taking into consideration a multitude of points of view in the final decision.	Participatory workshop	2.1; 2.2
Collaboration; Alignment	DT aligns participants, actively involving the team and contributing to the decision-making process.	Participatory workshop	2.2
Communication; Alignment	DT aligns participants, fostering a constructive dialogue among team participants.	Participatory workshop	1.2
Alignment	DT participants get a strong alignment on the project's next steps, considering and mediating everybody's opinions.	Participatory workshop	1.2; 2.1
Knowledge Creation	DT increases company Knowledge, reformulating and integrating ideas with the workshop's participants.	Participatory workshop	2.1
Decisiveness; Knowledge Creation	DT increases decisiveness, supplying the company with the information to take fast and confident decisions.	Participatory workshop	2.1
Action Orientation; Alignment	DT improves the organisation's action orientation, aligning people in a shared direction.	Participatory workshop	1.3; 2.2
Knowledge Creation	DT increases company knowledge, creating and experimenting with new ideas.	Validation	2.2
Communication	DT effectively communicates the ideas and avoids misunderstanding.	Validation	2.2
Debiasing	DT reduces customers' judgement bias, effectively communicating ideas and avoiding misunderstanding.	Validation	1.2; 2.2
Trust	DT improves trust in decisions, supporting ideas by customers' validation	Validation	2.2
De-Risking	DT reduce the risk o failure by testing earlier ideas with customers	Validation	1.2; 2.2
Knowledge Creation	DT increases company knowledge, learning from ideas validation	Validation	2.2
Adaptability	DT increases project adaptability, changing in response to the upcoming learnings	Validation	1.2; 2.2
Action Orientation	DT increase project speed, enabling quick decisions making, early mistakes and fast project adaptations	Validation	2.1
Decisiveness	DT increases decisiveness, supplying the company with the information to take fast and confident decisions	Validation	1.2

Table 3.38 Impact horizontal analysis 2.3.

Domani Agreement	Card	Issue	Correction
Accuracy	Collecting Episodic Knowledge	The interpretation of the discovery phase: "By researching, you collect a series of episodes that happen to your users." Over-laps with the one of "Finding Customer Knowledge."	This interpretation results only one time at the begin-ning of the playtesting activity.
Accuracy Completeness	Communi-cation	The interpretation of the "Communi-ca-tion" card has two different meanings: one is connected to facilitating communi-cation in the team. The other focused on concretising the knowledge in com-mu-nicative artefacts.	New Card: Visual Knowledge Creation
Completeness	Knowledge Crea-tion	The "Knowledge Creation" card assumed a too-broad interpretation, lacking enough specificity to describe the impact.	New Card: Research Knowl-edge Creation
Completeness	Knowledge Creation	The "Knowledge Creation" card assumed a too-broad interpretation, lacking enough specificity to describe the impact.	New Card: Idea Knowledge Creation
Completeness	Knowledge Creation	The "Knowledge Creation" card assumed a too-broad interpretation, lacking enough specificity to describe the impact.	New Card: Evaluating Knowl-edge Creation

Table 3.39 Tool's domain improvements 2.3.

Toward Version 3.0

After the release and use of the second version of the tool, the playtesting sessions revealed a decreasing number of macro and micro issues and the consequent reduction in the tool's modification. However, the horizontal analysis of the users' interpretations showed that users sometimes gave different meanings to the same card, stretching their definitions. In these cases, the researcher created new cards to address the users' interpretation and reduce the cards' ambiguity.

Especially the impact cards revealed some incongruences in their meaning. The users associated three defined interpretations of the "knowledge Creation" card, using it broadly over the whole design thinking practices. They distinguished among knowledge created from the research activity, the generation and concretisation of new ideas, and their assessment. Moreover, the users highlighted the design role in visualising and communicating those knowledge assets, suggesting its core importance in the design thinking process.

The horizontal analysis and the user's attention to the cre-ation and visualisation of knowledge suggested to the researcher a sub-clusterisation of the impact cards in three main areas. The first focused on value creation for the organisation, with the production and communication of new knowledge assets. The second concerns social interaction impacts aimed to ease employees' relationships inside and outside the organisational work environment. Finally, decision-making impacts are prone to facilitate and support the company's project decisions reducing risks and increasing quality and speed. Collectively, the three areas communicate and support each other in an interconnected structure. Knowledge creation seems to be the main output of the design activity. The knowledge created supported the collaborative practices, generating further learning, and enhancing collaboration to improve and support decision-making.

Overall, the impact's structure reframing described and the plenty of minor modifications in the cards accumulated in the playtesting activities gave rise to the third version of the tool (Table 3.40, Table 3.41 and Table 3.42).

Attitude	Description
Inquisitive	Attitude to discover as much as you can about something.
Visual	Attitude to make sense of the situation through visualisation and representation.
Optimist	Attitude to feel that good things are more likely to happen than bad things.
Human-Centred	Attitude to focus on human aspects, putting people at the centre of the design.
Collaborative	Attitude to involve people to work on a particular purpose.
Dialog Oriented	Attitude to exchange opinions between opposing perspectives by critical talking.
Tolerant to Uncertainty	Attitude to deal with unknown and ambiguous situations.
Holistic	Attitude to dealing or treating the amount of a situation.
Iterative	Attitude to think through the logic of what might be.
Abductive	Attitude to do smoothing again and again to improve it.

Table 3.40 Attitude level: framework version 3.0.

Mechanism	Description	Cluster
Finding customer Knowledge	Empathising with people's needs and contexts to acquire new knowledge	Finding & Analysing
Finding Stakeholder Knowledge	Bringing together the company's internal knowhow to align the project's team	Finding & Analysing
Collecting Episodic Knowledge	Accumulating experiences and visual references to foresee new possibilities.	Finding & Analysing
Analysing & Synthesising	Analysing different resources to synthesise complex information with immediacy.	Finding & Analysing
Communicating Information	Representing complex information to communicate with immediacy.	Finding & Analysing

Mechanism	Description	Cluster
Broadening the Problem	Introducing a new extended perspective to consider a larger problem context.	Framing & Reframing
Constraining the Problem	Identifying and selecting what is paramount for the project to focus on the problem context.	Framing & Reframing
Reframing the Problem	Looking at the problem from a competently new standpoint to rethink it from its foundation.	Framing & Reframing
Creating New Ideas	Synthesising different insights to create new ideas.	Creating & Experimenting
Experimenting by Sketching	Developing ideas by a visual and mental dialogue to explore po-tential problems and solutions.	Creating & Experimenting
Experimenting by Virtual Tools	Developing ideas by a virtual and mental dialogue to explore potential problems and solutions.	Creating & Experimenting
Experimenting by Prototyping	Developing ideas by a physical and mental dialogue to explore potential problems and solutions.	Creating & Experimenting
Assessing by Sense of Fit	Make a decision through a subjective sense of fit.	Evaluating
Assessing by Ideas Comparison	Comparing two or more ideas to judge them side by side.	Evaluating
Assessing by Criteria Analysis	Judging one or more ideas by analysing them by predefined parameters.	Evaluating
Assessing by Customers' Validation	Judging one or more ideas to validate them with external customers.	Evaluating
Learning from other Sources of Research	Accessing a broad pool of sources to get knowledgeable about the subject matter.	Learning
Learning From Empathising	Put yourself in the customers' shoes to experience their point of view.	Learning
Learning from Collective Critique	Critiquing ideas and opinions in a productive manner to increase common knowledge.	Learning
Learning by Doing	Reflecting carefully on your actions to dig into the situation and understand it.	Learning
Learning from Failure	Experiencing failure as a means to understand how to do better.	Learning
Enabling Team-working	Catalyse the team's potential to improve the overall team collaborative ability.	Managing
Facilitating	Dealing with complex situations to make them more manageable without getting directly involved.	Managing
Mediating	Helping to negotiate a solution to reach an agreement of finding a common solution.	Managing
Inspiring	Involving people in the situation to making them feel they want to do something and can do it.	Managing
Sharing Ownership and Accountability	Shearing or interchanging the leading activities to make the teamwork flexible.	Managing

Table 3.41 Mechanism level: framework version 3.0.

Impact	Description	Cluster
Decisiveness	Make decisions more quickly, confidently and with good results.	Decision Making
De-Risking	Reducing the possibility of a big failure and its consequences.	Decision Making
Adaptability	Responsively change the project direction in response to unexpected events.	Decision Making
Speed	Move faster the project foreword.	Decision Making
Action Oriented	Willingness to take practical action to deal with problems or solu-tions.	Decision Making
Alignment	Agree on something, sharing the same interest and aims.	Decision Making
Personal Bias	Not allowing personal opinions to influence your judgement in an unfair way.	Decision Making
Collaboration	Working together to create or achieve the same result.	Social Interaction
Breaking the Silos	Bring together people from all across the organisation.	Social Interaction
Communica-tion	Ease the exchange of information between people.	Social Interaction
Creative Con-fidence	Empower people's creativity and psychological safety.	Social Interaction
Engagement	Encouraging people's interest in work and taking part in something.	Social Interaction
Trust	Belief that you can depend on someone or something.	Social Interaction
Research Knowledge Creation	Get insightful information & understanding about something, making it a valuable asset	Knowledge Creation
Ideas Knowledge Creation	Get value from finding, finetuning and developing novel ideas.	Knowledge Creation
Evaluating Knowledge Creation	Get learnings & understanding from testing hypothesis	Knowledge Creation
Visual Knowl-edge Creation	Materialisation of abstract knowledge in a tangible form usable by other people	Knowledge Creation

Table 3.42 Impact level: framework version 3.0.

Version 3.0

After the second assessment loop, the third one involved an external subject matter expert and the Electrolux Professional innovation team in a reviewing process. The review focused on the card logic and labelling to fine-tune the framework contents and the connected tool. The positive feedback induced the researcher to stop the validation phase and move the research toward the next step.

3.1 Expert Review

The first review involved a design subject matter expert in logic and game design. The process takes two sessions of one hour, discussing the contents, the logical structure and the organisation of the tool connected to the overhead framework. The tool improvements inferred by this review are schematically described in Table 3.43.

Domani Agreement	Card	Issue	Correction
Accuracy	Finding Customer Knowledge; Finding Stakeholder Knowledge	The verb "finding" does not reflect the mechanism. It is more about a collection strategy.	Substitute the verb "finding" with "collecting".
Accuracy	Creating and Experimenting	This cluster has a misleading label. First-ly, the verb experimenting recalls the scientific and analytical activity that does not describe this group of strategies. Thus, the word exploring better describes the essence of these abductive mechanisms. Secondly, the creative activity results from the framing, reframing and explorative strategies. Therefore, it does not belong to this cluster.	New card title: Exploring
Accuracy	Assessing by Sense of Fit	The three human logical strategies can effectively cluster the evaluation mechanisms. Decisions made by gut feeling are intrinsically abductive.	New title: Assessing by Abductive Sense of Fit.
Accuracy	Assessing by Criteria Analysis	The three human logical strategies can effectively cluster the evaluation mechanisms. Decisions made by the analysis of statistical data are intrinsically deductive.	New title: Assessing by Deductive Analysis.
Accuracy	Assessing by Customers' Validation	The three human logical strategies can effectively cluster the evaluation mechanisms. Decisions based on a limited sample of information are intrinsically induc-tive.	New title: Assessing by Inductive Validation.

Domani Agreement	**Card**	**Issue**	**Correction**
Accuracy	Research Knowledge Creation	The "knowledge asset" term makes more sense to describe this content. A knowledge asset refers to an organisation's accumulated intellectual resources.	New Title: Research knowledge Assets
Accuracy	Ideas Knowledge Creation	The "knowledge asset" term makes more sense to describe this content. A knowledge asset refers to an organisation's accumulated intellectual resources.	New Title: Ideas Knowledge Asset
Accuracy	Evaluating Knowledge Creation	The "knowledge asset" term makes more sense to describe this content. A knowledge asset refers to an organisation's accumulated intellectual resources.	New Title: Testing Knowledge Asset
Accuracy	Visual Knowledge Creation	The "Reification" term makes more sense to describe this content. Reification is the act of changing something abstract into something tangible.	New Title: Knowledge Reification
Completeness	Analysing & Synthesising; Communicating Information	The two cards partially overlap. The synthetic action inherently entails a visualisation activity, namely the communica-tion of the information analysed.	Combine the two cards. New Card Title: Synthesis-ing & Visualising. New De-scription: Analysing different resources to synthesise complex information understandably.
Completeness	Creating new Ideas	The creative act is not a mechanism in itself. It is the result of framing, reframing and explorative strategies that give rise to novel thoughts. Thus, it can not exist an agent that symbolises this activity.	Discard this card.
Completeness	New Card	The explorative strategies clusterisation did not consider the narrative approach.	New card Title: Exploring by Storytelling. New card description: Developing Ideas by dialoguing with other people about potential problems and solutions.
Completeness	Knowledge Creation	The "Knowledge Creation" card assumed a too-broad interpretation, lacking enough specificity to describe the impact.	New Card: Research Knowledge Creation
Completeness	Assessing by Idea Comparison	Comparison vs solo assessment is an attribute of the evaluation. Therefore, it does not work as a cluster element.	Discard this card.
Completeness	Learning From Failure; Learning by doing.	The learning derived from the failure of a hypothesis is a direct consequence of doing something. Learning by doing exploit small and big failures to acquire new knowledge.	Discard the "Learning by Failure" card and keep only the "learning by doing" one.

Domani Agreement	Card	Issue	Correction
Completeness	Learning From Research	This card entails two different learning strategies at once. The acquisition of knowledge can occur by accessing a pool of sources directly or through the transfer of that know-how by an expert subject.	Split the card in two: "Learning from Knowledge Transfer" and "Learning from Research".

Table 3.43 Tool's domain agreement improvements 3.1.

3.2 Innovation Team Review

The second review involved the Electrolux Professional innovation design team reviewing the tool's new version in a one-hour session. The tool improvements inferred by this review are schematically described in Table 3.44.

Domani Agreement	Card	Issue	Correction
Accuracy	Collecting Stakeholder Knowledge	The "stakeholder" word refers to a wide range of people not necessarily connected with the company's know-how.	New title: Collecting Com-pany Knowledge. New description: Bring together the company's internal know-how to align the project's team.
Accuracy	Collecting Customer Knowledge	The focus on empathising is restrictive to a single learning strategy. Customers' knowledge can be gathered through different methods.	New description: Gathering customers' needs and context information to acquire new knowledge.
Accuracy	Managing	The title of the managing cluster looks reductive. In the underlying mechanisms, someone focuses even on the leading factors.	New title: Leading & Man-aging. New description: The activity of setting time, and goals and controlling or organising someone or something.
Completeness	New card	The collection of information strategies did not consider the trend aspects. The societal trends factors are paramount even if the literature design focuses primarily on human ones.	New Title: Collecting Social Trends Knowledge. New description: Gathering social information to track and foresee the upcoming fu-ture.
Completeness	New card	The collection of information strategies did not consider the business aspects. The business factors are paramount even if the literature design focuses primarily on human ones.	New Title: Collecting Busi-ness Knowledge New description: Gathering market and business information to acquire new knowledge.

Domani Agreement	Card	Issue	Correction
Completeness	New card	The collection of information strategies did not consider the technological aspects. The technical factors are paramount even if the literature design focuses primarily on human ones.	New Title: Collecting Technology Knowledge. New description: Gathering technical information to acquire new knowledge.
Completeness	Collecting Episodic Knowledge	In the new collection strategies clusterisation, the episodic knowledge card appears unsuited. It is part of human nature to collect experiences and use them as references to make decisions. It is not a deliberate mechanism.	Discard this card.
Completeness	New card	The new explorative strategies' clusterisation lacks the intimate mental exploration of the hypothesis.	New Title: Exploring by Thinking. New description: Developing ideas by mentally visualising potential problems and solutions.
Completeness	New Card	The impact structure misses the long-term impact that the project has once introduced and used in the market.	New title: Customer Experi-ence. New Description: Affects the customer experience through its project's outcome result.
Completeness	New Card	The impact structure misses the long-term impact that the project has once introduced and used in the market.	New title: Organisational performance. New Description: Affects the organisational KPIs through its project's outcome impacts.
Completeness	New Card	The impact structure misses the long-term impact that the project has once introduced and used in the market.	New title: Environmental & Social Value. New Description: Affects the environment and the social context through its project's outcome impacts.

Table 3.44 Tool's domain agreement improvements 3.2.

Final Version

After the playtesting session analysis, the review process logically restructures the framework, improving the labelling by balancing the academic and practitioner jargon.

The most impactful changes concern the logical re-organisation of the contents in their cluster. The "collecting and synthesising" strategies were broadened over the human focus on trends, businesses and technologies, acknowledging a more holistic perspective. Two contents were added to the "exploring" cluster: one about the narrative exploration and the other, the mental one. The "evaluating" clusterisation was consolidated, sorting them by the three logical operations. Finally, the learning mechanisms were re-organised to avoid overlaps by combining the "learning by doing" card with the "learning by failure" and distinguishing the "learning from research" in two channels: direct accessing the literature or indirect through knowledge transfer.

Moreover, a separate impact cluster was created to consider the long-term design thinking impacts. Despite the knowledge, social and decision-making groups of effects, an overhead set focuses on the project's outcome implications. In this group, the impact on the final customer experience, the organisational performance, the whole environment, and society are considered variables affected by the design process. Nevertheless, they lie on a distinct level. They are consequences of the solutions designed through design thinking practices. Therefore, they strongly affect the organisation, but not directly, from a management's perspective.

The final version of the tool presented here (Table 3.45, Table 3.46 and Table 3.47) and the interconnected framework could be considered the first stable version of the tool usable with internal validity[215] in the Electrolux Professional context. The framework described and used in the next chapter refers to this version.

Attitude	Description
Inquisitive	Attitude to discover as much as you can about something.
Visual	Attitude to make sense of the situation through visualisation and representation.
Human-Centred	Attitude to focus on human aspects, putting people at the centre of the design.
Collaborative	Attitude to involve people to work on a particular purpose.
Dialog Oriented	Attitude to exchange opinions between opposing perspectives by critical talking.
Tolerant to Uncertainty	Attitude to deal with unknown and ambiguous situations.
Holistic	Attitude to dealing or treating the amount of a situation.
Iterative	Attitude to think through the logic of what might be.
Abductive	Attitude to do smoothing again and again to improve it.

Table 3.45 Attitude Level: final framework version.

Mechanism	Description	Cluster
Collecting Customer Knowledge	Gathering customer's needs and contexts information to acquire new knowledge	Collecting & Synthesising
Collecting Company Knowledge	Bringing together the company's internal knowhow to align the project's team	Collecting & Synthesising

215 See the "Limits" paragraph of this chapter.

Mechanism	Description	Cluster
Collecting Social Trend Knowledge	Gathering societal information to track and foresee the upcoming future.	Collecting & Synthesising
Collecting Business Knowledge	Gathering market and business information to acquire new knowledge.	Collecting & Synthesising
Collecting Technology Knowledge	Gathering technological information to acquire new knowledge.	Collecting & Synthesising
Synthesizing & Visualising	Analysing different resources to synthesise complex information in an understandable way.	Collecting & Synthesising
Broadening the Problem	Introducing a new extended perspective to consider a larger problem context.	Framing & Reframing
Constraining the Problem	Identifying and selecting what is paramount for the project to focus on the problem context.	Framing & Reframing
Reframing the Problem	Looking at the problem from a competently new standpoint to rethink it from its foundation.	Framing & Reframing
Exploring by Thinking	Developing ideas by mentally visualising potential problems and solutions.	Exploring
Exploring by Storytelling	Developing ideas by dialoguing with other people about potential problems and solutions.	Exploring
Exploring by Sketching	Developing ideas by a visual and mental dialogue to explore potential problems and solutions.	Exploring
Exploring by Virtual Tools	Developing ideas by a virtual and mental dialogue to explore potential problems and solutions.	Exploring
Exploring by Prototyping	Developing ideas by a physical and mental dialogue to explore potential problems and solutions.	Exploring
Assessing by Abductive Sense of Fit	Make a decision through a subjective sense of fit.	Evaluating
Assessing by Inductive Validation	Judging one or more ideas by discussing them with stakeholders and/or customers	Evaluating
Assessing by Deductive Analysis	Judging one or more ideas analysing them by predefined parameters.	Evaluating
Learning from Knowledge Transfer	Transmission of knowledge from subject matter experts	Learning
Learning from Research	Accessing a broad pool of sources to get knowledgeable about the subject matter.	Learning
Learning From Empathis-ing	Put yourself in the customers' shoes to experience theirpoint of view.	Learning
Learning from Collective Critique	Critiquing ideas and opinions in a productive manner to increase common knowledge.	Learning
Learning by Doing	Reflecting carefully on your actions to dig into the situation and understand it.	Learning
Enabling Teamworking	Catalyse the team's potential to improve the overall team collaborative ability.	Leading & Managing
Facilitating	Dealing with complex situations to make them more manageable without getting directly involved.	Leading & Managing
Mediating	Helping to negotiate a solution to reach an agreement of finding a common solution.	Leading & Managing

Mechanism	Description	Cluster
Inspiring	Involving people in the situation to making them feel they want to do something and can do it.	Leading & Managing
Sharing Ownership and Accountability	Shearing or interchanging the leading activities to make the team-work flexible.	Leading & Managing

Table 3.46 Mechanism Level: Final Framework Version.

Impact	Description	Cluster
Decisiveness	Make decisions more quickly, confidently and with good results.	Decision Making
De-Risking	Reducing the possibility of a big failure and its consequences.	Decision Making
Adaptability	Responsively change the project direction in response to up-com-ing learnings or unexpected events.	Decision Making
Speed	Move faster the project foreword.	Decision Making
Action Oriented	Prompts the team's willingness to take practical actions.	Decision Making
Alignment	Reconciles the team on something, identifying shared agreement interests and aims.	Decision Making
Debiasing	Disincentivizes personal opinions to influence your judgment in an unfair way	Decision Making
Collaboration	Supports people working together toward creating or achieving the same result	Social Interaction
Breaking the Silos	Bring together people diversities from all across the organisation.	Social Interaction
Communication	Ease dialogue and exchange of information between people.	Social Interaction
Creative Confidence	Empower people's creativity and psychological safety.	Social Interaction
Engagement	Encouraging people's interest in work and taking part in something.	Social Interaction
Trust	Stimulates the team's belief in relying on something or being con-fident in someone	Social Interaction
Research Knowledge Assets	Collecting insightful information about something and trans-form-ing them into valuable company assets.	Knowledge Creation
Ideas Knowledge Assets	Finds, fine-tune and develop novel ideas, transforming them into valuable company assets.	Knowledge Creation
Testing Knowledge Assets	Get learnings from testing hypotheses, transforming them into valuable company assets.	Knowledge Creation
Knowledge Reifi-cation	Materialisation of abstract knowledge in a tangible form usable as valuable company assets.	Knowledge Creation
Customer Experience	Affects the customer experience through its project's outcome result.	Market Impacts
Organisational Per-for-mances	Affects the organisational KPIs through its project's outcome impacts.	Market Impacts
Environmental & Social Value	Affects the environmental and social context through its project's outcome implications.	Market Impacts

Table 3.47 Impact Level: Final Impact Version.

3.5 Framework

The final paragraph describes the framework's contents in detail, discussing its literature foundation in correlation with the insights collected during the tool evaluation process. The framework is organised into three main areas: attitudes, mechanisms and impacts. The first one describes the characteristical attitudes of design thinkers. The second one collects the strategies employed during the practices. Finally, the third one illustrates the impacts on an organisation.

While the first framework's level is founded in scholarly research, the second and third are partially based on the explorative activity run during the validation process. The attitude level is debated by presenting the literature foundation that supports the contents. The mechanism is discussed partially through literature evidence and partially through practice-based insights. Finally, the impact level is mainly founded on practice base clues. Thus, it is drafted using the evidence collected during this first explorative study.

Attitudes

The framework attitudes level aims to map and describe the attitudes that characterised the design thinking approach based on the collected literature and the insights elicited during the tool evaluation process (Figure 3.10).

Inquisitive

Design thinkers are prone to discover as much as they can about something. The design journey does not follow a unique path. It is potentially endless and subject to interpretations. From this viewpoint, designers' activity could be seen as a search for satisficing rather than optimal solutions (H. Simon, 1969). Fundamentally it is an inquiry process concerned with the desire to learn about something (Liedtka, 2000). The design thinkers' investigation is driven by the willingness to persist on a specific issue and ask more fundamental questions to find out solutions that are more and more satisfactory (R. J. Boland & Collopy, 2004).

To master those skills, design thinkers must surface assumptions, question the status quo, and collaboratively critique the project's decisions to push the search toward new and unexplored directions (R. Buchanan, 2004; Dunne & Martin, 2006; Heiman & Burnett, 2007).

Design thinkers' inquiry attitude influences the insights collection mechanisms, encouraging a deep exploration of the unknown. Similarly, inquisitiveness is a powerful force to question the project's basic assumption and trigger the framing and reframing mechanisms that, in turn, push the exploration of new solutions. Finally, curiosity motivates the learning process by stimulating the quest for knowledge.

Visual

Design thinkers are prone to make sense of a situation through visualisation and representation. Designers use the visual modelling medium as the language (B. Archer, 1979a; Nigel Cross, 1982) not merely to communicate design ideas but for the generation of ideas as well (Heather, 2007; Liedtka, 2000). Visualisation and representation are reflections-in-action languages (Schön, 1983), allowing the visual reasoning that triggers the emergence of a new hypothesis and the assessment of its possible consequences (Goldschmidt, 1991; Oxman, 2002). In this sense, visualisation skills are essential to amplify the design inquiry and support the understanding of the situation (Junginger, 2007; Ward et al., 2009). Moreover, representation ease communication by making ideas tangibles. Concretising fuzzy thoughts through a shareable medium, the inquiry can engage a more extensive audience, enabling those ideas to be shared, understood, tested, and challenged (Peng, 1994; Porcini, 2009). Visual storytelling helps communicate, engage and inspires people to generate enthusiasm and alignment in a common direction (Brown & Wyatt, 2010; Holloway, 2009).

Design thinkers' visual attitude influences the exploration mechanisms, offering a powerful medium to enhance the designer's capabilities of searching for and developing new solutions. Finally, it allows the reification of the information in tangible and usable forms synthesising the knowledge acquired through visual representations.

Human-Centred

Design thinkers are prone to focus on human aspects, putting people at the centre of the design. Within the new century, lavish attention on design thinking literature fell on the user- and human-centred design.

Especially, IDEO's methodology puts these aspects in the foreground, suggesting an iterative approach that starts and finishes with people's needs (Brown, 2007, 2009a). While other disciplines are business- or technology-centred, design thinking is human-centred (Camacho, 2016). Thus, design thinking must continually consider how what is being created will respond to the client's needs (Carlgren et al., 2016; Collopy & Collopy, 2009a; Dunne, 2018; Liedtka & Kaplan, 2019; Lockwood, 2010a; C. L. Owen, 2006; Ward et al., 2009). More recently, this focus is becoming more holistic, zooming out the users and human focus to the entire society and planet (Brown & Wyatt, 2010) especially paying attention to the solution's experience (Richard Buchanan, 2015). Even if some critiques turn around precisely this topic (D. A. Norman & Verganti, 2013), the human-centred focus seems to be one of the most consolidated pillars of design thinking.

Design thinkers' human-centred attitude influences knowledge collection mechanisms, focusing the research effort on human needs. Similarly, it drives the solution assessment toward the same users the solution is designed for. Finally, the willingness to feel and understand users' pain points and desires straightens the empathising mechanism, enabling deep learning of what people say, think, and feel.

Collaborative

Design thinkers are prone to involve people to work on a particular purpose. The design thinking approach is relentlessly open to as many other domains as possible (R. Boland & Collopy, 2004). It fosters an open-minded collaboration environment (Heather, 2007) that leaves the problem open to contamination, welcoming feedback found along the way (Porcini, 2009) and desisting from prematurely judging others' suggestions and ideas (Kelley & Kelley, 2015; Bryan Lawson, 1980). This attitude reduces people's discomfort in cooperating and creates confidence that encourages diverse people to collaborate (Liedtka et al., 2017). Design thinking catalyses cross-functional (Dziersk & Dziersk, 2009; Lockwood, 2009; Tischler, 2009) and multidisciplinary (Heiman & Burnett, 2007; Holloway, 2009; Sato et al., 2010) teams toward a process of exploration. Team diversity is one of the most reliable sources of new thinking (Liedtka, 2014a). Moreover, it is an excellent strategy to reduce the biases related to decision-makers proclivity to become trapped in their worldview (Liedtka, 2015). Combined with the visual attitude of prototyping, collaboration elicits stakeholders' reactions, concretely involving them in the design conversion (Brown, 2007). In this view, design thinking represents an effective and practical approach to managing stakeholder interactions in exploration projects (Mahmoud Jouini et al., 2016).

More than others, design thinkers' collaborative attitude influences most of the mechanisms holistically. However, collaboration seems highly influential in the decision-making assessment mechanisms, reducing the team's biases and creating a large consensus. In the learning mechanisms, where designers' vertical know-how is lacking compared to other disciplines, cooperation is essential to activate the knowledge transfer among the team. Finally, collaboration is the engine for the leading and managing mechanisms, especially to successfully enable teamwork activities and pursue a liquid leadership based on shared ownership and accountability.

Dialog Oriented

Design thinkers are prone to exchange opinions between opposing perspectives by critical talking. From the second-generation design methods, design descriptions focused on its argumentative nature (Hillier & Musgrove, 1972; Rittel, 1972; Schön, 1983). Each statement, move, or hypothesis made is systematically challenged to expose them to the viewpoints of the different sides. Iteratively alternating these steps, the design process proceeds dialogically. This conversation resembles a negotiation process where various parties have different objectives but are willing to reach an agreement that all parties can accept (Bryan Lawson, 1980). These dynamics are recognisable at the cognitive mico-level but even at the processual macro-level, where they are particularly worthy. A broad group of organizational stakeholders participating in a dialogue-based planning process shared their understanding, and ultimately, shared choices emerged (Liedtka, 2000). Usually, designers are comfortable with in-depth dialogue, critiques and negotiation about concepts and prototypes, rather than businesspeople that are more used to analytical reviews (Heiman & Burnett, 2007). Designers' training, mainly structured on a studio-based learning model, facilitates this way of working, additionally supported by the attitude to visualise the conjectures and use them as moderators of the discussion (Peng, 1994).

Design Thinkers' dialogue-oriented attitude influences the critique mechanisms of learning, driving productive discussion among stakeholders. Moreover, it acts as a fundamental skill for the mediation and facilitation mechanisms, thanks to its natural tendency to negotiate opinions and ideas.

Tolerant to Uncertainty

Design thinkers are prone to deal with unknown and ambiguous situations. In the new century, such uncertainty is becoming the norm rather than the exception in a world characterized by rapid change, intensive innovation, and increasing complexity (Mahmoud Jouini et al., 2016). Business leaders increasingly see this condition as the "new normal", using the military acronym VUCA[216] (Robbins, 2018) to describe the situation. In response to the increased uncertainty, management looked at design thinking to address the new condition. Indeed, being an emerging rather than deterministic process, design thinking seems especially suited to such an inquiry. At the very essence of the design problems, there is high uncertainty. With the adjectives "ill-defined", "ill-structured", and "wicked" (B. Archer, 1979b; Rittel & Webber, 1973; H. Simon, 1969), scholars described the incomplete essence of the problem the designers must deal with (Nigel Cross, 1990). This situation entails designers embarking on a journey where the destination is partially unknown. Therefore, a vital feature of the design thinkers' mentality is being comfortable with and maintaining the ability to work in the face of ambiguity (Hassi & Laakso, 2011). This context provokes an extreme state of mind with ups and downs. An optimistic mentality is paramount to controlling and managing the project's discomfort and enthusiasm over the process (C. L. Owen, 2006). Designers tend to assume that no matter how challenging the constraints of a given problem are, at least one potential solution is better than the existing alternatives, showing an unwillingness to give in to limitations and obstacles (Hassi & Laakso, 2011).

Design Thinkers' tolerance to uncertainty strengthens the design inquiry by allowing designers to explore unknown but potentially more promising directions. It supports the designers' resilience in that journey contrasting the risks faced with relentless optimism.

Holistic

Design thinkers are prone to dealing with or treating the whole

216 Volatility, Uncertainty, Complexity and Ambiguity. Volatility indicates chaos where reliable prediction is impossible and where change is regular and substantial [8]. Uncertainty refers to the difficulty in interpreting coherent patterns in the change (Ibid). In uncertain environments, the connections between cause and effect are understood, but the scale and timing of the changes are not. By complexity is meant the complex ecosystem of moving parts in any market. It describes iterations of simple patterns [9] combined in a labyrinth of overlaps and loops making it difficult to decipher the signal from the noise [8]. Finally, ambiguity refers to our lack of capacity to read the signals from markets or consumers with any clarity, certainty or accuracy (Robbins, 2018).

of a situation. Designers rarely focus precisely on identified parts of the problem. Instead, one idea in the solution is more often an integrated and holistic response to several issues (Bryan Lawson, 1980). They took a comprehensive systems approach to the problem rather than accepting narrow problem criteria (Nigel Cross, 2008; C. L. Owen, 2006). Within the management discussion, this attitude emphasized the earlier exploration by Peter Senge about system thinking (Senge, 1994), upon which Martin built his reasoning about design thinking (Cooper et al., 2009). Systems thinking depicts a design or managerial problem as a system of structures, patterns and events rather than just the events alone. Understanding the system means seeing the changing repercussions among one component on the others and the system (Dunne & Martin, 2006). Design and management require this holistic approach to face the project's complexity, including customer's needs (explicit and tactic), the end user's environment, social factors, market adjacencies and emerging trends (Holloway, 2009).

Design Thinkers' holistic attitude influences the problem-broadening mechanisms, prompting designers to widen the problem space and treat it as an extensive system of interdependent factors.

Iterative

Design thinkers are prone to do something again and again to improve it. The nonlinearity of the design process has been evident since the first study of design thinking. The inseparability between the analytical and synthetical phases (Akin, 1979) suggested the multi-directionality of the design process (Waldron & Waldron, 1988). Free of moving back and forth between conceptual analysis and detailed design. In the new century, this awareness converged under the label of iteration. Virtually every primary author of the discussion described design thinking as an iterative process (Brown, 2008; Dorst & Cross, 2001; Liedtka, 2000). Design Thinkers' iterative attitude is fundamental to enabling the explorative, assessment and learning mechanisms. Indeed without iteration, each learning cycle would not inform the next one. Thanks to iteration, a team can explore multiple solutions, use the results to mix and match elements, create new solutions, and test them until it finds a satisficing combination (Beckman & Barry, 2007). The end of assessment cycles is just a starting point for the next iteration. This view suggests that "fail early and fail often" is a goal to be sought, not a pitfall to avoid (Heiman & Burnett, 2007).

Design Thinkers' iterative attitude influences the whole design process at the marco- and micro-level addressing the inquiry toward a circular path.

Abductive

Design thinkers are prone to think through the logic of what might be (Dunne & Martin, 2006). Since the first study about design thinking, scholars observed that designers mainly adopted solution-focused strategies. In contrast with the analysis-synthesis model, designers allowed the existence of a solution from the earliest stage of the process (Hillier & Musgrove, 1972). Well described in the Lowson (1979) experiment with architectural and science students, many other studies confirm this orientation (Nigel Cross, 1982; Dorst, 2010; Roy, 1993). In parallel with these findings, several studies move from the logical perspective to prove that designers' prevailing logic is abductive. Calling into question Peirce's abduction arguments, March (1976) introduced the topic in the design field, suggesting the designers' dominant model of reasoning is essentially abductive, or as he called it, productive. Reviewing the abduction literature, Roozenburg suggested that there are two fundamental abductive logical approaches: explanatory and innovative. The first process merely uses a known (to be confirmed) principle, law, or theory for causal explanation. The second starts from a surprising, not yet explainable, fact (the result); and tries to conceive a new rule (not assumed to be confirmed) that allows inferring the cause (N. Cross et al., 1992). He suggested that precisely innovative abduction is the crucial mode of reasoning in design[217]. With other arguments, Dorst arrived at a similar conclusion:

> "Abduction comes in two forms [...] In the first form of Abduction-1, that is often associated with "problem solving" we also know the "how", a "working principle", and how that will help achieve the value we aim for. In the second form of Abduction-2, we ONLY know the end value we want to achieve. [...] So the challenge is to figure out "what" to create, while there is no known or chosen" working principle" that we can trust to lead to the aspired value. [...] This will involve the development or adoption of new "frame". [...] This establishes the designing professions as thinking fundamentally differently from fields that are based on analysis (deduction, induction) and problem solving (Abduction-1, see also Dorst (2006)). But the distinction is not very clear-cut, as we have learned that design is not one way of thinking: it is a mix of different kinds of solution focused thinking (Abduction), which includes both problem solving and a form of

217 It is key, but not unique to design. In both science and technology (and in daily Life) abductive steps are taken in the search for new ideas. And in both science and technology the four modes of inference - deduction, induction, the presumption of fact, and abduction - have to work together, to support each other.

design that involves reframing of the problem situation (in a co-evolution process)" (Nigel Cross, 1990, pp. 132–133).

The design thinking management discourse exploited this research to support their arguments. Liedtka (2000) noted that design abduction, focusing on conjectures and conjectural thinking, could help the hypothesis exploration in the strategy domain. Similarly, Martin (2009a) emphasized design thinking as a way of reasoning that perfectly balances deduction and induction with abduction, allowing companies to explore new hypotheses[218]. Finally, Heather (2007) proposed abductive logic that enables the "leap of inference" in tackling new opportunities and designing new possibilities.

Design Thinkers' Abductive attitude heavily addresses the design process. Indeed, the design mechanisms of framing, exploring, judging and reframing are mainly driven by abductive reasoning. In contrast, deduction and induction are left to the collecting and evaluating mechanisms to inform and validate the concepts created.

218 In contrast with the company's algorithmic thinking, favouring deduction and induction is better suited to explotit the company assets already in place. Only a company that balances both ways of reasoning could succeed in the long run.

Figure 3.10 Attitudes cards.

Mechanisms

The framework mechanisms level aims to map and describe the strategies that characterised the design thinking approach based on the collected literature and the insights elicited during the tool evaluation process.

Collecting and Synthetising

Historically, design scholars' research has paid more attention to the designers' creative activity than the other propaedeutic actions the profession had to deal with. Still, designers' creative potential seems to rely heavily on the available knowledge exploitable by the designer for a given domain (Oxman, 2002). Traditionally, designers use the reference material accumulated during their career to get from problem to solution, using more episodic than procedural knowledge (Bryan Lawson, 1980). However, in the new century, this trajectory rapidly changed. Studying the development of design theories, Findeli (2005) observed a transition from a profession organised around its creative outcome to one based on processes that have become more complex and knowledge-based over the years. In this context, designers imported methods and models developed by other sciences to improve their everyday practices (Mozota, 2008).

Indeed, the insights elected during the playtesting showed that the Electrolux Professional innovation team invests considerable energy in this activity. Since IDEO and other leading characters of the design thinking discourse advocated for a design at the centre of the human technology and business triangle (Brown, 2009b; Holloway, 2009), more and more practitioners have enlarged their operations over a growing number of domains. In design thinking practices, three primary strategies are adopted to collect and synthesise information: collecting company knowledge, collecting customers' knowledge, and synthesising and analysing. Still, from the practice base exploration done during the playtesting activities, the innovation team elicited other possible sources of information. Business, technology and trends knowledge seems to be increasingly a paramount aspect for the design thinking practices that aim to support innovation activities. The Electrolux Professional design team is not always directly involved in these collection processes. Still, it has to be able to manage this information to use them in practice (Figure 3.11).

(1) Collecting Company Knowledge: The collection of the company's internal knowledge is a mechanism the Electrolux Professional team

adopted at the beginning of the collection phase. It is helpful because it allows the team to understand the state of the knowledge about a subject matter, clarifying the different stakeholders' perspectives and fostering alignment. Indeed, this activity seems to have a critical role in organisational management dynamics. Involving all the company's stakeholders from the first stage of a project allows them to express their opinions, growing a feeling of membership. In addition to collecting valuable knowledge assets, this strategy impacts the social dynamics, enhancing the team cross-collaboration and engagement and laying the foundation for a better future alignment.

(2) Collecting Customer Knowledge. The design thinking literature paid utmost attention to the human-centred attitude of design, advocating the importance of being directly involved in observing, interviewing customers, emphasising their life and context, and getting intimate with them to collect primary data (Beckman & Barry, 2007; Holloway, 2009; Liedtka, 2011, 2014b; M.A. Fraser, 2007). Customer knowledge becomes a precious source of information that informs the project team in the creative and evaluative phases by supporting the team in their journey.

Nevertheless, especially in innovation, sometimes user research strategies are not effective as they could be. As Norman and Verganti argued (2013), the human-centred design approach rarely has contributed to radical innovation. The user research look at the present and therefore is more suitable for incremental innovation. For radical innovation, other methods should be explored. The clues elicited during playtesting suggested that this mechanism could mitigate this issue by selecting a different investigation sample. Especially in traditional businesses, customers can be averse to innovation. In this case, the innovation team used to scout what they called "early adopters": passionate users that show a strong inclination toward the future. Von Hippel (1988) arrived at a similar conclusion when he talked of " lead user": users that, thanks to their inclination and the context in which they are, anticipate the needs and pain points of the category of customers they belong to. This way, qualitative deep customer research with lead users could expose insight into a distant future.

(3) Collecting Business knowledge. Since the transition of design thinking toward the management discipline and its attention to innovation and strategic topics, business is becoming a critical field of research. While historically, design practices grew more closed to technical disciplines, design thinking seems to face more business and management

issues. Thus, collecting business knowledge and working with them is no more odd practice. In Electrolux Professional, the innovation team usually asks for support regarding business data collection. Still, they have to manage and understand that knowledge to use it to design participative practices. The playtesting activities showed that in more and more cases, strategic design thinking activities require going into detail about the business. Today the design team is still trying to get used to these topics, but they suggest that managing and working with this information is becoming paramount.

(4) Collecting Technology Knowledge. Technology is one of the three pillars of the three aspects that design thinking emphasises (Brown, 2009a). In Electrolux Professional, the innovation team was more used to technological know-how and jargon than the business one. Their colocation within the R&D department settled their work on the technical side of the organisation. As for the business topic, the team is not directly involved in collecting knowledge. Still, the capability to use and adapt it to the practice needs is vital to managing design thinking practices.

(5) Collecting Social Trend Knowledge. Another aspect considered during the collection process is trend research. Especially in innovation, design thinking practices should leverage the data collected from customers, business, technology and stakeholders in perspectives. Trend data should picture future evolutions to trigger imagination and support decisions today that will only affect future scenarios. In Electrolux Professional, trends are used during the innovation processes as a source of knowledge to inform and inspire the stakeholders involved in the practice.

(6) Synthesising and Visualising. Data collection is only the first step of each research process. The logical consequence of information gathering is making sense of it. Designer synthetic and visual attitudes make them particularly suited to reconfigure information in a meaningful and usable way. They use visual language to diagrammatically abstract concepts, reveal and explain patterns, and simplify complex phenomena to their fundamental essences (C. L. Owen, 2006). The ability to use this language becomes a powerful strategy that allows teams to gain more profound, intuitive empathy and understanding of the situation (Holloway, 2009), supporting convivial moments of productive dialogue among stakeholders (Goldschmidt et al., 1987).

Despite the source of information and the collection mechanism, the ability to analyse and synthesise information into visual and

Figure 3.11 Mechanisms cards: collecting and synthesising.

meaningful outcomes is an essential skill for the Electrolux Professional innovation team. In the organisation, few functions can diagnose and collect usable data. Still, probably no one can exploit this information to organise elaborate participatory activities. Realising tools and devices based on data-driven information is the foundation for any workshop, and the capability to design that information to be helpful and usable by a large team of stakeholders is crucial.

Framing

Design problems are characteristically unclearly stated. Thus, designers seem never to be satisfied with the situation as presented (Bryan Lawson, 1980). Instead of trying to solve the problem as given, they tried to widen, challenge and reframe it (Carlgren et al., 2016). Schön (1983) first described the dynamics of framing in his book: "The Reflective Practitioner". He observed that practitioners mentally frame the problem situation by choosing a defined set of elements upon which they make hypotheses. By reflecting on a hypotheses' effects on the situation, practitioners usually acquire new knowledge that leads them to reframe the initial position to resolve conflicts and create new opportunities.

From this perspective, this process proceeds in a dialogical iteration where the farming, exploring and reframing moves represent the engine capable of producing novel and unexpected solutions. In design thinking practices, three primary strategies are adopted to frame the problem space: broadening the problem, constraining the problem, and reframing the problem (Figure 3.12).

(1) Broadening the Problem. Eberhard (1970) suggests that there are two ways in which designers can retreat the hierarchy of problems, by escalation and by regression. Escalation leads to an ever broader definition of the problem. This strategy implies going beyond what is stated in the problem to see what lies behind it. Looking at the big picture may give insight beyond the problem the client initially brought, allowing new solutions to emerge (Lockwood, 2010a). Still, an excessive widening of the problem space could lead to a regression mechanism where the over-analysis causes the design process paralysis. The broadening agency is fostered by the holistic design attitude[219] that brought practitioners to consider a given problem situation as part of a complex system that can be faced from different perspectives. The broadening mechanism could be regarded as a strategy designers use to introduce a new extended perspective in the problem space, enlarging the original context.

(2) Constraining the Problem. Discussion around the importance of reducing the design problem cognitive complexity through the definition of constraints has gotten along since the first studies on design thinking. Levin (1966), followed by other scholars (Akin, 1979; Eastman, 1970; Krauss & Myer, 1973; Rowe, 1987), observed two kinds of constraints: external and internal (Hillier & Musgrove, 1972). External constraints are defined by the unique situation the design fall into. They are deterministic and independent of the designer's will. On the country, internal constraints are expressions of the designer's cognitive map. The designer imposed limits on the project to address it in a specific direction. Darke (1979) first identifies this element calling it primary generators: a group dominant organizing principle designers use to manage the project. Building on it, Schön calls it a "frame experiment" (1983): the dynamic frame of elements the designers impose on the situation to guide the

219 See the holistic attitude content.

outcome from the project's beginning. However, he also noted that each designer bases their frame not only considering the unique given situation but influenced by a set of values the designer rely on. This appreciative system is dynamically framed around the role the practitioner interprets and the dominant theories of the time[220] (Schön, 1983). The definition of a shared frame becomes even more critical in participative activities. In this situation, a joint agreement on the project's priority should be achieved despite differences in the practitioners' appreciative systems and dominant values. The designers' ability to deal with the framing strategies seems valuable when a team need to focus on what matters to reduce confusion and information overload and reach engagement and alignment on it (Liedtka, 2014b). The constraining mechanism could be considered a set of deterministic and contingent decisions that designers made to organise the problem situation in a manageable and meaningful manner.

(3) Reframing the Problem. Reframing is the logical consequence of a dynamic framing activity. Schön (Schön, 1983) described the framing activity as a continuous dialogue between the practitioner and the situation that led to framing an initial position, exploring its consequences, and finally reframing it accordingly with the reflections that occurred. The reformulation of a problem seems to be a strategy designers use to change perspective and trigger the exploration of novel hypotheses. Eastman (Eastman, 1970) observed that there are two ways in which design moves can proceed: evolutionary and revolutionary. While evolutionary moves gradually evolve the project in a defined direction, sometimes a revolutionary reframing of the situation changes the project radically. Innovation comes when the initial frame is repositioned at another point in the framework, raising new questions and ideas (Richard Buchanan, 1992a). Usually, this epiphanic moment is a surprising and unexpected expansion of the initial concepts in which the situation is initially framed (Dorst, 2010; Dorst & Cross, 2001). The revolutionary reframing of the problem does not happen only by chance but from the designer's willingness to challenge the problem assumption and resolve the self-contradictory and conflicting situation inherent in the project (M.A. Fraser, 2007). Dorst (2006) described this process as working towards resolving the core paradox. Namely, opposing views, standpoints, or requirements must be reconciled to find a novel solution. Practitioners can not resolve the paradox until it is trapped in the frame from which the paradox arises.

220 Which are also subject to change over time

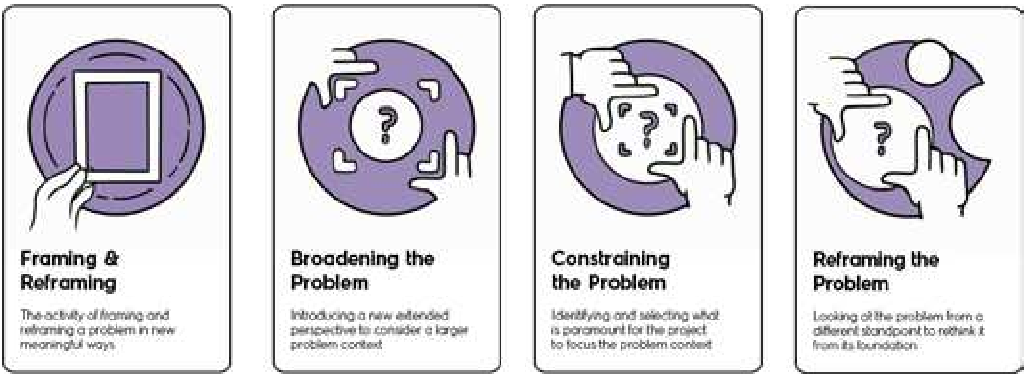


Figure 3.12 Mechanisms cards: framing and reframing.

To disarm the paradox, practitioners should reframe the situation rewriting the problem as if the conflicts have no reson to exist. The reframing mechanism could be considered a strategy designers use to reorganise the problem situation more sensibly and resolve the project's emerging conflicts and paradoxes.

Exploring

Designers use explorative strategies to delve into the consequences of their hypotheses. In the most generic sense, it is an act aimed at discovering more about a situation (Schön, 1983). In Schön's constructivist framework, design practice consists of a series of moves where the practitioner sets a frame, explores the consequences of it and plans the next move in response to the outcome. Each move explores the hypothesis that stimulates the situation's back-talk, which causes them to appreciate things in the position that go beyond their initial perceptions of the problem. Buchanan (1992) uses the term "placement" to describe the situation in which the designer is situated after each exploration. Using placements allows the designer to make sense of one's design intent without an undue commitment to the idea while it is still embryonic (Wylant, 2008). During the playtesting activities, the participants elicited different possible categorisations of explorative mechanisms. A possible functional representation could be framed into five primary strategies: exploring by thinking, storytelling, sketching, virtual modelling and prototyping (Figure 3.13).

(1) Exploring by Thinking. As Dorst (2010) suggested, there are thought experiments and experiments that involve simulation techniques.

In every exploration, designers create a mental dialogue between the medium employed and their thoughts. Still, a possible way to explore the consequences of a hypothesis is just by thinking and reasoning about it. Not involving another simulation technique in the dialogue seems to reduce the potentiality of the exploration, but it is a very economical way to explore ideas. Everyone can use this exploration technique to imagine the possible consequences of their decisions in their everyday life. It is the most common strategy humans employ to explore a problem or a solution. Still, it is heavily limited by the personal capability to imagine and mentally visualise a situation. There is a limitation in the number of mental operations that can be achieved without using a medium.

(2) Exploring by Storytelling. The second explorative technique identified is dialogue-based exploration. As with all the explorative strategies, it seems to work dialogically. However, while in the other mechanisms, the dialogue is individual, this approach is inherently collaborative. Meetings, brainstorming, and debates exploit the verbal medium to delve into a topic and create an arena where the situation is discussed and explored. This strategy is highly effective for two reasons. First, it broadens an individual's available pool of knowledge thanks to the constructive exchange of information and ideas stimulated by others' know-how. Secondly, it supports the alignment among the people involved in the discussion. However, several biases could be faced during this process. People with the attitude, role and ability to engage and catalyse the audience's attention will be more prone to receive credits. At the same time, other introvert people could feel unable to express themselves at best. Compared to the different strategies, discoursive techniques are easy to adopt and have few barriers to entry. Everybody is used to talking and discussing. It is an excellent strategy when the team involved do not have time, skills or willingness to use other, more action-oriented techniques.

(3) Exploring by Sketching. The most common and studied way to explore a situation is by sketching. Designers always used sketches as a fast, reliable and economical way to explore the consequences of their hypothesis. Compared to dialogue or thinking, sketches can amplify exploration capabilities by visualising the results and implications of an idea in a virtual world (Schön, 1983). Drawing is the medium of constructing a virtual world that engages in a dialogue with the objects and materials (Goldschmidt et al., 1987). In this view, the virtual world, built by sketching, is a learning laboratory where mental experiments can be conducted risk-free

and investments in early choices can be minimized (Liedtka, 2000).

More than only extending the mental capability, sketching seems even to stimulate the designers' creativity. Indeed, Goldschmidt's work (Goldschmidt, 1991, 1994) showed that sketching does not follow ideas in the mind but sometimes precedes them. Sketches contain clues that can be isolated, recombined, and deciphered as reminiscent of something meaningful in a particular context. These clues can trigger relevant information stored in the memory, but otherwise difficult or impossible to tap. In this sense, a paper's dots, lines and other marks generate new combinations and relationships among these elements that we could not have anticipated or planned.

(4) Exploring by Virtual Tools. A strategy similar to the exploration by sketching but that involves other mediums is the virtual one. In today's digital world, several virtual modelling mediums can be used. Every year new tools are developed to support the exploration of hypotheses. Tridimensional and bidimensional modelling software, videomaking, rendering, augmented reality, and digital twins are all virtual simulators used to visualise and explore ideas. Compared to sketching skills that require time and exercise to be acquired, they have fewer barriers at the entrance, and they have visualisation and simulation capabilities both for the technical and aesthetical side that freehand drawing does not have. Still, sometimes these tools are less immediate than sketching, less fast, and too precise to stimulate inspirational thinking. Indeed, the playtesting sessions showed that sketches have a role in the process despite the many virtual tools employed. Sketching is used in the first phases of creation to allow maximum flexibility and transfer a feeling of indefiniteness. The virtual simulators are used after a first alignment on sketches to explore and validate the ideas in more detail.

(5) Exploring by Prototyping. Together with sketching, prototyping is another means of exploration highly cited in design thinking. Compared with previous exploration techniques, prototyping involves creating a concrete artefact in the real world that can evoke feedback from the target sample and explore the problem (Brunner & Brunner, 2009). Through rapid prototyping and iteration, teams build solutions that facilitate a more concrete basis for discussion (Heather, 2007), enabling those solutions to be shared, understood, tested, and challenged by any function inside and outside the organization (Porcini, 2009). Prototypes are used outside the organisation to gather new knowledge from customers and

inside the organisation to collect feedback, increasing the buy-in and sponsoring ideas in the organisation. In the Electrolux professional practice, we can observe different kinds of prototypes. There is a mockup used to show the form of the idea. There is the Minimum Viable Product (MVP) that is functional enough to be tested by someone to gather feedback. Finally, there is the Prove of Concept (POC), a prototype that should work as the actual product without needing to be fully industrialised and developed. The possible range of protoypes are infinite from one extreme to the other. Still, the playtesting activity showed how, usually, iteration by iteration, the prototypes reached higher reliability to gather more valid feedback.

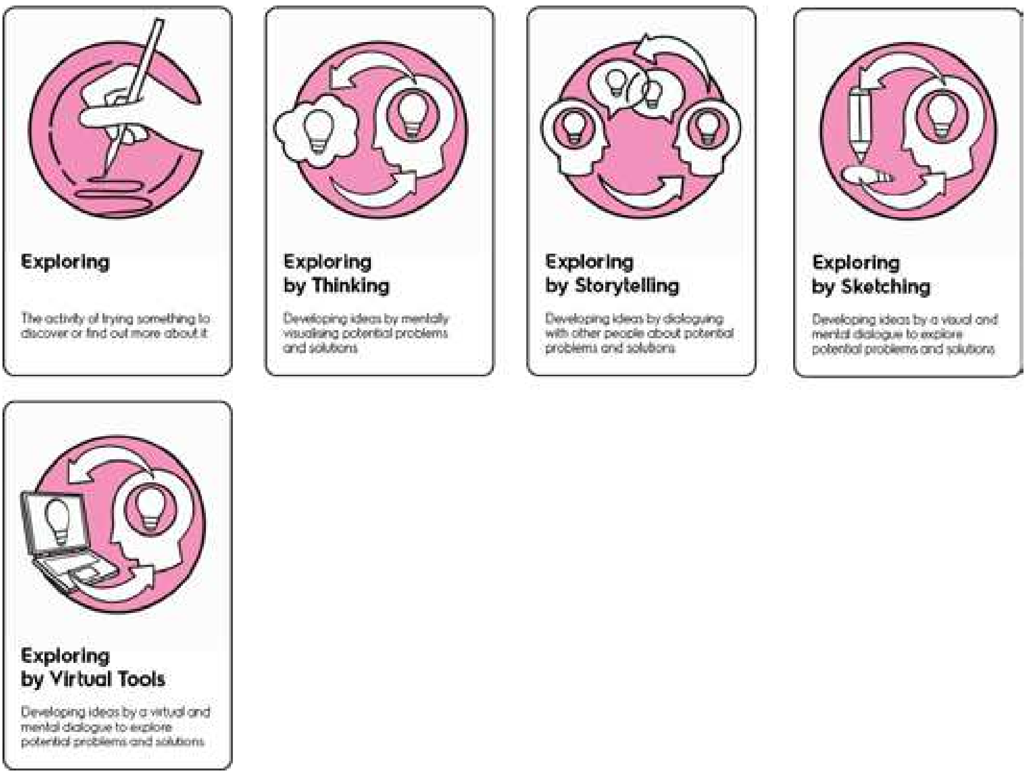


Figure 3.13 Mechanisms cards: exploring.

Evaluating

Design thinker uses both objective and subjective way of evaluation. We can distinguish between two levels of assessment: personal and team. At the individual level, design thinkers are involved in judging their cognitive moves that lead the exploration of the hypothesis forward (Liedtka, 2000). As discussed for the framing and exploration strategies, this mechanism is based on the appreciative system of the individual (Schön, 1983). Thus, it is subjective in nature. Then there is the team level, where stakeholders evaluate ideas to decide the project's strategic direction (Bryan Lawson, 1980). The Electrolux Professional case showed that these decision-making moments are usually as objective as possible, especially when the project requires considerable development resources. These two approaches are connected. Personal judgement shapes the solution that, in turn, is assessed by the team. Still, they are different because different decision-makers are involved. We can categorise the evaluation strategies using the three logical operations: abduction, induction and deduction (Figure 3.14).

(1) Assessing by Abductive Sense of Fit. At the personal level, the decision-maker is the design thinker. Therefore, decisions are mainly based on their sense of fit. Schön (1983) describes the judgment of the designer moves as founded in their appreciative system, that in turn, is founded on the designer's experiences and influenced by the central philosophies of the time. Verganti (2017) call it felt-sense, the deepest level of cognition that drives the design thinkers' exploration of innovation. The sense of fit or the felt sense seems to be a gut feeling settled in a deep area of our cognition. They can be considered heuristics, abductive judgments that economically address our decisions. Abduction is the most used approach to make decisions about a situation. It is a process that uses the knowledge available at that moment to jump to a conclusion instinctively. In the Electrolux Professional context, gut feeling evaluations are more common at the beginning of the practice, where the consequences of the decision are negligible. The more the decisions have high economic repercussions, the more decisions have to be supported by additional data.

(2) Assessing by Inductive Validation. Induction is about inferring the most likely option from a sample of information. It exploits the data available to induce a decision. In innovation, inductive logic is a common decision-making strategy. Usually, the team collects information about an idea using a prototype to elicit feedback from a sample of customers

(Brown, 2007). Then, the group uses that information to make inductive decisions (Liedtka, 2011). For instance, the innovation team usually collect and supplies credible clues at each milestone review in Electrolux Professional to support the stakeholders' decisions. They typically design an interview brief or a user test to collect critical metrics from the customer interaction with a prototype. Data that the stakeholders use to make inductive decisions about the project continuation.

(3) Assessing by Deductive Analysis. The deduction is usually associated with analytical reasoning based on data-driven decisions. Still, deductive logic is extremely rare in an innovation setting. On the one hand, innovation is an ongoing experimentation process that leads to the market where you could never have logical certainty of a decision because your premises are always hypothetical. On the other hand, competitors' data analysis and market sales projects are rare in innovation because the competition usually does not exist or is weakly defined. In the Electrolux Professional playtesting activities, we observe that the deductive card was typically selected for a certain kind of inductive judgement. Indeed a common threat is to consider the induction as a deduction. The data collected from surveys or scorecard exercises support analytical decision-making in an organisational setting. Even if they resemble a deductive logic of proceeding, they are inductions with different degrees of statistical reliability. The risk for a team is to overestimate the reliability of an inductive decision and sometimes mistake it for a deduction. Misusing a term for another does not always seem a big deal. Still, it is crucial to be aware of the differences between the two strategies.

Figure 3.14 Mechanisms cards: evaluating.

Learning

We saw in the attitude level that design is mainly an inquiry process. Indeed, in everyday practices, design thinking exploits collection, exploration and judgement mechanisms to trigger further learning to embed into the final solution (Hassi & Laakso, 2011; Liedtka, 2000; Melles, 2011). There are different strategies the design thinker uses to acquire new knowledge and share it with the whole team (Figure 3.15).

(1) Learning from Knowledge Transfer: Anyone has proper skills and know-how accumulated through their education path and working experience. A possible strategy to exchange knowledge is by transferring it from one person to another. For instance, in Electrolux Professional, the innovation team specifically design some parts of the participative activity to allow this mechanism. In the so-called "ask the expert" exercises, they coordinate different subject matter experts that expose their knowledge to the whole team to align everybody on the same pool of information, leaving additional time for questions. At the end of the exercise, the entire team would be aligned on the same pool of knowledge and ready to move to the next phase.

(2) Learning from Research. Probably the most common way to acquire knowledge is by directly assessing a source of information. This strategy is helpful, especially as individuals want to learn separately and interpret the data evaluated differently. For example, in the Electrolux Professional practices, as we have seen, the innovation team do not always run the research activities first-person. They receive information from different sources and analyse and study another person's research output. Then the data has to be elaborated to suit the participative practice activities.

(3) Learning from Emphasizing. One of the most discussed topics in the design thinking literature is empathy. Strongly connected with the human-centred attitude (Hassi & Laakso, 2011), IDEO first and many other design thinking actors then fostered empathy as the key to innovation. It lets you get fresh, original insights about your market and customers, thanks to the direct first-person observation of what is happening in the market (Brown, 2007). It allows you to understand the implicit and explicit customers' needs and design a suitable solution (Holloway, 2009). Moreover, it supports you at the end of the cycle when your idea must be tested with the customers to elicit feedback. Empathy is a valuable way to understand others inside and outside the organisation and widen your viewpoint (Dunne & Martin, 2006). For example, the innovation team

used empathy strategies for different scopes in the Electrolux Professional practices. It used them during observation to empathise with the customers' needs and situations. It exploited it to understand the stakeholders' perspectives. Furthermore, it employed it to foster this strategy even as a shared team practice. For instance the team prepared learning devices such as personas and scenario for an empathy exercise. During this exercise, everyone had to read, understand, and interpret the information, putting themselves in the customers' shoes.

(4) Learning from Collective Critique. We already discussed the design thinking dialogical attitude. Connected with it, critiquing could be considered a powerful strategy for collaborative learning. It is not about merely transferring knowledge from one person to another but discussing, arguing, and debating a situation from a critical perspective to learn more about it. In Electrolux Professional, the innovation team exploited this strategy on different occasions. For instance, during participatory workshops in the so-called "Speed Critique" exercise. After creating new ideas, they followed a review process that led them to listen and understand their teammates' perspectives, point out critical elements, and suggest possible improvements, building on the opinions of others. Another critique example is the debate between stakeholders or customers around a new prototype. In such discrete moments in the interactive design process, in-depth dialogue about the concepts and design elicits insights that trigger new learning and improvement.

(5) Learning by Doing. Design thinkers are prone to explore their hypotheses through various mediums. In this iterative process, they continuously learn from the exploration. Sketches, prototypes or simulations become working devices for learning in action (Dorst, 2010). The practitioner simulates the results of their hypothesis in a virtual and safe environment where move after the move, you are allowed to make mistakes without risks. Learning from your own mistakes is usually more powerful than relying on gaining experience from others (Bryan Lawson, 1980). From loss, practitioners learn and act by consequence, improving their idea. In this sense, knowledge creation in design thinking is practical as the process proceeds through reflection-in-action (Schön, 1983). For example, in the Electrolux professional practices, we observe that this mechanism has been fundamental since the first sketches. It tested the concept in different virtual scenarios to reduce the global risk of failure. The more the development is in an advanced stage, the more the prototype

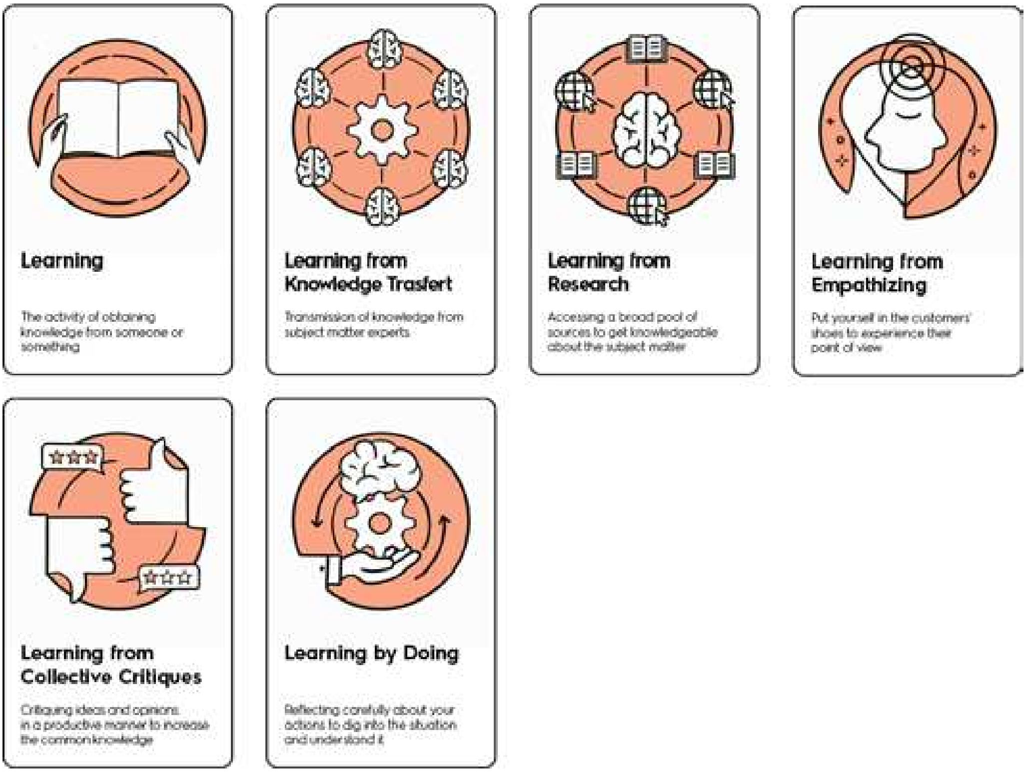


Figure 3.15 Mechanisms cards: learning.

will be realistic, and the more the learning-by-doing strategy will face real problems that, by the end, will make the concept stronger and stronger, reducing the overall risk of failure.

Leading & Managing

As we have seen in the attitude level, design thinking is a collaborative practice that involves different people from different functions and skills. Design thinking practices extensively use participatory activities to organise and engage colleagues and customers as active actors in the process. Design thinkers exploit different strategies to manage and lead these practices (Figure 3.16).

(1) Enabling teamworking. Design thinkers are used to designing ad-hock activities to engage a broad pool of people in a structured process to achieve a specific result by exploiting the effort and capabilities of the team. In Electrolux Professional, the innovation team is used to organise participatory workshop design to support crucial moments of

the organisation process. For instance, a pivoting decision-making point, a co-development session, or a strategy-making process. The team collect and design the information and the interactions required by the situation to allow a team to accomplish the activity.

(2) Facilitating. Design thinkers are used to supporting the activity without being directly involved in the process. The design function acts as a "glue" binding multidisciplinary teams together, exploiting collaborative practices and visual tools to manage complex situations (Heiman & Burnett, 2007). For instance, in Electrolux Professional, the innovation team facilitate workshops, meeting and the overall project coordinating people's activity and schedule. Compared to other managerial approaches, the innovation team tend to be more visual, using tools and material to ease communication.

(3) Mediating. Design thinkers are used to listening and understanding contradictory perspectives to negotiate a situation and seek a shared agreement. They are polyglots: capable of translating vertical knowledge from one discipline to another thanks to their horizontal know-how and sense of empathy (Porcini, 2009). For example, in Electrolux Professional, the innovation team is used to supporting different functions in their communication, reshaping presentations or simplifying information to be more comprehensible by the overall group. Moreover, it uses dialogue-based exercises with voting sessions to manage the negotiation in the team alignment.

(4) Inspiring. Design thinkers are used to motivating the team to maintain a high level of engagement and positivity, designing specific activities to provoke the team and spark their imagination. In Electrolux Professional practices, the team designs ice-breaking moments to engage people. It exploits gamification to involve and affect the team positively. Finally, it designs ad-hoc tools to trigger the participants' imagination and creativity.

(5) Sharing Ownership & Accountability. Design thinkers are used to adopting horizontal leadership, exchanging it in a liquid fashion based on the knowledge and skills required for the issues under consideration (R. Buchanan, 2004). This sense means that team leadership is frequently passed back and forth. One analogy that is often used is a jazz ensemble. A jazz group is expected to be comfortable with passing a solo back and forth among players within the structure of a song (Heiman & Burnett, 2007).

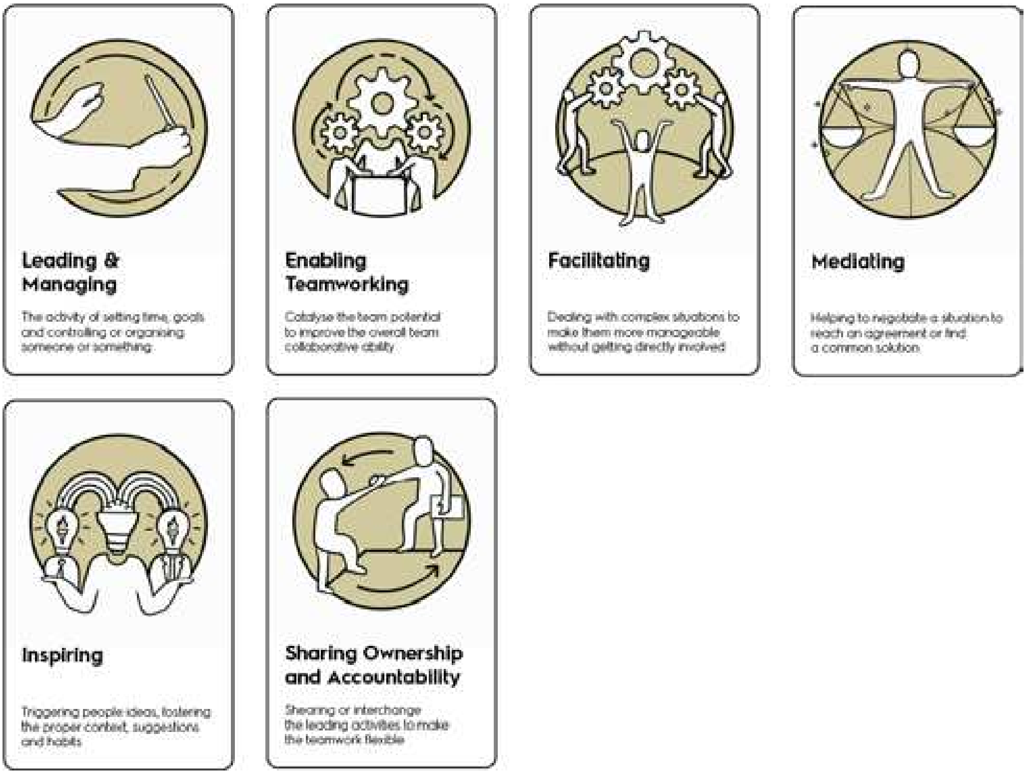


Figure 3.16 Mechanisms cards: leading and managing.

Impacts

The framework impact level aims to map and describe the impact that characterised the design thinking approach based on the collected literature and the insights elicited during the tool evaluation process.

Knowledge Creation

Design thinking is an inquiry process that allows the emergence of ideas and their development. From an organisational perspective, the learning acquired and embedded into the concept or other artefacts become an asset of knowledge that the organisation can exploit for different initiatives. In this sense, design thinking is a process that impacts the organisation by creating knowledge. We could identify many ways to sub-impact that concern knowledge. Still, from the explorative study in Electrolux Professional, the innovation team seems to distinguish four ways design thinking supports knowledge creation (Figure 3.17).

(1) Research Knowledge Asset. The first impact highlighted by the team concern the knowledge created from the research activities. The inquiry and human-centred attitude of design thinking foster a research-based approach to innovation. In Electrolux Professional, the first part of the practices is usually focused on collecting information from customers, stakeholders or other sources. All this information is then analysed and synthesised into a usable artefact. At that point, the data collected becomes a functional asset for the organisation that could use and re-use to trigger an idea, develop it or make decisions.

(2) Ideas Knowledge Assets. Another approach for create assets of knowledge is by developing ideas. Ideas are visions about something. They are flexible entities that change and take more and more concrete form over a process that make them real solutions in the market. From an organisational perspective, they could be considered knowledge assets because they embedded and concretised the information, feedback and practical learnings accumulated over the design thinking practice. The more developmental activity is done, the more knowledge an idea has embedded. Thus, the status of knowledge of an idea could be considered a direct expression of the work effectively executed by the team in developing the idea.

(3) Testing Knowledge Assets. Finally, the other impact in generating assets of knowledge for the organisation is testing the hypothesis. Validate the idea by simulating and testing it with the stakeholders and customers increases the organisational expertise about a specific concept giving it more validity. In Electrolux Professional, the innovation team iteratively tests the idea at different steps to validate it. Those knowledge gets embedded into the ideas through improvements and fine-tuning activities. Still, sometimes the failure of a project is inevitable. Even failure can become a lesson for the organisation if properly used. Failure is a step forward in the journey to understand what is not working, why it does not work and ultimately correct the direction for the next time—the more experiment, the more failures, the higher the likelihood of success.

(4) Knowledge Reification. Ultimately, the reification impact is the capability to transform an individual or team-level learning into organisational assets. Knowledge becomes helpful when it goes beyond its individual use. Reification gives a tangible form to private intangible aspects such as personal learning, making them usable by others. In Electrolux Professional, accumulated knowledge is reified in various

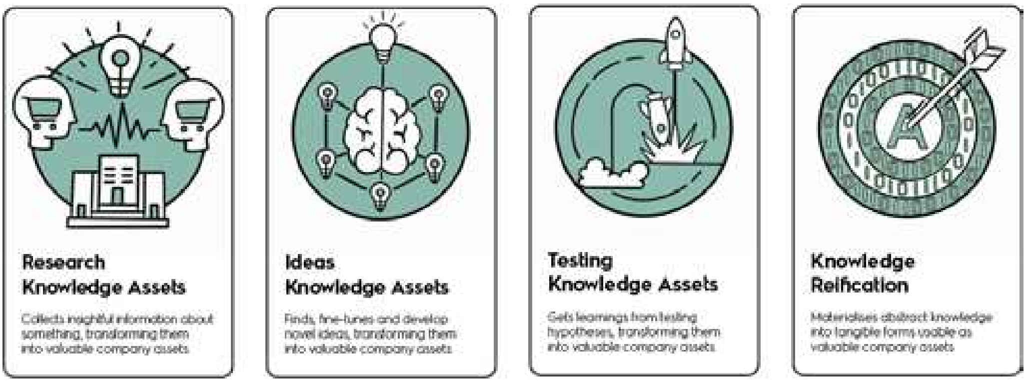


Figure 3.17 Impact cards: knowledge creation.

shapes and translated into company assets. For instance, research know-how is usually reified in tools and devices that a larger team can use to find new ideas. Ideas knowledge gets refined into concrete actions that embed the learnings into the concept in the form of improvements. Testing learnings become reports that inform possible improvement or become unsuccessful stories usable to learn from the successes or failures. Knowledge is almost useless without the proper capability of reifying and transforming it into valuable assets.

Social Interaction

Design thinking is a collaborative approach that involves many stakeholders and customers throughout its process. It extensively uses participatory activities to develop, manage and promote projects within the organisation. The involvement of diverse people, with their skills and capabilities in design thinking practices, impacts organisations from many social aspects (Figure 3.18).

(1) Collaboration. Participatory activities are especially suited to improve cooperation, not for its own sake, but for an action-oriented achievement of the same results. Design thinking exploits collaboration and diversity as a working engine for innovation. It orchestrates team collaboration, using each individual's best characteristics to efficiently drive the team toward a shared result, involving them in participatory practices. In Electrolux Professional, the innovation function is founded on the collaboration principle, and design thinking supports this management style. The innovation team is used to design ad-hoc activities for collaboration

for its own and other team's initiatives. From multi-day workshop sessions to focused participatory online meetings, the tool, methods and principles to design collaborative activities belong to the design thinking attitudes.

(2) Breaking Silos. Similarly, to collaboration, another impact of the design thinking practices seems to be the involvement of diverse actors in the same process. From the organisation's perspective, breaking the silos means coordinating people from different departments with other backgrounds and values. Collaboration between values- goal-contrasting people is not easy. For instance, in Electrolux Professional, the business and technical departments, with their partially contrasting objectives, generate complex situations to manage. Through dedicated participative design thinking practices, the innovation team was able to support these critical moments. They use tools and techniques to mediate the different interests through the human-centred lens, sharing the decision-making process and aligning the team diversities into a unique vision.

(3) Engagement. More than collaboration, design thinking seems to support the team and stakeholder engagement in innovation activities. On the one hand, collaborative practices exploit gamified strategies to involve people, increasing their attention. On the other hand, participation creates commitment in the team and stakeholders that develop a particular obligation toward the initiative making them more prone to support it. Even the proper environment and context are variables for engagement. The Electrolux Professional case suggests that physical participation engages people for a long time. While in a virtual environment, the concentration is less prolonged. Thus, additional inspirational strategies and breaks should be scheduled to prolong the team's attention.

(4) Trust. Design thinking, as a social process to manage people, supports the creation of profound bonds between people. Especially in live activities where the hierarchy of the organisation becomes flat and different stakeholders have the opportunity to discuss and work in an open arena, design thinking practices stimulate reciprocal trust. In Electrolux Professional practices, the innovation team suggests two perspectives from which design thinking generates trust in the organisation: firstly, by promoting confidence among colleges. People who invest time and energy in working together share convivial experiences of teamworking that cause long-term trust between people; secondly, boost confidence in the outcome of the process. Again, the participatory nature of design thinking and the customer validation process make stakeholders more trustful

toward the project's results.

(5) Creative Confidence. Connected to the broad concept of trust, "creative confidence" is another impact of design thinking participative practices. Made famous by the Kelley brothers (2015), creative confidence is focused on the capability of design thinking to make people uncomfortable with creative processes at ease with design. It does it by creating guided activities that destructured the creative mechanisms into ad-hoc exercises, managing the process straightforwardly. It simplifies the creative process to make it accessible to everyone. That does not aim to substitute expert designers' skilled and nonlinear creative process. Still, it aims to support unskilled people in creating ideas, allowing them to participate, give their contributions and develop new skills. For instance, in the Electrolux Professional practices, expert and non-expert creative processes are sometimes mixed, trying to achieve the best from both. The innovation team usually designed workshops combining different tools in a linear process to support the participation of the whole team in the creative process. Still, it exploits even the expert design skills to create suggestive ideas to inspire the team. Or, on the contrary, use the inspiration generated by the team to develop the concept further.

(6) Communication. The design thinkers' attitude toward visualisation and the reification of knowledge makes design thinking a communicative process. On the one hand, creating participatory activities creates the perfect arena to exchange information. On the other hand, visualising abstract contents into usable devices or through visual tools increases the usability and shareability of the data. For instance, in Electrolux Professional, the innovation team uses digital tools such as Miro and Mural to ease the exchange of information or facilitate discussion through dynamic conversation representations. Alternatively, it designs a facilitated environment to share knowledge or feedback with rules and devices that visually coordinate and mediate the discussion.

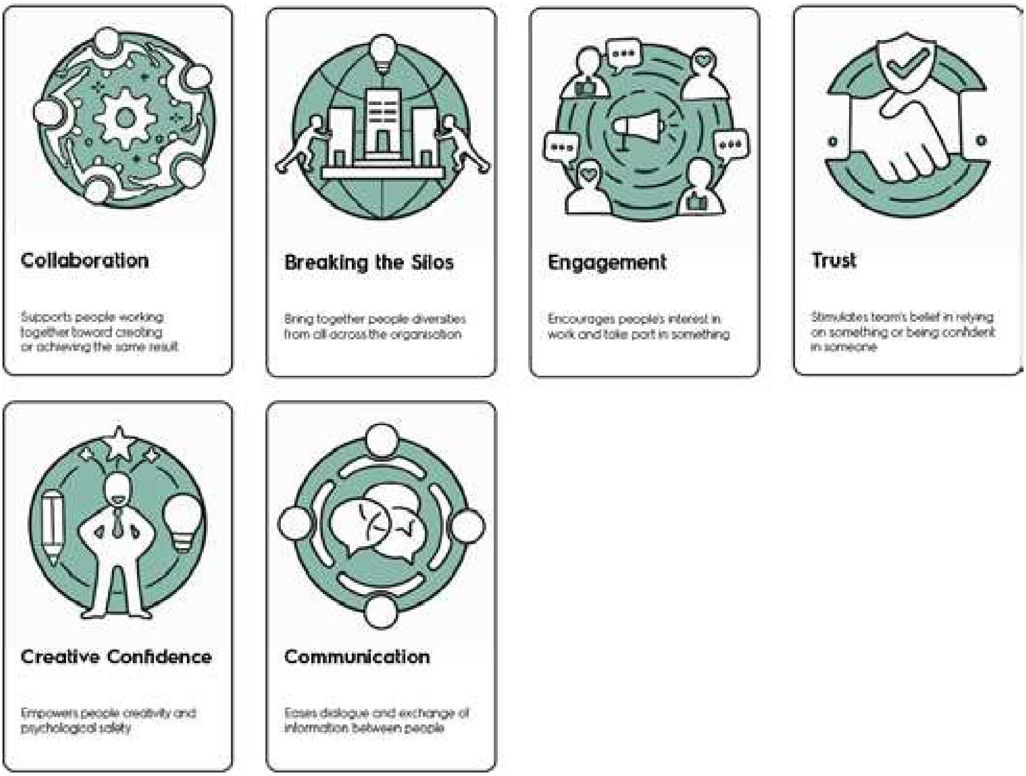


Figure 3.18 Impact cards: social interaction.

Decision Making

Design thinking has another essential role in company dynamics: it supports organisational decision-making. Decisions are the pivoting points for any management process addressing the project's direction. Organisations make decisions considering the opportunity available and selecting the most suited one. Still, to make a good decision, you must choose among the best available options (R. Boland & Collopy, 2004). As we have seen till now, design thinking focuses on accumulating knowledge and improving social dynamics. These impacts support the creation and identification of the best options offering valuable collaborative strategies for decision-making. During the playtesting activities, different approaches were identified. (Figure 3.19).

(1) Decisiveness. Design thinking supports the decision-making process by supplying the company with the knowledge to take fast and confident decisions. Knowledge creation grants access to insightful

information. The social practices bring the right stakeholders on board. Together they offer the right ingredients to improve decision-makers confidence. Even in Electrolux Professional, this pattern is clear. We can see them in the workshop mapped by the playtesters. We observe that firstly the innovation team collected knowledge. Secondly, it used that data collaboratively to generate different options. Finally, participative practices led to the decision among the alternatives collaboratively.

(2) De-Biasing. Several biases are involved in the participative activities fostered by design thinking. Some of them are positive (Liedtka, 2015) others require more attention.[221] A positive effect of participative practice is the reduction of personal decision bias. For instance, individual appreciation is mitigated by considering multiple points of view in the final decision. Similarly, even data-driven clues give more objectivity to the process reducing personal prejudices. In Electrolux Professional, the innovation team designed a multi-level voting approach to allow a step-by-step decision-making approach. The method tries to minimise the biases by structuring a multi-phase process. First, an individual blind voting session enabled personal opinions to emerge. Second, an alignment voting session converged the team in the same direction. Finally, an explicit vote gave ownership and accountability to the decision-makers in charge, letting them choose the project's strategic direction. This process exploits both a democratic and lead-based approach to combine the best of the two strategies.

(3) Alignment. An essential aspect of good activity management is the team's decision-making alignment. The participative nature of the design thinking practices connected with some valuable tools can support good alignment between the team and the decisions. In contrast with a hierarchy approach, design thinking is democratic. Involve people in an open arena and allow everyone's opinion to get considered. These two aspects make people feel considered and more inclined to support or accept the decisions. For instance, the innovation team usually stresses this aspect, especially when stakeholders with contrasting values are involved in the practice. As discussed in the de-biasing example, the multi-level decision-making process is democratic and open to critique. Still, it is not deterministic. It does not replace the role of the decision-maker in charge. Give all the valuable information about the possible options and the democratic alignment of the team. However, it allows decision-makers to address the project direction even toward another path, taking

221 Let see the bias topic discussed in the next setp

accountability for their decisions.

(4) De-Risking. As discussed in many other parts of the thesis, innovation is inherently uncertain. Thus, taking decisions in this context is a risk. However, there are some possible strategies that design thinking uses to de-risk the decision-making process. The most common one is by supporting decisions with customer base evidence. The human-centricity and inquiry attitudes make design thinking a method focused on customers. Initial research activities and the iterative validation processes support decision-making by supplying clues that stakeholders can use to make inductions. In Electrolux Professional practices, this aspect is always present. Still, it is good to notice that this approach minimises the risks but does not avoid them.

(5) Adaptability: In the daily changing and uncertain context, projects and especially innovation projects, should be able to shift rapidly in response to new inputs. Design thinking and its iterative and learning-oriented attitude seem suited to create an adaptable process. Instead of a stage-gate methodology, design thinking emphasises rapid and iterative learning loops that shape the ideas over their path. Sometimes clues suggest an idea is not proceeding in the right direction, risking failure. In those moments, the pivoting ability to embrace an alternative approach is crucial for giving a second chance to the concept. It does not mean getting stuck too much on a single idea but being able to size alternative emergent opportunities while the learning process proceeds. In Electrolux Professional, the project analysed are almost all at their first learning loop. Still, in at least two of them, we can observe this dynamic and flexible adaptation according to the new learnings.

(6) Speed: The concept of speed is limited and dependent on what you confront it with. Design thinking is not a fast process in absolute terms. Still, the participative practices designed to condense many activities in a few hours could be considered a quick process compared to habitual organisational work. This practice requires a long time to get adequately designed and scheduled. However, if properly structured, it can rapidly move the project forward, involving the suitable stakeholders only for the time needed. In the Electrolux Professional context, the innovation team spend weeks or months designing a complex practice investing a few people's time for a long time. Still, it saves more hours than discussing all the decisions meeting by meeting. Indeed, incorporating multiple steps in a collaborative practice reduces the time required to align everyone every

time, saving stakeholders time.

(7) Action Orientation: Design thinking practices are focused activities that aim to affect the project course. They are designed to move from one initial state to another, involving the team in practical actions. They move in the opposite direction of meetings in which topics are discussed, no decisions are made, or unclear tasks are assigned. They get strict to the point, coordinating the team's time in challenging slots to accomplish a task that one after the other moves everyone's work forward. For instance, in Electrolux Professional, the innovation team use participative practices as a workshop to manage complex requirement definition processes. Alternatively, it uses similar methods to support the company's strategizing. Still, sometimes they used them even for simple but actionable meetings to discuss topics within a schedule that marks the pace of action.

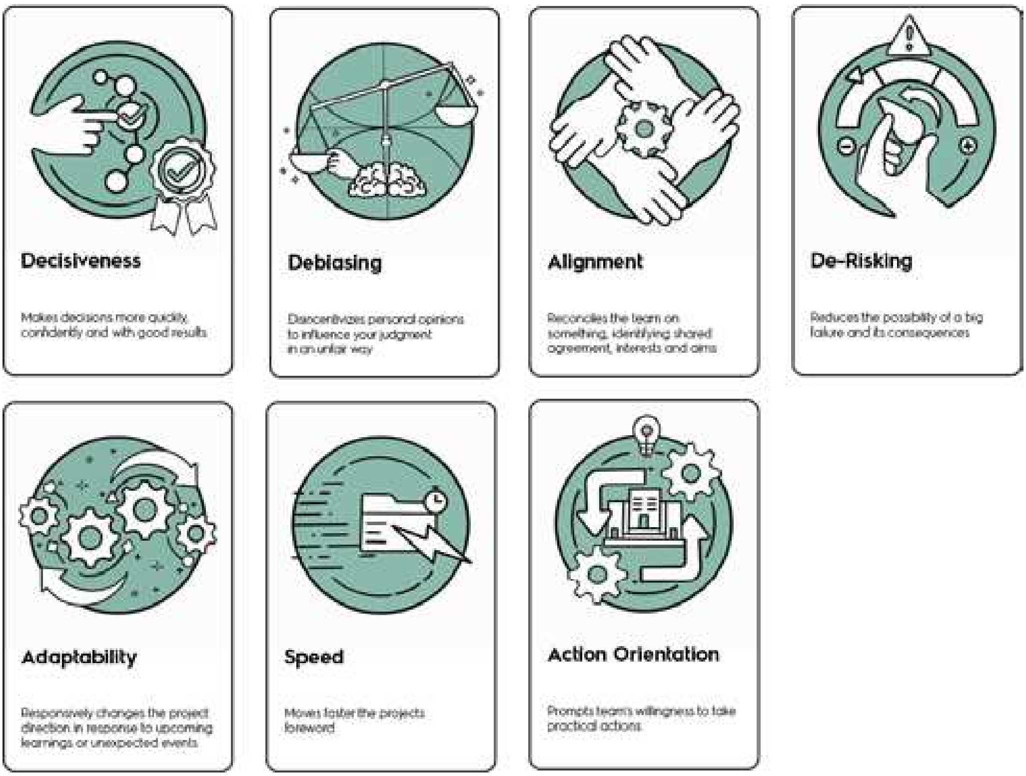


Figure 3.19 Impact cards: decision-making.

Market Effects

Upstream the organisational effect on the management of the practices we discussed till now, other impacts are influenced by the design thinking practices. Design thinking is mainly a managerial approach from an organisational point of view. Still, it is even a creative process that aspires to develop innovative solutions that will have other effects after their market implementation. The playtesting activities and the review elicited that these aspects should be considered in the overview of the design thinking impacts. Thus, even if this research aims not to study or assess those impacts, they should be acknowledged in the framework structure. There are three main areas that the solution output of a design thinking practice can impact once in the market (Figure 3.20).

(1) Customer Experience. The solution designed by the design thinking practices will impact the customers' experience. Especially for the Electrolux Professional case, the B2B solution will be used in a professional environment as machines to work. They are heavy-duty solutions with high productivity, usually used several hours daily in stressful contexts. Designing an ergonomic and usable solution that improves the customers' overall experience makes a difference at the end of the working day. The design thinking process is particularly suited to designing a human-centred experience that could make the solution used as satisficing as possible.

(2) Organisational Performances. The solution designed by the design thinking practices will impact the organisational performance once in the market. Solutions with a high investment return are highly beneficial for any organisation. With its innovative ambition, design thinking should have a good potential for gaining good market results. Indeed, solutions that create a sizeable competitive advantage should be rewarded by the market, increasing or creating a new market share. Still, as discussed in the previous chapters, an invention does not make an innovation. Despite the theoretical likelihood of success in the market, sometimes, time, society or any unexpected black swan events could proclaim the failure of a potentially innovative idea. In Electrolux Professional, there are not yet new solutions with measurable market results to use here as examples.

(3) Environment & Social Value. The solution designed by the design thinking practices will impact society and the environment. Any solution designed today must consider its impact on the planet and the communities directly affected by them. With its human-centred attitude,

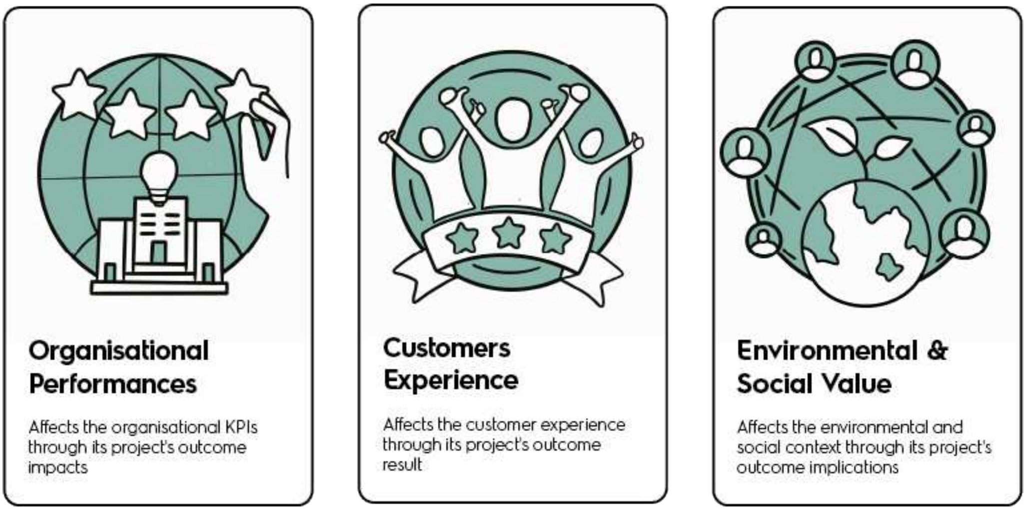


Figure 3.20 Impacts cards: market effects.

design thinking is mainly focused on human aspects. Still, recently we can observe a general transition from a human-centred philosophy to a planet-centred one. As the design discipline and the whole world are moving in this direction, even design thinking cannot put aside environmental issues. In Electrolux Professional, this topic is particularly felt. Indeed, the company strategy and mission have always been devoted to the sustainability cause—a heritage rooted in the Electrolux Major Appliance vision and its Sweden cultural identity. Sustainability is becoming continually more central in the development process, and design thinking practices are fostering these aspects more and more as critical drivers of design.

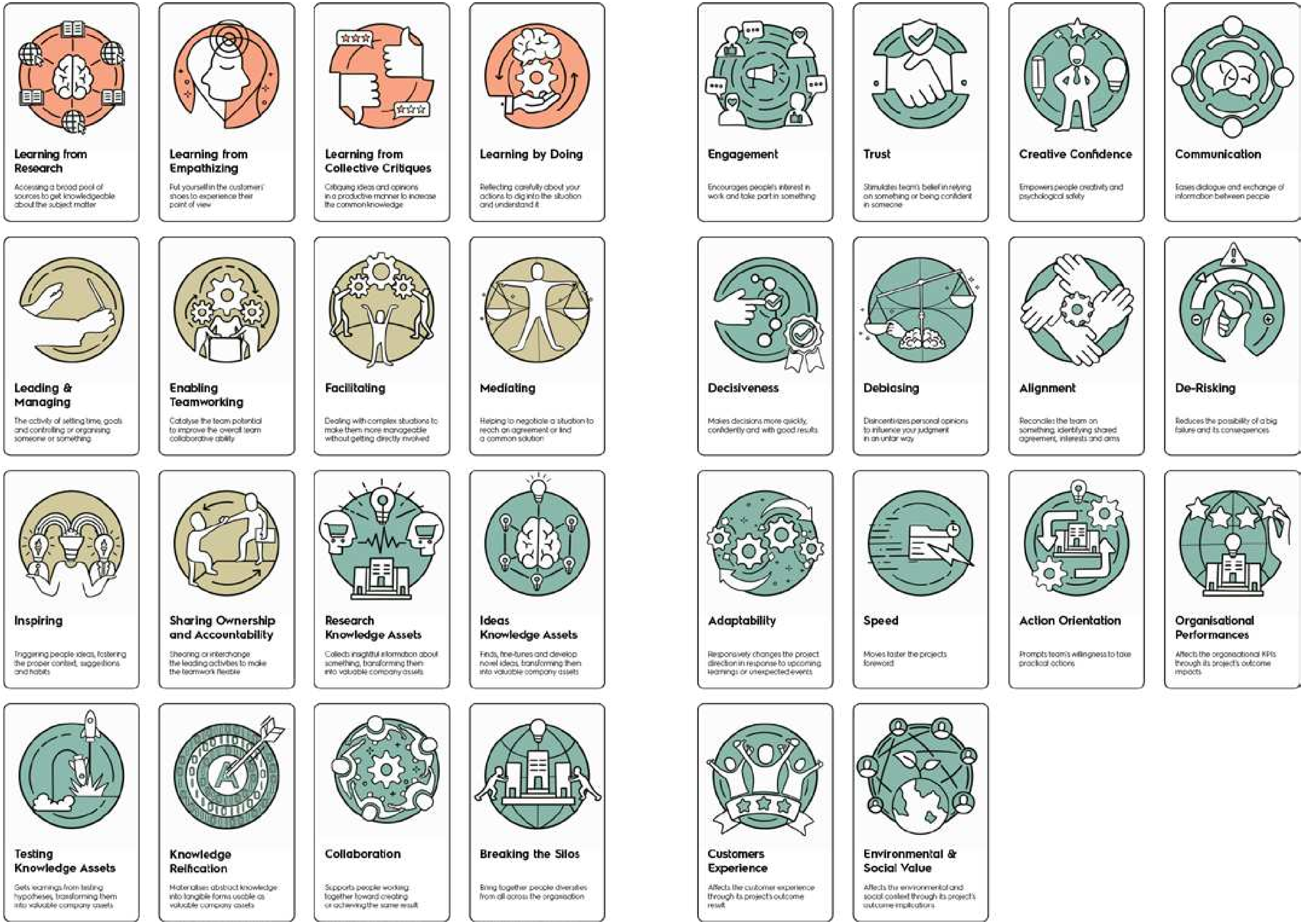
Conclusion

The literature review about the design thinking assessment practices showed that design thinking has positive economic repercussions in organisations that successfully embrace it. Still, despite this generic evaluation, few examples exist, and they seem far from being standardized and structured. To hinder a cohesive assessment appears to be the difficulty in agreeing on what design thinking is, despite the context-dependent differences.

This chapter tries to face the problem by developing a flexible framework capable of analysing the plurality expressions of design thinking practices. Preliminary discussion about the first version of the framework elicited the need to transform it into a more usable device to validate its structure and explore the design thinking practices in context. The researcher developed a tool of cards representing the different contents of the framework and an interconnected exercise to map and analyse the Electrolux Professional practices with the stakeholders that created them. The tool and the activity were tested in eight playtesting sessions and three expert reviews, iteratively fine-tuning the framework and the exercise rules. At the end of the process, the first stable version of the framework and the interconnected device was realised with a discrete degree of internal validity (Figure 3.21). The last part of the chapter discusses the framework, pinpointing its literature roots and the main topics elicited by the explorative playtesting activities. Still, it is far from being exhaustive. Especially in some areas, the literature identified, and the insights produced are few, opening more questions to address than comprehensive answers. The framework and the interconnected tool and exercise are developed for this aim: creating a shared base for discussion, explorations, and hopefully, developing new lines of research to deepen and enlarge the topics identified.

The following chapter offers a practical example of how the framework could be employed to explore design thinking in a specific context, such as Electrolux Professional. Moreover, it tries to lay the foundation for an evaluation approach to assess the impact of design thinking on organisational innovation processes. Firstly, it describes the design thinking practices by examining them through the framework lens. Secondly, it discusses the evaluative approaches considered and used, highlighting the practical barriers faced in employing them. Finally, it narrated the assessment path taken, discussing the steps completed and the ones still required to develop an effective assessment system.

Figure 3.21 Design thinking tool.


Learning from Research
Accessing a broad pool of sources to get knowledgeable about the subject matter
Learning from Empathizing
Put yourself in the customers' shoes to experience their point of view
Learning from Collective Critiques
Critiquing ideas and opinions in a productive manner to increase the common knowledge
Learning by Doing
Reflecting carefully about your actions to dig into the situation and understand it
Leading & Managing
The activity of setting time, goals and controlling or organising someone or something
Enabling Teamworking
Catalyse the team potential to improve the overall team collaborative ability
Facilitating
Dealing with complex situations to make them more manageable without getting directly involved
Mediating
Helping to negotiate a situation to reach an agreement or find a common solution
Inspiring
Triggering people ideas, fostering the proper context, suggestions and habits
Sharing Ownership and Accountability
Sharing or interchange the leading activities to make the teamwork flexible
Research Knowledge Assets
Collects insightful information about something, transforming them into valuable company assets
Ideas Knowledge Assets
Finds, fine-tunes and develop novel ideas, transforming them into valuable company assets
Testing Knowledge Assets
Gets learnings from testing hypotheses, transforming them into valuable company assets
Knowledge Reification
Materialises abstract knowledge into tangible forms usable as valuable company assets
Collaboration
Supports people working together toward creating or achieving the same result
Breaking the Silos
Bring together people diversities from all across the organisation
Engagement
Encourages people's interest in work and take part in something
Trust
Stimulates team's belief in relying on something or being confident in someone
Creative Confidence
Empowers people creativity and psychological safety
Communication
Eases dialogue and exchange of information between people
Decisiveness
Makes decisions more quickly, confidently and with good results
Debiasing
Disincentivizes personal opinions to influence your judgment in an unfair way
Alignment
Reconciles the team on something, identifying shared agreement, interests and aims
De-Risking
Reduces the possibility of a big failure and its consequences
Adaptability
Responsively changes the project direction in response to upcoming learnings or unexpected events
Speed
Moves faster the projects foreword
Action Orientation
Prompts team's willingness to take practical actions
Organisational Performances
Affects the organisational KPIs through its project's outcome impacts
Customers Experience
Affects the customer experience through its project's outcome result
Environmental & Social Value
Affects the environmental and social context through its project's outcome implications

4. Electrolux Professional Innovation Practices Evaluation

The last chapter of this thesis aims to assess the design thinking impacts on the Electrolux Professional innovation system. In the first part, the researcher exploited the design thinking framework developed in the previous chapter to analyse the different practices used by the innovation team in Electrolux Professional, discussing some exemplificative case studies. From that analysis, the researcher induces three models to synthesise the design thinking adoption in the organisation, delimiting the boundary of the inquiry. Then, the researcher uses the model to identify which design thinking impacts affect the innovation ecosystem and try to assess them. The evaluation process is still under implementation in Electrolux Professional. However, the last part of the chapter describes the methods and practices employed till now and discusses the next steps planned for the final implementation.

4.1 Practices' Assessment

This paragraph describes the methods and the main findings collected by analysing the Electrolux Professional design thinking practices through the design thinking framework lens. After the analysis, three main kinds of practice have been identified. To illustrate their characteristics, the researcher selected one case study for each to describe the events held in practice and discuss the differences and similarities identified.

Method

The analysis of the design thinking practices in Electrolux Professional adopted the design thinking framework to map the innovation team activities within the same content structure. The mapping analysis run by the researcher is grounded on two primary sources of knowledge: the researcher's participant observation of the practices carried out by the innovation team and the information collected through the playtesting activities shown in the previous chapter.

Sampling

The researcher used the same sampling strategy previously used for selecting the projects evaluated for the design thinking framework. The analysis considered only the design thinking practices the design team led to support innovation activities, limiting them in terms of time. In contrast with the previous sampling, the time laps defined (from 2018 to 2022[222]) acknowledged more projects. Within these boundaries, the research identified eleven projects (Table 4.1).

Participant Observation

The first source of information came from the observation and participation in the practices analysed. Due to the industrial nature of the PhD, the researcher takes an active part in all the activities considered. In this sense, the researcher's participation in the Electrolux Professional design team and his involvement in the research environment over an extended period (2018-2022) make this activity akin to the participant observation methodology.

222 Whether the practice is still ongoing, the researcher limited the analysis to October 2022.

Sample of Projects	Figure	Year
Warewashing	Figure 4.1	2018 – Still Running
QSR Special Appliance	Figure 4.2	2019
Beer Drafting	Figure 4.3	2019
High-Speed Oven	Figure 4.4	2020 – Still Running
High Productivity Appliance	Figure 4.5	2021 – Still Running
Hobs	Figure 4.6	2021 – Still Running
Holding Station	Figure 4.7	2021 – 2022
Robotics and Automation	Figure 4.8	2021
Automatic Opening	Figure 4.9	2021 – Still Running
Automatic Cooking System	Figure 4.10	2021 – Still Running
Innovation Day	Figure 4.11	2022

Table 4.1 Projects selected as sample for the practices' assessment.

Indeed, the direct observation of the practices, the participation in the life of the group, the collective discussion with the management team, and the analysis of the document produced allowed the researcher to accumulate a vast amount of qualitative information about the practices undertaken. The researcher collected the personal experiences in notes, presentations, and video-recorded documents used for this analysis to support the researcher in recreating the project's context and events into a coherent story.

However, as Spradley (1980) suggested, there are risks in such complete participation. There is a substantial possibility of losing objectivity in evaluating the information collected. As indicated in the introduction, the industrial PhD's nature inherently affects the study's objectivity level because the direct involvement of the researcher in the context influences the research. To mitigate this effect, the researcher employed a mix of methods to collect and analyse the information and arrive at a conclusion. Still, the impossibility of involving other researchers to triangulate the data[223] or study different contexts limited the researcher's objectivity to a certain degree.

For this reason, the participant observation data has been used as a secondary source: propaedeutic information used to analyse and map the practices through the framework lens.

223 This approach was not feasible mainly due to privacy and intellectual property reasons.

Practice Map

Defined a stable and valid version of the framework, the researcher applied it to analyse and map the design thinking practices employed in Electrolux Professional. The method resembles the approach adopted for the playtesting activity described in the previous chapter.

Each practice has been schematically reconstructed by adopting the format employed with the playtesting activities. To design a correct representation of the activities, the researcher used the experience gathered during participant observation and, where possible, the information on the playtesting exercises. In this way, each practice has been framed in a readable format.

Then, the researcher mapped the activities with the last version of the framework's cards, following the rules and precautions highlighted in the evaluation phase. The researcher associated the mechanisms cards with the methods and tools employed and the impacts cards with the general practice. The mapping work is based on the researcher's expertise combined with the experience accumulated from the playtesting evaluation and the participant observation.

The analysis has been summarized in specific figures (Figure 4.1, Figure 4.2, Figure 4.3, Figure 4.4, Figure 4.5, Figure 4.6, Figure 4.7, Figure 4.8, Figure 4.9, Figure 4.10 and Figure 4.11), illustrating each practice with the same format. Each board describes one procedure through a sequence of the methods and tools employed, the mechanisms triggered, and the impacts produced.

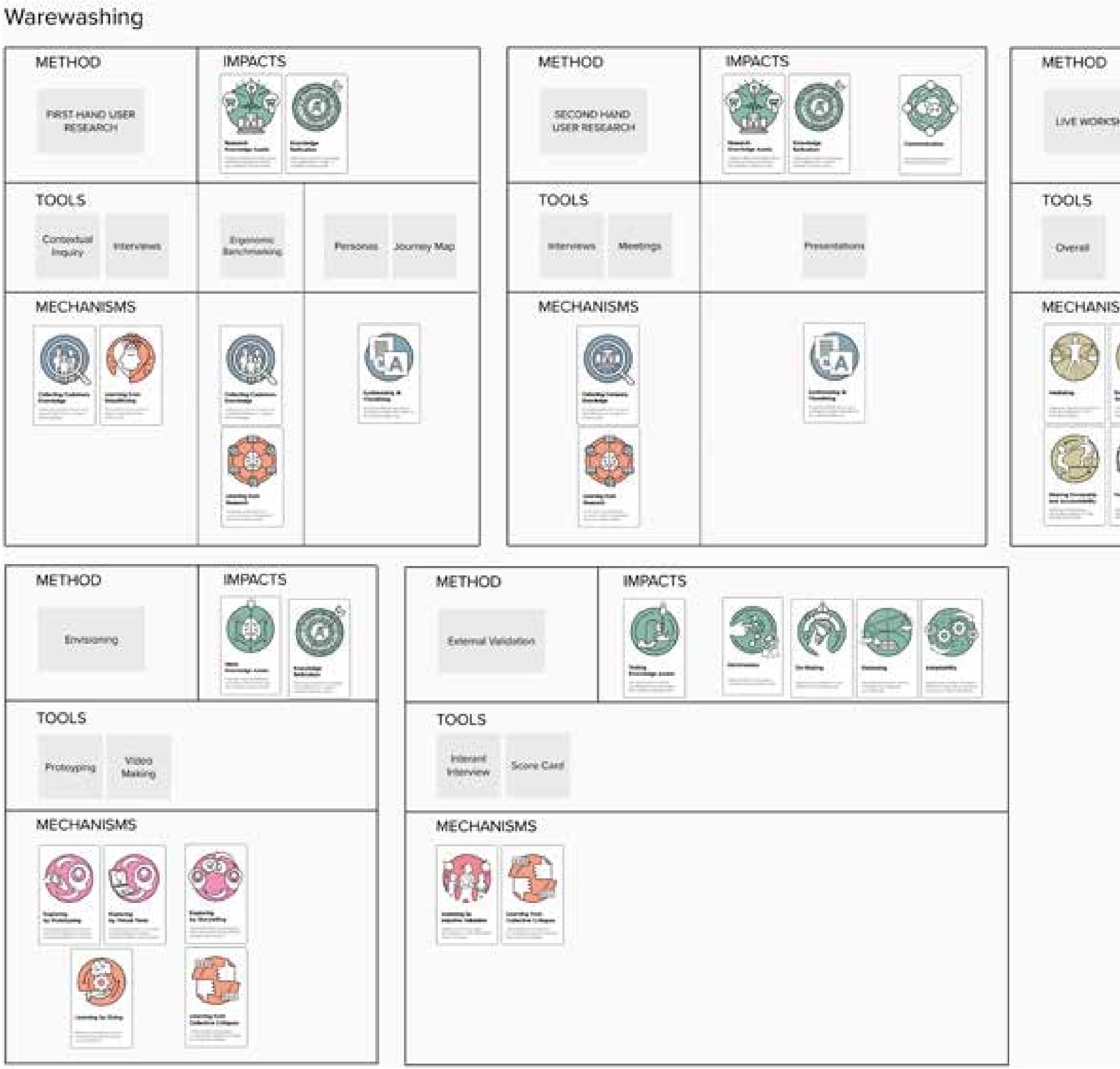
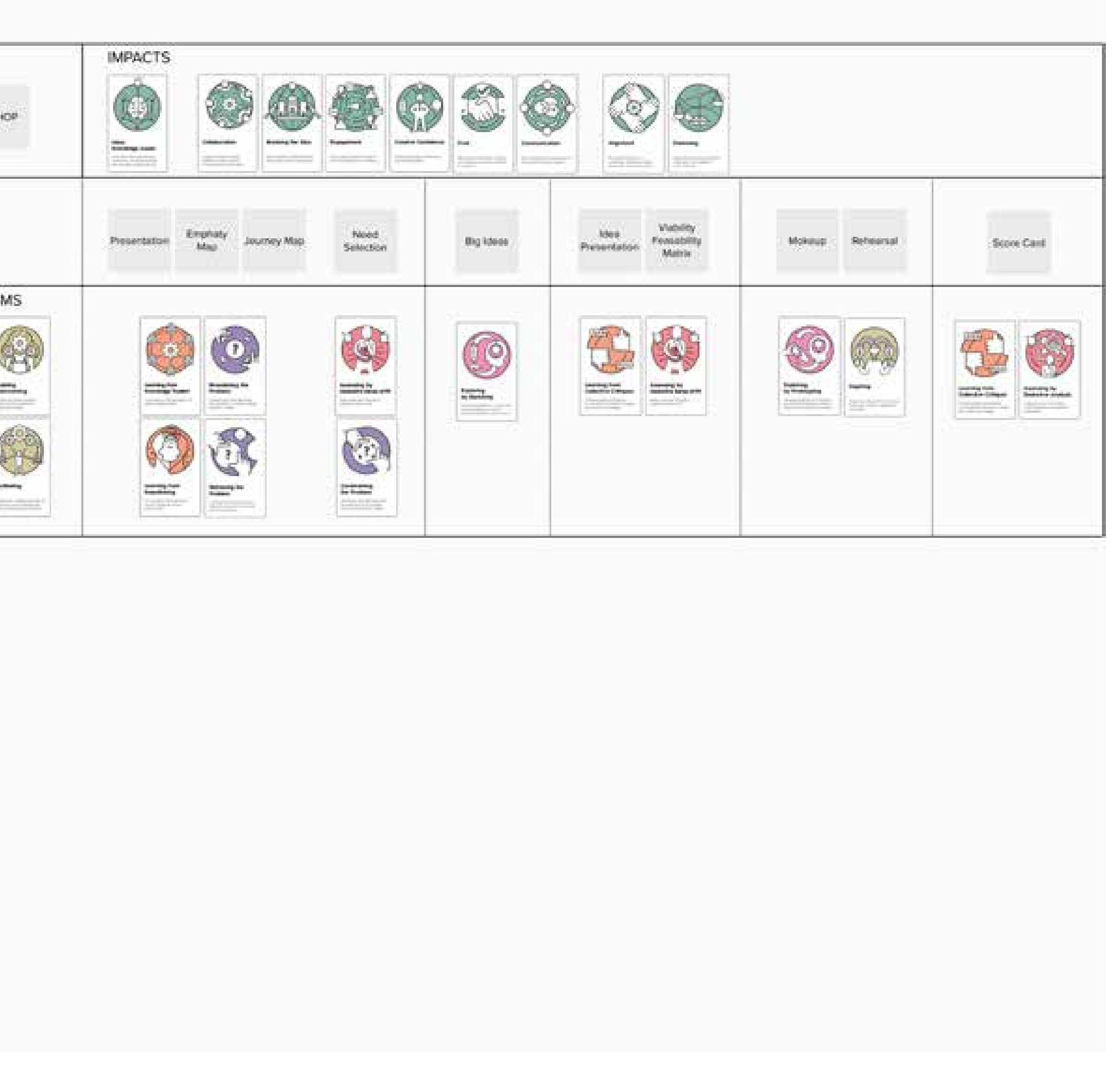


Figure 4.1 Werwashing practice map (2018 – 2022).


IMPACTS
Presentation
Emphaty Map
Journey Map
Need Selection
Big Ideas
Idea Presentation
Viability Feasability Matrix
Mokeup
Rehearsal
Score Card

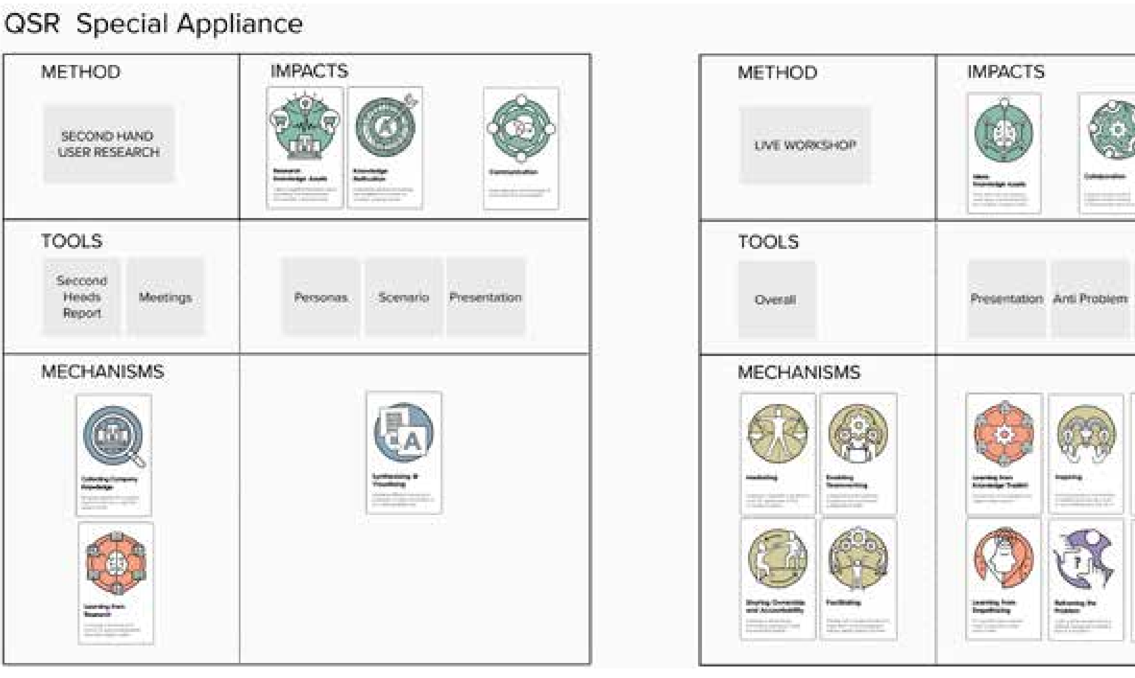


Figure 4.2 QSR special appliance practice map (2019)

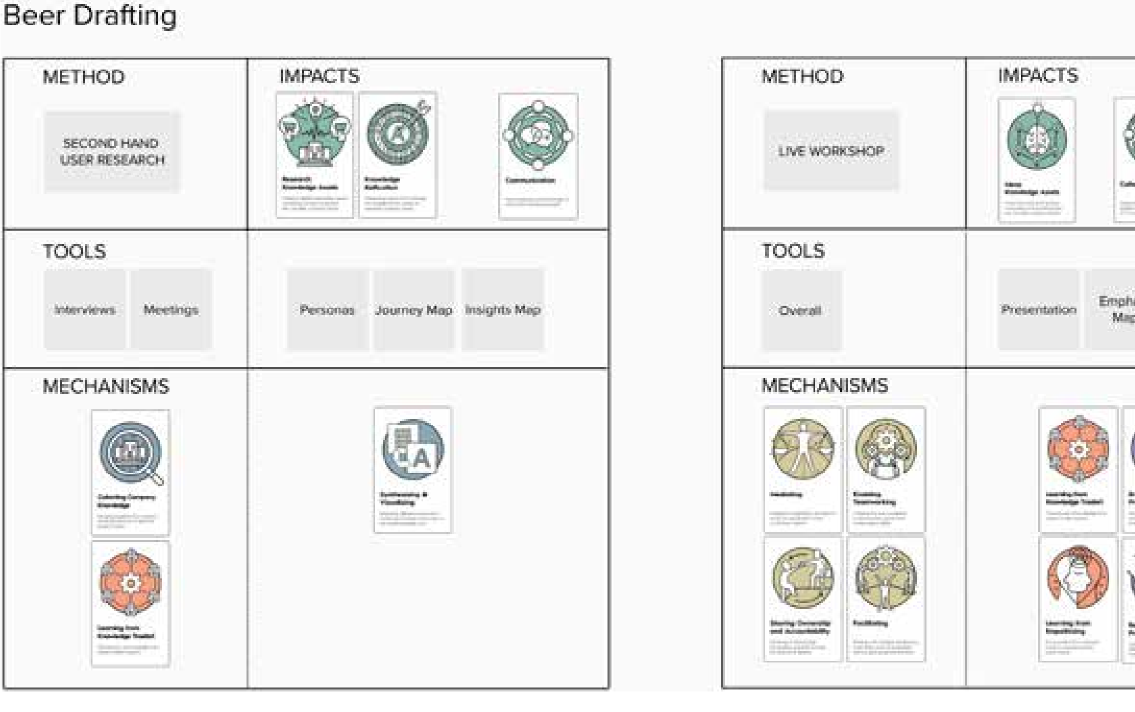
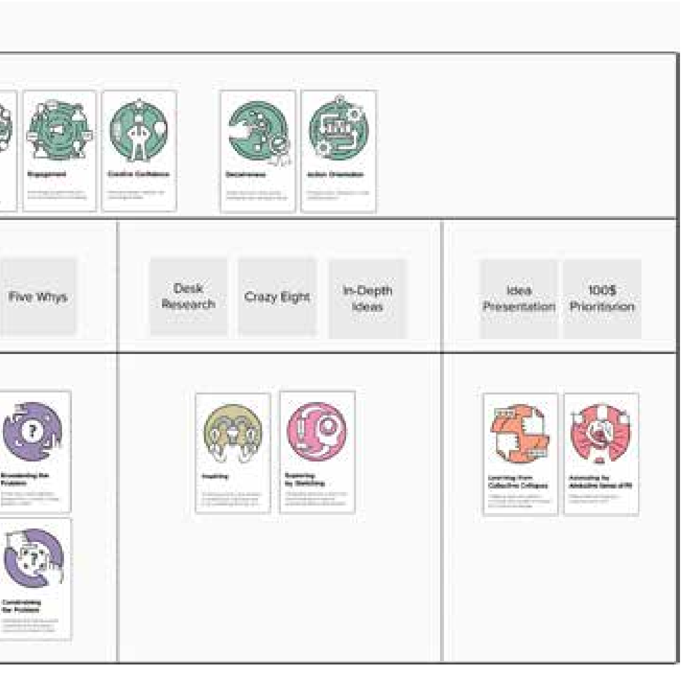
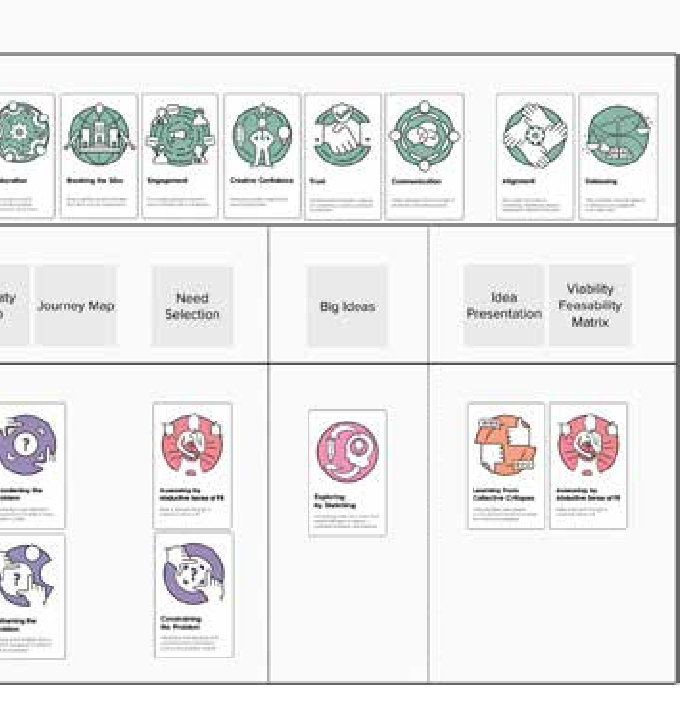


Figure 4.3 Beer drafting practice map (2019).


Five Whys
Desk Research
Crazy Eight
In-Depth Ideas
Idea Presentation
100$ Prioritisation


Journey Map
Need Selection
Big Ideas
Idea Presentation
Viability Feasability Matrix

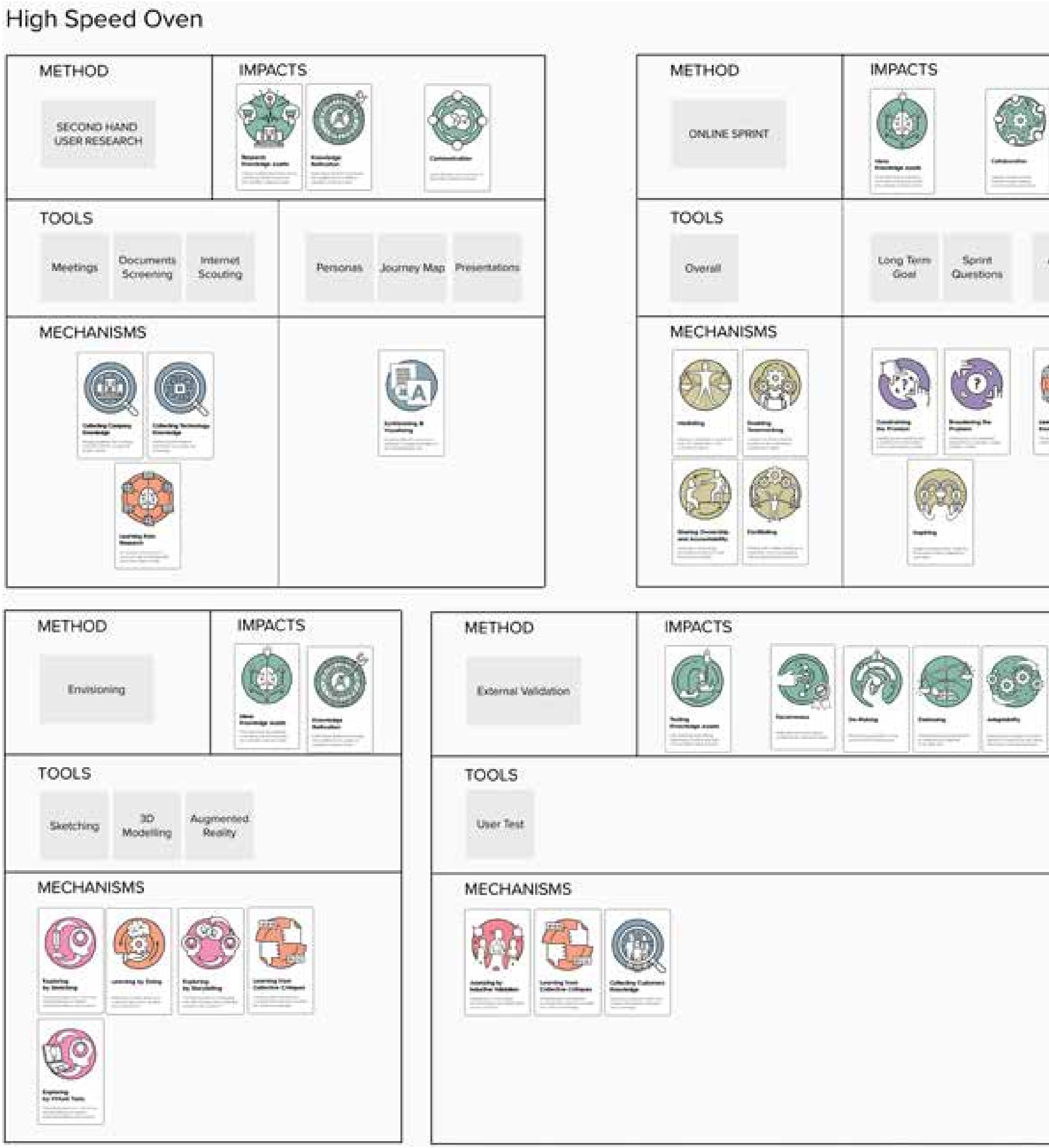


Figure 4.4 High-speed oven practice map (2020 – 2022).

Ask the Expert
How Might We Note
How Might We Map
Dot Voting
Lightning Demos
Ideas Notes
Crazy Eight
In-Depth Ideas
Art Museum
Speed Critique
Strowpoll
Deciders Dot Voting

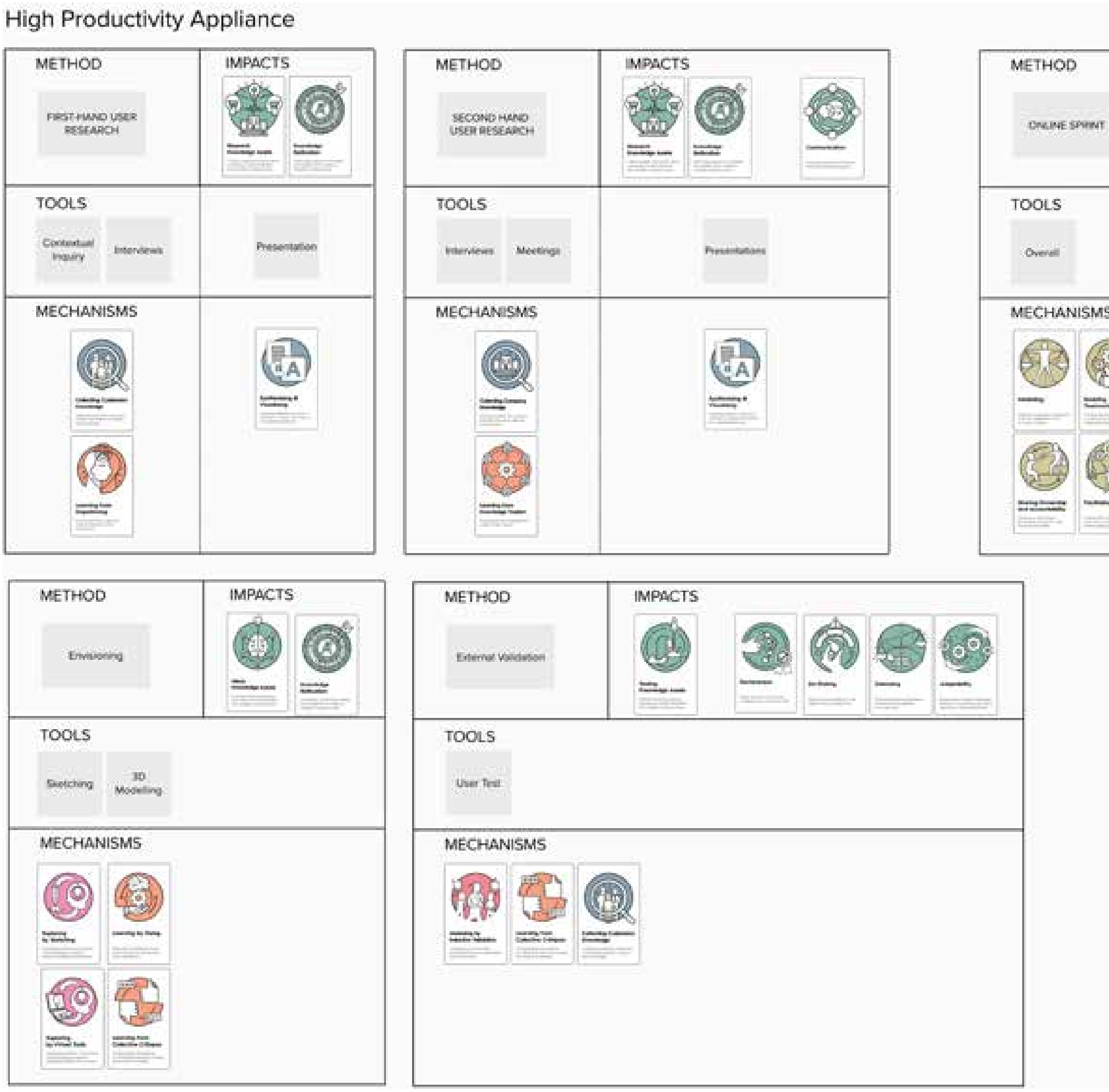


Figure 4.5 High productivity appliance practice map (2021 – 2022).


IMPACTS
Long Term Goal
Sprint Questions
Ask the Expert
How Might We Note
Dot Voting
Lightning Demos
Crazy Eight
In-Depth Ideas
Art Museum
Speed Critique
Strawpoll
Deciders Dot Voting

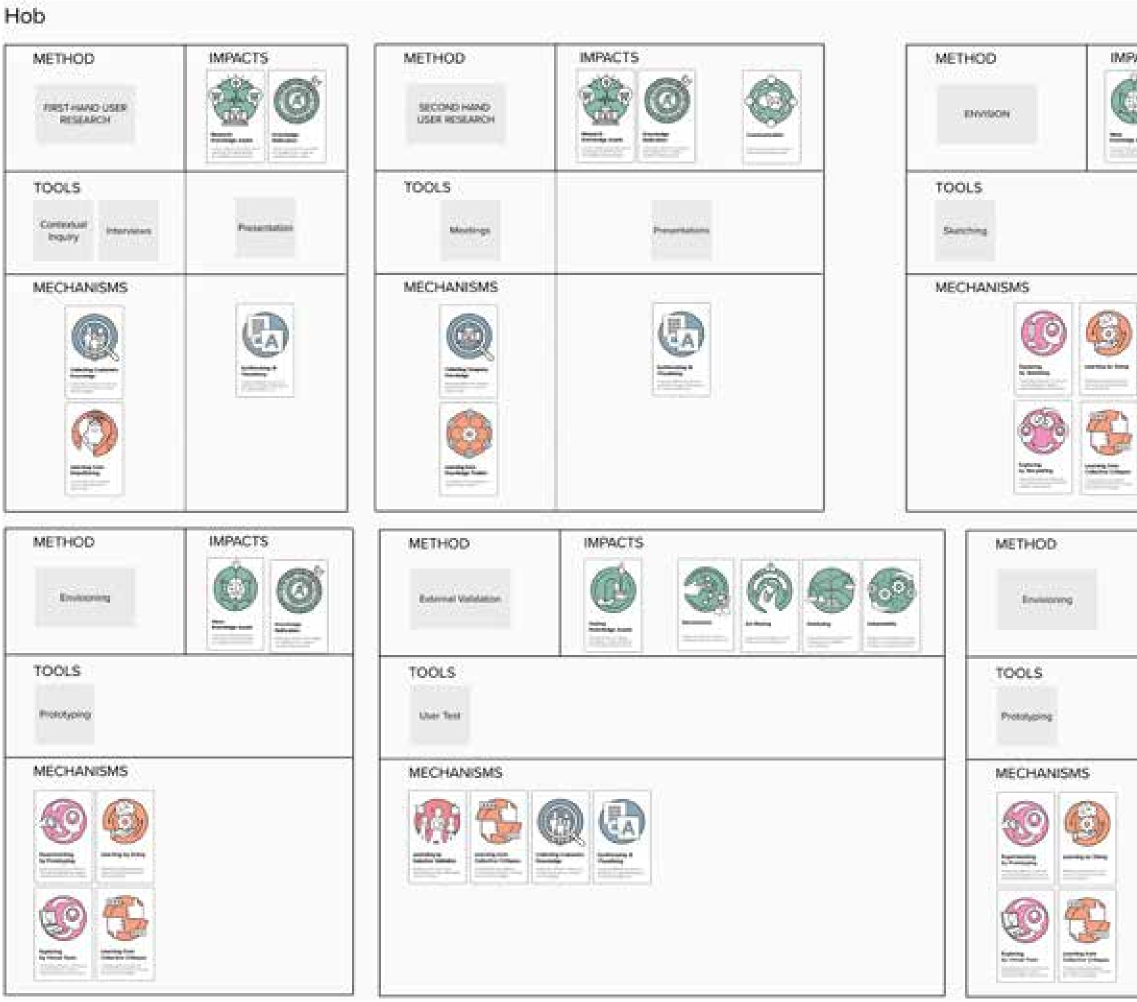
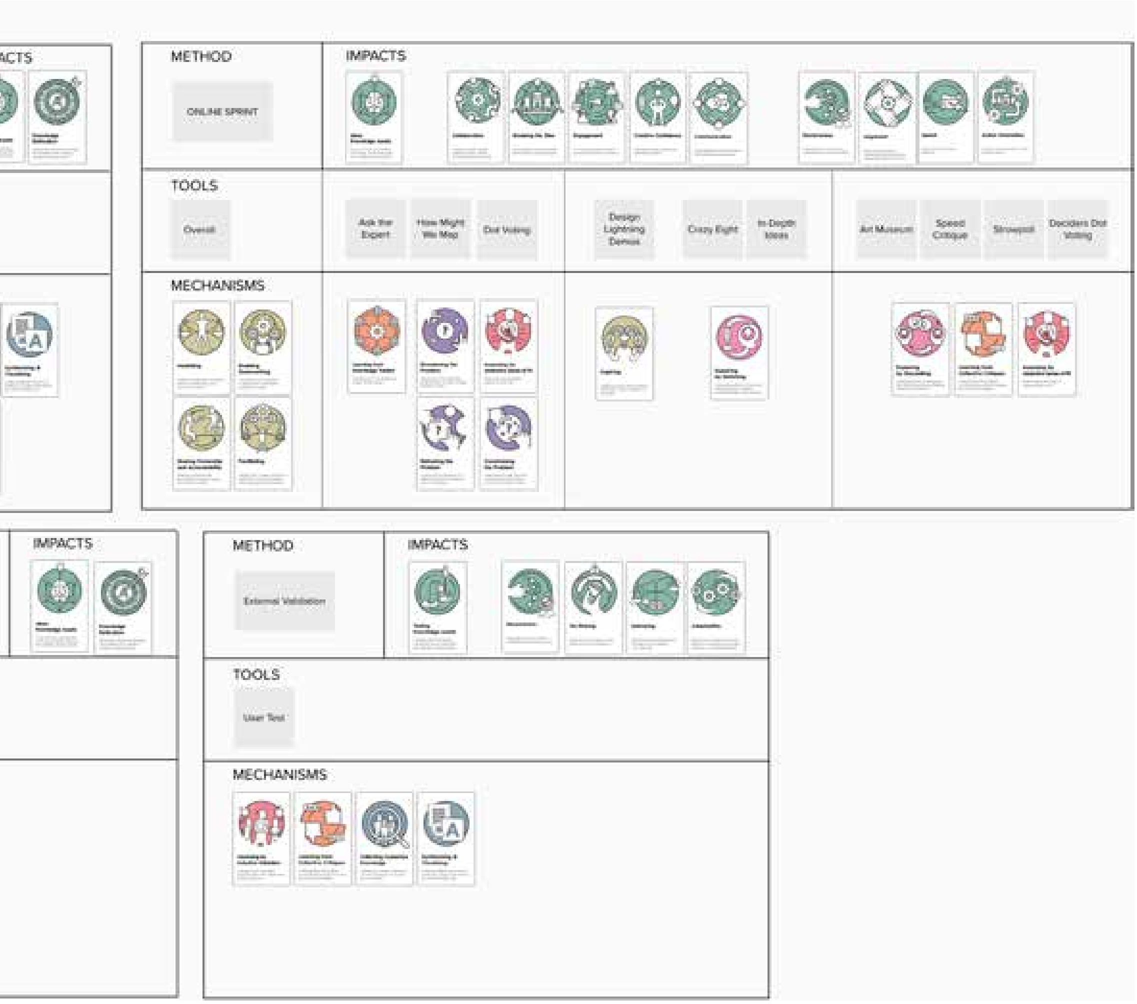
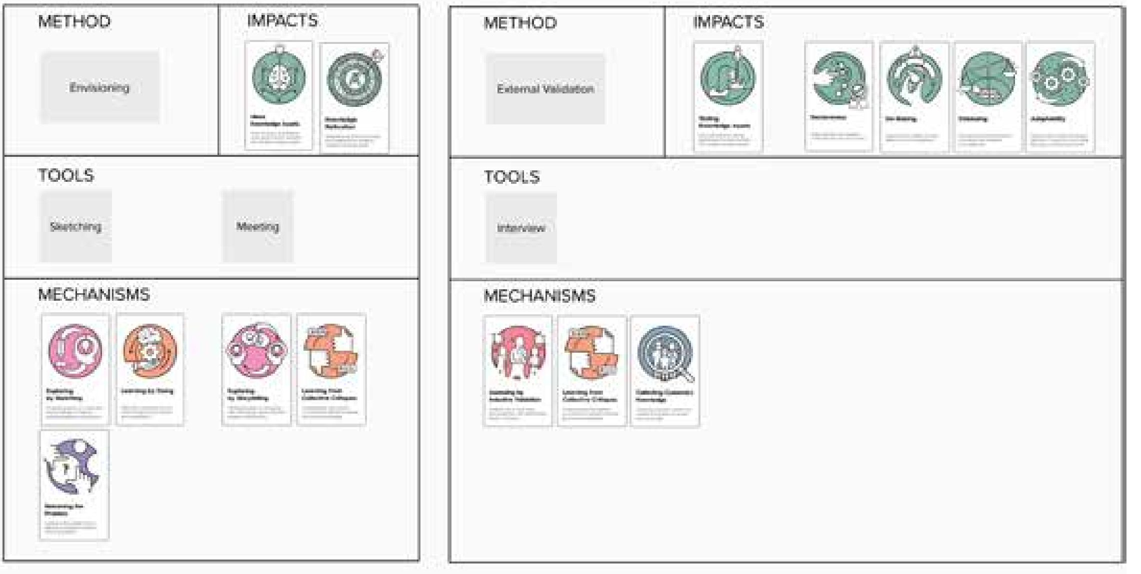


Figure 4.6 Hob (2021 – 2022).



ACTS
METHOD
IMPACTS
ONLINE SPRINT
TOOLS
Overall
Ask the Expert
How Might We Map
Dot Voting
Design Lightning Demos
Crazy Eight
In-Depth Ideas
Art Museum
Speed Critique
Strawpoll
Deciders Dot Voting
MECHANISMS
IMPACTS
METHOD
IMPACTS
External Validation
TOOLS
User Test
MECHANISMS

Figure 4.7 Holding station practice map (2021 – 2022).


METHOD
IMPACTS
Envisioning
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Sketching
Meeting
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METHOD
IMPACTS
External Validation
TOOLS
Interview
MECHANISMS

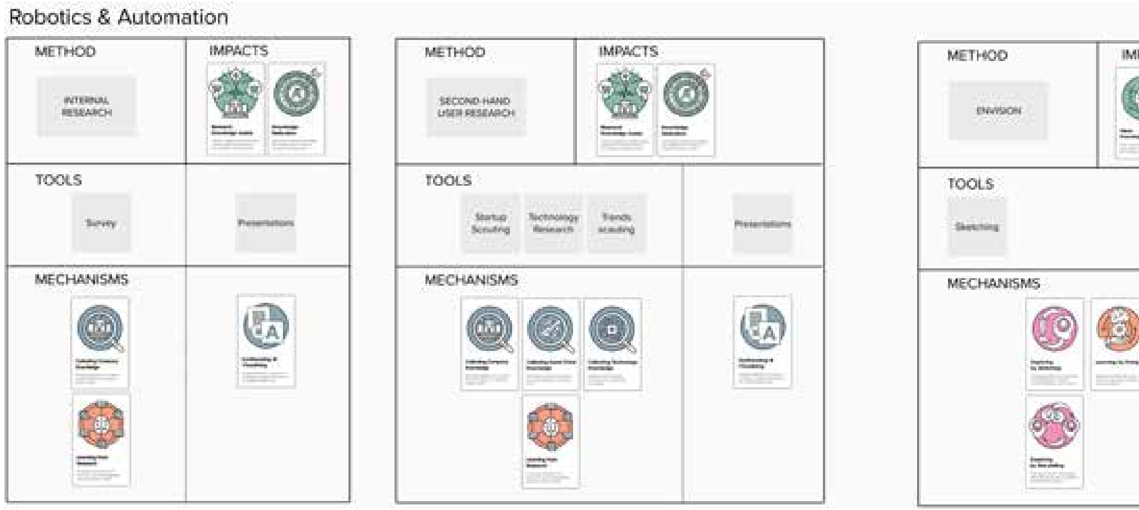


Figure 4.8 Robotic & automation practice map (2021).

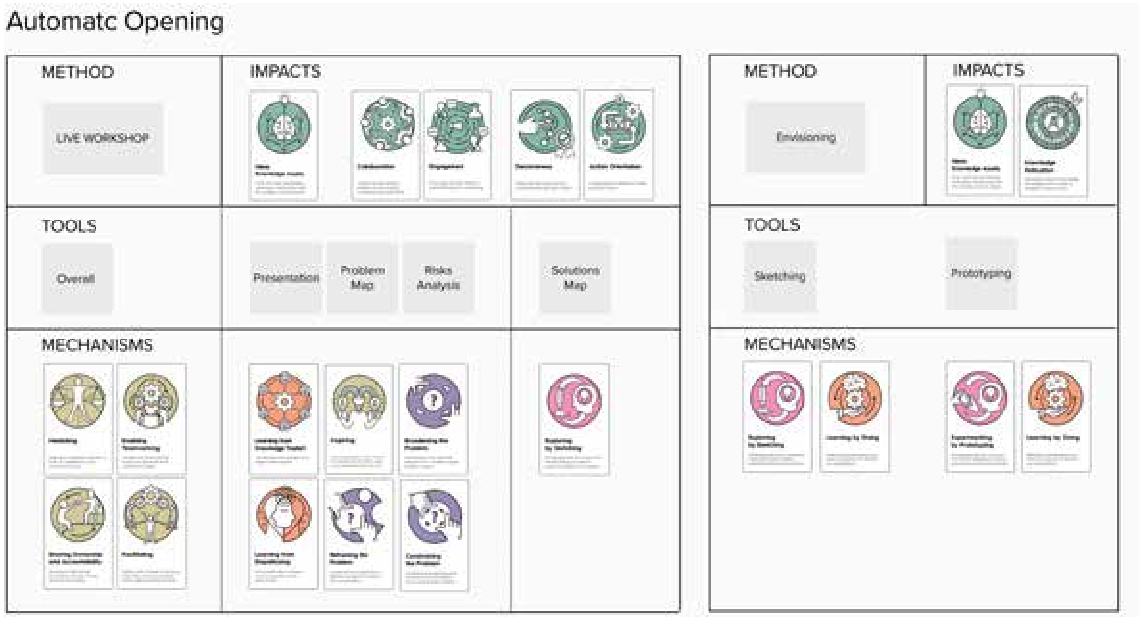
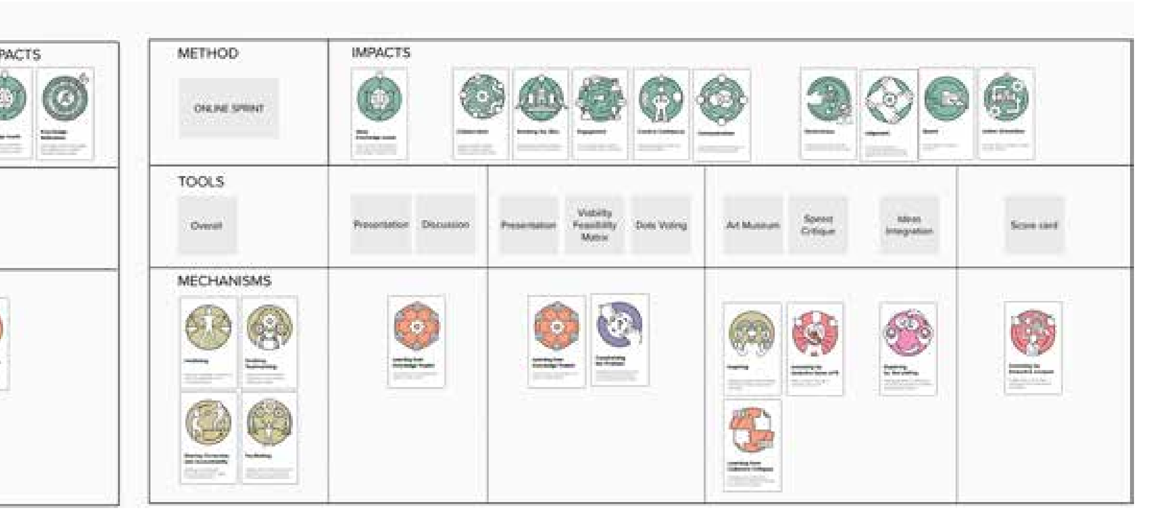
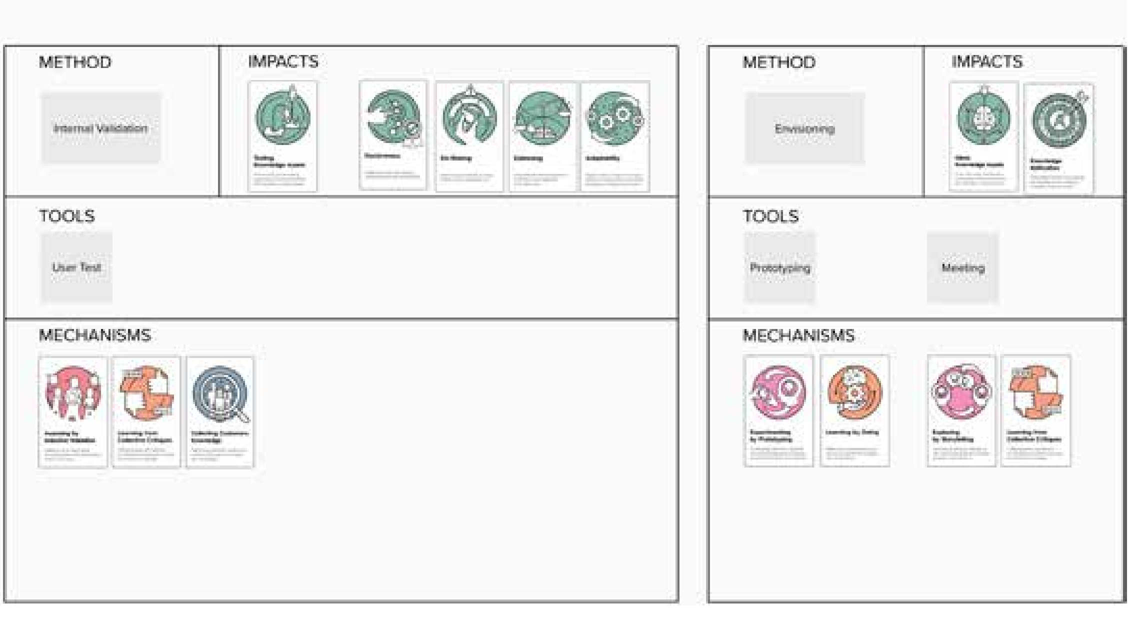


Figure 4.9 Automatic opening practice map (2021 – 2022).


IMPACTS
METHOD
ONLINE SPRINT
IMPACTS
TOOLS
Overall
Presentation
Discussion
Presentation
Viability Feasibility Matrix
Dots Voting
Art Museum
Speed Critique
Ideas Integration
Score card
MECHANISMS


METHOD
Internal Validation
IMPACTS
TOOLS
User Test
MECHANISMS
METHOD
Envisioning
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TOOLS
Prototyping
Meeting
MECHANISMS

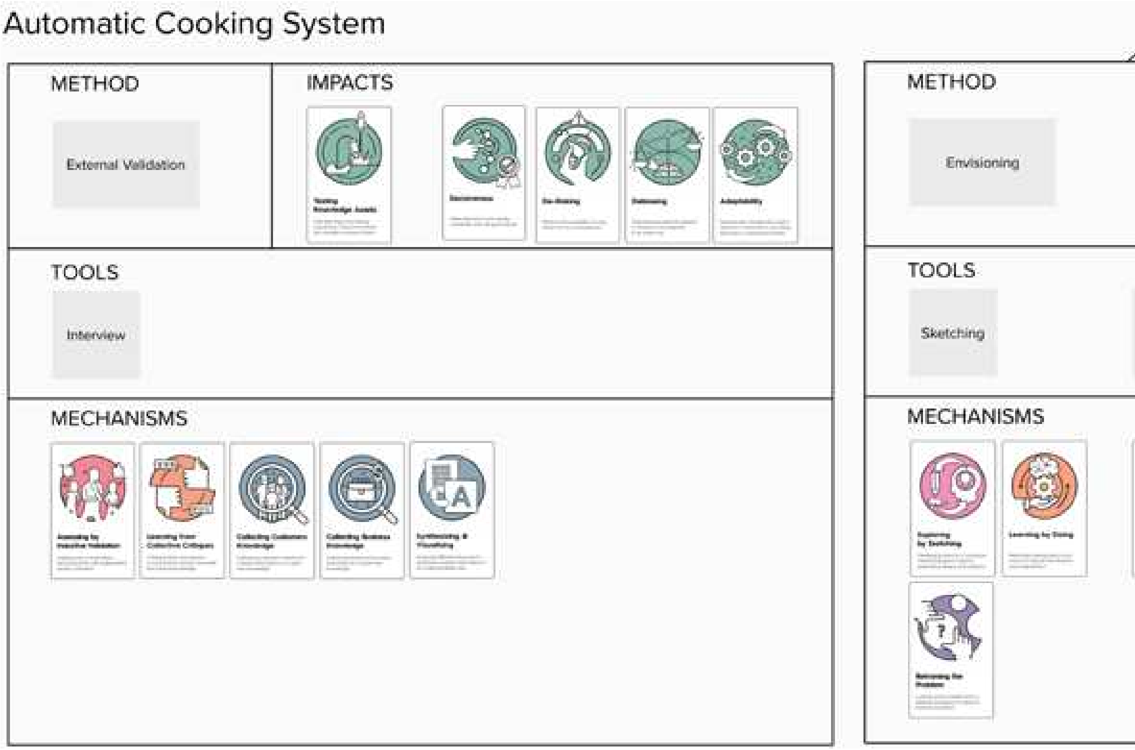


Figure 4.10 Automatic cooking system practice map (2021 – 2022).

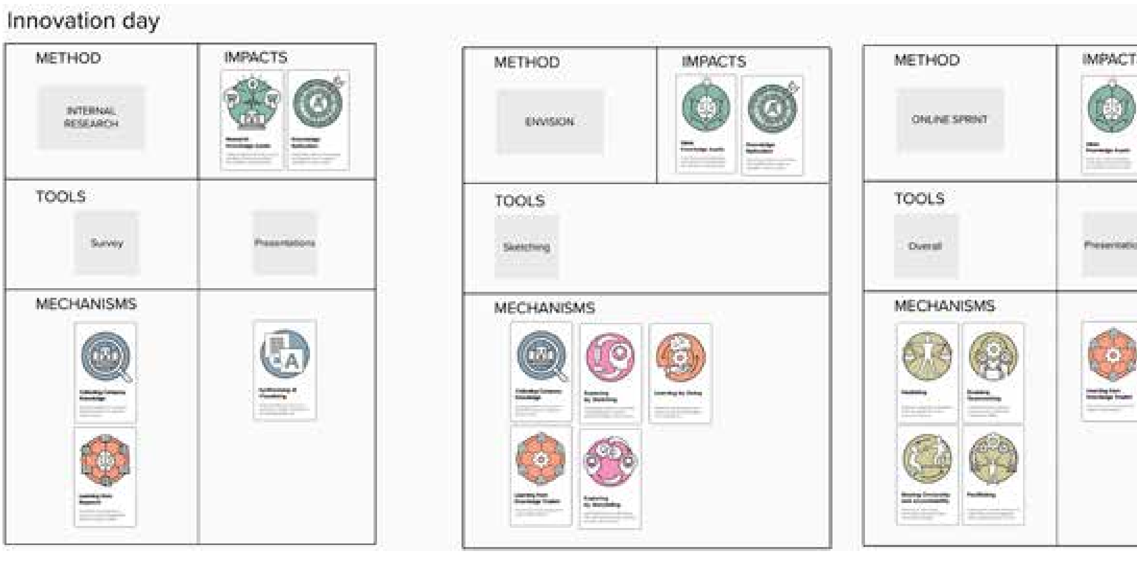
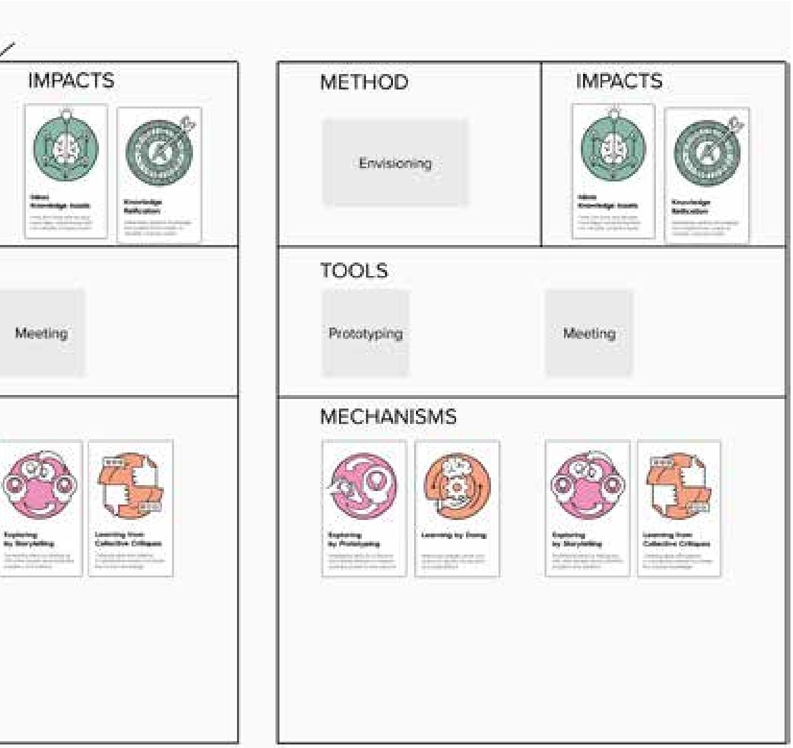
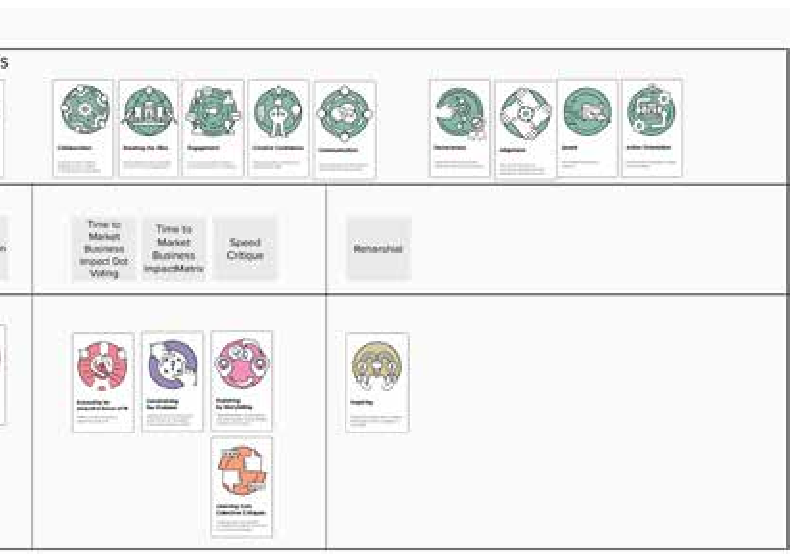


Figure 4.11 Innovation day practice map (2022).


IMPACTS
Meeting
METHOD
Envisioning
IMPACTS
TOOLS
Prototyping
Meeting
MECHANISMS


Time to Market Business Impact Dot Voting
Time to Market Business ImpactMatrix
Speed Critique

Cluster Analysis

The mapping activity led to a schematic representation of the projects that the researchers cross-analysed to determine the practises' commonalities and differences.

The analysis considered five main factors. The "activity path" variable indicates the high-level course of action, summarising each step in four essential activities: research (Re), participatory workshop (Pw), envisioning (En) and validation (Va). The "what" variable defines what the practice focus on: designing new features for an existing project (Fe), selecting ideas for innovative projects (Pr), and improving a solution (Im). The "When" variable classifies when it is employed along the company decision-making chain: project strategy (Ps), Project requirements (Pr), and product development (Pd). The "Why" variable noted the reason why the practice is used: to align (Al) the team on a shared decision, concept development (Cd) or idea generation (Ge). Finally, the "Who" variable establishes which function has been involved in the practice: business functions (Bu) or technical functions (Te).

The analysis (Table 4.2) chronologically lists the projects considered, exploiting the abovementioned variables to organise the practice in coherent categories (Table 4.3). The pattern that emerged is shown and discussed in the following paragraphs using three case studies as examples to argue the study's results.

Case Study

The cluster analysis highlighted three categories of practices employed by the Electrolux Professional design and innovation team. To discuss and argue their distinctive elements, the researcher selected a weighty example for each cluster to build a case study, contextualise and discuss their characteristical factors.

The case study methodology entails the study of one or more "cases" that could be described as instances, examples, or settings where a phenomenon can be examined (Mills, Durepos, & Wiebe, 2010). To explore the design thinking practices, the researcher considered the previous cluster analysis to orient the case study boundaries. Defined the three categorisations, the researcher selected one case for each, considering the

Project	Activities Path	What	When	Why	Who
Wearwashing	Re; Pw; En; Va	Fe	Pr	Al, Ge	Bu; Te
QSR Special Appliance	Re; Pw	Im	Pd	Ge	T
Beer Drafting	Re; Pw	Fe; Pr	Pr	Al; Ge	Bu; Te
High-Speed Oven	Re; Pw; En; Va	Fe	Pr	Al, Ge	Bu; Te
High Productivity Appliance	Re; Pw; En; Va	Fe	Pr	Al, Ge	Bu; Te
Hob	Re; En; Pw; En; Va; En; Va	Fe	Pr	Al, Ge	Bu; Te
Holding Station	En; Va; En; Va; En; Va	Pr	Ps	Cd	Bu; Te
Robotics & Automation	Re; En; Pw	Pr	Ps	Al	Bu
Automatic Opening	Pw; En, Va	Im	Pd	Ge	T
Automatic Cooking System	En; Va; En; En	Pr	Ps	Cd	Bu; Te
Innovation Day	Re; En; Pw	Pr	Ps	Al	Bu

Table 4.2 Cluster Analysis.

Project	Category
Wearwashing	Project Requirements
QSR Special Appliance	Product Development
Beer Drafting	Project Requirements
High-Speed Oven	Project Requirements
High Productivity Appliance	Project Requirements
Hob	Project Requirements
Holding Station	Project Strategy
Robotics & Automation	Project Strategy
Automatic Opening	Product Development
Automatic Cooking System	Project Strategy
Innovation Day	Project Strategy

Table 4.3 Practice categorisation.

confidentiality of the project[224], the relevance of the practice[225] and the completeness[226] (Table 4.4). There were two possibilities for the "Product Development" case: the "QSR special appliance" or the "Automatic opening". Despite the higher relevance, the choice felt on the first practice mainly for completeness reasons. For the "Project Requirement" case, it was selected the "Hob" practice. Indeed, it was the latest practice run in this category, displaying the best scores in the other criteria. Finally, for the "Project Strategy" example, it was selected the "Robotic and Automation" and the "Automatic Cooking System" practices. However, for the sake of the case study, they could be considered a single practice that involved the innovation team in activities that are consequences of one another. This element is the main discriminant that guided the selection choice. Indeed, even if this practice has a high level of confidentiality and is still running, the relevance is much higher than the others, making it unique.

The purpose of these case studies is to provide descriptive information about the selected examples and to support the theoretical relevance driven by the analysis of the practices. For this goal, the methods used have an explanatory scope (Yin, 2017): a case study whose purpose is to explain how or why some condition came to be or why some sequence of events occurred or did not occur. Each case used the maps of the practices to mark the chronological events that occurred, exploiting the design thinking framework contents as shared guidelines to narrate the three stories coherently.

Each case study is subdivided into sub-paragraphs: firstly, explaining the context of the practice; secondly, the narration is marked by the activity path identified in the cluster analysis. Finally, the three case studies are compared in the last paragraph using the cluster analysis factors to argue the fundamental differences and similarities in the Electrolux Professional design thinking practices. Due to confidentiality reasons, the name of the projects and the people involved have been

224 The confidentiality criteria consider the level of secrecy of the project. If the project successfully arrives on the market, its secrecy is low. If it is still under development, its secrecy is high. It is medium if it is on the market, but there are still son confidentiality issues. This criterion influences how many details could be described in the case, increasing the case's descriptive value.

225 The relevance criteria consider the practice degree to which it is helpful to explain the characteristics of the cluster. Due to the practice influence, the results achieved or its maturity level.

226 The completeness criteria indicate whether the design thinking practice has been completed or is still running. This criterion influences how exhaustive the case could be.

Projects Analysed	Categories	Confidentiality	Relevance	Completeness
Warewashing	Project Requirements	High	Medium	Completed
QSR Special Appliance	Product Develop-ment	Medium	Medium	Completed
Beer Drafting	Project Requirements	High	Low	Completed
High-Speed Oven	Project Requirements	High	Medium	Completed
High Productivi-ty Appli-ance	Project Requirements	High	Medium	Completed
Hob	Project Requirements	High	High	Completed
Holding Station	Project Strategy	Low	Medium	Completed
Robotics and Automation	Project Strategy	Medium	High	Completed
Automatic Opening	Product Develop-ment	High	High	Still Running
Automatic Cook-ing Sys-tem	Project Strategy	High	High	Still Running
Innovation Day	Project Strategy	Medium	High	Completed

Table 4.4 Boundaries Setting: underlined the projects selected for the case study.

changed. Moreover, considering the practices' confidentiality level, the details about solutions and the supporting pictures have been omitted or modified.

Electrolux Professional Practices

The case base analysis identified differences and similarities in the Electrolux Professional design thinking practices. This paragraph exploits that information to describe and compare three case studies that exhaustively illustrate the characteristics of the design thinking practices in Electrolux Professional.

The same pattern of activities

Methods, tools, and mechanisms employed differ from project to project. No one is the exact repetition of another one. The methods used, the sequence of tools and the consequent strategies employed are continuously adapted to the needs and context of the project. Thus, we can say that there is no unique design thinking practice in Electrolux Professional.

Although their differences, the analysed practices showed the repetition of a common pattern, sequentially combining four interconnected actions. Research activity used "collecting and synthesising" strategies to generate reified knowledge assets usable by a larger group of people. Participatory workshops are complex and highly structured activities that align people on decisions. These practices exploit strategies from each category to collaboratively arrive at a common interpretation of the situation. This activity could involve creating and operating on pre-existing knowledge assets to make shared decisions. The envisioning methods used the "exploring" mechanisms to examine the hypothesis's consequences and develop them further, generating additional knowledge assets. Finally, validation practices use "evaluative" strategies to collect further knowledge about the ideas and support other decisions. In this sense, the design thinking practices in each project impact the organisation following the same pattern. It supports the accumulation, generation, and reification of knowledge assets that the organisation can exploit collaboratively to make decisions.

Different decisions, different practices

However, the practices seem to change in response to the decision it has to support. Approaches that support strategy decisions work differently than those focused on improving an existing solution. The cluster analysis showed that the main discriminant seems to be the company decision-making chain the practice aims to support.

Electrolux Professional's decision-making chain could be modelled in a five-level structure (Figure 4.12). The company strategy is at the top of the pyramid, with decisions influencing the organisation's aspiration. Then there is the project strategy decision, where the company has to choose which project challenge it wants to address. In the chain's middle, there are project requirements decisions where the characteristics of each project should be defined before the development. Then there are product development decisions influencing how the solution will look, how it functions, and how much it will cost. Finally, there are implementation decisions about who, how and where it will be manufactured. In this model, the stakeholders involved in the decision-making process are different. At the top of the chain are business-driven decisions about the company and the project strategy. While at the bottom of the chain are technical decisions about project development and manufacturing. In the middle of the chain is the definition of project requirements: where business and technical decisions should be balanced to find a joint agreement.

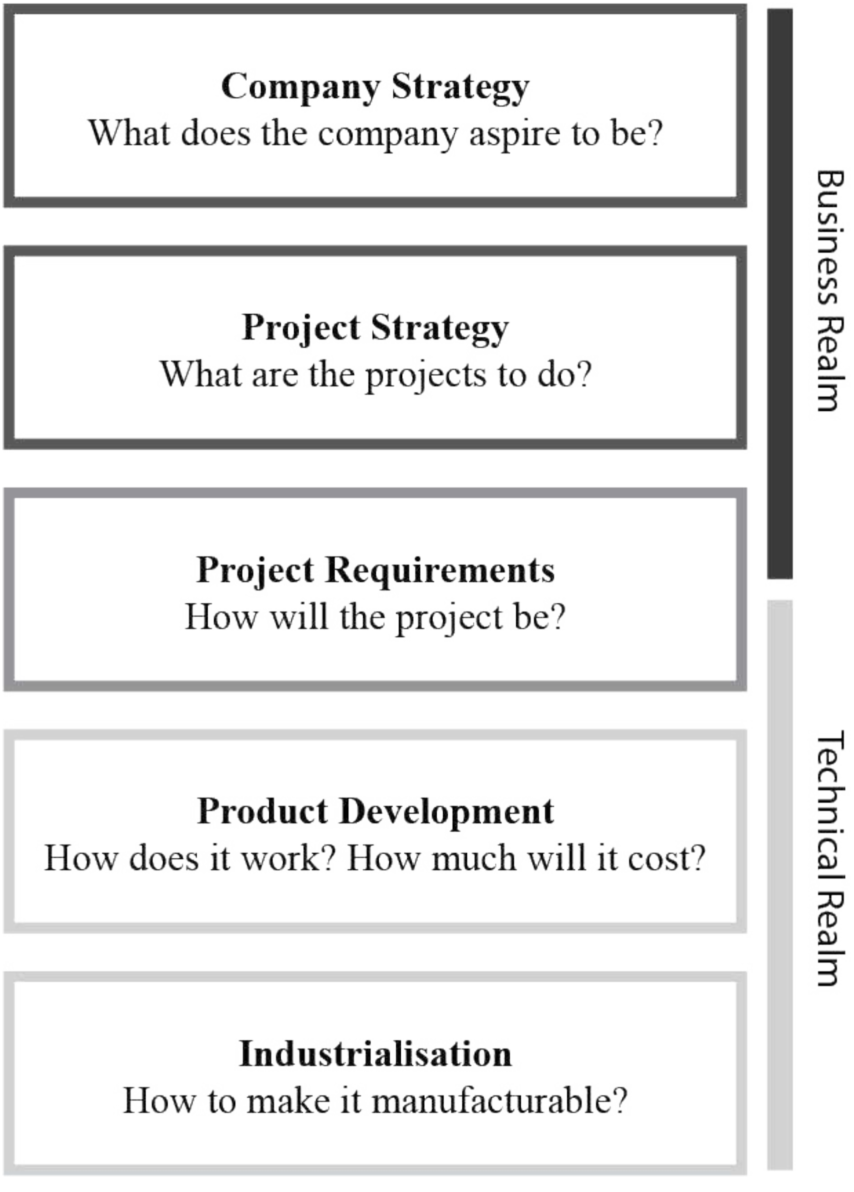


Figure 4.12 Electrolux Professional decision-making chain.

Three kinds of practices

Following the decision-making chain structure, the projects and practices analysed showed a profound interconnection.

Chronologically examining the projects, the innovation team progressively adapted their practices to work on a higher level of the decision-making chain. The higher the level, the higher the possibility of influencing the organisation's direction by having the opportunity to support more significant and potentially disruptive decisions. In this sense, analysing the progressive adoption of these practices in the decision-making chain gives a first clue of how effective design thinking was in supporting the design culture and leadership inside the organisation. According to the Electrolux Professional meanings[227], design thinking is a methodology to support innovation. By pursuing this aim, the team climb the organisation's decision-making chain, getting more influential and spreading the design culture at the top management level. Indeed, it is hard to truly innovate, working only at the bottom of the chain. Upper decisions already constrain innovation at the bottom, considerably reducing the potential degree of innovation. Almost only at the top of it the innovation potential could be disruptive.

The diversity of the contexts, stakeholders and subjects seem to make the design thinking practices differ depending on the decisions they have to support. Practices that support product development decisions involve a technical team to improve an existing solution through a participative problem-solving process. At this level, decisions at the aesthetical and functional level have a low degree of innovation, constrained by several upstream decisions. Practices that support product requirements decisions involve a business and technical team through a participative alignment process to select a shared set of features for an existing project and validate them. At this level, decisions about new functionalities have a moderate degree of innovation, but its potential is mainly incremental because the project's structural frame has already been decided. Practices that support project strategy decisions have been analysed as two separate procedures: one focused on prioritising the higher potential projects, and the other focused on exploring the consequences of those choices. The main difference is that the first practice generates multiple project opportunities, which usually have to be explored individually through a

227 See the meaning second Electrolux Professional meaning assessment in the second chapter.

dedicated procedure. However, they are one consequence of the other and could be debated as a single practice. In this sense, practices that support project strategy decisions involve a business team through a participative alignment process aimed at selecting a shared set of projects among several options. Then, the business and the technical team follow a developmental procedure to validate previous decisions. At this level, there is a higher potential degree of innovation thanks to the possibility of deciding the challenge the company have to face.

This categorisation displays a similar path and similar motivations at each level. However, they are not the same. A closer look at the adoption level reveals that the practices have different subjects and stakeholders to consider that inherently modify their characteristics. The following paragraph discusses three cases from the Electrolux Professional practice to illustrate the similarities and differences of each category.

Product Development: QSR Special Appliance

This first case study analyses the design thinking practice employed to support a product development decision about an appliance specifically designed for a quick service restaurant (QSR) chain. The practice goal was to solve a specific problem detected by the QSR in some of their stores. They noted that some insects got into the appliance, jeopardising food safety. This practice aims to find and select innovative solutions to avoid insects entering the machine.

Context

The request for collaboration arrived directly from the R&D team in September 2019, asking for support in developing a participative problem-solving workshop to address a request from the QSR. On that occasion, the technical team in charge of the project, aware of the participatory practices the design team was promoting, asked for collaboration. The leading actor of the group was the prominent supporter of the kaizen philosophy in the company that, finding process commonalities between the two approaches, promoted the process in his team.

Practice: Research

Defined the activity schedule with the R&D, the User Discovery and Experience Innovation[228] (UDEI) team tried to collect as much infor-

228 The design team that promoted the design thinking practices in the organisation was called “User Discovery and Experience Innovation” (UDEI). It was founded in 2018 and, in

mation as possible launching a research activity. However, the timing and geographic conditions for the investigation were tight[229]. Thus, the team opted for a second-hand research method to gather the needed know-how.

Collecting

For the scope, two main clusters of information were collected: technical, centred on the appliance, and human, centred on the context of the machine and the insects that could get into it. From the technical side, the UDEI team scheduled a series of meetings to support the creation of a presentation highlighting a general overview of the appliance's functionality and the critical areas from which the insect could enter (Figure 4.13). From the human side, the UDEI team asked service technicians to dig deeper into the issue by visiting the location to take pictures and asking employees about their habits in using the appliance. Finally, a subject matter expert in food technology was consulted to commission a study about the insects' habits and characteristics.

Synthesising

After data collection, the UDEI team synthesised all the knowledge collected into visual artefacts capable of making the data acquired usable during the workshop. The research output was two presentations: one about the technical elements and the other about the human aspects, such as contexts and insect characteristics. Moreover, the team generated two visual devices to empathise with information during a workshop exercise: Scenarios and Personas. The scenario (Figure 4.14) synthesises the context knowledge in a communicative artefact that people can use to emphasise the situation. It showed information about the QSR business, the employees' operations, and the environmental conditions. The personas (Figure 4.15) synthesise the knowledge of the subjects we want to know about. In this case, the insects and the information about the life cycle, attractive elements, and enemies. As a whole, data collected and reified become organisational assets of knowledge: usable content that improves communication supporting knowledge transfer and effective dialogue between functions.

2020, changed its name to the "Innovation Hub" team.

229 The timeframe to collect data was short: the workshop was scheduled three months after the kick-off meeting, and the context where the issue emerged was in Australia.

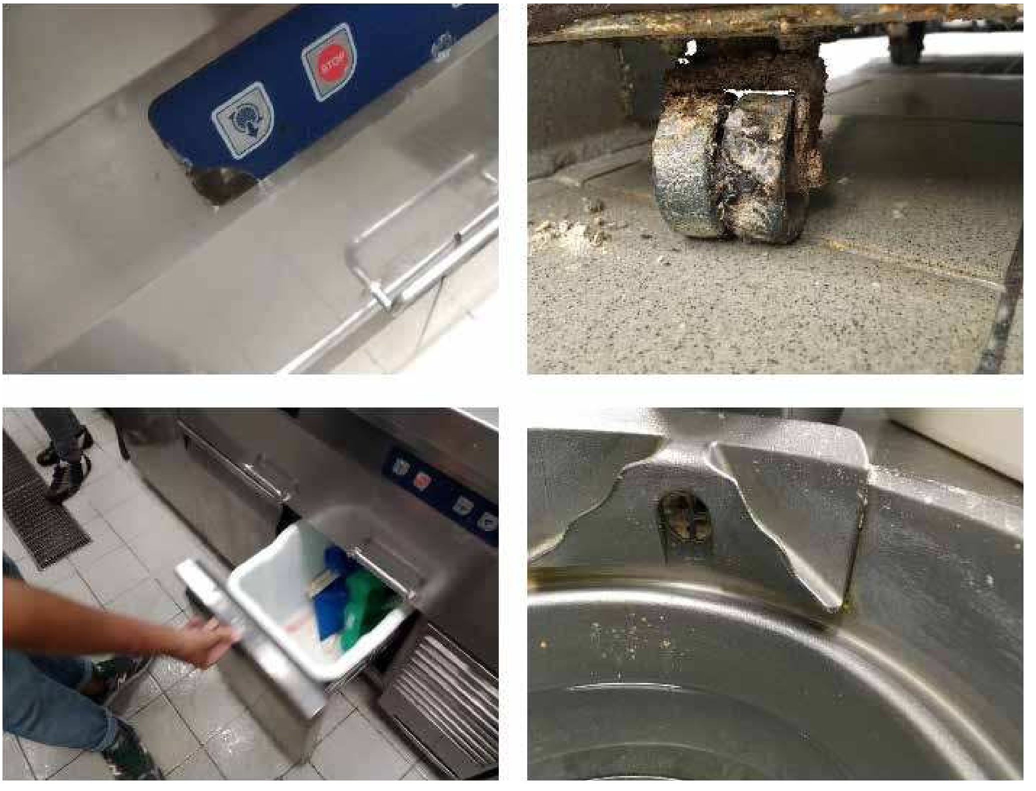


Figure 4.13 QSR special appliance: location pictures.

Figure 4.14 QSR special appliance: case study: scenario.

Figure 4.15 QSR special appliance: personas.

Practice: Participative Workshop

After the research, the UDEI team worked to organise the participative workshop. The activity was scheduled for a full immersion day in a dedicated room of the company where the propaedeutic material and the actual product under examination were fiscally organized in the location to inspire and inform the participants. The UDEI team planned to involve a group of highly knowledgeable subject matter experts supported by some designers and out-of-the-box participants from other functions. The team was composed of fourteen people: two designers, four service technicians, six R&D experts, and the two R&D decision-making leaders of the project. Due to the number of participants, the sample was split into two teams—each with a dedicated facilitator managing the workshop's schedule and timing.

Figure 4.16 QSR special appliance: Antiproblem.

Learning

The workshop started in a plenary session where subject matter experts took turns sharing the knowledge collected from two perspectives: technical and human. After a coffee break, the team split into two groups. The first tool used was the “Antiproblem” (Gray, Brown, & Macanufo, 2010), an ice-breaking exercise that helped the team engage the collaborative dynamic and enter a proactive mindset. The activity required each participant to find a creative solution to the opposite problem the workshop aimed to solve: fill up the appliance of insects (Figure 4.16). To do that, people have to read the personas and the scenarios previously developed and emphasise with them to imagine what could help or attract insects in the appliance. This exercise has a double role: support learning by emphasising the information collected and inspire people by breaking the ice and triggering crazy ideas that could even become a real solution if overturned.

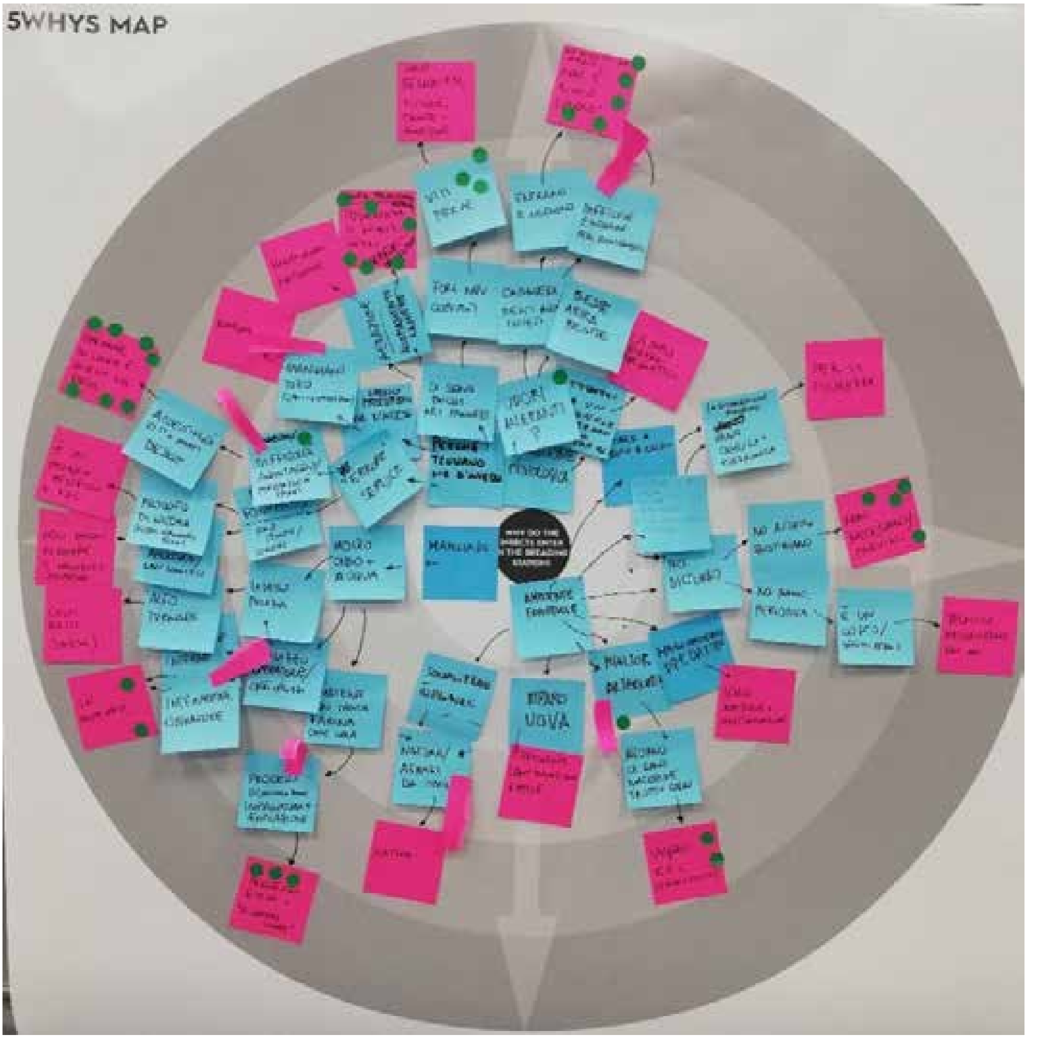


Figure 4.17 QSR special appliance: five whys.

Framing

To conclude the morning session, the two teams go into the "Five Whys" exercise to determine a shared problem frame. It is an iterative interrogative technique to explore the cause-and-effect relationship underlying a particular problem. It is a radial chart composed of five concentric circles, wherein the central one is written the main question: why do the insects enter the appliance? Then the group filled the second circle with their answers to that question. After that, the answers become questions until they ask five times whys (Figure 4.17). This way, the team move toward the root of the issue, broadening the problem space. For instance, in the first question, a group answered that insects entered because service technicians left the appliance panel open. Therefore, the second why was: why did service technicians leave the panel open? The answer was: sometimes they forgot to insert the screw back on the panel. So, why did they forget the screw? The answer was: that they lost it. Therefore, why did they lose it? Because the condition in which service technicians have to operate in such a context is messy and stressful, and it is easy to lose a screw. In this example, we can see how by digging into the issues, the problem space gets reframed: the problem is no more avoiding insects from entering but avoiding the service to losing the pannel's screws. Finally, after reframing, the exercise is concluded by dots voting the most challenging issues to select a shared frame.

Exploration

After lunch, the two groups came together for the solution-finding part. In the first step, each participant had time to run some informal research on the internet to take notes about examples and solutions and get inspiration. In the second one, the "Crazy Eight" tool aimed to loosen up the team's creativity by freely sketching multiple solutions (Figure 4.18). The exercise consists of a fast-sketching activity that challenges people to draw eight distinct ideas in eight minutes. No writing is allowed. Each participant folded a sheet of paper in eight parts, starting to sketch their idea following the facilitator's schedule. The exercise helps people to not stop at their first idea, develop it, look for other possible solutions and warm up their creativity. However, the results are more than mere personal reflections. They are propaedeutic for the last phase: the "In-Depth Idea". With this tool, participants must communicate their final idea through sketches and text. The format comprises a title that should frame the concept immediately and multiple drawings accompanied by short texts description that should explain the idea.

Evaluation

After a coffee break, the final part of the workshop focusses on decision-making. In this phase, each participant pitched their idea to the team for two minutes in an open arena with a three-minute Q&A session. This way, doubts about the concept were immediately clarified, and the critique from the audience increased the shared learning about the potential solutions. After that, decision-making was supported by the "100 Dollars" prioritisation tool: a technique that gives each participant

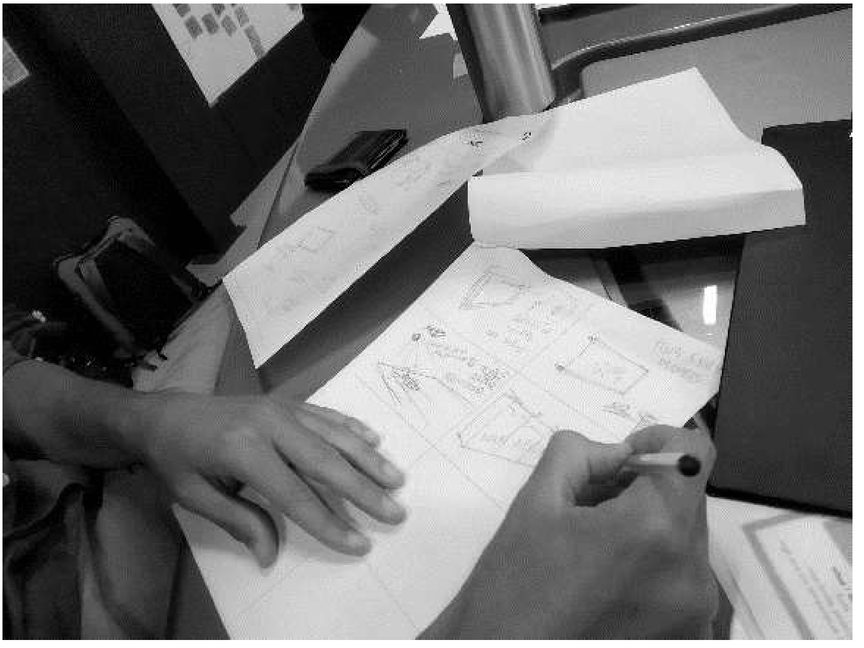


Figure 4.18 QSR special appliance: crazy eight.

Figure 4.19 QSR special appliance: 100 dollars prioritisation.

100 dollars in 10 dollars notes to bake the most promising ideas. To reduce internal biases, the team used envelopes attached below each idea as boxes to anonymise the backing amount. This approach exploits the participant's gut feeling to judge ideas. Indeed, the participant's subject matter experience was enough to make a good decision in such a technical context. At the end of the baking process, money was calculated to obtain a ranking of the best ideas.

Conclusion

After the workshop, the final ranking was discussed and evaluated by the decision-makers, and finally, two simple ideas were selected and implemented in the product. The first selected idea focused on finding a solution to the above example about the screw lost by the service technician. The idea was a simple screw that never unscrewed totally from the panel. This way, you solve the issue by substituting the type of screw for a slightly increased cost (Figure 4.20). The second one focused on replacing the wheel of the appliance with a skate-like foot. This way, in the face of a cost reduction, bugs will struggle more to climb the machine, maintaining at the same time the possibility of moving the appliance for cleaning purposes (Figure 4.21). The two solutions implemented were not the most baked in the last exercise. They were in the third and fifth positions of the ranking. However, this prioritisation exercise aims not to make mathematical decisions but to allow the team to give their opinion democratically and use that feedback to make the final decision.

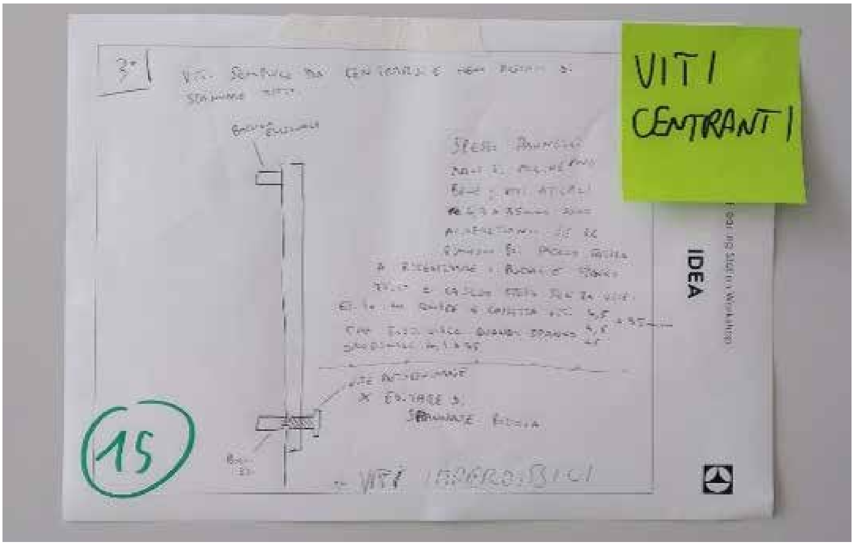


Figure 4.20 QSR special appliance: partially unscrewable screw.

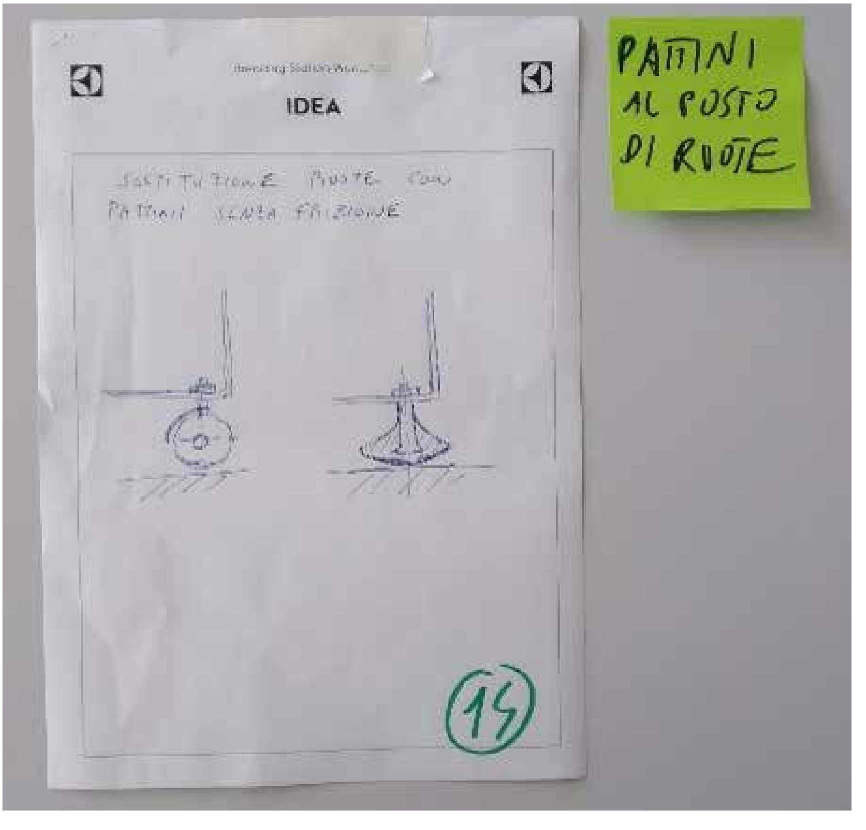


Figure 4.21 QSR special appliance: skate-like foot.

Project Requirements: Hob

This second case study analyses the design thinking practice employed to support project requirement decisions about a new hob designed for the professional segment. The practice goal was to co-create some innovative features to implement in the new hob and align a transversal team on selected a balanced set of requirements.

Context

The request for collaboration arrived directly from the Research and Development (R&D) and Product and Marketing (PM) food directors in December 2020, asking for support in developing a participative workshop to align the team to a shared set of requirements. This activity was the third of the kind that the UDEI team managed in the organisation with the same stakeholders. Firstly, the speed oven project in February 2020 and, almost in parallel, the high productivity appliance in January 2021[230] proved to internal projects' owners the value of this practice. Indeed, after the first promising results, the owners of the food category became strong sponsors and supporters of this method all over the organisation.

The practice owner was the User Experience (UX) team, which involved the UDEI team in supporting the participative practice creation. Indeed, at that time, the company's separation from the Electrolux group was changing the basic structure of the design department: changes that led the experience design team to become design and innovation. Following this reorganisation, the UDEI team became the Innovation team, less and less directly involved in the project requirements and product development practices but more focused on the project strategy topics. For this reason, defined the basic processes the whole design team take turns in managing the internal requests for participative activity by involving the UDEI/Innovation team as consultants for the design of the practices.

Practice: Research

Defined the activity schedule with the PM and the R&D. The UX and UDEI team tried to collect as much information as possible, launching a research activity.

230 For this project, the research started in the autumn of 2019. Still, after the covid sanitary situation, it was postponed. The high-productivity appliance and hob project move into the project requirement phase almost simultaneously: the first workshop in January and the second in March.

Collecting

On the one hand, recurring meetings with technical and business functions used second-hand research methods to set the basis for two presentations, summarising the needs of the two perspectives. On the other hand, a series of online interviews with chefs was scheduled to gather first-hand user information about their habits, needs and pain points related to the appliance.

Synthesising

After data collection, the UDEI team synthesised all the knowledge collected into visual artefacts, making it usable during the workshop. From the business side, a presentation synthesised the main project's goals, showing the market ambition, the competitor benchmarking, the features requested and the identified area for innovation. From the technical side, the presentation debated topics such as how technology works, its readiness, and examples of available technologies with their pros and cons. Finally, the human perspective uses the insights gathered to point out what users love about this kind of appliance and what they struggle to do with them, suggesting some strategies identified by the customer to overcome them. Even in this case, the knowledge collected and reified became an organisational asset, valuable to improve communication and support learning transfer between departments.

Practice: Participative Workshop

After the research, the UX and UDEI team worked to organise the participative workshop. The activity was scheduled for March 2020 in two slots of four hours on two consecutive days. The workshop was designed in a Mural[231] virtual environment where the design team developed the proper infrastructure to run the workshop. The practice took inspiration from the design sprint process (Knapp, 2016), modifying it to address the project needs. It was run digitally due to the covid sanitary situation. It was simplified to discard unnecessary phases[232]. Finally, it was compacted, considering only the first three days of the workshop, leaving the testing

231 Mural is a web app that offers a digital workspace for visual collaboration. You can create digital environments exploiting facilitation features to make meetings and workshops online more interactive.

232 These decisions were based on the experience accumulated using the process, the timing and medium constraints and the project's specific need. For instance, in this practice, they avoided the "Long Term Goal" and the "Sprint Questions" exercises because they were already clear to the team. The "Hoe Might Be" tool was simplified, pre-populating the board to reduce the timing.

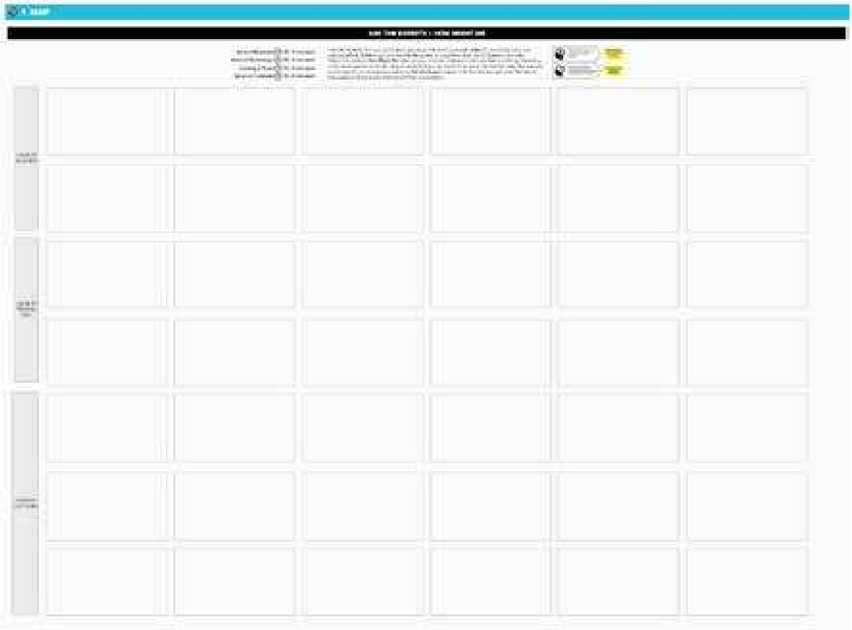


Figure 4.22 Hob: ask the expert.

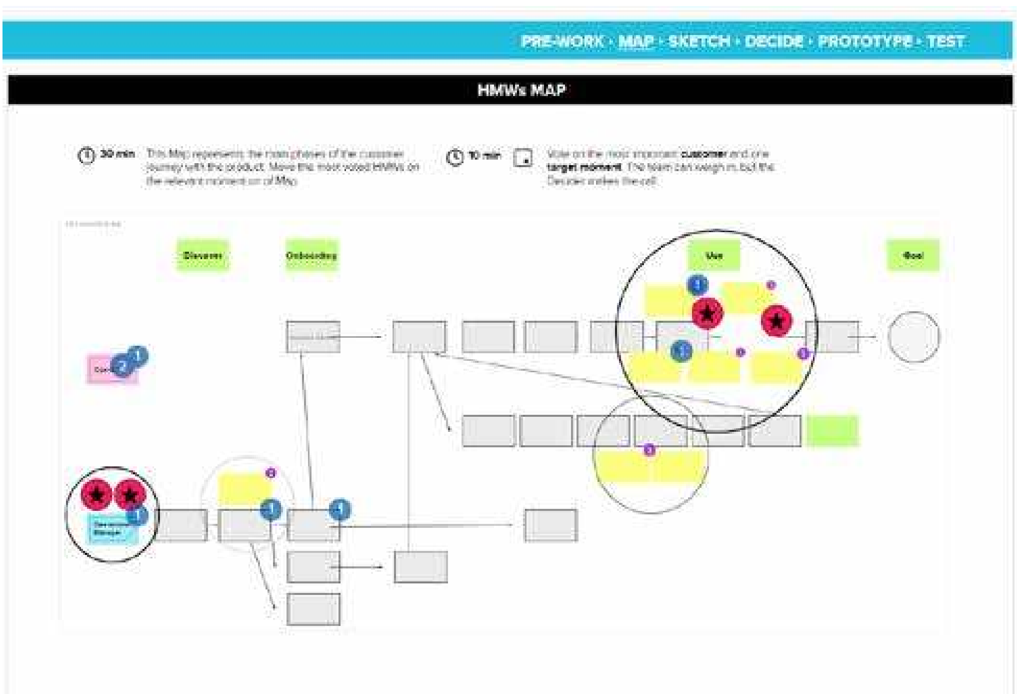


Figure 4.23 Hob: HMWs map.

part to other methods. The workshop participants were seven: four engineers from R&D, one designer, one chef from marketing, and the two decision-makers, from the technical and business sides. Moreover, two subject matter experts were involved in transferring their knowledge to the team. Two facilitators moderated the workshop's schedule and timing to manage the participative activity.

Learning

The workshop began with the "Ask the Expert" exercise (Figure 4.22)[233]. In this technique, subject matter experts took turns sharing their knowledge with the team in an open forum designed for a short presentation followed by a brief Q&A session. During the discussion, the advocate of business, technology and customers presented their slides in the virtual environment aligning the team on the same pool of knowledge.

Framing

After that, it followed the "How Might We Map", a revisited and simplified version of the Design Sprint exercise used to frame a shared understanding of the problem situation. Instead of following all the steps (the How Might Be sentence creation, the clustering and prioritisation, and the journey map visualisation[234]), the design team arranged in advance a journey map[235] with some HMWs sentences associated with each step of the journey. In this case,[236] the exercise prompted the team to discuss and modify the HMWs in the map and vote for them to align the team on which challenges should focus on, constrain the problem, and define a new shared frame (Figure 4.23)[237].

Exploring

After a brief break, the team worked toward the solution-finding part. In the first step, a revisited version of the "Lighting Demos"

233 The slides in the white rectangular spaces were deleted for confidentiality reasons.

234 The "How Might We" (HMW) exercise requires reformulating your knowledge in a format that challenges the entire team toward a specific direction. Creates an atmosphere for innovative solutions by reframing known challenges in new meaningful ways. In the sprint exercise, participants exploit the knowledge of the "Ask the Expert" to write notes that subsequently are translated into HMW sentences. Then, the team prioritise them, clustering and voting for the most promising ones. Finally, the team built a journey map where the HMWs are inserted and used to select the most critical customer and phase of the journey.

235 A journey map is a visual artefact that maps the experience of one or more customers using or accessing a specific product or service.

236 The process redaction was possible due to the previous knowledge accumulated and the level of pre-alignment that the team already had.

237 The content inside the post-its spaces were deleted for confidentiality reasons.

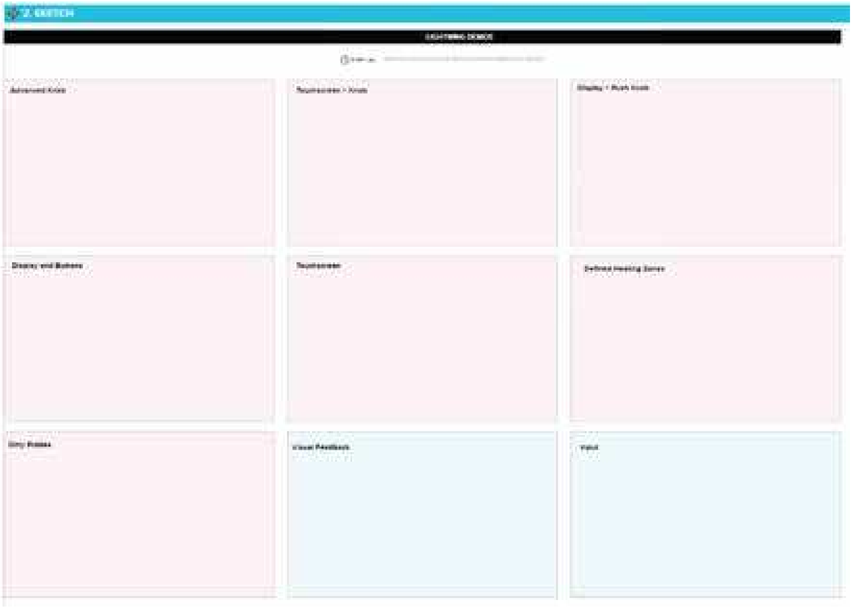


Figure 4.24 Hob: design demo.

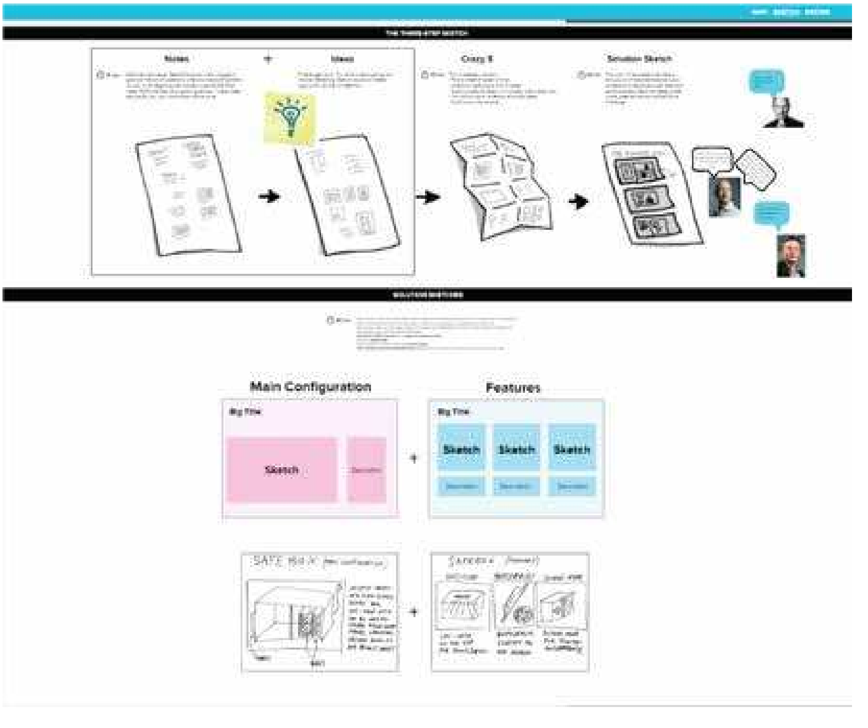


Figure 4.25 Hob: crazy eight and in-depth idea.

exercise[238] exploited previous arguments run among the design team as modular Lego bricks to inspire participants and unleash their creativity (Figure 4.24)[239]. Indeed, a few weeks before, the design team ran a pre-workshop to design possible high-level concepts focused on solving the critical issue pointed out during user research. A first brief alignment, followed by a one-week conceptualisation, and a second alignment to discuss the results produced a set of combinable and easy-to-modify concepts presented during the workshop. This experiment, called "Design Demos," used that work to inspire the participant creation, trying to get the best from the solo and participative approaches. This way, the solo design conceptualisation could happen with time and tools not allowed in a workshop. At the same time, the design concepts inspire the less skilled workshop participants to build upon them and design their alternative ideas.

In the second step, the "Crazy Eight" tool followed by the "In-Depth Idea support the participants' idea generation process[240]. To further facilitate the communication of the ideas, the design team prepared a detailed idea format. Each concept was described through two sheets of paper: one representing the main configuration of the idea, the other illustrating up to three detailed features that characterised the concept. Indeed, in the previous workshop activities, the UDEI team observed businesspeople struggling to express their ideas[241]. Formatting the concept in a clear structure showed better results, increasing creative confidence, and reducing the communication capability unbalances between the different functions (Figure 4.25).

Evaluating

The day after the creative part, the final part of the workshop focused on decision-making. This phase started with the "Art Museum" exercise. Like in a museum, all the ideas designed are anonymously attached to the virtual board and exposed to the team. In the first phase, each participant must silently read and dot vote on the most exciting parts

238 The "Lightning Demos" exercise asks participants to collect examples on the web of how other industries solved problems similar to the ones the team is trying to address. Then, each one has to present their arguments to the whole team. It is a powerful tool for inspiring and triggering imagination in the group.

239 The design demos sketches were deleted for confidentiality reasons.

240 The "Crazy Eight" and the "In-Depth Idea" exercises have already been described in the case study of the "QSR Special Appliance."

241 On the contrary, those who could express their ideas saw format as constrictions.

Figure 4.26 Hob: art museum, speed critique, straw poll and decision vote.

of the concepts. There is no limit to the dots to use. If you have doubts or questions, do not ask them directly, but write them down on a post-it. This part aims to develop a heat map representing the team's feelings and concerns. In the second step, called "Speed Critique", the facilitator synthetically summarises the idea leaving time to debate, critique and develop the concepts further. The facilitators moderated a streamlined debate by marking the time of each session and summarising the discussion outcome in a few post-its. In this process, the team systematically evaluates the idea, exploring the hypothesis's consequences through critical dialogue, progressively reaching a shared alignment.

Discussed the concepts, a "Strow Poll" voting session was used to show the popular opinion of the team. Each participant had to anonymously vote for the best two ideas presented to help decision-makers know the team's preferred directions and help them decide how to proceed. Indeed, as the Sprint methodology suggests, a democratic decision in a hierarchical environment as organisations seldom works. Some stakeholders must make certain decisions and bypassing that hierarchy could be counterproductive. These exercises aim to support and involve the team productively in decisions, leaving the final action to decision-makers. Indeed, the last activity, called "decisions vote", asked decision-makers to discuss the straw poll result and figure out the best way to move the project forward. In this phase, the two project owners from the business and technical sides bargained for solutions to find a shared agreement (Figure 4.26)[242]. In these and other similar practices analysed, the final selection did not focus on a single idea but combined two or more to get the best form of teamwork. The choice seems to focus mainly on a central idea that frames the general structure, combining it with other specific features hypothesised by the team.

Practice: Envisioning and Validation

After the participative practice, the UX and UDEI teams focused on envisioning the hypothesis decided by the team during the workshop.

First Cycle

The teams met in a full-day meeting organised in a workshop area of the company where it was possible to experiment with ideas in a collaborative environment. After a short alignment on the workshop's results, the two teams split the work in two—the UDEI team focused on

242 The solutions' sketches were deleted for confidentiality reasons.

physically prototyping the general structure to explore the idea through cardboard modelling. In parallel, the UX team designed the interface wireframe using digital tools to simulate the possible user interaction flows. At half of the day, the two parts of the prototype were combined to test the whole experience. The knowledge gained through the simulation addressed a partial re-design of the prototype. This approach was repeated till it achieved a good result.

After the envisioning activity, the UX team exploited the prototype to validate the hypothesis. Before the test, some meetings sharing the envisioning result activity aligned the project team on the solution to test, discussing the modality and the questions to present to the users. The sample selected was of nine chefs: five internal, part of the marketing division and four external, part of the Electrolux Professional Chef Academy[243]. The Design team run the validation in a training kitchen, asking the chefs to answer some questions[244] after completing simple tasks. The findings were summarised in a report and presented to the internal team. Based on that feedback, the stakeholders evaluated the prototype, debating and deciding what feature may be unnecessary and what aspects of the prototype could be the object of further inquiry.

Second cycle

After the first validation loop, the UX and UDEI teams worked on a second and more refined prototype version. The UDEI team commissioned an internal long-service prototype maker, a plexiglass version of the model, integrating knobs and branding elements for the physical part. For the digital aspect, the UX team develop a functional mockup prototyping the realistic interaction and an eye-catching interface using a smartphone screen as the medium. The UX team used the same sample and inquiry format in the second validation loop to assess the new prototype version. In addition, a User Experience Questionnaire[245] aimed to measure the interaction experience, using semantic differentials to identify the

243 Electrolux Professional Chef Academy is a global centre of excellence composed of more than 70 expert chefs worldwide.

244 Questions such as: Are the proposed concept meeting the chefs' needs? Is the user interface understandable, and can the most common use cases be accomplished? How is the workflow connected to the feature designed? Are proposed options and features considered valuable for the chefs? Which further ideas arise after this initial stimulation?

245 The scales of the questionnaire cover a comprehensive impression of user experience. Both classical usability aspects (efficiency, perspicuity, dependability) and user experience (originality, stimulation) are measured.

pragmatic and hedonic quality of the product. The survey and the user test results were again discussed with the project's stakeholders to decide the next steps. After this second loop, the team feels confident enough to define the requirements and move the project into the development phase.

Project Strategy: Automation & Robotics

This second case study analyses the design thinking practice employed to support project strategy decisions in the Automaton & Robotics field. The practice goal was to identify the best organisational opportunities and validate those decisions by envisioning and testing the selected ideas.

Context

The request for this activity arrived directly from the Chief Executive Officer in March 2021, asking for a company mobilisation toward a strategic topic: Automation & Robotics in the food segment. The new-born innovation team, composed of the Open Innovation (OI) and Innovation Hub (IH) functions, size the opportunity to design and test a new kind of practice.

This challenge required a completely different approach compared to the previous practices. Before focusing on the methods, the team first determine the research boundaries. The Innovation team stated the "Automaton & Robotics" challenge as identifying the possible opportunities Electrolux Professional could have decided to invest in within the next five years. The challenge was to support the executive team to frame such a big topic and constrain it toward concrete opportunities by making shared decisions. Then, explore and evaluate those opportunities to understand if they are worth investing in.

Practice: Research

In this case, the topic was too broad to face with the team's previous research methods. There was no defined field of action where to interview customers, no unique artefact to compare with competitors and no specific technologies. Several variables were considered to collect the information needed to support the framing process.

Collecting & Synthetising

From the human part, the team wanted to understand which customers could have been interested in automation, why they are looking for robotic solutions and their needs behind that. To answer these questions

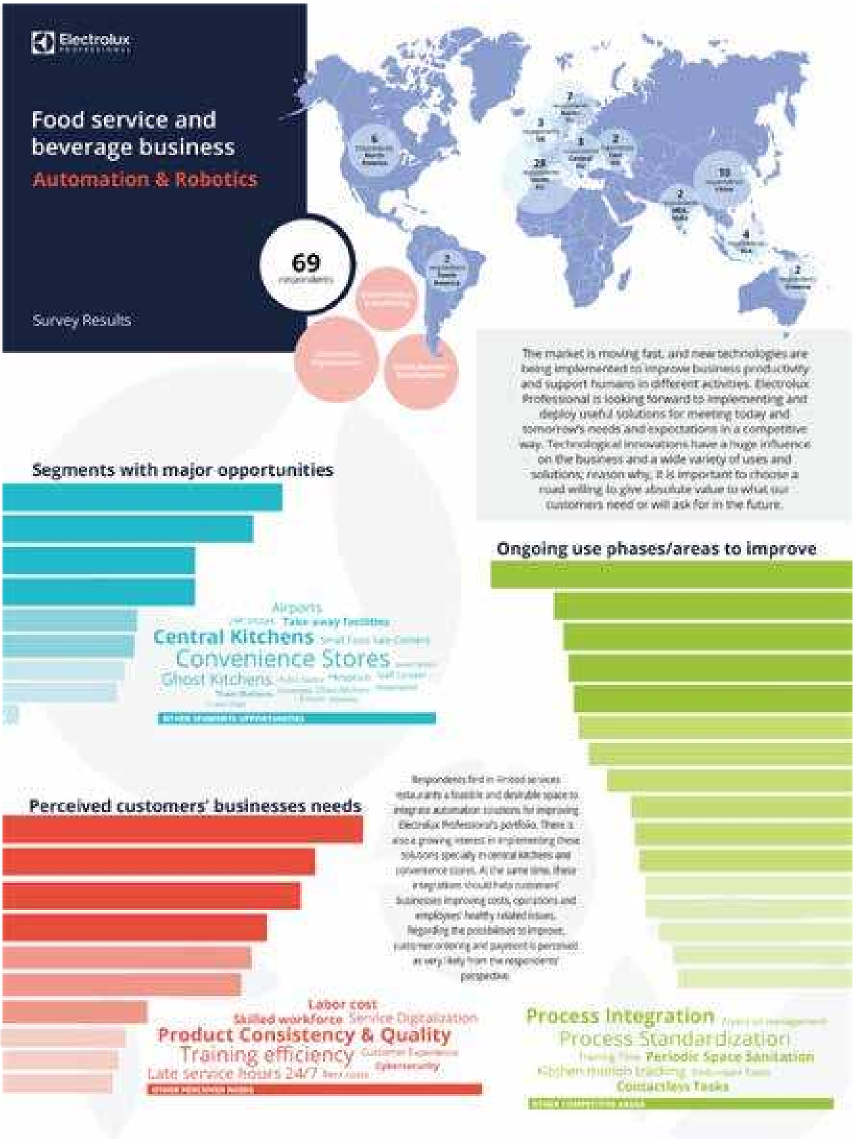


Figure 4.27 Automation & Robotics: survey poster.

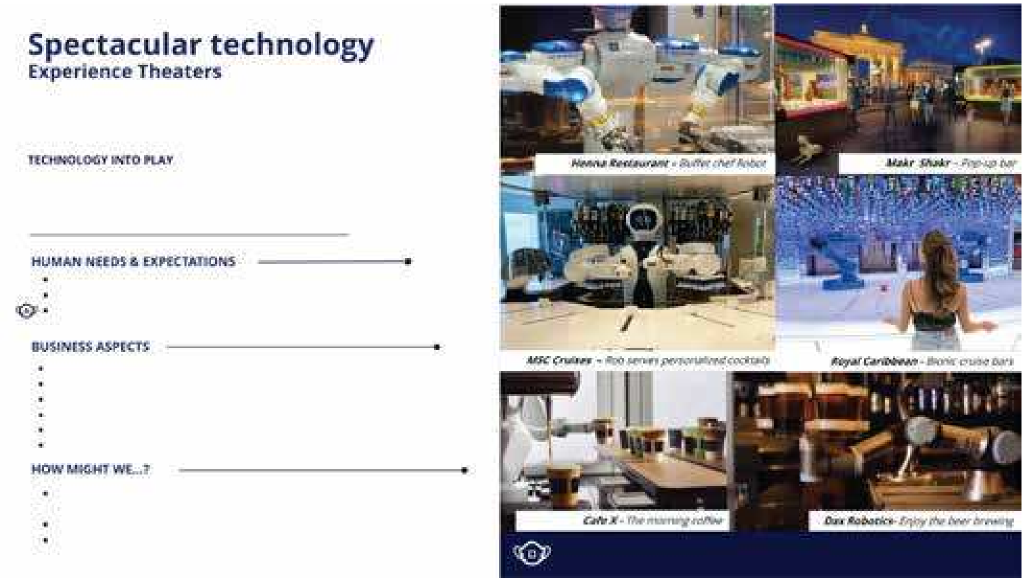


Figure 4.28 Automation & Robotics: trends board example.

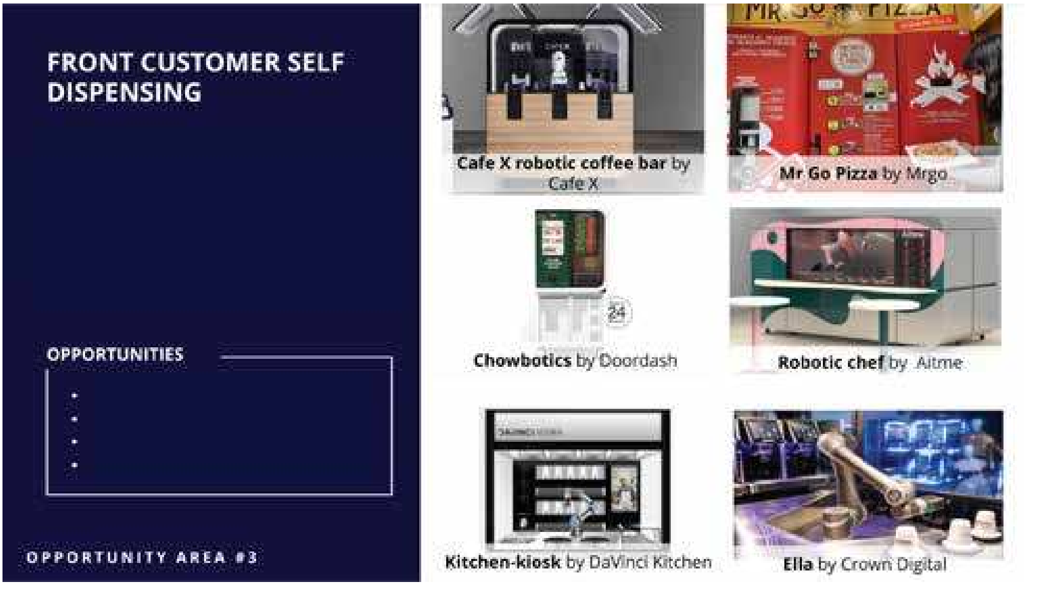


Figure 4.29 Automation & Robotics: opportunity area board example.

within the limited time and resources, the team opted for an internal research method, using a survey to collect information from the commercial organisation, global product and marketing and business development. Supported and sponsored by a colleague in the business development function, the survey received 69 responses worldwide. Finally, the data gathered was summarised in a poster presented during the workshop (Figure 4.27)[246].

Given the nature of the topic, the team decided to run trend research to help the workshop's participants to assume a future-oriented mindset. However, it had no experience in trend research. Thus, it asked a consultant agency to support the research. The enlarged team identified four trends connected to the topic, highlighting the catalysers spreading the adoption of automation in the hospitality segment, the future customers' expectations, the technological trend involved and the possible repercussions of these events for the Electrolux Professional business (Figure 4.28)[247].

Finally, another part of the research focused on identifying the areas of opportunity the company could have decided to invest in. For this activity, the innovation team, supported by the consultant agency, scouted the startup world, looking for every signal about automation in the hospitality and food industry. After long-lasting research, more than 80 startups have been considered, analysed, and clustered into eight opportunity areas. For each, the team synthesised the knowledge acquired in a graphic card showing a summary of the opportunities and the most insightful startups of the category. Moreover, the innovation team asked consultants to give a technology relevance assessment[248] of the opportunity areas to support the stakeholders' evaluation during the workshop (Figure 4.29)[249].

Even if, in this case, the research was partially delegated to outside resources, the knowledge collected and reified became an organisational asset—a fundamental resource to support learning transfer and, consequently, decisions making.

Practice: Participative Workshop

After the research, the innovation team worked to organise the

246 The survey numeric results were deleted for confidentiality reasons.

247 The trend contents were deleted for confidentiality reasons.

248 The judgment ranged from low to high and considered startups' market trend fit and their maturity landscape.

249 The opportunuty areas contents were deleted for confidentiality reasons.

Figure 4.30 Automation & Robotics: open debate.

participative workshop. The activity was scheduled for the end of June 2020 in a half-day morning session. The workshop was designed in a Miro virtual environment where the design team developed the proper infrastructure to run the workshop. It was run digitally due to the covid sanitary situation and for the global composition of the workshop team. The workshop participants were twelve: six product categories of food, four people from the business development team and two technology experts from the advanced development. Moreover, two subject matter experts from the consultant agency implicated during the research were involved in transferring their knowledge to the team. Three facilitators moderated the workshop's schedule and timing to manage the participative activity.

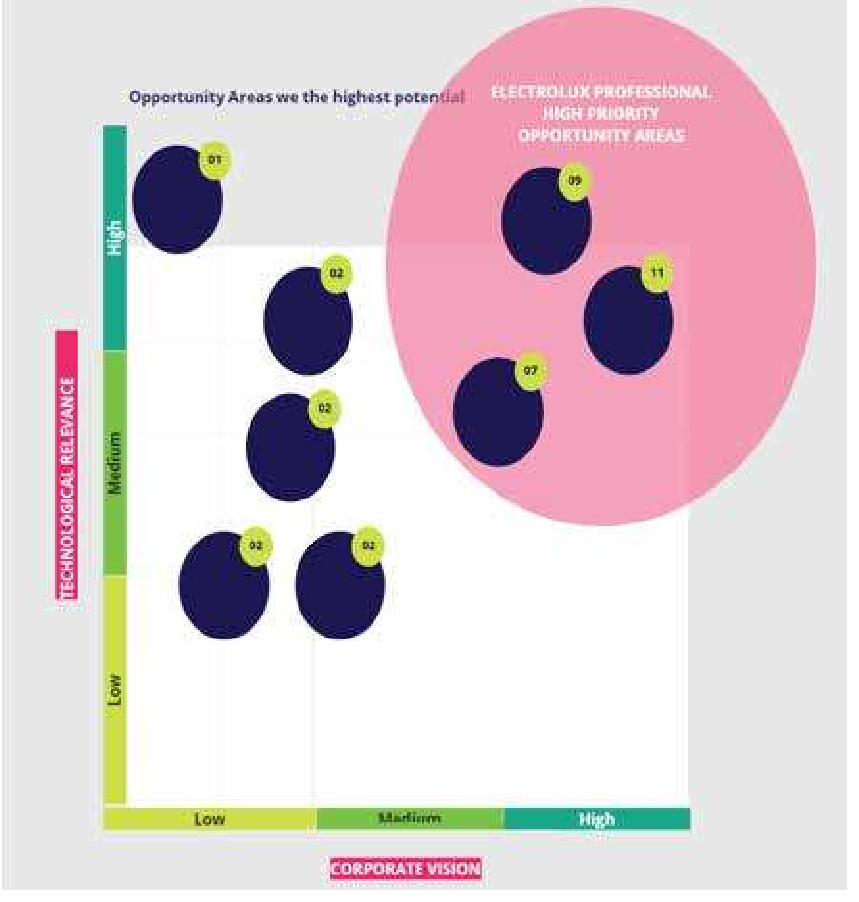
Learning

The workshop began with a one-hour introduction about the Automaton and Robotic topic. Firstly, the team presented the survey outcome underlining the topic's urgency for the organisation. Then, followed the trend research that reinforced the global concept, pointing out additional clues about automation and the main drivers of this shift. The discussion was organised as a frontal presentation in the Miro environment, allowing the participants to express their observations on appropriate post-its. In the end, the post-its were used to moderate an open debate, where participants shared their impressions and know-how with the team (Figure 4.30).

Framing

After a short break, the facilitators presented the eight opportunities asking the team to vote on the most strategic investment areas. The presentation briefly described each opportunity area, exploiting the startups as examples to let participants emphasise as company investors interested in baking some of them. Then, considering the information shared, the participants had to select the most promising opportunity area for the company. The criteria to consider in this decision were: the strategic fit with the company strategy, the market potential, the market access, and the deployment time (0 to 5 years)[250]. Each participant had three anonymous votes given through the Miro remote voting system. Exploiting a ten-minute break, the facilitator teams visualised the voting session results in a two-axis chart that sorted the opportunities area by

250 The participant did not have to consider the technological and technical feasibility because it was a criteria assessment by the expertise of the consultant agency.



Fiagure 4.31 Automation & Robotics: opportunity areas selection.

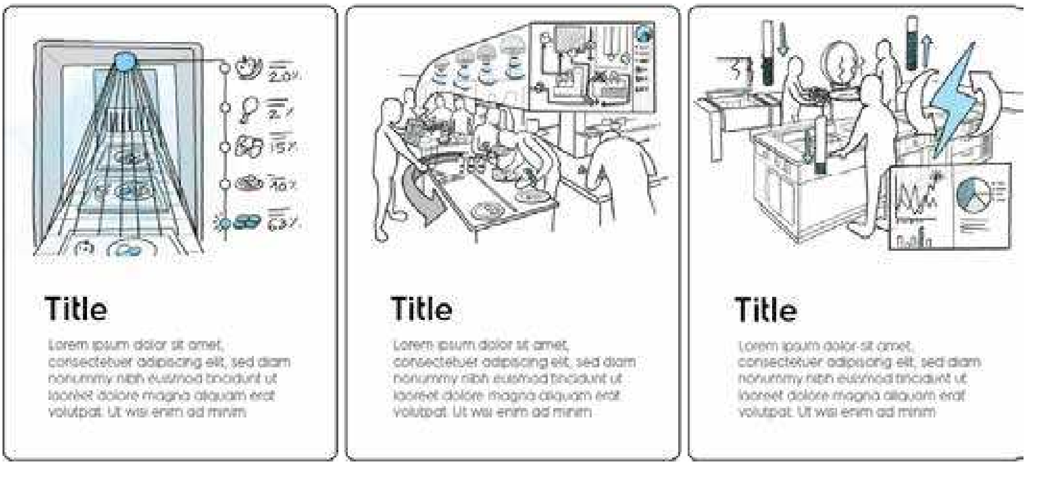


Figure 4.32 Automation & Robotics: idea card examples.

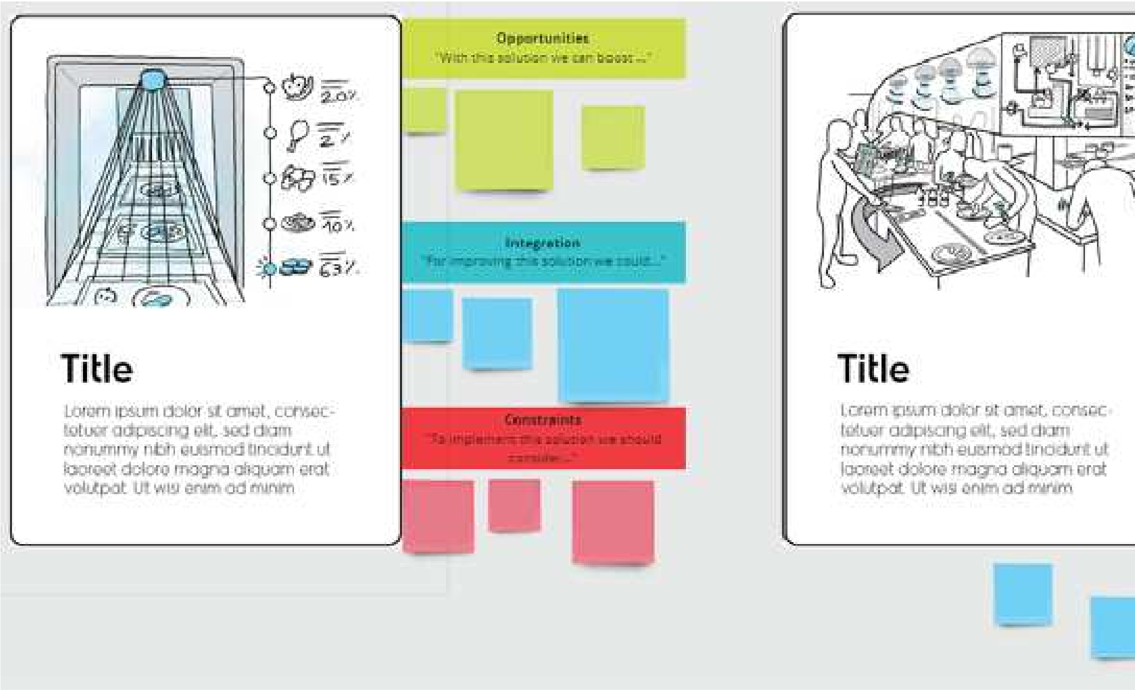


Figure 4.33 Automation & Robotics: speed critique.

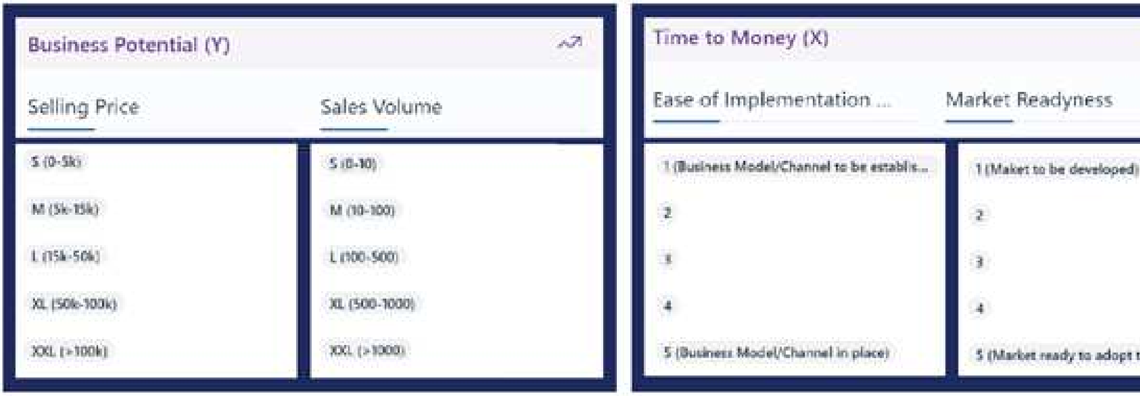
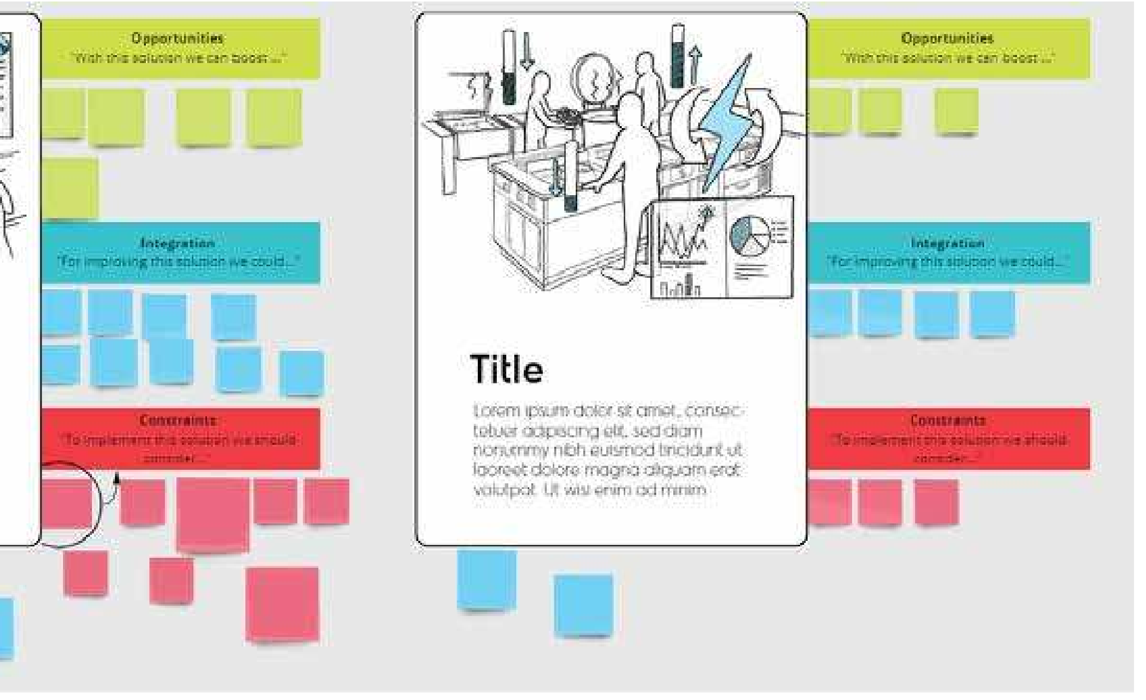


Figure 4.34 Automation & Robotics: scorecard parameters.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Integration
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Constraints
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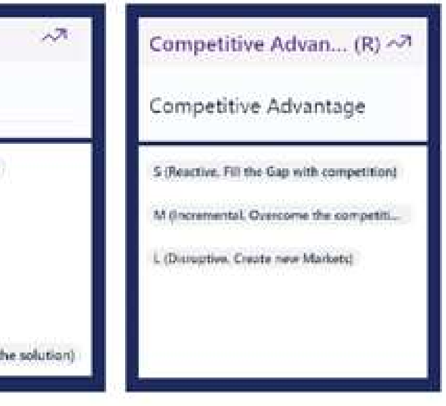
Competitive Advan... (R)
Competitive Advantage
S (Reactive. Fill the Gap with competition)
M (Incremental. Overcome the competiti...
L (Disruptive. Create new Markets)

technological relevance (evaluated by the consultant's expertise) and the corporate vision (calculated by the stakeholders voting session). Finally, the team discussed the voting result in the chart, sharing their opinions about those areas. After a short alignment, the team chose to explore three opportunity areas (Figure 4.31)[251].

Exploring

The final part of the participative workshop focused on presenting and discussing the opportunities inside the selected areas. Indeed, as for the previous case, the innovation team prepared a set of idea cards to inspire and moderate the workshop discussion toward concrete opportunities. For each of the eight areas, the IH team designed several high-level idea cards representing the concept through a sketch, a title and a short description (Figure 4.32)[252]. The ideas came out from different sources. Some of them just interpreted the startup examples into a me-too formula. Others came from meetings with stakeholders that suggested possible solutions the company had already started to evaluate. Finally, others brainstormed with the innovation team about other potential opportunities. Formatted the concepts in the same way they have been clusterised by opportunity area and organised in the Miro environment. After the opportunity area selection, the facilitators unveiled only the ideas belonging to the three selected areas. In this final exercise, the facilitator presented each idea card, asking participants to comment on the ideas following a colour-coding format: green post-its highlighting the concept's opportunities, blue ones for integrations, and red ones for constraints. This way, as for the speed critique exercise, participants had the chance to critique ideas, build on others' concepts and explore each hypothesis through a discursive process mediated by the facilitator. After the presentation, the facilitator read the post-its using them to moderate a brief discussion on ideas to align the team on everyone's opinion. In conclusion, time was left to add alternative opportunities that the company should consider not presented in the list (Figure 4.33) [253]. The workshop ended by explaining the following process step: the scorecard evaluation.

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251 The voting session contents were deleted for confidentiality reasons.

252 The idea card contents and the sketches were modified for confidentiality reasons.

253 The post-its contents were deleted for confidentiality reasons.

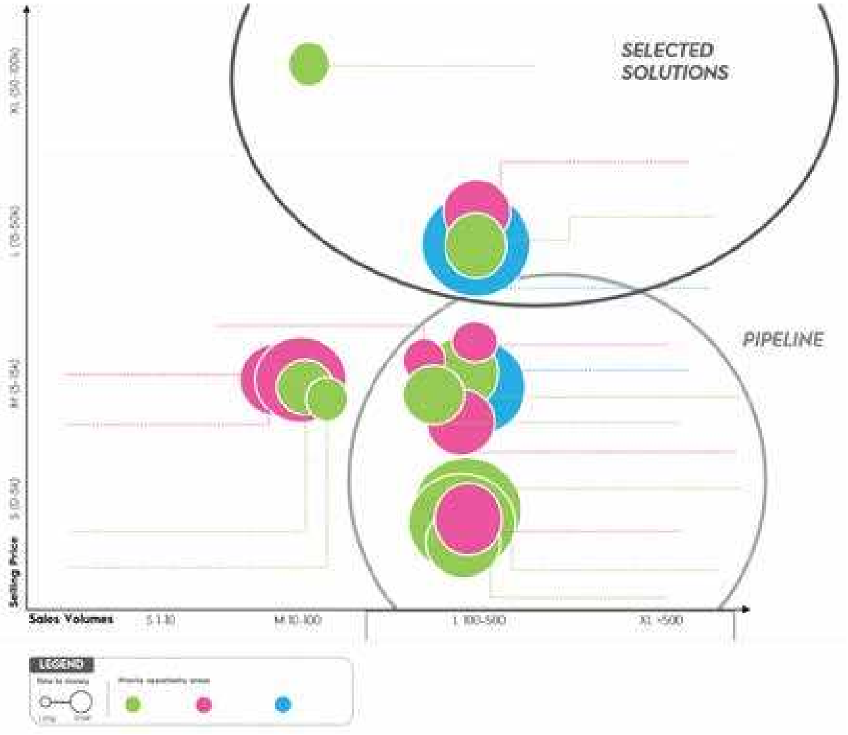


Figure 4.35 Automation & Robotics: priority chart.

Figure 4.36 Automatic Cooking Appliance: strategic landscape.

Evaluating

In the scorecard evaluation, an enlarged team of seventeen people[254] had two weeks to complete an evaluation assignment. Each participant must judge the selected opportunity areas' ideas on three criteria: business potential, time to market and competitive advantage. The business potential was subdivided into sub-criteria: potential selling price and sales volume. Similarly, time to market considered the ease of implementation and the market readiness (Figure 4.34). The innovation team presented the results, synthesising them in a two-axes chart to discuss and prioritise which opportunities to move forward in the process (Figure 4.35)[255]. The scorecard pointed out a group of four potential opportunities worth to be explored. For the sake of this case study, only one is presented to show how the practice evolved: the automatic cooking system.

Practice: Envisioning and Validation

The innovation team took responsibility for exploring most of the opportunities selected in the participative workshop and the scorecard activities. Among them, the IH team start to work on the automatic cooking system.

First cycle

The first step in the process focused on validating the company assessment with customers' evidence. To acquire the correct information with a qualitative approach, the IH team ran ten online interviews, selecting a highly targeted sample of customers: owners of quick service restaurants with high productivity volume working in the US market. The team interviewed customers about their habits of using unautomated appliances, pain points, and needs. However, more than a standard customer inquiry, the more the interview moved forward in the discussion, the more the interviewer alluded to a possible automatic solution to understand the customers' reaction and the most important task to automate. The interviews ended by asking for a commitment from the owner to purchase the hypothetical solution and a related target price. At first glance, this process seems like a research activity, but instead of just observing and collecting information, the interviews aimed to validate an idea. Therefore, more than pure research, the practice resembled a high-level validation process discussed through discursive fiction more than using a more common

254 Up to the original team were added four executive stakeholders to the evaluation.

255 The chart contents were deleted for confidentiality reasons.

physical medium[256].

After the evaluation, the IH team exploited the information gathered to sketch a plausible solution hypothesis, summarising the data in a presentation. The deck had a business-oriented focus, pointing out the high-level business requirements of the project: price tag, food types to cook, meals per day, the main benefit to achieve, the jobs to be done, and esteem of the person-hours saved by the solution. The information helped the team realise a strategic canvas map: a blue ocean strategy (Kim & Mauborgne, 2015) diagnostic tool for building a compelling strategy. In one simple picture, it graphically captured the current strategic landscape and the prospects for the solution (Figure 4.36)[257].

Second cycle

After getting the company stakeholders' approval, the innovation team worked on realising a Proof of Concept (POC). To build a functional prototype, the group asks for support from a specialised company in automation. The two teams worked together from the end of December 2021 till September 2022 to develop the solution in a continuous iterative dialogue. In the first step, the research presentation aligned the extended team on the same pool of knowledge detailing the POC's expected requirements. Then a sequence of arguments mediated by a 3D modelling medium developed the conversation between the POC's builders and the Electrolux Professional team. The dialogue triggered a learning-oriented atmosphere that improved the concept, mingling the technical consultant's expertise with the customers and business know-how of the company. Defined a satisficing hypothesis in a virtual environment, the two teams worked on the second step: realising the POC. In this phase, most of the work falls on the consultants, intent on translating the 3D concept into reality. The dialogue continued slower, checking the POC construction or supporting some decisions about incoming secondary-order issues.

In September 2022, completed the POC, an internal presentation unveiled the potentiality of the solution convincing the internal stakeholders to move the idea forward toward another validation phase. During winter 2022, the POC will be presented to several quick-service restaurant chains to find an agreement for a field test. In Spring 2023, the plan will be to test the solution in a natural context with real customers. The project is still uncertain, and the following months will tell more about the project's evolution.

256 Usually, similar interviews are run using sketches or physical prototypes. Still, the IH team found it complex to visualise such a vague idea being worried about influencing the customers too much. Moreover, the intellectual property sensibility in such a topic was another constraint to consider in these activities.

257 The slide's contents were deleted for confidentiality reasons.

4.2 Design Thinking Models

The examples described in the previous case studies are exploited in this paragraph to support the theory construction of three models aimed at summarising the behaviour of design thinking practices in the Electrolux Professional context. Two models represent the stable nature of the design thinking mechanisms and impacts, and one shows the practices' diversities accordingly to the organisational decision-making dynamics.

Mechanisms Model

The case studies showed that the practices changed depending on the unique context and time, making the strategies employed inevitably different. Observing even the most similar ones, we can not find a symmetric relation between practices, the same tool triggers the exact mechanisms, but the order and the typology of methods used differ to adapt to the unique condition of the project. For instance, in the "QSR Special Appliance", the need for a quick answer to the problem and the distance from the study context (Australia) prompted the team to use second-end research methods, even if a contextual inquiry would be a more valid option. On the contrary, in the "Hob" practice, the availability of internal chefs made them easy to interview during the research and evaluation phases. In the same way, in the first practice, a live participative workshop reasoned with the need to look at the appliance in the first person to understand the insect issue and hypnotise possible solutions. While in the second case, the covid sanitary situation forced the team to do an online workshop, limiting the practice to only some methods and tools.

The context contingencies drive these differences prompting the practice to change. This adaptation is reflected in the diverse methods, tools, and mechanisms employed. However, a much high intent seems to guide those practices. Indeed, in all the projects analysed, we can observe the same pattern of activities repeated in a coherent sequence. Looking at the maps, we see how the cards selected, despite the strategy name, are

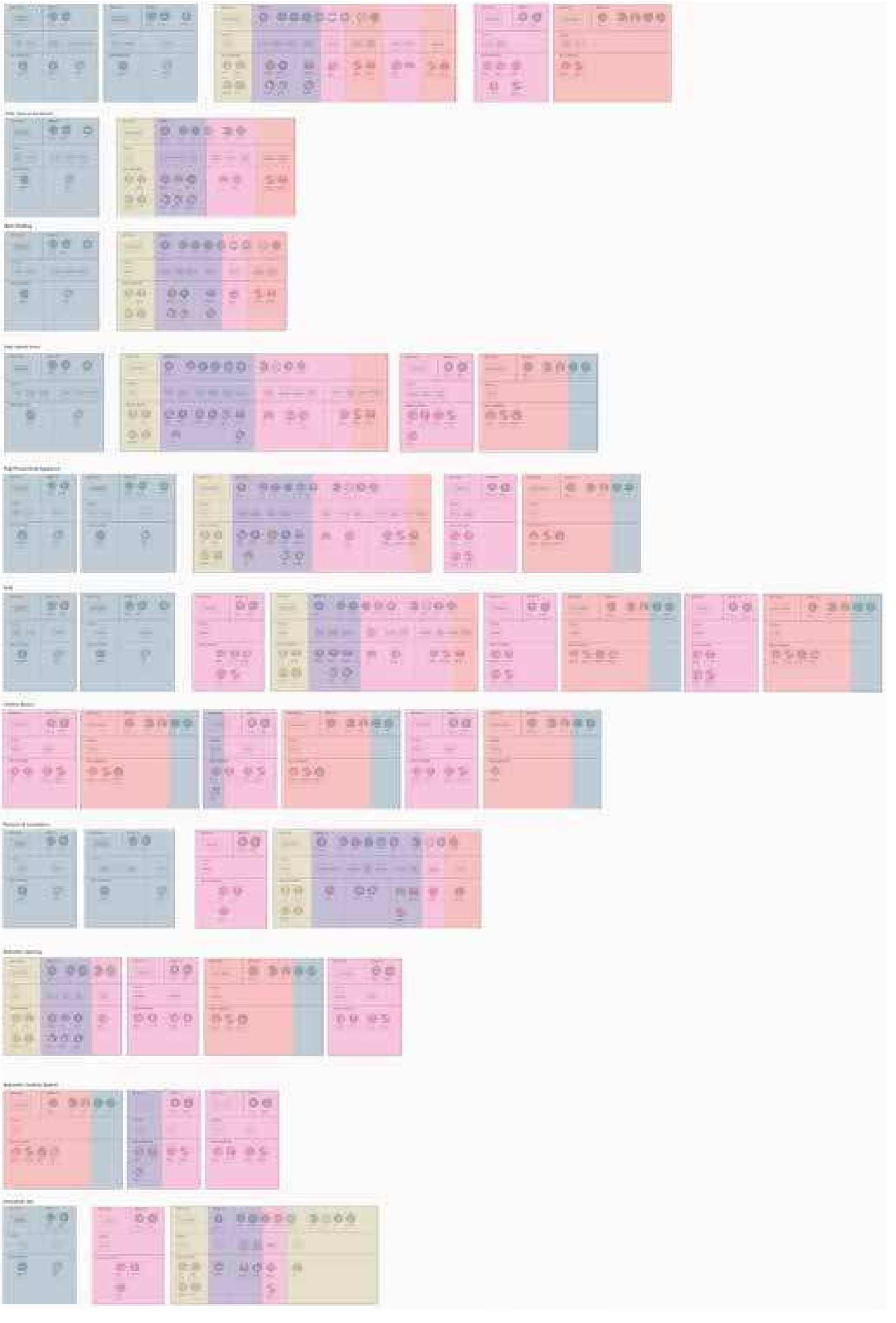


Figure 4.37 Mechanisms colour coding clusterisation.

organised by colour[258] and condensed in specific areas. This disposition means that in the practices, there are identifiable phases in which the practitioners intend to drive the team through the same cluster of strategies. In the transition between these phases, sometimes the mechanisms seem to mingle. Still, a pattern of activities emerges by considering the framework's colour coding. In the practices, we can see that clusters of strategies are repeated in a specific sequence for each of the three primary activities described during the cases: research, participative workshop and envisioning and validating (Figure 4.37).

Research

In the research activity, the strategies employed mainly belong to the collection and synthesis cluster. For example, in "Automation and Robotics", broad second-hand business-centric research on the startups' world and global trends allow the team to acquire and transfer that knowledge to the stakeholders' group, allowing them to make a strategic decision. Similarly, in the "QSR Special Appliance" case, human-centric information was collected through second-hand methods and translated into functional devices, used by the team to emphasise the data collected. Instead, in the "Hob" example, the same human-centric knowledge has been collected with first-hand methods and used in a presentation format.

In these instances, different kinds of expertise were collected with diverse techniques and synthesises into various formats. Still, we can recognise that a standard cluster of strategies has been intentionally employed to achieve a higher goal: collect and reify assets of knowledge used to support communication.

Participative Workshop

In the participative workshop activity, the clusters of strategies employed follow a defined sequence. Firstly, all the analysed participative activities started using framing mechanisms. To define a shared problem space, practitioners must align the team on the same knowledge pool and then set the frame. For instance, in the "Hob" practice, with the "Ask the Expert" tool, practitioners organised a structured forum where the three company perspectives (business, technology and human) were discussed

258 The colour represents their belonging to the same mechanism cluster. The blue colour represents "collecting ad synthesising" mechanisms. The purple colour represents "framing and reframing" mechanisms. The violet colour represents "exploring" mechanisms. The red colour represents "evaluating" mechanisms. The orange colour represents "learning" mechanisms. The yellow colour represents "leading and managing" mechanisms.

in Q&A sessions, transferring the expert knowledge to the team. Then, the "How Might We Map" technique drove the team toward constraining the problem into a shared space. With a different approach, the "QSR Special Appliance" case exploited the "personas" and "scenarios" devices to make participants work with the information collected and emphasise the situation. Then, the "Five Whys" tool supported the problem exploration, broadening the problem space with the knowledge acquired, reframing it, and converging on a shared interpretation of the situation.

Secondly, defined a shared frame of the problem, the team started to explore the solution space. For instance, in the "Hob" practice, the team followed a structured exercises sequence to move from the problem frame to the solution communication. Firstly, it used the "Design Demos" tool to get inspired by the design team's previous exploration. Secondly, it applied the "Crazy Eight" exercise to explore by sketching multiple hypotheses, diverging the solution space. Finally, it employed the "In-Depth Idea" tool to converge into a unique idea and communicate it at best. Another strategy used in the "Automation and Robotics" example was to present ideas previously designed to explore them in a workshop session exploiting dialogical mechanisms to modify and improve the concepts.

Thirdly, the hypothesis exploration led to the idea evaluation and decision-making. For instance, in the "QSR Special Appliance" practice, the ideas have been evaluated through an abductive assessment. The "100 dollars" tool gives back a gut feeling ranking of the best concepts that decision-makers use to make confident choices. On the contrary, the "Automation and Robotics" case required a detailed "Scorecard" exercise involving several stakeholders to support a deductive-like assessment and decision.

In all four phases, the techniques employed differ and evolve based on the context and needs. The mechanisms reflect those adaptations. Still, the belonging clusters are the same, showing an intentional infrastructure in the design of the participative practices.

Envisioning and Validating

The strategies employed in the evaluating and validating activity belong mainly to the exploring and evaluating categories.

In the envisioning phase, the team further explore the concept previously identified to define and visualise it better. For instance, in the "Hob" example, the team realised low-fidelity physical and digital prototypes to explore the consequences of the hypothesis made during the workshop. Differently, in the "Automation and Robotics" case, external

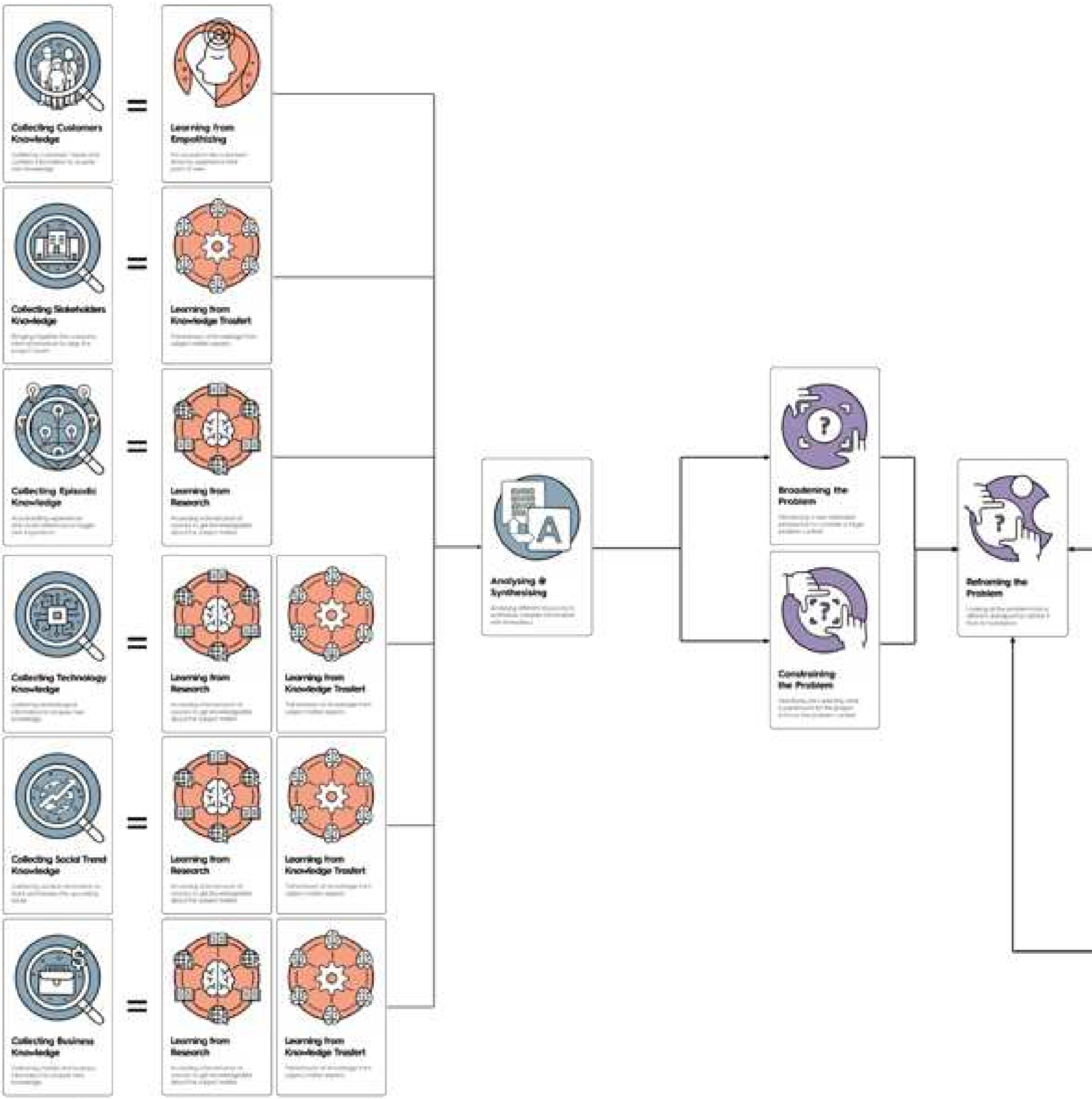
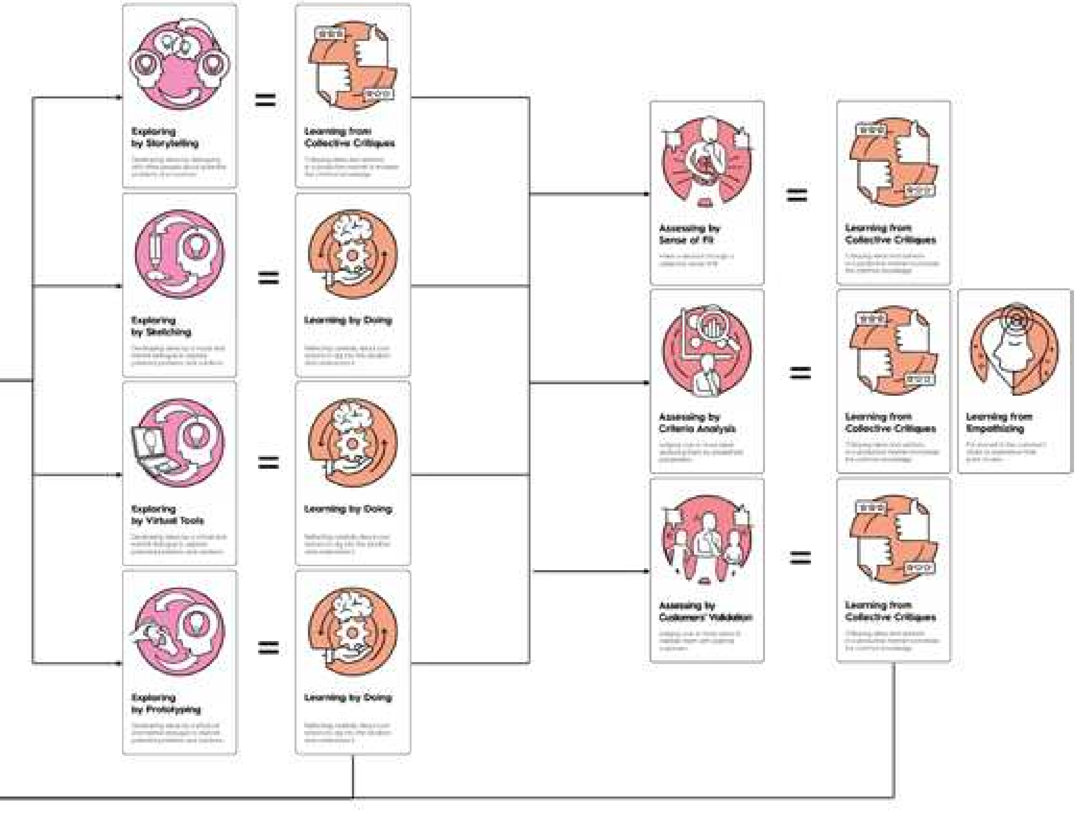


Figure 4.38 Mechanisms model.


Exploring by Storytelling
Learning from Collective Critiques
Exploring by Sketching
Learning by Doing
Exploring by Virtual Tools
Learning by Doing
Exploring by Prototyping
Learning by Doing
Assessing by Sense of Fit
Learning from Collective Critiques
Assessing by Criteria Analysis
Learning from Collective Critiques
Learning from Empathizing
Assessing by Customers' Validation
Learning from Collective Critiques

consultants build a functional prototype to prove the concept, experimenting with the idea to face the emerging issue and solve them.

Following the envisioning phase, validation uses evaluation strategies to acquire additional knowledge about the exploration done. Moving on with the “Hob” case, the prototypes were tested by internal chefs that gave their opinion about the proposal. Then, the team used that information to improve the idea, build another prototype and finally assess it again to support the final decision. Similarly, In the “Automation and Robotics” example, QSR owners were interviewed to validate the automatic cooking system concept. That knowledge served for defining the functional prototype, which, when completed, will be again tested in the natural context.

As the examples show, these activities are iterative and progressively more realistic experimentation that supplies the team with the needed know-how to develop the concept further. Indeed, in both the second and third cases, the conceptualisation required a double loop of envisioning and validation to support the company’s decision-making.

Mechanism Model

Summing up the lessons from these examples, we observe that the single mechanisms used in the practices are different because they must adapt to the context. However, the practitioners’ intent in leading these procedures follows a stable and definable flow. The path could be summarised in a flowchart model (Figure 4.38) divided into four interconnected and iterative areas. Each displays the possible strategies the practitioner could employ depending on the context.

Firstly, the practices start with the collection of information through different strategies. No matter the mechanism used, a certain amount of knowledge is acquired to introduce new content into the project discussion. This information is assimilated through learning mechanisms by a limited number of people and then synthesised to make it meaningful and communicable to a larger group. Secondly, accumulated knowledge becomes the primary input for supporting the project’s creative decisions. If the practice involves more than one person, knowledge should be transferred using diverse learning strategies to align the team on the same pool of information. Then, this knowledge is used to define the situation using framing mechanisms to broaden, constrain and reframe the problem space. Thirdly, the frame is used to address the hypothesis-making process. People could employ different strategies to explore the consequences of their hypothesis. Still, all of them are essentially learning activities, a form of experimentation that helps to develop the idea. Finally, the exploration results are assessed through different logical models based on the type of validity level we aim to achieve. As a consequence of the evaluation, additional knowledge is gained and used to inform the situation. When the idea satisfies or complies with the expectation, final decisions are made, and the design process ends.

This flowchart model suggests us some considerations about design thinking practices.

(1) Design thinking is a practice with a stable internal structure. We can recognise an intentional common thread in all design thinking practices. This flow is not unique to design thinking practice. In a more general term, it is a mental structure that practitioners (Schön, 1983) and human beings (Nigel Cross, 1999b) use to face daily contingencies. Still, considering all its characteristical mechanisms, this flowchart represents a visual summary of how the design thinking practices are structured. (2) Design thinking is a non-linear sequence of statuses. Design Thinking does not have a beginning or an end. It is an asynchronous process composed of statuses. The practice could begin in the evaluation phase and then go back to the creative stage. For example, the "Holding Appliance" practice does not start with a research activity followed by a participatory process to design the idea. In that case, the ideation came directly from an internal crowdsourcing process. Then, it has been developed through envisioning and validating activities. The concept has been first explored and evaluated. Then, from the information collected, the problem was reformulated, re-explored and re-evaluated and so forth. The process jumps into the middle of the flow, focusing on developing the concept through exploration and evaluation mechanisms. On the opposite side, in the "QSR Special Appliance" example, the ideas have never been evaluated and validated because the situation does not require it. This flowchart shows a standard flow of interrelated mechanisms, but their relationships are not linearly defined: they compose a network of strategies sometimes used asynchronously. (3) Design thinking is essentially a learning process. From this flow, we observe that the learning strategies are present throughout the entire design thinking practice. The collection of information requires learning. Problem framing needs the aligned on the same knowledge pool. Al the exploring mechanisms enable learning in action. The evaluation becomes another way to collect knowledge. This flowchart described design thinking essentially as a learning process.

Design thinking practices follow a stable and intentional flow. They showed a resilient character that makes them adaptable to the situation to which they are required to respond. Indeed, we can observe that design thinking is essentially a learning path that adjusts the problem and solution according to the inquiry's findings. Building on this mechanism model flowchart, the following paragraph discusses the organisational impacts of these practices.

Impacts Model

Analysing the impact structure of the case studies, we can observe that the design thinking procedures have a similar organisational purpose. Whatever the context, the stakeholders involved, or the project's subjects, all the practices aimed to design a solution by supporting the company's decision-making. Acknowledging the three clusters of impact identified in the framework, we can try to deepen their relationships by discussing the case studies examples.

Research

The research activity's purpose is the accumulation of information and its synthesis. From an organisational perspective, this activity generates reified assets of knowledge: usable content that improves communication supporting knowledge transfer and effective dialogue between functions. As seen in the flowchart model, the knowledge accumulated during the research is usually exploited in the participative workshop to frame the problem space. That information reified in communicative artefacts became organisational assets. Indeed, they could be used to face existing and future problems. For example, in the "Hob" practice, technical and human research could be re-used in projects with the same technology or customers. Similarly, in "Automation and Robotics", the trend and startup research could support the exploration of a virtually infinite number of opportunities belonging to this topic. In general, the research process could be considered a first informative step used to collect as much data about the subject as possible and reify it in assets of knowledge usable to inform the project's future decision-making.

Participative Workshop

In the participative practices, we can identify all three design thinking impacts categories: knowledge creation, social interaction and decision making. Regarding knowledge creation, participants exploited the research to generate new ideas that the organisation could use as assets to face existing and future issues. For instance, in the "QSR Special Appliance" example, the solution found could become a good practice for other appliances with insect problems. Or, in the "Hob" case, the user experience interaction pattern could become a standard for several digital applications. In both cases, today's solutions are assets of knowledge collaboratively developed and employable to face future situations.

Regarding social interactions, we can observe that participatory activity elicited several impacts. For instance, in the "QSR Special Appliance" case, people not used to participate in the design process, such as service technicians, collaborated to frame better the problem space, which as a result, led to one of the implemented solutions. Similarly, in the "Hob" example, the involvement of people from the technical and business organisational realm broke the company silos, working together to understand their different needs and find a compromise. Or again, in the same practice, the "Design Demos" with the "Crazy Eight" and the In-Depth Idea" tools build a step-by-step creative path that supports people in expressing their creativity and improving their confidence. Participative practices are structured methods that facilitate social interaction among people. In all the cases, we observe a wide use of this method with consequent impacts on collaboration, engagement, trust, communication, and other effects from the social cluster.

Regarding decision-making, sharing ownership and accountability with an extended group of people positively affects decisiveness, supporting quick and action-oriented decisions. For instance, in the "Hob" example, the "Ask the Expert" and the "Speed Critique" exercise gradually aligned the team on a defined solution. Moreover, this participative process speeds up decision-making, avoiding prolonged meetings and debates. Similarly, alignment was gained in the "Automation and Robotics" practice. The team created a facilitated open arena where everybody could express their opinion and vote for their preferences. Participative methods are precious in weak team alignment conditions and when decisions must be made quickly.

In general, participative practices could be considered a collaborative social process used to involve stakeholders in decision-making by using participative strategies to increase team alignment.

Evaluation and Validation

We can observe the same impact pattern in the iterative evaluation and validation process. The design team build on the assets of knowledge previously generated to improve and reify them in more usable and shareable formats. And again, these assets are used to moderate the discussion with a select sample of reviewers to gather additional learnings from them. For example, in the “Hob” situation, by visualising how a feature could interact with a chef’s workflow, customers emphasised the case by giving valuable feedback and arguing their opinions. The accumulation of this information supports decision-making, improving decisiveness and reducing the risk of making wrong choices. For instance, following the “hob” case, an innovative lighting feature selected during the participative process gets negative feedback during validation, making the team withdraw from its previous decision. Without the test, a costly and complex technical feature would probably be developed, investing time and resources in something with low customer value. In this case, an internal bias was avoided, and the final solution was adapted to the upcoming learnings.

In general, the envisioning and validation process could be considered a fine-tuning process used to assess the project direction taken by iteratively generating enough knowledge to make confident decisions about the project development.

Impact Model

Summing up the lessons from these examples, we notice that the final goal of design thinking practices seems to be to support organisational decision-making: decisions that support both the concept design and the management process. Indeed, design thinking does not aim only at designing satisfactory solutions but creating the right organisational conditions to make decisions about them. However, these conditions seem achievable only when the proper amount of information and the right stakeholders’ participation occurs. Observing the analysed impact pattern, we can identify causal relationships between the three impact clusters. We can describe these relationships by imagining a pyramidal impact model with three layers: at the top, decision making; in the middle social interactions; and at the bottom, knowledge creation.

At the basis of decisions, there is information. Whether it comes from research activity, developing novel ideas, or testing, you need enough knowledge to make a conscious organisational decision. In the "mechanisms model", we have observed that learning strategies are present over the entire design thinking practices, allowing knowledge assets to be continuously created, modified and implemented collaboratively. In this view, knowledge becomes the foundation of the pyramid without which no decision could happen.

However, this is not enough. In a corporate setting, decision-making is a group activity where different stakeholders have to share a common project vision to proceed forward. At the core of this process are a set of social practices that influences from one side the knowledge creation from the other decision-making. Involving stakeholders in those activities make them feel part of the design process. For example, by contributing to knowledge creation, they are more prone to accept and use a shared pool of information. Similarly, giving their opinion in decision-making makes them more aligned on decisions and positively accepting their consequences. In this model, social collaboration becomes the glue of the process, an interface that allows knowledge to become effective for decision-making and decision-making effective for the project.

At the top of the pyramid, there is decision-making. From an organisational perspective, we can consider projects a chain of choices that orient them toward one of the infinite possible directions. Decisions are like pivoting points that define the destiny of the project. In the practices analysed, we can observe how the activities are designed to support those moments. There are different levels of decisions, but all follow the same pattern: gather information, collaboratively work on them, and make decisions. In this model, decision making are pivoting points that shape the project's direction, decreeing its failure or success.

The three steps model described until now focuses on the ongoing impacts of design thinking practices on an organisation. However, if we consider the output of these practices as a direct consequence of design thinking, a broader spectrum of impact should be acknowledged. Indeed, assuming that design thinking practices produce better solutions, we should consider to some extent even the solution's effects on the organisation, the customers and the whole planet. From this perspective, the pyramid becomes a four-layer (Figure 4.39) structure where the practices' output effects are described at the summit.

This additional layer acknowledges three clusters of impacts: customers' experience, organisational performances and environmental and social value. In the first case, the design choices made in the design thinking practice affect the customers' experience influencing their satisfaction. In the second one, the market response to the solution impacts the business company KPIs[259]. In the last case, the solution affects the environment and the social context in which it operates. All these impacts could be reconducted back to the design thinking practice effect for a certain amount. However, this study considers them second-order consequences of the practices that do not directly impact the organisational dynamics. The impact model acknowledges their existence but treats them in a separate layer that the researcher chose not to examine in depth[260].

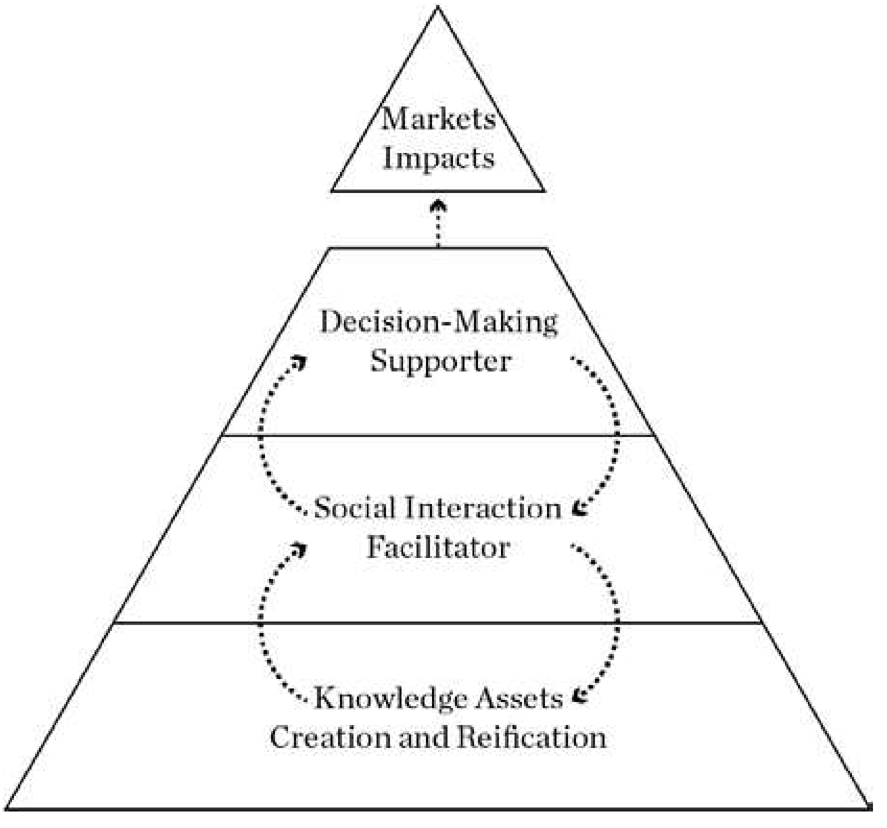


Figure 4.39 Impacts model.

259 For instance, influencing the economic parameters of the company with their ROI (Return on Investment) that affects the organisational's EBIT (Earnings Before Interest Tax)

260 Other researchers with different methods and expertise have addressed these topics (Forrester, 2018). This study does not focus on the economic return of the solutions designed with design thinking practices nor their effect on customers and the planet.

With this model in mind, we can describe design thinking practices as a creative and managerial process. Indeed, they exploit the mechanisms for both aims at the same time. On the one hand, it uses knowledge, social practices and decision-making to influence the design of the solution. On the other hand, it uses the same model to support management. From this perspective, design and management are two consequences of the same practice.

Electrolux Professional Practice Model

Despite the similarity between the mechanism and impact structure summarised in the models above, we can observe some systematic differences in the Electrolux Professional design thinking practices. From the cluster analysis, two main variables seem to affect the practice behaviour: the stakeholders involved and the organisational decision-making chain level.

Stakeholders Involved

Considering who was involved in the practice, we can notice the involvement of technical and business stakeholders during the design thinking practices. Three possible scenarios emerged from these conditions: practices with only technical stakeholders, with only businesspeople or both.

In the first scenario, technical stakeholders are engaged in the practices in problem-solving situations or when an expert opinion is required to support technical decisions. For instance, in the "QSR Special Appliance" case, a clear-cut problem required a prompt response. There was no doubt about the issue, just the need to find a technical solution to an emerging situation. In the second case, business stakeholders are involved in the practices in strategy-making situations or when an expert opinion is required to support business decisions. For example, business stakeholders should take the strategic company direction in the "Robotics and Automation" practice. There, they put in second order the technical constraints, making strategic decisions for the organisation's future. There was no issue to solve, but the intent was to lead the organisation to size new potential opportunities. In the third scenario, when business and technical stakeholders are involved in design thinking practices, the two realms meet to negotiate a shared vision balancing the project strategy and the product development needs. In this case, design thinking participative approaches were particularly precious to managing these dynamics compared to the previous organisational processes[261]. For instance, in the "Hob" example, the participative workshop represents an open arena that allows both parties to share their needs and converge in a dialogical guided alignment process. First, the team used third-party customer information as evidence to mediate and address the arguments between parties on a shared pool of knowledge. Then it aligned the participants on the problem frame and the hypothesis-making. Finally, it facilitated and collaborative decision-making process. All followed a convergent dynamic that supported understanding, collaboration and negotiation between the parties.

In the three scenarios, we saw that the kind of practice determined the involvement of one type of stakeholder over another. However, this relation is true even in reverse. When different stakeholders are involved, the mechanisms, methods and tools employed in the practices change. For instance, technical people are more used to exploring mechanisms and have high creative confidence compared to businesspeople. In the "QSR Special Appliance" case, a low-structured creative process was enough to enable technical people to design functional solutions.

On the contrary, in "Automation and Robotics", executive business stakeholders could not have the time and possibility to create from scratch completely new opportunities. In that case, a previous activity per-designed a set of options, facilitating the exploration during the workshop with discursive mechanisms. Another element to consider is the methods used, with jargon, variables and goals that are more or less like-minded to stakeholders. For instance, in the "QSR Special Appliance" case, the team analysed the problem with methods belonging to the kaizen philosophy. While in the "Robotics and Automation" practice, Blue Ocean Strategy and Lean Startup methods took turns supporting the design of the Automatic cooking system. In the first example, design thinking gets influenced by techno-centric processes that facilitate the practice adoption. Lastly, business-centric methods were put side-by-side with design

261 As mentioned in the innovation audit and other conversations, the organisational dynamics involving contrasting cultures are naturally pernicious and risky. For instance, in the requirements selection process, business decisions arrived first, followed by a technical rebut. However, this process triggered a bargaining dynamic between the functions that waste energy and resources on both sides. The business tended to exaggerate the requirements to achieve as many innovative features as possible from the development. On the opposite side, technicians tried to lower the expectations, undermining their feasibility, sometimes even exaggerating some considerations. As a result, a long-lasting loop of arguments between business requests and technical feasibility concerns slows down the entire process, generating misunderstandings and reducing the trust between departments.

thinking to ease stakeholder communication. Thus, despite the similar intents, it seems that the processes and tools employed took inspiration from a wide array of methodologies, both for the technical and business realms.

From these examples, we see that different stakeholders have been engaged in the case study analysed and that their presence directly influences the construction of the practices. Looking for the reasons why the stakeholders change, we can observe that this variable is influenced by the type of decision the design thinking practice aim to support. In the next paragraph, this relation is deepened, discussing the differences that emerged from the findings.

Decision-Making Chian

As for the stakeholder, even the decision-making chain variable influences design thinking practices. At first glance, they resemble the mechanism and impact pattern. Still, depending on the decision-making chain level the design thinking practice operates on, the approaches and ways to deal with the situation change its variables.

At the product development level, design thinking practices have limited possibility to influence the project structure. In these cases, the design subject is constrained to a delimited topic, such as a feature improvement. Therefore, you can not rethink the overall system from its foundation. For instance, the ideas selection process was oriented toward easy-implementable solutions in the "QSR Special Appliance" example. Concepts that forced a redesign of the appliance were costly or complex to develop were discarded, even if solved the issue definitively and innovatively. This limitation is caused by the impossibility of withdrawing the hierarchy of the decision-making chain. Therefore, working at this level, it would be best to plan an approach acknowledging the limited innovation possibility, maybe less divergent and more convergent on laser-focus solutions.

Compared to the product development example, in project requirements, there is much more freedom to influence project decisions. There is no existing artefact upon which to refer, nor a set of features already defined. Still, you already have the subject, which can not be changed. For instance, in the "Hob" case, the topic was to find a new interactive way to use it and develop a pre-determined feature connected to the system. The team were free to design in those areas, but it could not think of new technologies to stoke the hob. That design variables would be off-topic. Even in this case, this limitation is caused by a previous company decision that addresses the project to redesign a hob, not an oven.

Thus, leaving people diverging too much, already knowing this limitation, would be a time and energy waste. For instance, in the "Warewashing" practice, almost no restrictions have been set, leaving the discussion too much open to divergent thinking. In that case, the process has been counterproductive. Off-topic ideas have been hard to assess, even if they received good feedback. Indeed, off-topic concepts risk not matching the project's business case, causing frustrations in the idea's owner and the team that wasted time and resources trying to develop it. By learning from these experiences, the design team paid attention to designing procedures according to the decision-making level degree, imposing the proper limits to the exploration since the beginning of the practice.

Finally, design thinking practices at the project strategy level showed the highest degree of freedom to influence the company's direction. Only the high-level company strategy directly affects the project strategy addressing Electrolux Professional as a producer of professional solutions for the hospitality sector. There are no predefined subjects or previous examples to refer to. The choice to develop a project or another is made at this level. For instance, in the "Automation and Robotics" practice, the team explored dozens of completely different opportunities about the automation topic before converting to a few of them. Each was a different opportunity that would have addressed the company in parallel directions. The selection of the "Automatic Cooking System" compared to a "Warewashing Automatic System" or an "Automatic Dispensing System" led the organisation toward a clear direction that constrained the future chain of decisions. At this level, divergency is welcomed, even if sometimes it could become a limitation. For example, choosing the best opportunities would be impossible without gradually reducing the boundaries of the "Automation and Robotics" topic and dividing it into opportunity areas. Too many possibilities would be plausible, and their assessment would become too complex to achieve. In these practices, divergency is paramount, but the risk of never reaching a decision is high. The procedure should follow an operational process that gradually prompts the team to make decisions to contrast this tendency.

In the three examples, we see how moving upstream the organisational decision-making chain, the practice's degree of freedom increases and, with it, its innovation potential. Indeed, the more the previous decision does not constrain the design thinking practices, the more its output can be innovative. The final paragraph connects the dots traced till now and widely discusses the potential innovation of design thinking practices.

Innovation Potential Model

In summary, we observe that the processes and output of design thinking practices differ. The element that seems to trigger these differences are the level of the decision-making chain that the procedure aims to support. Indeed, the stakeholders involved, the practice's subject and the design degree of freedom vary in response to this variable. We can try to understand these relationships by describing them in a model comparing the three categories of design thinking practice with the organisational decision-making chain (Figure 4.40).

(1) At the lower level, we have product development practices. Here, design thinking supports decisions regarding a solution's form and function. The project to develop has already been chosen, and its requirements defined. It is all about determining how to realise the plan according to the specifications. Indeed, the main stakeholders involved are technical people focused on finding functional solutions to given problems. Design thinking practices could support the resolution of an unexpected emerging issue, like in the "QSR Special Appliance" case, or support the development of a new feature, such as in the "Automatic Door" example. Still, they are tactical and operational decisions with limited freedom to disrupt upstream choices. This condition means that in product development practices, the innovation potential is limited. They support fast action-oriented decisions about minor improvements that could, in any case, create a small innovative gap from the competition.

(2) At the middle level, we have project requirements practices. Here, design thinking negotiates technical and business needs with human ones to support a shared definition of the project requirements. The project to develop has already been stated. These practices aim to determine its characteristics, defining what the project would and would not be. In these decisions, technical and business stakeholders are called to collaborate to balance a valuable project offer with a reasonably feasible one. Design thinking practices could mediate and facilitate the bargaining process, like in the "High-Speed Oven" case, or add to the discussion human-centred knowledge, such as in the "Hob" example. In any case, they are mainly tactical decisions that have to refer to the strategic direction already in place. There is much more freedom than in the product development case, but the innovation potential to work at this level is still constrained. They support business and technical negotiation by exploiting participation techniques and

human-centred knowledge to agree on the project's requirements.

(3) At the highest level, we have project strategy practices. Here, design thinking looks for new, potential innovative opportunities. At this level, only broad strategic company directions are in place. Therefore, these practices aim to support the organisation's project strategy by identifying new ideas and exploring their consequences. In these decisions, the main stakeholders involved are executive businesspeople focused on analysing the market situation to define the most valuable strategy for the company. Design Thinking practices could support the identification of potentially innovative opportunities, like in the "Automation and Robotic" case, or explore an idea to assess its potential, such as in the "Automation Cooking System" example. At this level, design thinking is involved in strategic decisions with the highest freedom to design an innovative solution and disrupt the organisation. They support decisions about the project strategy by uplifting the organisation to seize risky but potentially innovative opportunities.

This model suggests that design thinking practices vary in response to the decisions the practice supports. However, this diversification does not happen by chance. Analysing the practice chronologically, we observe how design thinking practices scale upstream the decision-making chain over time, and with them, the design department too. Between 2018 and 2020, design thinking practices focus mainly on project requirements. Only after 2021 the company and the design department reorganisation allowed the team o work at the project strategy level. Over time we observe an evolution from product development and project requirements to project strategy. This path followed the bottom-up approach described by the interviewees in the second chapter: it moves from the decision-making chain bottom to the summit by proving its value to the stakeholders involved. However, only the right organisational conditions allowed the team to access project strategy decisions. The credit goes to the team that shows promising results and that step by step increased its credibility, but to some extent, even to the casual events: the organisational split that allowed the team to achieve the innovation mandate officially.

Junginger's model (Junginger, 2009) described a similar path and could support the explanation of this phenomenon. Her model explores four locations where design thinking can "take place" in organizations. In a subsequent article (Westcott et al., 2013) Juginger model was used to support the development of a scorecard to assess and represent the

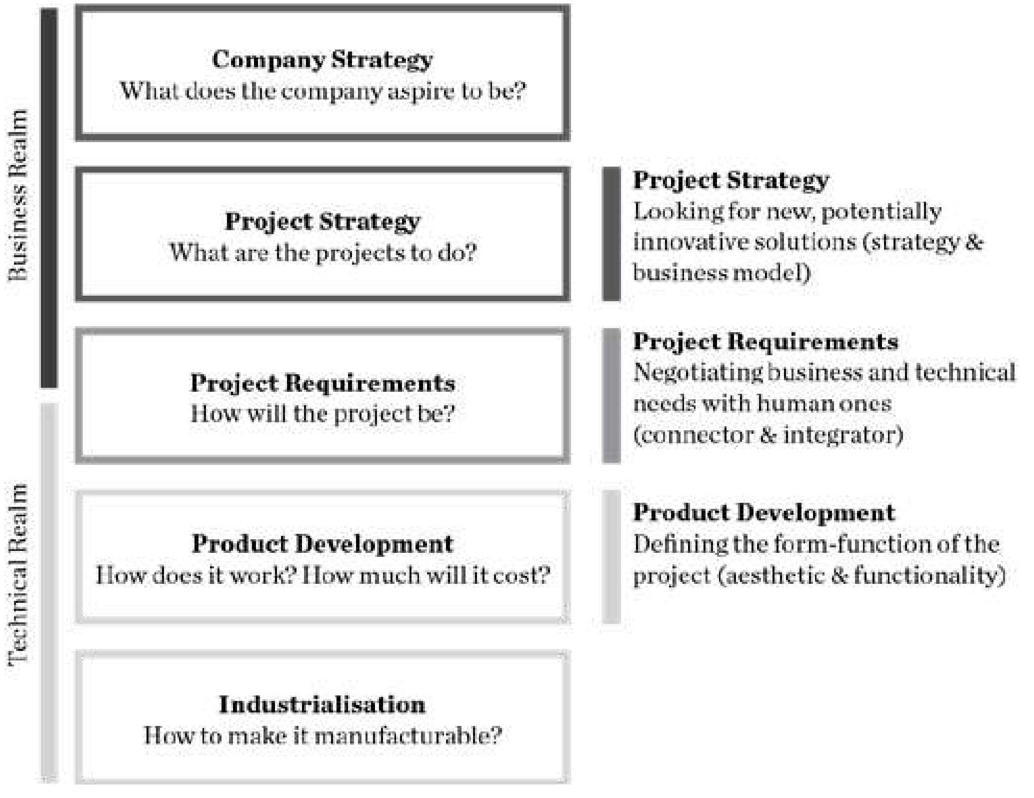


Figure 4.40 Innovation potential model.

roles of design in the organisation. In this model, the design activity could affect the company as a tactical, organisational and strategic driver. As a tactical driver, the design focuses on development and delivery mainly on aesthetical and functional aspects. As an organisational driver, the design focuses on management activities working as a connector among functions and knowledge integrators. As a strategic driver, design took part in the company's planning activities, paying attention to business models and strategy-making. The progression and adoption of design as a driver in increasingly critical areas of the organisation is a sign of maturity for design and design management. From this perspective, the Electrolux Professional practice model describes the evolution of the design thinking practices and the role of design in the company, suggesting a correlation between the analysed practices and the escalation. Indeed, if the design department was mainly focused on delivering tasks in the pre-design thinking era, introducing design thinking practices opens them up to new opportunities. Firstly, it proves its capability to connect and integrate knowledge through the project requirements practices, and finally, showed its value even in strategy-making.

This model synthesises the evolution of the role of design thinking in Electrolux Professional, showing how different practices could be used in different situations to support company decision-making. This model and the other two discussed synthesise what is and how design thinking works in the Electrolux Professional context. The accumulated understanding is exploited in the next paragraph to explore a possible strategy to evaluate design thinking.

4.3 Evaluation

This paragraph discusses a methodological approach and the strategy designed to assess the design thinking impacts on the Electrolux Professional ecosystem. After identifying the goals and the metrics to track for a suitable assessment, the researcher tried to set up the data collection process integrating the recordkeeping system into the Electrolux Professional innovation platform. Still, the process is not completed yet. The last paragraph discusses the next steps of the evaluation anticipating the future research intentions.

Methodology

The methods selection process starts by exploring the ROI methodology to understand its applicability to design thinking practices. After its review, more lessons and inspirations from the OKRs framework were collected to deepen other possible complementary approaches. Finally, the methods identified were evaluated to select the most suited ones for the design thinking evaluation.

Lessons from ROI Methodology

As anticipated in the introduction, this industrial PhD thesis started with a given topic: the design thinking Return on Investment (ROI). The subject was then broadened to a more generic evaluation. Still, the ROI methodology has been a subject of study since the beginning of the research. After deep analysis and discussions, the methodology turns out to be partially unsuited for the scope. However, the main structure and several methods described in the process could serve as methodological foundations for the design thinking practices assessment.

ROI methodology

The ROI methodology provides organizations with a process that can link programs, strategies or initiatives to measures to evaluate them (Phillips et al., 2019). The ROI methodology's richness is inherent in the types of data monitored during the implementation of a particular program. These data are categorized into five levels: input, reaction, learning, application, impact and ROI.

Input data is usually classified as volume (how many people are involved), costs (direct and indirect costs of the program), and time (the time that they are involved). Reaction data focus on the perceived value of the program from participants. Learning data considers the knowledge gained by the practice and the development of proper skills and competencies to drive the programme's success. Application data refers to the use of knowledge, skills and competencies. The Impact data express the process outcome as a business impact measure. Finally, ROI data convert the impact on monetary values. Each level of data can support the overall evaluation by supplying information about the success of a program. However, it is not necessary to reach the ROI level to produce a valuable assessment.

The methodology process is designed in four main phases: plan the evaluation, collect data, analyse data, and optimise results. The first phase focuses on programming the assessment. Here, evaluators have to clarify the program's purpose, identify the right metrics, select the proper methods and set the program's objectives. The second one is about data collection. Considering a wider variety of possible information, the reviewer has to apply the proper method and use the right tool and mechanisms to gather the required data. In the third phase, data must be analysed. The researcher has to isolate the program's effects to determine the amount of outcome performance directly related to the project. Then, he has to use the proper technique to convert data to monetary values and calculate the program's cost to obtain the ROI value. Finally, data are used for communication and optimisation. The reviewer has to share with the stakeholders the results through the proper communication strategy and exploit the knowledge acquired to optimise the program according to them.

During this process, the conversion of the impact to monetary value is not always needed and possible. Indeed, we can distinguish between two kinds of measure: Tangible and intangible. Tangible metrics are easily convertible data that could be transformed into an equivalent amount of money—for instance, sales, profit margin, workload market share or loyalty. Instead, an intangible benefit is a measure that is not converted to money because the conversion cannot be accomplished with minimum resources and with credibility. Some examples are agility, collaboration, communication, decisiveness, engagement, mindset, risk, sustainability, trust or work-life balance. In one study or another, each item on the list has been monitored and quantified in financial terms. However, in typical programs, these measures are considered intangible benefits because of the difficulty in converting them to monetary value.

In design thinking, intangible values are the norm rather than the exception, making them challenging to capture and convert. The ROI methodology is not the perfect answer to evaluate design thinking. Still, it has its value as an assessment practice. To understand its potential benefits and limitations, we can deepen an existing case that could give us more clues about this approach.

ROI for design thinking

The report introduced in the third chapter (Forrester, 2018) is an excellent example of assessing design thinking with the ROI methodology. We can analyse how they face the challenge of evaluating tangible and intangible benefits.

From the tangible side, Forrester assessed IBM's design thinking by collecting mainly input data about time and costs to evaluate the cost reduction of the process and the faster time to market. Then, they use it to esteem a standard per project data model that they projected for three years. This practical calculation was possible because they analysed the data by isolating the effect through an experimental design method. The Forrester assessment team esteemed the reduced cost of the design thinking practices compared to a control group that did not employ any design thinking process. This evaluation was possible due to the availability of data and the consultant nature of IBS's practices[262]. However, in the Electrolux Professional case, this is not possible. No previous procedures can be used to compare those adopting the design thinking approach. There are no records of how many hours people spend on a specific activity despite another. No data system is put in place to track this information.

On the contrary, Forrester's team identified the intangible benefits using a survey but did not try to convert them to monetary value. Here is the second obstacle faced in trying to adopt this kind of approach. This research shows how design thinking value lies in intangible benefits. Only speed and action orientation could be directly attributed to tangible metrics. The others are intangibles that require a significant effort to track and convert to monetary value. The ROI methodology suggests various methods to measure and analyse intangibles. The first instrument lists the intangible items and asks respondents to agree or disagree on a five-point

262 The consultancy has a clear beginning and an end. They usually employ a standard practice repeater time after time with little adaptation. Moreover, data about people's hours have been methodically collected to report the payment bill.

scale. The second one assesses the intangible connecting it to a measure easier to track or value. Finally, a third instrument is to develop an index[263] of different values that combine hard and soft data. While the first and third options are reasonable solutions for the Electrolux Professional case, the second strategy is challenging to implement because of the variety of intangible elements to consider and the unavailability of records.

The study run and described in this thesis suggest that design thinking intangibles impacts are the most critical outcomes. This aspect hinders the design thinking's impacts conversion to monetary value. Still, the ROI methodology offers insightful learnings on how to run a successful program evaluation.

Useful Considerations

There are pros and cons to the ROI methodology applied to design thinking. As a procedure, it does not describe only a static process but a rich array of valuable strategies, methods, tools and examples that any evaluative approach should acknowledge. From the above example, we can highlight three primary considerations about the design thinking assessment.

Design thinking is not a program but a living practice. Thus, it is complex to identify what it is and what to measure. Without the proper understanding of what design thinking is and its meaning for Electrolux Professional, it would be impossible to plan the evaluation. A large part of the thesis was dedicated to this aim. Determining the design thinking practices and impacts and modelling them required a lengthy exploration of the phenomenon. The models presented in the previous paragraph set the foundation for planning the assessment. Without them, the evaluation would not be able to identify the metrics to collect.

Design thinking has mainly intangible benefits. Thus, they are hardly convertible to monetary value. Despite the speed and action orientation, design thinking impacts are complex to assess. There are no standard metrics to collect or methods to convert them to monetary value easily. To convert those intangibles to economic value, esteeming methods exist. However, they are complex and time-consuming, requiring the involvement of participants, stakeholders and experts to gain a credible result.

Design thinking data in Electrolux Professional are not available. Thus, they are arduous to collect and isolate efficiently. In almost every program, multiple factors influence the impact metrics the evaluation

263 An index is a single score representing some complex factor constructed by aggregating several measures.

targets. Without a step to separate the program's effects from other influences, the program's success cannot be validated. There are quantitative or qualitative techniques to isolate the impacts. The most reliable is the experimental design described in IBM's case. Other quantitative methods are trend line analysis[264] and mathematical modelling[265]. However, both need previous data to work, and there are not in the Electrolux Professional case. Other qualitative approaches involve a group of expert individuals to estimate contribution. The method could include participants, managers, experts or crowd estimation. Each asks what factors have contributed to a given improvement and to which percentage the program influenced it. This method could pinpoint the contribution to a problem in Electrolux Professional. However, compared to the quantitative one, it requires a substantial time involvement of the program's participants.

The ambiguous nature of design thinking and its intangible metrics makes them hard to collect and even more complex to convert into monetary value—moreover, the lack of pre-existing tracking systems worsens the situation. Nevertheless, the methodological structure described in the ROI methodology offers a valuable framework for structuring the design thinking assessment.

Lessons from OKRs Framework

In program planning, the definition of objectives is fundamental because they provide participants with direction, focus, and guidance. Goals should be defined at multiple levels: from input to ROI, and they should be interconnected to ensure the program has a cohesive direction. This paragraph explores the goal topic and introduces the OKRs methods to discuss the role of objectives for the assessment.

Evaluation Goals

As discussed in the third chapter, design thinking evaluation is far from standardisation because it is a complex subject. However, it remains one of the main priorities for design managers. Electrolux Professional stakeholders expressed this need too, so why is that important? The first question to address, before even setting the goals of the design thinking

264 This approach draws a trend line to project the future, using previous performance as a base. When the program is fully implemented, actual performance is compared with the trend line projection.

265 A more analytical approach to trend line analysis is the use of mathematical modelling to predict a change in performance variables. "is approach represents a mathematical interpretation of the trend line analysis when other variables enter the situation at the time of implementation.

practices, is: what are the objectives of this evaluation?

Analysing the reasons behind it, we can identify three main interconnected goals. Firstly, it is fundamental to determine the effectiveness and efficiency of program delivery in response to the particular needs of various groups that benefit from it. Secondly, this data serves as a venue for reflection to gain insights, identify the lessons learned, and generally understand project experiences. This way, you can acquire a realistic and valid basis for inferences and decisions necessary for programming future actions and recommendations. Thirdly, it keeps supporters updated on the project's status, providing information which will assist the donors and other local coordinating groups in formulating policies and guidelines relevant to the program. Usually, interest does not end when funds have been transferred to the proponent. Hopefully, it is the beginning. As the program evolves, new information supports donors' decisions to increase, reduce or keep the investment in the program stable.

These objectives are vital to programs and practices aimed at learning, improving, and growing in an organisational context. To achieve these results, we must first determine the program's impacts in relation to the needs of the stakeholders interested in it. Without goals that give context to metrics, the evaluation risk losing its focus and becoming meaningless. Before discussing the design thinking goals topic, we have to introduce the Objective and Key Results (OKRs) framework (Doerr, 2018).

OKRs Framework

OKRs is a critical thinking framework and ongoing discipline that seeks to ensure employees work together, focusing their efforts on making measurable contributions that drive the company forward (Niven & Lamorte, 2016).

An objective is a concise statement outlining a broad qualitative goal designed to propel a program forward in the desired direction. A key result is a quantitative statement that measures the achievement of a given objective. Together, objective and key results force you to quantify what may appear vague or nebulous words in your goal to indicate your performance. The OKRs framework aims to give a structure to the objectives interconnecting the higher goals level with the underneath ones to ensure that the achievement of the lower goals thrives the higher ones.

Objectives must be inspirational but attainable, finding the balance between inspiration and reality. They should represent what you hope to accomplish and be expressed in words, not numbers. Moreover, they must be time framed and controllable by the team. Instead, Key results are necessarily quantitative, so they can be applied numbers to determine whether or not they met the objective. They should be aspirational, stretching the limits to challenge your teams to think differently and drive the right behaviours. We can set three types of key results: metric, milestones and health. Metric key results track quantitative outcomes designed to measure success on your objectives[266]. Milestone key results stimulate progress and innovative thinking to meet the targets. Health metrics are something the company will frequently monitor because they represent the successful execution of its strategy. They should derive directly from your strategy and be considered a complement to the OKRs.

Each key result has to be calibrated, creating a series of targets delineating the expectation of bad, good, or mediocre performance. Scores should be applied to communicate expectations, enable continuous learning, and provide valuable clarity around what progress looks like for the key result. The score scale is set on a rescale from 1.0 to 0, where 1.0 is a highly ambitious outcome that may appear nearly impossible to meet. 0.7 represents the progress that is difficult but ultimately attainable. Finally, 0.3 represents the performance we can achieve with standard effort. Setting targeted performance levels is one of the trickiest aspects of any monitoring system. Usually, you have to take advantage of any quantitative background material you have, but sometimes it is not possible and subjective evaluations and “gut feelings” is required.

This framework exploits OKRs to manage programs and practices by setting the team’s objectives and involving them in recurring assessment meetings to check results and update the evaluation. This process is off the topic of this evaluation because the data collection method would be too expensive for the participants involved in the design thinking practices. Still, the framework offers valuable insights into the role and relationship between objectives and key results. The next sub-paragraph discusses the relationships between the design thinking practice and the OKRs approach.

OKRs for Design Thinking

By analysing the OKRs framework, we can identify critical insights for a functional evaluation of the design thinking practices.

Firstly, objectives have a strict relationship with metrics. Thus,

266 There are three sub-types of metrics: positive, negative, and threshold target (requires a range to describe the key result adequately).

it is paramount to set the goals along with the criteria to check their achievement. Without a plan that stimulates the participant in a desirable direction, the evaluation loses one of its primary purpose: facilitating learning, reflection and change. In the design thinking case, we saw that the fundamental purpose of the practices is to support decision-making, both from the managerial and design perspectives. Thus, objectives should be set to define the ambition of the design thinking practices that, in turn, will inform the metrics to use.

Secondly, objectives work on multiple levels, one drawing upon the others. Thus, you have to design an interconnected network among them. Goals should be interconnected to the department strategy to lead the practices in the right direction. In the design thinking case, decision-making is the higher purpose of the practices from a managerial perspective. Still, in turn, good decisions are uplifted by other impacts. The model discussed in the previous paragraph defines their relationship in a pyramidal structure where knowledge creation and social interaction impact support decisions. The same interconnection should be identifiable in the objectives if we want to build a practical evaluative framework.

Thirdly, objectives need calibration and targets to get practical. Thus, you have to set thresholds and score scales feedback to encourage improvement. The goals of a program are clear-cut, but a living practice such as design thinking sets the right target is not a foregone conclusion. The target of each practice may depend on the project's size, time frame, and stakeholders involved. In the Electrolux Professional case, no background information exists to calibrate the objectives. Thus, subjective targets cannot be avoided. A possible strategy suggested by the OKRs framework could be to score a challenging target and adjust it by collecting data along the way.

Objectives are essential to address participants in improving the measured targets. If adequately defined, each goal is interconnected with a higher one, moving the individual effort in coordination with the global strategic direction. This way, the evaluation mechanism starts moving properly, gaining data, improving the system and demonstrating the value of the practices. However, before setting the goals and defining the metrics, we must discuss the proper method to acquire and analyse the required information.

Evaluation Strategy

Combining the lessons from the ROI methodology with the OKRs framework, we can now sketch a strategy to evaluate the design thinking's impact on innovation.

Regarding the method selection, the researcher compared the techniques suggested by the ROI methodology to identify the proper data collection and isolation approaches. For this selection, the researcher ran a multiple-factor assessment, comparing the methods to select the most suited ones. The analysis considered three main aspects: the level of accuracy of the technique, the implementation impact on the organisation, and the participants' involvement effort in the assessment[267]. The researcher scored them on a three-point scale, always considering the lower value a negative impact and the higher value a positive one[268]. Then he calculated the sum of the numerical values to rank the methods. Finally, he selected the most appropriate methods, arguing the choice. Before discussing the methods and the evaluation results, a premise and some limitations must be clarified to understand the nature of this last part of the thesis's work.

Premises and Limitations

The premise is that the method described and the results discussed in the following paragraphs are incomplete. Currently[269], the evaluation process is still in the data collection phase. The evaluation structure has been drafted, but not enough data have been collected for enough time to draw appropriate conclusions. The process is still running. Therefore, it should not be considered a representative case but more as the end of a thesis anticipating future results. The limitation that refers to the premise is that the evaluation process is a practice that requires time and iterations to be adequately refined. There are not enough examples to draw from to select reliable metrics. They have been chosen, at best, by looking at the few pieces of literature evidence identified[270]. Still, this process should not be considered complete. The intangible nature of the design thinking impact and the context variable makes the process tricky.

267 Each of the three aspects has been divided into two factors. In the first case, the two parameters selected are credibility and accuracy. In the second case, they are implementation cost and feasibility. In the third case, they are the participants' work-life disruption and the participants' time required for the assessment.

268 For instance, the researcher scores the "cost" factor one when the method is expensive. He scores it with three when it is cheap.

269 Dicemebre 2022.

270 The researchers do not have time to do dedicated research for each impact to measure.

The assessment is not scientific. It is a practice used to manage and drive results and should be regarded as the first iteration of a cyclical process.

In summary, the final part of this paragraph discusses the exploration and the results achieved till now. It is not a comprehensive study of the design thinking evaluation. This part of the thesis is still ongoing and could not be considered closed.

Tangible Benefits Methods

Different methods exist to collect the required metrics to assess the design thinking practices. To compare and select the more appropriate, we can first distinguish between two groups of methods: tangible and intangible.

Analysing the Forrester report (Forrester, 2018) and the impact model developed in the previous paragraph, we can see that despite the many possible benefits, design thinking's most fundamental tangible impact refer to speed. Indeed, time is the most used metric for this assessment.

In the IBM case, the reduced design and maintenance cost and increased profit from faster time-to-market use time saving as the primary metric for the evaluation. Exploiting this calculation, the Forrester team compared IBM's consultancy practices employing design thinking with the ones that did not, identifying a higher ROI of the design thinking practices. This evaluation was possible due to the data collected by IBM by monitoring performances in standard and design thinking practices. However, Electrolux Professional does not have any monitoring process in place. A proper method to collect this data should consider the involvement of a large group of people over a prolonged timeframe. Hypothetically all teams and colleagues involved in the innovation projects should use this method continuously over and over without overwhelming the daily work of people and reviewers.

Considering these elements, we can compare the methods the ROI methodology suggests for data collection (Table 4.5). The researcher assessed each of them by weighing[271] six variables: the method's feasibility, accuracy, credibility, cost of implementation, disruption in work activities, and time required for participants involved. For the collection of tangible benefits, the most promising methods seem to be surveying and monitoring performance due to their reduced impact on the cost of implementation, disruption and time required. The others are time-consuming and not adaptable to collecting metrics related to time.

271 Each variable was scored on a three-point scale showing the value's sum in the last column. The methods with a higher score should be considered the most promising ones.

Collection Method	Feasi-bility	Accuracy	Credi-bility	Cost	Disruption	Time Required	Tot
Survey	3	2	2	2	2	2	13
Interview	3	2	2	1	1	1	10
Focus Group	3	2	2	1	1	1	10
Observation	1	2	2	1	1	1	8
Action Plan	1	3	3	1	1	2	11
Performance Contract	1	3	3	1	1	2	11
Monitoring Performance	1	3	3	1	3	3	14

Table 4.5 Tangible benefits methods comparison: underlined the selected methods.

Questionnaires are the most common data collection method used to gather personal information about participants and document them. The questionnaire may contain open-ended questions, checklists, ranges of responses, multiple-choice or ranking scale questions about the practice and collect data by submitting a form to a selected sample of people. Realising a survey is highly feasible, and it can gain good information still is not always efficient in terms of cost and time. On the contrary, a performance monitoring method is highly efficient for the participant when implemented but costly to develop and make it feasible. In Electrolux Professional, the lack of a monitoring process for the required metrics makes it complex to realise but paramount for efficiencies of the overall process. For the successful acquisition of the input-related metrics necessary to evaluate the tangible design thinking benefits, the survey methods could collect information once in a while. Still, only a monitoring process could guarantee an efficient collection of the necessary information for the evaluation.

Intangible Benefits Methods

Looking at the design thinking impact model described in the previous paragraph, we can observe that the tangible benefits connected to design thinking are only a tiny amount compared to the intangible ones. The "Value for Money" book authors suggest that, as a general rule, only about 15 per cent of the value of a contemporary organization can be tied to tangible assets. Intangible assets have become the dominant investment in businesses, becoming a growing economic force. These measures are usually identified at the beginning of the program and monitored after the program has been completed. However, as for the design thinking case, sometimes they are the most critical outcome and must be assessed.

In the IBM case, intangibles have been just acknowledged, using a survey to explore the design thinking perceived intangible value. A similar step was done with another method in this research through the explorative playtesting activity narrated in the previous chapter. In both cases, intangible metrics were revealed, but no assessment was done. The ROI methodology suggests three methods to assess the intangible benefits. We can use an agree or disagree Likert scale, developing a significant correlation between the intangible and tangible value or creating an index of hard and soft value representing the factors that influence the intangible value.

Comparing these methods using the previously described variables (Table 4.6), we can see a similar scoring result. The correlation method is the most reliable and less disruptive approach. Still, it is hardly feasible due to the lack of links between the easy-to-value ad hard-to vale items. The Likert scale method is easy to implement and has a mid-point impact on the time and disruption variables. However, this approach will add only a bit more credibility to the result of the previous exploration, straightening the perceived impact but not offering a credible verification. Finally, the value index has intermediate values in all the sectors with no particular weaknesses. The value index method combines hard and soft data items that make up a specific index value and collects them through a proper process.

In the design thinking case, the first method does not offer enough additional value to the evaluation. Moreover, a survey about the design thinking topic would be complex to answer for the practice participants. Two are the main impediments. Firstly the difficulty of identifying design thinking as an approach adopted for a specific practice. Secondly, the little interest of the organisation in such information in comparison with the effort required by participants to gain these data. The second method is nearly impossible to adopt in the Electrolux Professional context due to the lack of records about hard metrics and the number of impacts the design thinking practice aims to measure. Finding the proper hard value to correlate each intangible and track their performance is complicated. The third case offers a halfway method. Each impact is decomposed in a pattern of hard and soft metrics collectable by monitoring or surveying some values.

Collection Method	Feasi-bility	Accuracy	Credi-bility	Cost	Disrup-tion	Time Required	Tot
Likert Scale	3	1	1	3	2	2	12
Correlation	1	3	3	1	2	2	12
Value Index	3	2	2	2	2	2	13

Table 4.6 Intangible benefits methods comparison: underlined the selected methods.

Isolating Methods

The design thinking tangible and intangible benefits could be collected by identifying the proper set of metrics and acquiring them using monitoring techniques and, if necessary accurate surveys. Still, collecting this information does not guarantee their correct use. Data should be isolated from other influences to have a valuable result.

The Forrester case used the experimental design method to gather the correct value for the data collected. The experimental design method is the most reliable way to isolate the effect. However, it is not always applicable to all contexts. There are both qualitative and quantitative methods to isolate the results of the impacts. By comparing them (Table 4.7), we can notice how the quantitative methods (experimental design, trend line analysis and mathematical modelling) are reliable and accurate. Still, they are almost not feasible in Electrolux Professional context. The lack of comparable practices or records of data to distinguish before and after the design thinking adoption makes these approaches complex to use.

On the contrary, the qualitative methods are more accessible to implement but lack the same credibility and accuracy. In particular, the participant estimation method is the most reliable but even the most time-consuming and disruptive. The expert estimation is efficient from this point of view but not enough accurate and credible. A reasonable compromise seems to be the manager estimation, which mediates an acceptable level of credibility with a balanced implementation effort. Whether the people involved in the methods, there is a standard process to measure the attribution using estimates. Given an improvement, firstly, the appraiser must list the possible factors they believe have contributed to the improvement. Secondly, discuss the linkage of each element to the impact. Thirdly, define a percentage of how much of the improvement is due to the practice. Fourthly, indicate on a scale from 0% to 100% how confident you are of the estimation. Finally, analyse the data by multiplying your

Isolation Method	Feasi-bility	Accuracy	Credi-bility	Cost	Disrup-tion	Time Required	Tot
Experimental Design	1	3	3	1	2	2	12
Trend Line Analysis	1	3	2	1	2	2	11
Mathematical							
Modelling	1	3	2	1	2	2	11
Participants' Estimation	2	2	2	2	1	1	10
<u>Mangers' Estimation</u>	3	2	1	3	3	3	15
Customers'							
Estimation	1	2	2	1	1	2	9
Internal or External Expert Estimation	3	1	1	3	3	3	14

Table 4.7 Isolating methods comparison: underlined the selected method.

impact value for the estimated contribution (third point value) and the error adjustment (fourth point value). The first two points identify the influential factors and focus the reviewers' attention on them. The second two collect the estimations. Finally, a simple calculation adjusts the initial impact value considering the other possible influential factor.

Summary

Design thinking has mainly intangible benefits for an organisation compared to tangible ones. By definition, intangibles are complex items to measure and monitor that require a proper method to become trackable. The value index method seems the most practical choice in the Electrolux Professional context. Indeed, it correlates the intangibles with a pattern of hard and soft metrics that are easier to collect with other methods. This way, intangibles are made tangible by an index of values that could be monitored and tracked like the other impacts. Comparing different alternatives, the best strategy to collect tangible data seems to be monitoring performance and the survey methods. Indeed, these approaches could be effortlessly combined to collect the required metrics. Monitoring techniques foster the acquisition and registration of data into a proper database. This information could be automatically registered or manually tracked by an evaluator. While survey could be used when this information is not directly capturable and additional data acquisition is required. Whether the methods are used to collect tangible or intangible benefits, we need to isolate the effects from other influences. For this scope, qualitative approaches seem to be the only ones practicable in the Electrolux Professional context. In particular, the manager estimation appears to be a good compromise between efficiency and credibility compared to participants or expert estimation.

Acknowledging the Electrolux Professional context and the design thinking characteristics, the combination of four methods seems to support a proper evaluation strategy. Firstly, the value index approach should translate intangible values into tangible ones. Secondly, monitoring and survey methods should collect the identified metrics in appropriate records. Finally, managers should adjust the impact results according to other possible influences by the estimation method.

Plan the Evaluation

This paragraph discusses the interconnection between design thinking and the Electrolux Professional innovation objectives. By defining the metrics that influence their goals, we can identify which are the design thinking's impacts on innovation and sketch a draft framework of how they are related.

Method

Selected the evaluation strategy, the researcher focused on defining a framework to assess the design thinking impacts on innovation. To identify which design thinking impact affects innovation, the researcher first delineated the goals-metrics architecture of the design thinking practices and the Electrolux Professional innovation system. Then, he cross-analysed the two frameworks to pinpoint the relationships between design thinking and the innovation system's objectives and metrics.

To structure this association, the researcher exploited the previous studies. He used the innovation strategy framework discussed in the second chapter to state the innovation company objectives and the impact model described above to sort out the design thinking goals. In both cases, the objectives have been organised in a hierarchical construction, connecting the broader purpose with the underlying goals. They have been defined akin to the existing models and following the OKRs principles[272].

272 Goals should be inspirational, attainable, doable in a datum timeframe, qualitative,

After that, the researcher assigned to each objective some key metrics. For the innovation system framework, the selected metrics represent generic indicators of the strategy application[273]. They were selected based on the results of the innovation audit research, which specifically asked the interviewees about the KPIs to use for innovation. Instead, in the design thinking case, the deep modelisation of its impacts largely facilitated the identification of the proper metrics. For the tangible benefits, key indicators were selected to monitor the activity[274]. While for the intangible benefits, the index value method was used to collect and monitor the proper set of metrics[275]. Three primary sources have been used to identify the metrics: the literature review of the design thinking assessment methods[276], some extemporaneous deep on the literature and the informal access to grey literature. Additional health metrics[277] were identified to check the overall framework's status and facilitate the calibration. Then, the two goals-metrics models were combined to highlight the interconnection between design thinking and the innovation system.

Finally, the researcher discussed the first draft version with the internal stakeholders to gather feedback and set the threshold targets of the objectives. Still, only negligible advice and no precise answer about the targets came from the assessment. The stakeholders involved in these informal discussions have little experience with the design thinking evaluation topics. They suggest trying out the framework in a pilot-like test and collecting feedback and data by applying it. Goals, metrics and their thresholds targets have to be calibrated in response to the pilot response because, until now, there is not enough knowledge or experience to judge the framework properly. This approach resembles the validation process of the design thinking framework process described in the third chapter. However, in this case, we are only at the beginning of the process.

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controllable by the team, and provide clear value.

273 This thesis does not aim to dig deeper into the innovation metrics assessment.

274 The researcher selected only hard metrics for tangible benefits. They are acquired by monitoring the metrics and collected in a specific ledger.

275 The researcher selected both hard and soft metrics for intangible benefits. Hard data are acquired by monitoring the metrics. In contrast, soft data are obtained by surveying the participants of the practices. In both cases, they are collected in a specific ledger. However, while the hard data are continuously monitored over time, the soft ones are collected periodically as additional assessment information.

276 See chapter three.

277 Health metrics are measures to frequently monitor because they are representative of successful execution of the objectives.

As indicated in the limitation, this evaluation process described is not exhaustive. It just gave some indication about the first draft version of the framework. There seem to be not a one-size-fits-all approach for evaluating design thinking, but more a recursive practice to gain better and better result practising it.

Set the boundaries

This thesis aims to evaluate the design thinking impacts on innovation. Thus the main subjects of the evaluation are design thinking and innovation.

As discussed in the first chapter, design thinking has different meanings in diverse contexts and times. Ultimately, it is definable as a dynamic practice with some common denominator. In the third chapter, the design thinking framework tried to frame the possible expression of design thinking practices, using a tool to analyse and map the Electrolux Professional context. As for design thinking, innovation is another world that assumes different nuances depending on the context or discipline that adopts it. As discussed in the second chapter, innovation in Electrolux Professional preserve this ambiguity of meaning. Still, an effort was made to capitalise the innovation audit research into a framework describing the organisation's innovation strategy. Both subjects have been studied and analysed deeply during the thesis to define them, at least in the Electrolux Professional context.

Now that it is time to plan the assessment, the researcher exploited them to set the boundaries of a practical evaluation. Here we consider as design thinking all the practices that the Electrolux Professional innovation team run that fall within the "mechanisms model" pattern. Still, only the impacts that influence the Electrolux Professional innovation strategy will be considered for this evaluation. Indeed, as the "impact model" showed, design thinking practices have several impacts on the organisation, not only directed toward improving innovation. To determine the relationships between the design thinking impacts and the company innovation process, we have to define the goals and metrics from both sides and see if they are synergies.

As discussed in the ROI methodology and the OKRs framework, goals and metrics are strictly connected. Objectives set the direction, and the metrics give feedback about its achievement. Together they form an engine that pushes practitioners, teams and organisations toward better results. However, they must be interconnected and aligned to work in the right direction. By defining the design thinking and the Electrolux Professional innovation goals, and their interconnected metrics, we can see if they move toward the same purpose and which design thinking impacts affect innovation.

Innovation

In the second chapter, the researcher studied the innovation context of Electrolux Professional. From that inquiry, the innovation team defined its innovation strategy. Electrolux Professional's innovation strategy focus on five main pillars: focus, human centricity, process, community and culture. For each pillar, we can state an objective that directly connects the strategy to its actual implementation in the activities of the innovation team. Then, each goal is assessed by monitoring some key results: metrics that should give feedback about the achievement of the objective. This model (Table 4.8) shows the relationship among the strategic innovation pillars, the goals and the related metrics.

Innovation Objectives and Metrics

The objective of the focus pillar is to address the organisation's limited energies on the most promising innovative opportunities. Electrolux Professional's multi-brand and multi-specialist DNA make the organisation struggle to identify the best options. Its little energy does not allow the organisation to bet on every one of its segments. The innovation team must support the organisation in deciding the most promising opportunities. To assess this goal, the key indicator the team should monitor is the number of ideas that move through the innovation process. How many ideas have been generated? Which are the sources of these ideas? What percentage gets discarded, and what passes to the development phase? These numeric indicators give feedback about the innovation team's capability to direct the company's energy toward a reduced number of potential innovations[278].

The objective of the human-centricity pillar is to put customers at the centre of the company's innovation process. In a B2B global market, the human perspective is essential to capitalise on all the stakeholders' needs involved in the business. The innovation process starts and ends with customers, focusing on people's present and future needs. The innovation team must gather insights for and validate ideas with customers to

278 Ideas are likely innovations until they do not prove their innovativeness in the market. To assess the innovativeness, see the "health metrics" discussed at the end of this paragraph.

Pillar	Objective	Metric	Source
Focus	Focus the organisation's limited energies on the most promising innovative opportunities.	Number of ideas through the innovation funnel.	Innovation Audit
Human Centricity	Put customers at the centre of the company's innovation process.	Number of customer interactions	(Royalty & Roth, 2016a)
Process	Manage the innovation process efficiently.	Time through the innovation funnel	Innovation Audit
Community	Build an internal and external innovation community.	Number of colleagues and external entities involved	Innovation Audit
Culture	Become the catalyst of the organisation's innovation culture.	Number of initiatives	Innovation Audit

Table 4.8 Innovation strategy objectives and metrics.

design human and planet-centred innovations. To assess this goal, the key indicator the team should monitor is the number of customer interactions. How many customers have been involved in the research or testing? Do we consider and listen to all the different possible categories? This indication gives feedback about the innovation team's ability to collect customer knowledge to design a potential human-centred innovation.

The objective of the process pillar is to manage the innovation process efficiently. Before the innovation team was in charge of innovation, there was no structured process to manage potentially innovative opportunities. Innovation was left to product development, which already struggled with day-to-day activities to have time for innovation. The innovation team must set up the proper process investing enough time and resources to have a chance to innovate. To assess this goal, the key indicator the team should monitor is the time that ideas take to move through the innovation process. How long does an idea take to get explored? This indication gives feedback about the innovation team's ability to process opportunities efficiently.

The objective of the Community pillar is to build a large internal and external innovation community. Electrolux Professional used to rely too much on internal resources that already had their main work concerns to figure out. No time or people were dedicated to innovation. The innovation team must involve internal and external resources in the innovation process, building a community that participates collaboratively. To assess this goal, the key indicator the team should monitor is the number of colleagues and external entities involved. How many colleagues do we reach out to? From which department do they come? How many startups, universities, or other entities do we talk to? Were people engaged in innovation? These indicators give feedback about the innovation team's ability to build a network of innovators willing to support and participate in innovation.

The objective of the culture pillar is to make the innovation team the catalyst of the organisation's innovation culture. The right culture is fundamental to setting the suitable condition for innovation. Acknowledging risks ad failure as part of innovation is a cultural aspect that cannot be avoided. The organisation's transition toward new values goes through everyone's everyday experiences in their work life. The innovation team must involve the highest number of people in training, workshops and other initiatives to spread the innovation values to the organisation. To assess this goal, the key indicator the team should monitor is the number of initiatives run and their resonance level in the organisation. How many initiatives does the innovation team run? What kind of activities are: training, workshop, challenges? How many people did they reach? These indicators give feedback about the innovation team's ability to transfer innovation values to the organisation.

Framework

The goals-metrics framework summarises the evaluative architecture of the Electrolux professional innovation strategy (Figure 4.41). We can observe the innovation strategy objective with its five main sub-objectives, each with its key indicator. In addition, three external health metrics have been identified to check and calibrate the framework.

All the sub-objectives and their key indicators should be considered together. Singularly, they give feedback about a part of the innovation story. Together they return a rich picture of innovation. For instance, we can identify the most effective innovative practices by knowing the sources of the ideas, the rate of success and the time to explore them. Or we can understand the best way to build a community and foster an innovation culture by knowing the kind of initiative, the number of people successfully involved, and their engagement rate. Metrics could be mingled creatively to speculate on how to improve innovation and use them to pinpoint the narration of the team's achievements.

However, other company metrics should be considered to check, adjust and give more credibility to the data collected. Health metrics are measures to frequently monitor because they are representative of the successful execution of the strategy. For example, by monitoring the sales coming from the developed innovation opportunities, we can understand the real impact of innovation downstream of the process. By evaluating the time to market, we can determine if the innovation process speeds up or slow down the overall development. By looking at the investment rate on innovation, we can understand if the innovation team effort is evaluated positively or not by the organisation. They supply reliable evidence about the strategy's success and are data that check if the overall objective-metric framework is working correctly.

Despite the different aspects, the innovation strategy framework considers and assesses criteria that do not directly refer to design thinking. Before cross-checking the interconnection between innovation and design thinking, an objective-metric framework should be sketched even for the design thinking side.

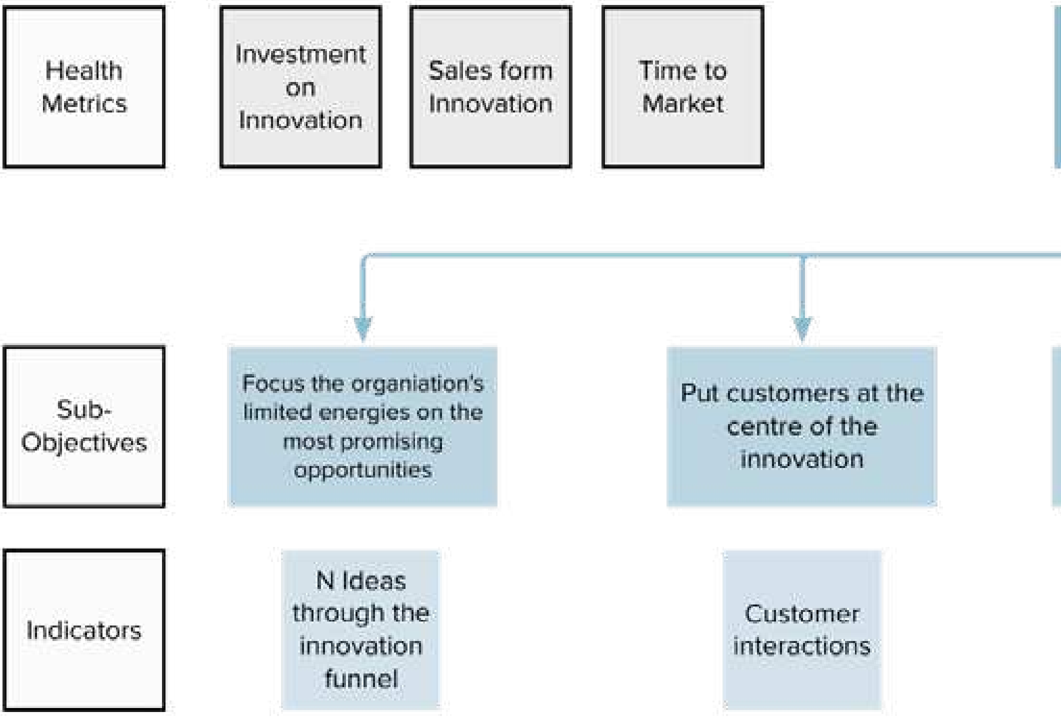
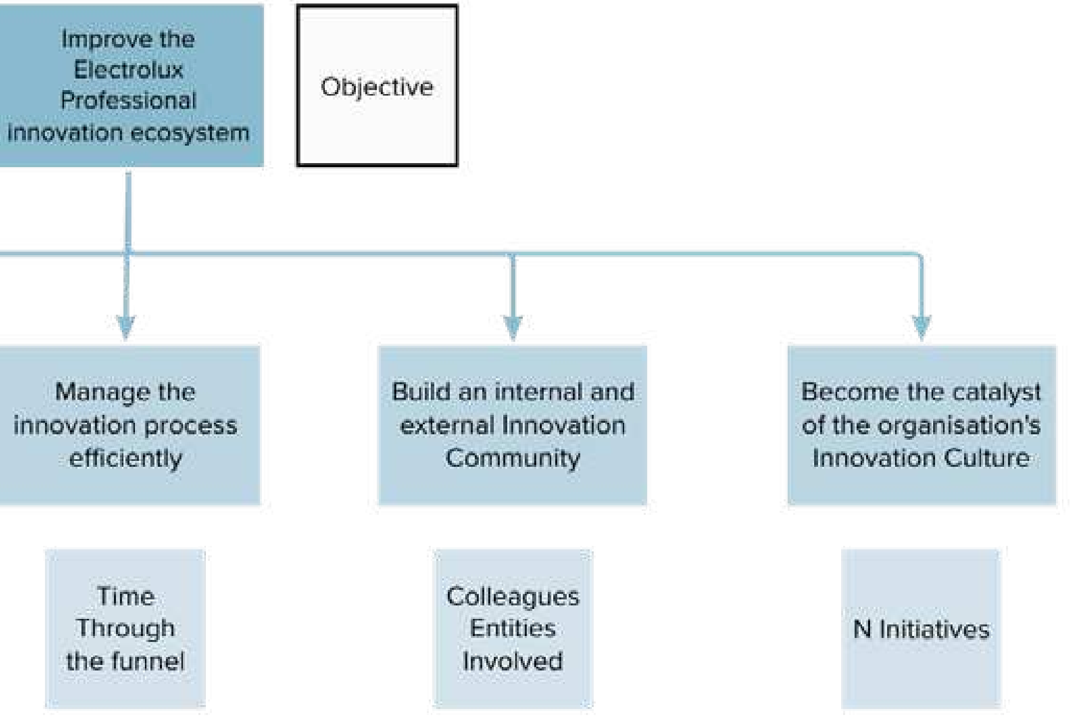


Figure 4.41 Innovation strategy objectives-metrics framework.


Improve the Electrolux Professional innovation ecosystem
Objective
Manage the innovation process efficiently
Build an internal and external Innovation Community
Become the catalyst of the organisation's Innovation Culture
Time Through the funnel
Colleagues Entities Involved
N Initiatives

Design Thinking

In the previous paragraph, the researcher exploits the design thinking framework to study Electrolux Professional practices and induce an impact model that summarises the relationship between design thinking and its organisational impacts. Three primary clusters of impacts emerged from that inquiry: knowledge creation, social interaction and decision-making. All of them are mainly intangible values. Therefore, this model creates a value index for each of the three primary design thinking impacts, exploiting the sub-impact as descriptive elements of the index. In each group, the sub-impacts inform the definition of an objective. Indeed, impacts represent both the effect and the purpose of design thinking, making them easily translatable in goals. Then, each objective is assessed by monitoring some key results: metrics that should give feedback about the progress toward achieving the objective. This model shows the hierarchical relationship among the three primary design thinking impacts, their sub-impacts, the goals and the related metrics.

Design thinking Objectives and Metrics

The objective of the knowledge creation cluster is to generate and collect usable knowledge assets for the organisation. The design thinking mechanism model shows that design thinking is a learning process. During the entire practice, practitioners adopt different learning mechanisms to acquire knowledge about the project and use it to design and manage the process. This knowledge, if adequately reified, becomes an asset for the organisation. We could categorise them by typology into four clusters, each with its sub-goal and metrics (Table 4.9 Knowledge creation value index: objectives and metricsTable 4.9).

The objective of the social interaction cluster is to facilitate organisational social interactions. Design thinking practices catalyse collaboration by making extensive use of participative processes. In almost all the analysed cases, workshops involving the main stakeholders of the projects are employed to ease the internal interactions, improving both knowledge creation and decision-making. Design thinking impacts social interactions from many sides. We could categorise them by typology into six clusters, each with its sub-goal and metrics (Table 4.10).

The objective of the decision-making cluster is to support organisational decision-making. Whether decisions focus on idea development or management, design thinking supports those decisions by supplying practical knowledge and facilitating the suitable social conditions to make

Sub-Impact	Sub-Objective	Hard Metric	Soft Metrics	Source
Research Knowledge Assets	Collect Insightful information about Customers	Number of Research Activities	Reliability Impact	(Royalty & Roth, 2016a); Grey Literature
Ideas Knowledge Assets	Find, fine-tune and develop novel Ideas	Number of Ideas	Creativity Assessment	(Hawthorne et al., 2016); Innovation Audit
Testing Knowledge Assets	Get leanings from testing the hypothesis	Number of Ideas Tested	Reliability Impact	(Royalty & Roth, 2016a); Grey Literature
Knowledge Reification	Concertise knowledge into tangible and usable forms	Status Ideas in the innovation process		Innovation Audit

Table 4.9 Knowledge creation value index: objectives and metrics.

Sub-Impact	Sub-Objective	Hard Metric	Soft Metrics	Source
Collaboration	Support people working together	Number of people involved		Grey Literature; Innovation Audit
Breaking the Silos	Bring together people's diversity	Number department involved		Grey Literature; Innovation Audit
Engagement	Encourage people to work together.		Engagement level Survey	Grey Literature
Communication	Ease dialogue and exchange of information	Number of participative activities		Grey Literature
Creative Confidence	Empower people Creativity		Creative confidence Survey	Grey Literature
Trust	stimulate people's belief in relying on or being confident in colleagues and information.		Trust Survey	Grey Literature

Table 4.10 Social Interaction value index: objectives and metrics.

decisions. In some way, decision-making is the primary purpose of design thinking practices, the reason why knowledge is acquired and social interaction facilitated. However, we can distinguish other decision-making sub-impacts in design thinking. We could categorise them by typology into seven clusters, each with its sub-goal and metrics (Table 4.11).

Framework

The goals-metrics framework summarises the evaluative architecture of Electrolux's professional design thinking practices (Fig.4.42). We can observe the design thinking overall objective with its three main goals, each with its sub-goals and key indicators. In addition, four external health metrics have been identified to check and calibrate the framework.

Dozens of metrics could be monitored for each identified design thinking impact. The researcher kept the value index model simple to make a practical and straightforward evaluation. Design thinking has three primary purposes: create assets of knowledge, facilitate decisions and support decision-making. As the impact model already showed, they are interconnected. For each intangible benefit, the value index metrics identified proper metrics exploiting the framework sub-impacts to inform the selection. Two kinds of metrics have been determined: hard data to monitor the execution of the practices and optional soft data to assess the quality of the execution by surveying the participants. The first is mandatory and easy to monitor constantly. The second one is optional to periodically check the quality and reliability of the metrics.

Moreover, like for the innovation goal-metrics framework, some health metrics should be identified to check the credibility of the data collected. In this case, additional clues about possible metrics came from the summit of the previously designed impact model. Indeed, we saw that decisions support organisational management by influencing project results. That, in turn, impacts the organisation, the customers and the planet once in the market. In this sense, some health metrics could be customer satisfaction, the CO_2 equivalent emissions, or the sales coming from innovative ideas for the organisational side. These three metrics could supply reliable evidence about the success of the projects designed with design thinking practices. By cross-referencing this data with the ones coming from the design thinking assessment, they can check if the overall objective-metric framework is working correctly.

Sub-Im-pact	Sub-Objective	Hard Metric	Soft Metrics	Source
Decisiveness	Support decisions more quick-ly, confidently and with good results.	Number decisions		Grey Literature
Debiasing	Disincentivise unfair per-sonal judgments	Number of People Involved in deci-sions		Grey Literature
Alignment	Align the team toward a shared vision		Alignment level Survey	Grey Literature
De-Risking	Reduce the possibility of big failures	Number of Itera-tions		(Royalty & Roth, 2016a)
Adaptability	Change the decision in re-sponse to upcoming learnings	Number of Adap-tations		Grey Literature
Speed	Move faster the project forward	Hours per Person		Grey Literature; Innovation Audit
Action Orien-tation	Take practical actions	Time each step in the knowledge funnel		Grey Literature

Table 4.11 Decision-making value index: objectives and metrics.

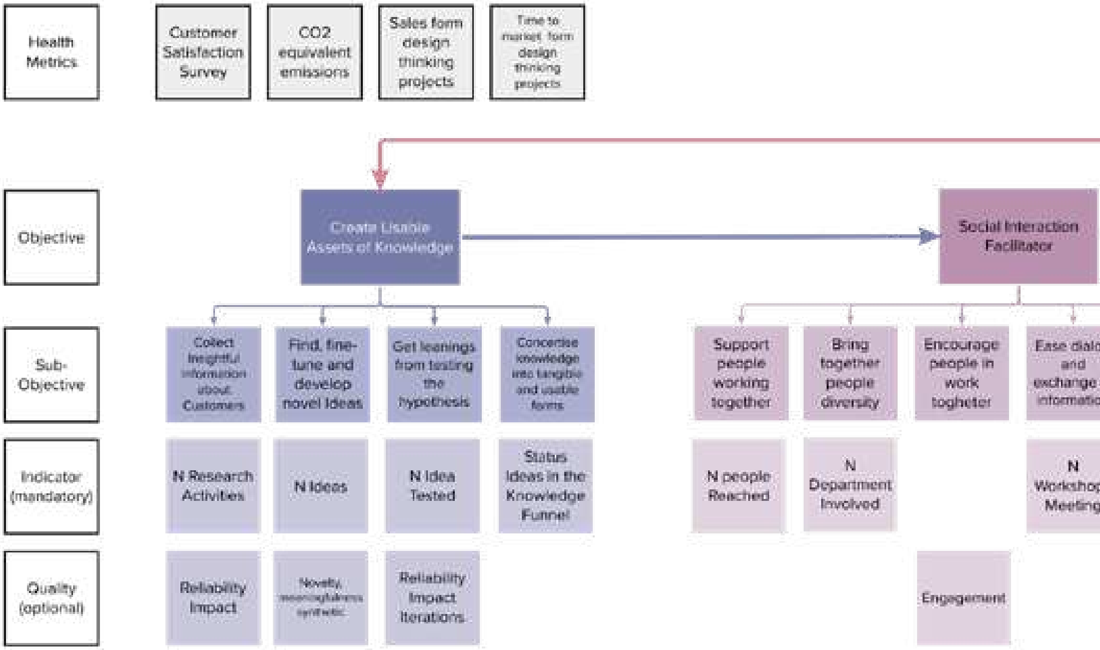
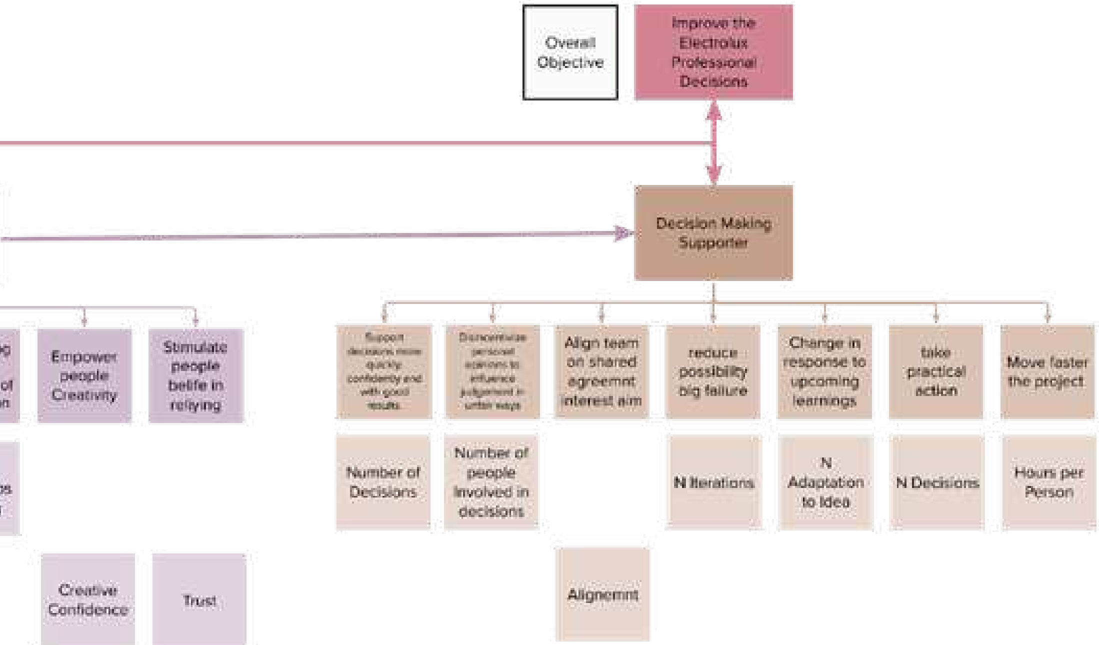


Figure 4.42 Design thinking objectives-metrics framework.


Overall Objective
Improve the Electrolux Professional Decisions
Decision Making Supporter
Empower people Creativity
Stimulate people belife in relying
Align team on shared agreemnt interest aim
reduce possibility big failure
Change in response to upcoming learnings
take practical action
Move faster the project
Number of Decisions
Number of people Involved in decisions
N Iterations
N Adaptation to Idea
N Decisions
Hours per Person
Alignemnt
Creative Confidence
Trust

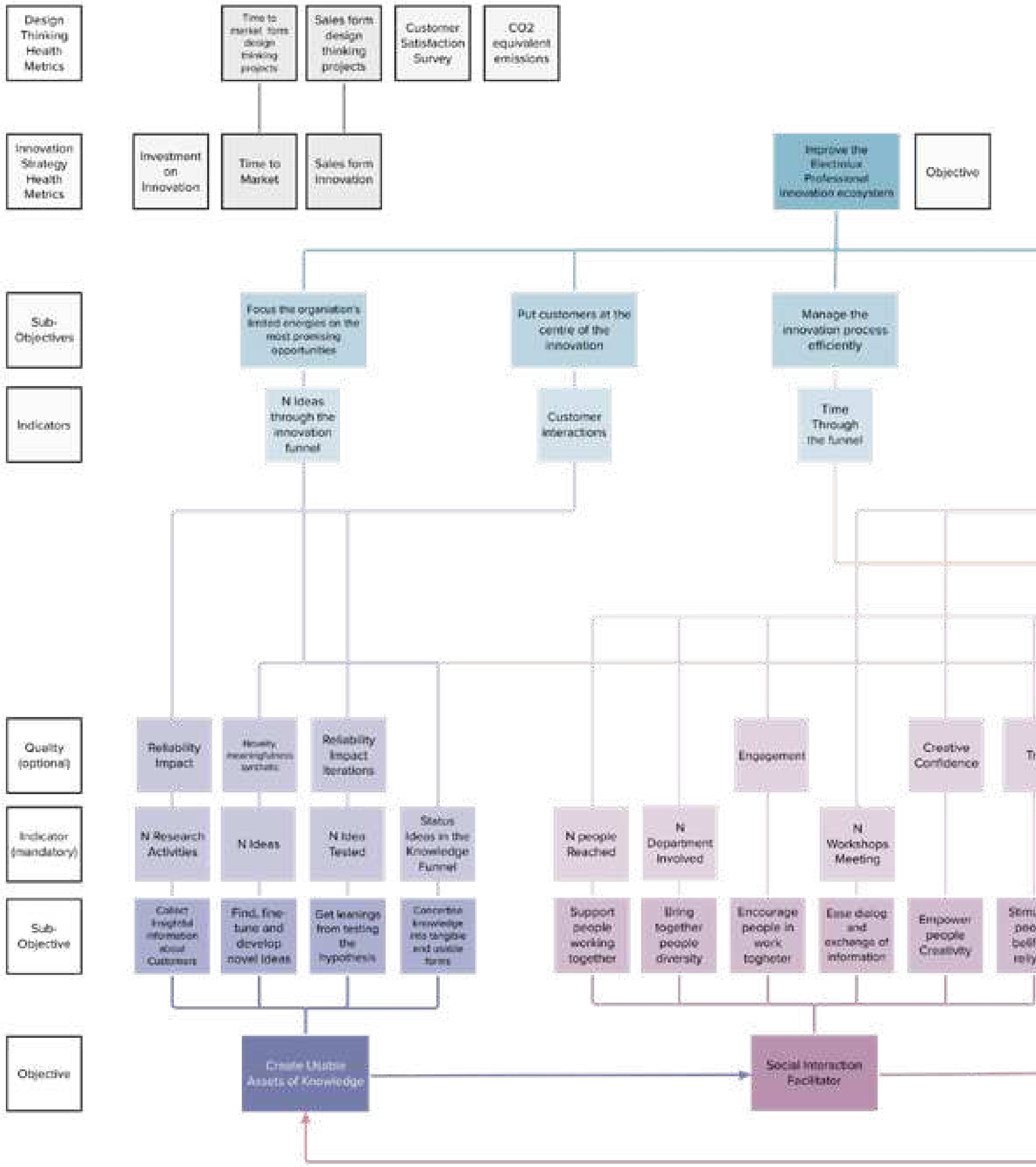
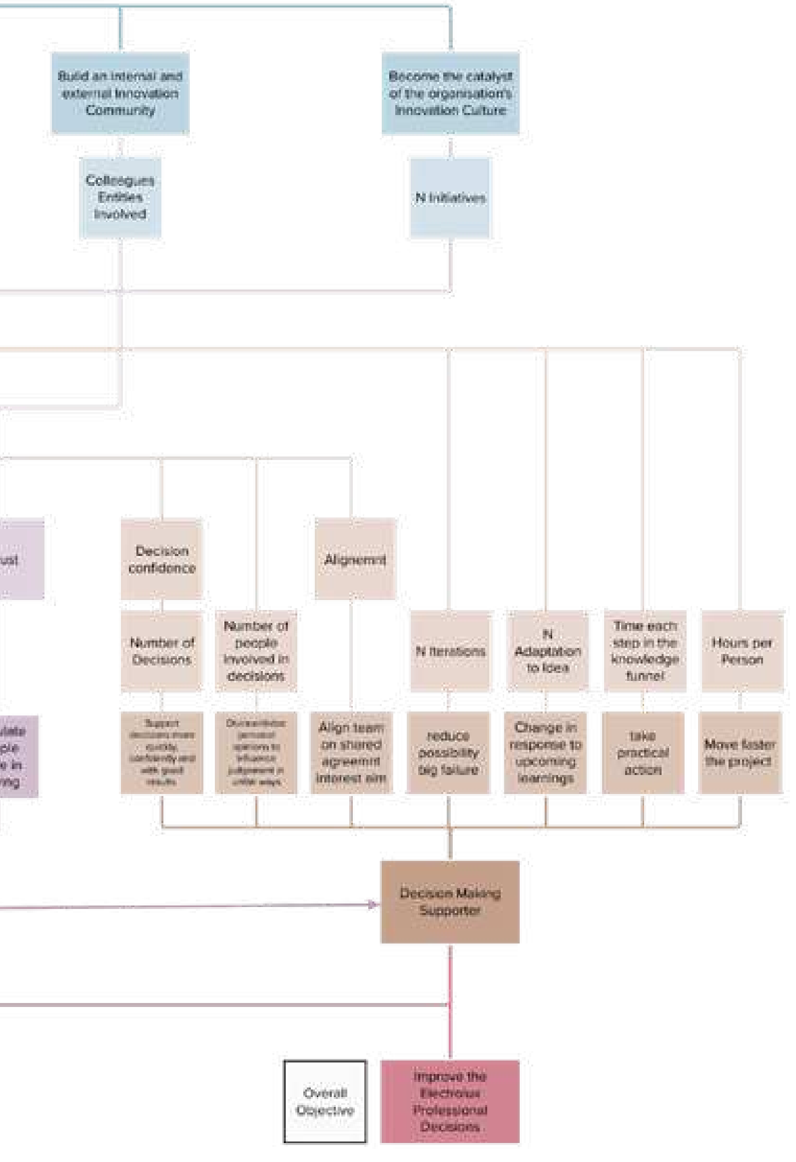


Figure 4.43 design thinking and innovation objectives-metrics framework.


Build an internal and external Innovation Community
Become the catalyst of the organisation's Innovation Culture
Colleagues Entities Involved
N Initiatives
Decision confidence
Alignemnt
Number of Decisions
Number of people involved in decisions
N Iterations
N Adaptation to Idea
Time each step in the knowledge funnel
Hours per Person
Align team on shared agreemnt interest aim
reduce possibility big failure
Change in response to upcoming learnings
take practical action
Move faster the project
Decision Making Supporter
Overall Objective
Improve the Electrolux Professional Decisions

Interconnections

The two goals-metrics frameworks summarise the evaluative architecture of Electrolux Professional's innovation and design thinking practices. Comparing their objectives and metrics, we can identify the interconnection between the models and pinpoint the design thinking impact on the innovation system (fig.4.43). We can observe that every innovation strategy pillar has implications with one or more design thinking impacts.

Focus

Design thinking affects the focus pillar by supporting organisational decision-making. As we saw in the impact model, decision-making is at the pyramid's summit. Namely, those impacts are influenced by the other two underneath the model: knowledge creation and social interaction. In practice, we observe that design thinking uses the knowledge acquired and reified into ideas in participative methods to facilitate stakeholders' decisions. This process helps the organisation to focus on the most promising opportunity and discard the others.

The main interconnection between the focus pillar and the design thinking impacts is in the knowledge creation and decision-making clusters (Figure 4.44). We can map the ideas in the innovation by tracking the number of ideas created and their status throughout the process. For instance, by subtracting the number of ideas from one status to another in the innovation process, we learn more about the number of ideas discarded and kept and, therefore, the selection rate of the process. Moreover, more discrete information could be identified by tracking the number of decisions in the process and using it as a qualifier variable. This data shows the team's capability in filtering priorities. By narrowing the filter too much, the company risks losing potential opportunities. In contrast, leaving it too broad the process risks losing efficiency. To calibrate this parameter and score it, the reviewer must collect data to set "good practice" thresholds and balance them by checking collateral information. For instance, a possible way to fine-tune the calibration could be by surveying the participant in the decision to understand their level of alignment and confidence. Still, this method is time-consuming and cannot be done every time a decision is made. Another valuable high-level indicator could be the sale volumes of the innovation idea developed. This parameter is easy to collect and gives quantitative clues about the good result of the filtering process.

If design thinking supports the organisation's opportunities prioritisation by selecting successful solutions, it means it can focus the organisation's limited energies on the most promising opportunities.

Human centricity

Design thinking affects the human-centricity pillar by embedding customer knowledge into ideas. Knowledge creation is the fundamental activity of design thinking. Whether from research or testing activity, design thinking usually exploits inductive logic to collect customer information. This learning gets reified through the idea's development, advancing its status in the knowledge funnel. This process helps the organisation to develop its ideas through a human-centred lens.

The knowledge creation cluster is the main interconnection between the human-centricity pillar and the design thinking impacts (Figure 4.45). We can map the number of knowledge-creation activities over the state of advancement in the innovation process. Indeed, by assessing the research activities and tests and dividing them by the number of steps per idea, we gain a customer interaction rate. The lower the value, the less customer knowledge is embedded into the concept. The higher the number, the more customer knowledge has been successfully integrated. Even for this case, more discrete information could be identified by analysing the data per ideas category, practice typologies, or innovation process stage. To calibrate this parameter and score it, the reviewer must collect data to set the "good practice" thresholds and balance them by checking the quality of the customer data gathering. For example, a possible way to assess it could be by surveying the researcher to understand the method's reliability or to inquire the participants about the impact that the insights collected had on the project. Still, these approaches are time-consuming and should be applied now and then to collect additional information or verify a new practice standard.

If design thinking increases the customer interaction rate by maintaining good reliability, it means that its practices put customers at the centre of the process.

Process

Design Thinking affects the process pillar by moving ideas rapidly through the innovation process. The likelihood of achieving innovation is directly proportionate to the number of ideas processed by an

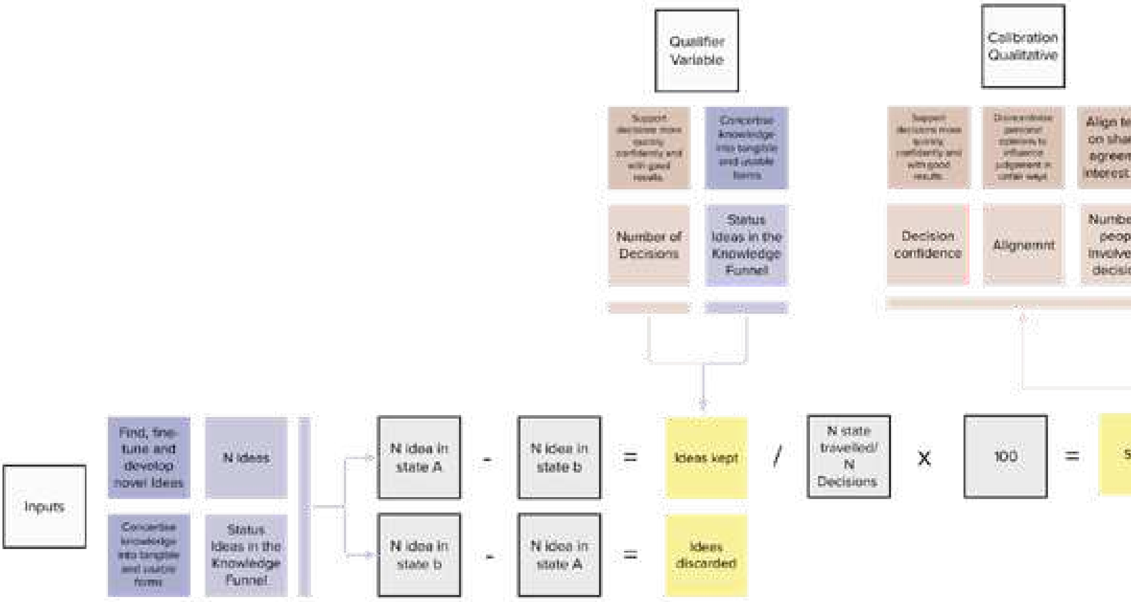


Figure 4.44 Metrics model: focus pillar.

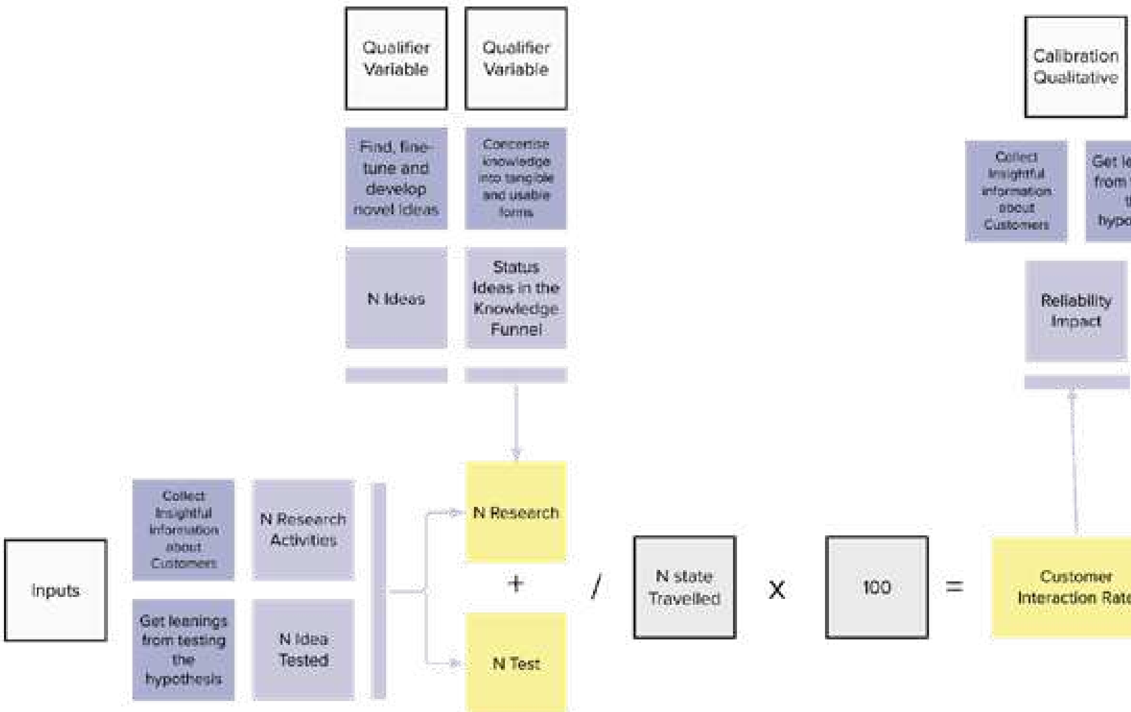


Figure 4.45 Metrics model: human centricity pillar.


Calibration Quantitative
Health Metric
Sales form Innovation
Status Ideas in the Knowledge Funnel
Focus the organisation's limited energies on the most promising opportunities
Customer interactions
Put customers at the centre of the innovation

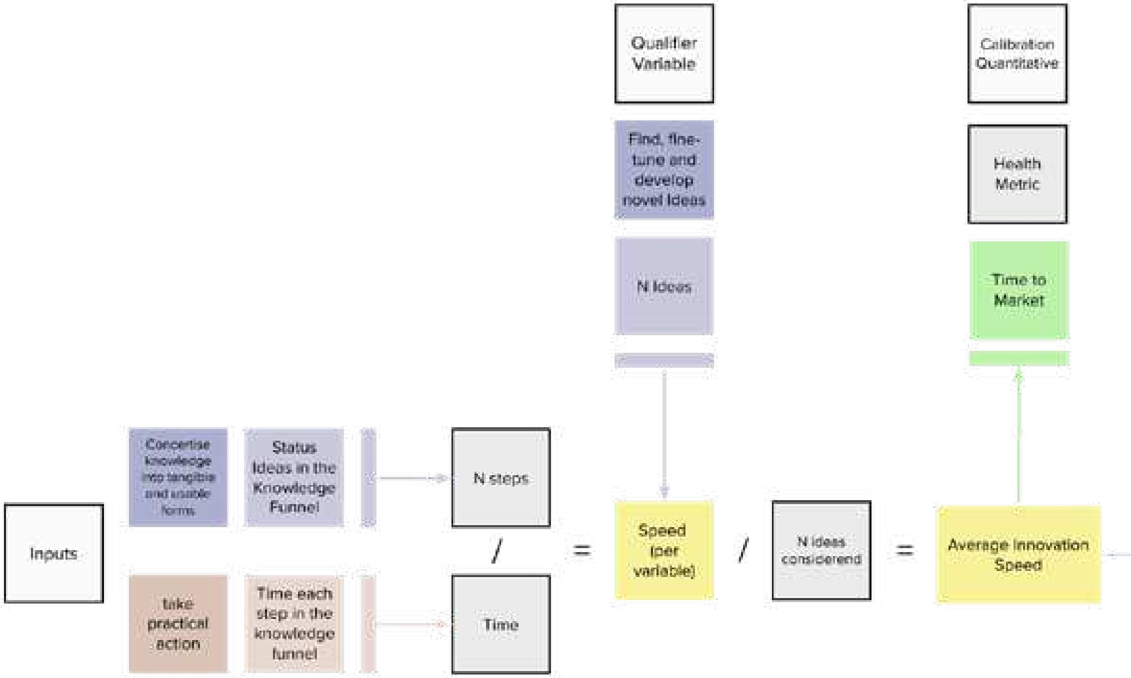


Figure 4.46 Metrics model: process pillar.

organisation. The more the pace of validating or invalidating options, the more the likelihood of some of them turning successful. Design thinking's ability to embed knowledge and support participative decision-making makes ideas move through the process. This practice helps the organisation to manage ideas efficiently.

The knowledge creation and decision-making clusters are the primary interconnections between the community pillar and the design thinking impacts (Figure 4.46). We can map the speed of the innovation process by dividing the steps an idea does in the process and the time employed to accomplish this advancement. The higher the result value, the faster the practice is in processing ideas. The data can refer to the average speed per idea, but could be qualified even more by analysing it per typology of practice, timespan or specific project. To calibrate this parameter and score it, the reviewer must collect data to set "good practice" thresholds and balance them by checking the overall project time. For instance, a possible way to fine-tune the calibration could be by comparing it with the project time to market. This parameter is easy to collect but

requires time to be collectable. Moreover, contextual contingencies and differences in the project scale make this data hard to use as a valid sample for calibration.

If design thinking increases the ideas' speed rate through the funnel, maintaining reliable results, it means that it can manage the innovation process efficiently.

Community

Design Thinking affects the community pillar by designing and facilitating social participative practices. A general attitude toward collaboration and a specific use of the workshop and other participative methods make design thinking a collaborative management approach. In these activities, colleagues from all over the organisation engage in participative practices growing trust and deeper bonds between people. This process helps the organisation build up an internal community of innovators.

The social interaction cluster is the primary interconnection between the community pillar and the design thinking impacts (Figure 4.47). We can map the colleagues involved in design thinking practices

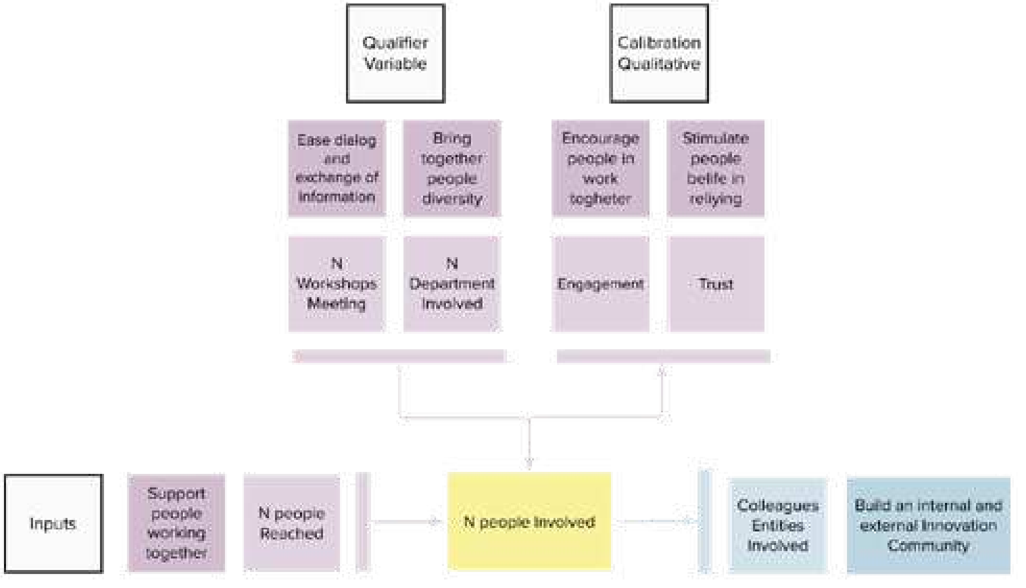


Figure 4.47 Metrics model: community pillar.

by analysing the number of people participating per initiative or their average number. The higher the number, the more people engaged in innovation. More rich data could be collected by analysing the data per ideas department involved, practice typologies, or initiative category. To calibrate this parameter and score it, the reviewer must collect data to set "good practice" thresholds and balance them by checking the quality of the interaction. A possible way to assess it could be by surveying the participants to understand the level of engagement in practice and the trust among participants. This activity could offer valuable additional data to understand the quality of collaboration. Still, like the other qualitative approaches, it is time-consuming and should be sparingly used.

If design thinking involves a high number of people in a quality interaction, it means that it can support the creation of an internal innovation community

Culture

Design Thinking affects the culture pillar by directly involving people in innovation activities. Organisational cultural aspects are a fuzzy and pernicious topic, especially if the goal is to try to change it. However, some possible strategies emerged from the innovation audit. Practical hacks are actions to create positive cultural change. Design thinking participative activity could be considered hacks because they nudge people to move through a facilitated process that makes participants experience innovation in the first person. This process is one possible way to positively spread a culture of innovation in the company. Still, design thinking could be considered a tool to hack the organisation's culture and make people feel more confident about their creativity.

The social interaction cluster is the primary interconnection between the cultural pillar and the design thinking impacts (Figure 4.48). We can map the time colleagues spend on innovation activity by analysing the number of participants multiplied by hours invested per initiative. The higher the number, the more people work on and get used to innovation. Additional data could be collected by analysing the data per department involved, practice typologies, or initiative category. Even in this last case, to calibrate this parameter and score it, the reviewer must collect data to set "good practice" thresholds and balance them by checking the confidence toward innovation. A possible way to assess it could be surveying the participants to understand their creative confidence variance level.

If design thinking involves a high number of people for several hours in hacking activities, it means that it can be a catalyst practice for spreading the innovation culture into the organisation.

Conclusion

Design thinking affects all the pillars of the Electrolux Professional innovation strategy in different measures. It is not the only practice and approach that affect it. Other influences not part of the current topic contribute to the achievement of the strategy. Still, clear evidence supports the interconnection between the design thinking impacts and Electrolux Professional innovation objectives.

To summarise, design thinking supports innovation strategy in five ways. Firstly, embedding customer knowledge in the ideas endorses a company's human-centric innovation approach. A good indicator of this impact is the customer interaction rate because it describes the number of interactions with the customers and their impact on advancing the idea throughout the innovation process. Secondly, supporting organisational decisions making with knowledge and participatory activity helps filter the most promising opportunities. The selection rate is a good indicator of

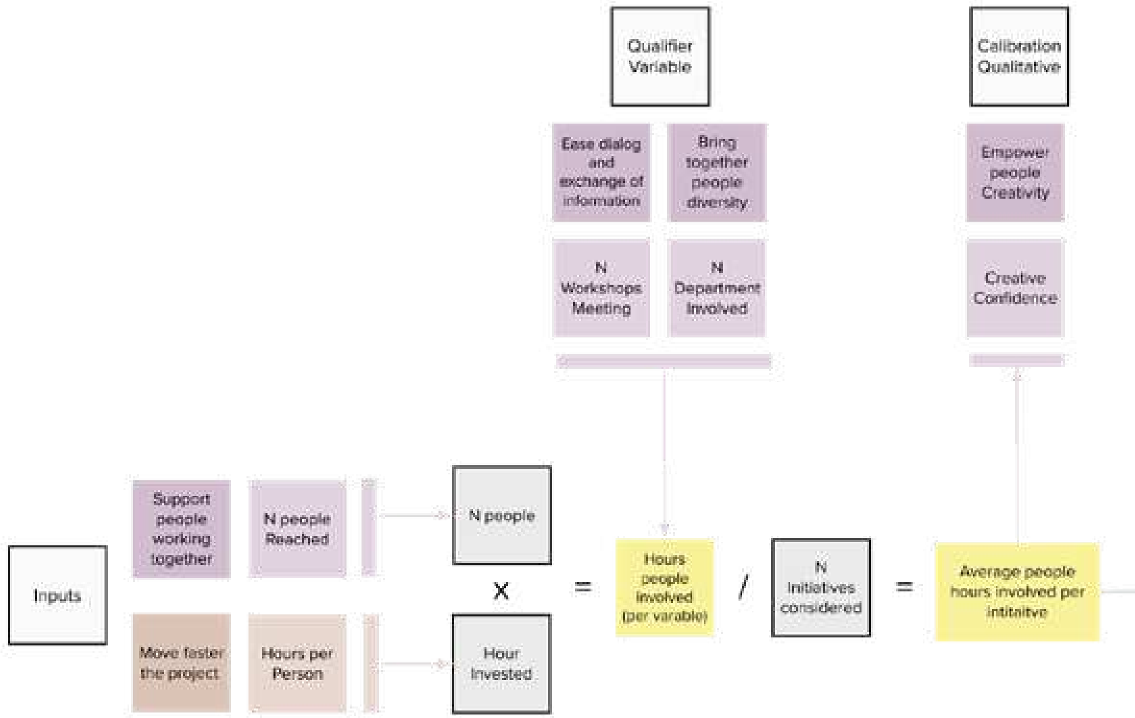


Figure 4.48 Metrics model: culture pillar.

this impact because it defines the percentage of ideas discarded and kept for each process step. Thirdly, rapidly processing ideas through the funnel make the innovation process more efficient. The innovation speed is a good indicator of this impact because it measures the ideas' rate of crossing the process. Fourthly, designing participative activities that facilitate social interaction endorses the growth of an innovator's community. The number of people involved is a good indicator because it pinpoints the number of colleagues the design thinking practices were able to rich. Finally, participative practical activities catalyse cultural hacks engaging people in innovation. A good indicator of this impact is the time people invest in innovation activities because it assesses the time people immerse themselves in the innovation culture and get influenced by it.

With all their possible variables and additional qualification, these indicators synthesise the theoretical evaluative framework of the design thinking impacts on innovation. Defined the theoretical aspects, the researcher must collect data by calibrating them and testing the system's

viability. The following paragraph focuses on the data collection phase and tries to make data recordkeeping and management feasible in practice.

Collect Data

Defining the method and the data to assess is the first part of the evaluation process. This paragraph aims to identify an efficient approach to managing data collection.

Firstly the researcher built a prototype of the recordkeeping system to gather feedback from the organisation. Then the researcher chose to change the collection strategy exploiting an upcoming opportunity to create a more ambitious and efficient data collection system. The researcher takes the responsibility to manage and develop a company innovation platform aimed at supporting the innovation activities and tracking their impacts. Its development is still under implementation, but some preliminary considerations could be anticipated.

Modelling the Metrics

The sources of impact data, whether hard or soft, are plentiful. They usually come from routine reporting systems in the organization. However, when they do not exist, the organization must develop new recordkeeping systems if economically feasible. This paragraph describes the prototype of the data collection system. It debates the evaluation metrics model, the draft version of the scoring system, and the collection management process. Finally, it discusses the feedback gained through the prototype assessment.

Contextualise the Indicators

In the previous paragraph, we discussed how design thinking impacts the Electrolux Professional innovation strategy, highlighting a draft model interconnecting the two frameworks' metrics. By cross-analysing them, the researcher identified that seven metrics must be monitored to obtain the five critical indicators required: number of ideas, number of steps, times taken per idea to move in the process, number of research, number of tests, number of people and time invested by each of them (Table 4.12). We can try to model the relations between these metrics and the Electrolux Professional innovation system in a schematic representation that summarises the elements to assess (Figure 4.49).

(1) The first metric to assess is the number of ideas currently present in the innovation process. They are the building block of any innovation system and the main subject. However, what precisely are they? Ideas are fuzzy concepts with ambiguous meanings. They must be defined to assess them. In a more generic form, they are suggestions or plans for doing something. However, for this evaluation, ideas are meant as reified expressions of the knowledge acquired by the organisation. Ideas become such when they are expressed and reified in a tangible form and made available to the organisation. There are many ways to categorise ideas, but for this assessment, we can distinguish them by their innovation potential: core, adjacent and transformational (Nagji & Tuff, 2012). No matter their focus, we can distinguish them by the amount of knowledge embedded in the ideas that inform their state in the innovation process.

(2) The second metric to assess is precisely the status of an idea in the innovation process. As discussed in the first chapter, Martin (R. Martin, 2010b; R. L. Martin, 2009b) adopted the "knowledge organisation" (Senge, 1994) theoretical standpoint to argue the design thinking capability to support the company exploration processes. For him, every idea in an

Indicator	Metric 1	Metric 2	Metric 3
Selection rate	Number ideas	Number Steps	
Customer Interaction	Number Research	Number Tests	Number Steps
Innovation speed	Number Steps	Time	
People Involved	Number of People		
Time Investment	Number of People	Hours per Person	

Table 4.12 Electrolux Professional indicators and metrics.

Stage	Business	Customer	Technology
Stage 0	I Know Nothing	I Know Nothing	I Know Nothing
Stage 1	I See Potential	I Know Nothing	I Know Nothing
Stage 2	I See Potential	I See Interest	I Know Nothing
Stage 3	I See Potential	I See Interest	I know how to do it
Stage 4	I See Potential	I See Interest	I have a working prototype
Stage 5	I See Potential	I Found Customers	I have a working prototype
Stage 6	I have a Business Model	I Found Customers	I have a working prototype

Table 4.13 Electrolux Professional knowledge funnel stages.

organisation moves through a knowledge funnel, describing it as a process that brings ideas from a position of "mystery" to one of "algorithms". On one side of the funnel, we have the unknown. On the other, the known. Ideas move from unknown to known as more knowledge is embedded in them. At the beginning of the funnel, we have only a weak intuition that we need to explore by reifying new knowledge into it to reduce its state of uncertainty. The more knowledge is acquired and embedded into the idea, the more it moves through the step of the funnel. This allegory works well in the theoretical realm but could be used to identify the different phases of an innovation process. For the Electrolux professional case, we can distinguish among six steps in the knowledge funnel (Table 4.13). From a broad viewpoint, we observe two main iterations in the process, each aimed at validating the idea from the business, customer and technology perspective in a progressively more reliable way.

(3) Combining the second and third metrics with the time taken by the ideas across the knowledge funnel, we can determine the third metric: the speed of the innovation process. Time is a fundamental

variable in understanding the overall process's efficiency and identifying which phases require more attention and improvement. It is an essential indicator of the rate of knowledge collection and reification.

(4) The fourth and fifth metrics to assess have been combined due to their similar nature. The number of tests and research did represent the ability to acquire and use knowledge to generate, improve or fine-tune ideas. It is easy to identify the number of research or test activity. More complex is determining the impact the knowledge acquired had on the process. There is no stable relationship between research and the amount of knowledge. Still, the effect on the process could be esteemed by assessing the number of steps the ideas accomplished in the knowledge funnel. Whether they are forward, advancing in the process or backward, being rejected. In both cases, the organisation exploits the information to make decisions with intrinsic value: selecting and discarding ideas based on their potential. Considering customer knowledge, we can see three central moments in the funnel process where research and test activities should happen: at stage zero, we usually observe that a previous research activity triggers participants to create new ideas; at stage two when ideas are presented to the customers to test their interest; at stage five when a working prototype is tested in the field to identify potential customers.

Finally, the sixth and seventh metrics focused on capturing information about the people that work on the system. (5) The number of people and the time invested in representing the working engine of the process. People work to accumulate knowledge, embedding it into ideas, facilitating participative activities and making decisions. These indicators are more straightforward to assess than others, focusing only on the number of people and time. Still, the management complexity increases if we want to distinguish the number by department's origin, role level or activity involved. Evaluating the people's involvement in a multi projects scenario require time and a dedicated tool to be practically feasible to manage. In Electrolux Professional, there are different levels of participation. The core innovation team works full-time on innovation. The innovation hub team represents a flexible and fluid group of people involved ad hoc in a project depending on the type of ideas the team is working on. The innovation community includes all the organisation's employees participating in innovation. Finally, external collaborators support the company's busy department or supply capabilities that the organisation lack.

Indicator	Type	(0.3)	(0.7)	(1.0)	Timespan
Selection Rate	Transforma-tional	1	2	4	3 years
	Adjacent	3	6	10	3 years
	Core	6	12	20	3 years
Customer In-ter-action Rate	Research	(>0 <1) or >4	(>1 <2) or (>2 <4)	2	1 year
	Test	(>0 <0.5) or >2	(>0.5 <1) or (>1 <2)	1	1 year
Innovation Speed	Transforma-tional 1	4 m.	2 m.	1 m.	3 years
	Adjacent 1	3 m.	1.5 m.	0.75 m.	3 years
	Core 1	2 m.	1 m.	0.5 m.	3 years
	Transforma-tional 2	12 m.	6 m.	3 m.	3 years
	Adjacent 2	8 m.	4 m.	2 m.	3 years
	Core 2	6 m.	3 m.	1 m.	3 years
People Involved	Innovation Hub	60	100	150	1 year
People Time Invested	Innovation Hub	240 h	600 h	1200 h	1 year

Table 4.14 Scoring system and thresholds.

The model summarises the primary metrics of the system. A mix of data about time, people, and knowledge management could give a picture of the impacts o design thinking on innovation. Still, the system does not make complete sense without a proper scoring system to contextualise the data and set the targets.

Scoring system and thresholds

As suggested by the OKR framework and discussed in the methodological section, another critical part of the evaluation is the calibration of a scoring system. The expectations should be balanced, creating targets delineating exceptional, good, and mediocre performance. Scores should be applied after defining the key metrics to communicate expectations, enable continuous learning, and provide valuable clarity around what progress looks like for the key result. The OKR framework suggests scoring three threshold targets for each indicator in a challenging way (Table 4.14) to stimulate creativity in the participant that has to achieve the goal.

However, setting the target level of performance is one of the trickiest aspects of the monitoring system. The best way to define them

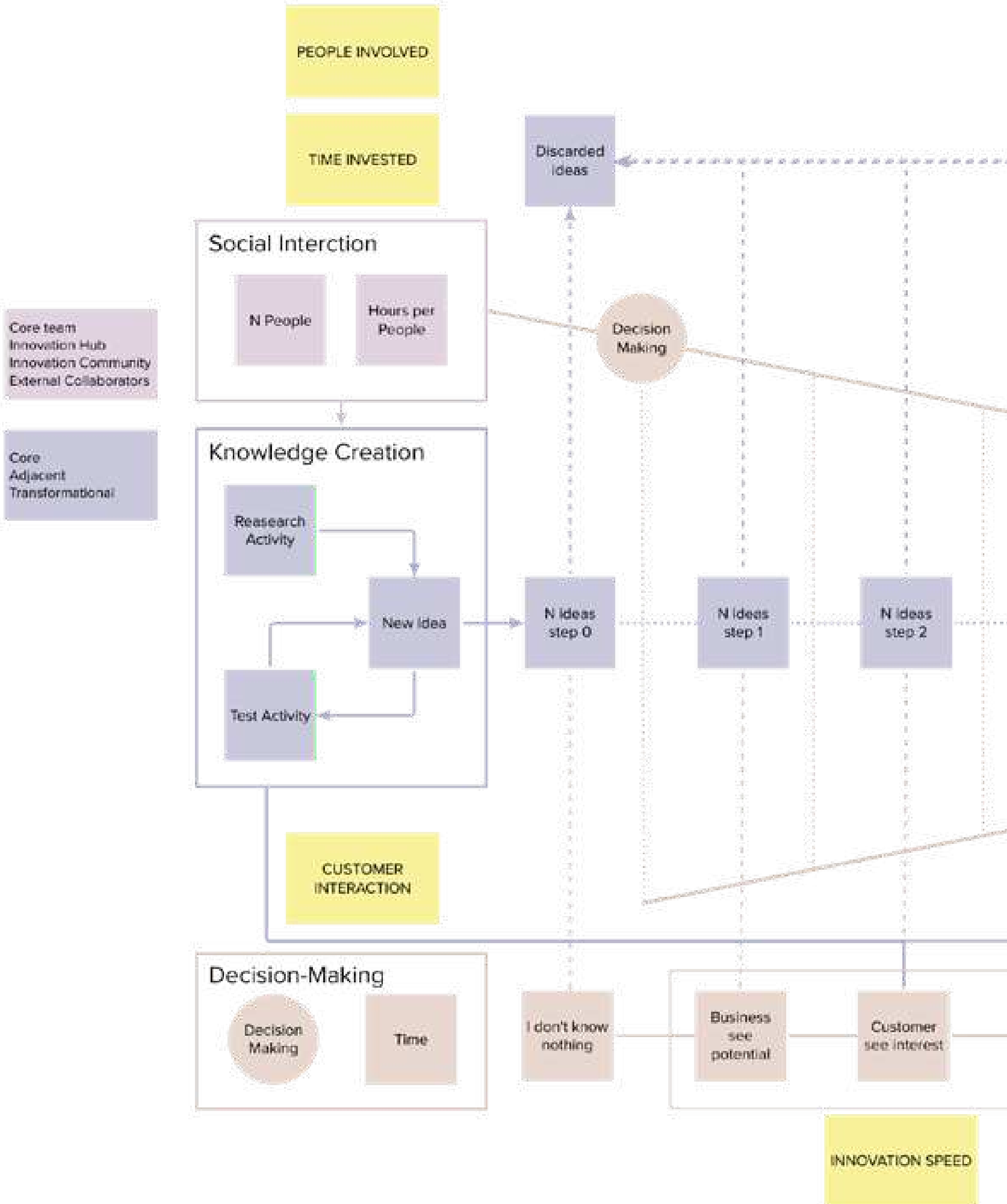
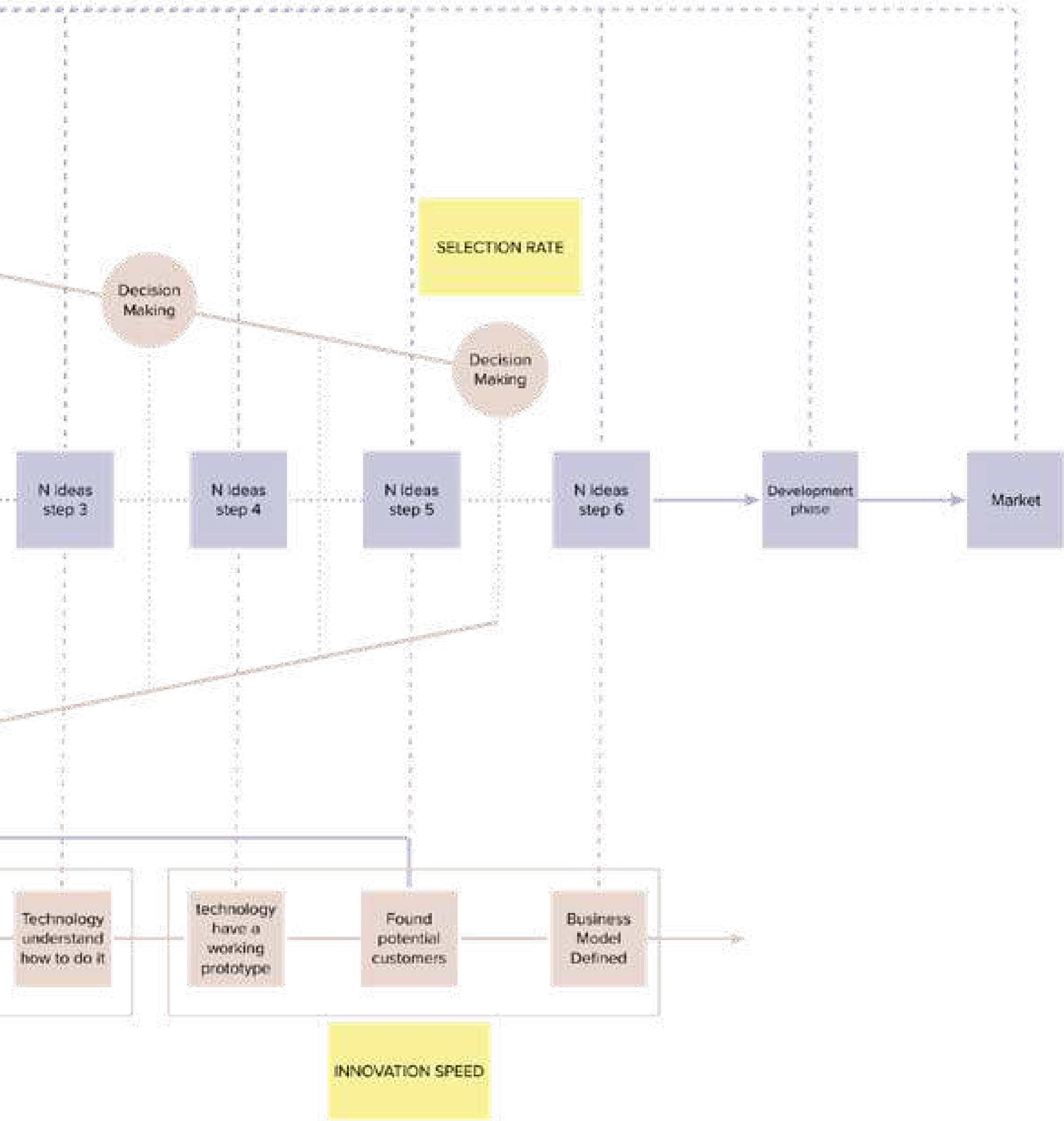


Figure 4.49 Electrolux Professional metrics model.


SELECTION RATE
Decision Making
Decision Making
N ideas step 3
N ideas step 4
N ideas step 5
N ideas step 6
Development phase
Market
Technology understand how to do it
technology have a working prototype
Found potential customers
Business Model Defined
INNOVATION SPEED

is by taking advantage of any quantitative background material (baseline data, industry averages, organisational performances). Still, when this is impossible, the reviewers must rely on subjective evaluations and "gut feelings" to set them. In this case, the monitoring process informs the thresholds that should be adjusted based on the data collected. For instance, if the team reaches the target early in the evaluation, a more challenging target should be set. On the contrary, if they come out to be an entirely too ambitious target should be reduced a bit.

In the last section, we identified five primary indicators with seven key metrics that have to be collected to assess the design thinking impacts on the Electrolux professional innovation system. Each of them should be calibrated and scored. For any indicator, no previous background data is coming from the organisation because no information has been collected before about innovation. Therefore, the targets have been set by discussing them with the innovation team that agrees on defining them by gut feeling and adjusting them along the way. The final calibration considered the five indicators distinguishing the type, threshold level and timespan.

(1) The objective of the selection rate is to bring the largest number of ideas to the end of the innovation knowledge funnel. However, as discussed in the previous paragraph, ideas are of different typologies. To precisely define the targets, we must distinguish among ideas with transformational, adjacent, and core innovation potential. Each of the three categories has been targeted using three threshold levels. The team set them by considering the average corporate innovation proportion suggested by the Nagji Tuff model (2012)[279] and the team direction stated in the innovation strategy[280]. For this indicator, the team decided to set the target on a three-year timespan[281], considering the time it takes transformational innovations to get validated. However, periodic checks could be done every four or six months to understand the progression status.

(2) The objective of the customer interaction rate indicator is to be customer focused. Thus, the ideas' creation and validation should be based on the right amount of customer knowledge. There are two ways

279 They suggested that organisation effort should be split among core (70%), adjacent (20%) and transformational (10%) Innovations.

280 From the interviews discussed in the second chapter, the company stakeholders suggested the innovation team focus 80% of their energy on adjacent and transformational innovations.

281 In the innovation audit, the CEO suggests setting the assessment timespan for innovation every company cycle, defined as three years. This way, innovation projects have time to get digested and processed by the company processes.

design thinking acquire customer knowledge: by research activities or by testing hypothesis. The first one, usually, is an explorative activity aimed at achieving knowledge about a predefined topic; it happens at the practice's beginning and supports the development of new ideas. The second is a focused method to validate ideas and collect additional learnings to develop the concept further. Looking to the stage in the innovation funnel (Table 4.1), in perfect condition, an idea that reaches the end of the funnel should have embedded information from one customer research and two tests. Considering the whole ideas portfolio, having a rate minor than three customer interactions mean not being as many customers focused as possible. On the contrary, having a rate higher than three means inefficiency, requiring more work activities to move a stage on the funnel. In this case, the timespan to consider could be yearly with periodic quarterly checks.

(3) The objective of the innovation speed indicator is to move ideas through the funnel as faster as possible. Speed is measured by dividing distance over time. However, establishing the distance ideas travelled over the knowledge funnel is not trivial. They have different levels of complexity and do not necessarily start their travel from the beginning of the funnel. To set the distance in the funnel, we should determine the knowledge status for each phase. We can distinguish two primary iteration cycles, each with a knowledge component from the customer business and technology side. We could have already validated ideas in the technological realm, not requiring additional activity to acquire new knowledge. Or you can have already customers-centric clues that support your argument. Still, only by achieving the three knowledge components can allow the idea to move toward the following iteration. Moreover, the first loop is not time-proportionate to the second one, which is far more complex. To set the goals, we have to consider all these variables. Firstly, the type of innovation potential to understand the idea's level of complexity. Secondly, its initial and final status of knowledge to determine its actual distance travelled. Thirdly, the two iteration timespan are not proportionate. Acknowledging these variables, the innovation team set six targets multiplied by the three thresholds, using a rule of thumb to define them according to previous experience with other similar projects. The timespan to assess this indicator has been aligned with the selection rate to compare them on a three-year scale, with quarterly updates.

Finally, (4; 5) the objectives of the people involvement and time invested indicators are to engage a higher number of colleagues in the innovation discussion. People are the workforce of innovation. In the design and innovation team, there are three full-time dedicated to innovation, and only two focused on design thinking practices. However, the team was structured to be flexible and involve a fluid group of colleagues based on the innovation activities run. The “Innovation Hub” concept is about an open community of innovators that invest an amount of their work time to support innovation projects depending on the skills required. Considering the plausible number of projects run in a year and the average time invested by each, the innovation team set the number of internal colleagues involved and the overall time spent in innovation activities defining three thresholds.

The key indicators were selected to give a bird’s eye view of the innovation status and could be assessed straightforwardly by the innovation team monitoring them. However, they do not return a granular representation of the impacts. An ad-hoc qualitative approach has been drafted in the next paragraph to fill this gap.

Optional Qualitative Metrics

Quantitative indicators are paramount to monitoring the situation without involving colleagues in tedious recurring assessment activities. They are key parameters that give feedback about the overall achievement of a goal. Still, they do not give back enough details to understand the quality of an impact in all its nuances. For this aim, we could couple an additional qualitative data collection strategy to straighten and supply more rich data to the quantitative approach. This assessment considers the use of qualitative data critical for a comprehensive evaluation. However, due to the contingencies of the PhD time, they have been put aside. The definition of the correct format, questions and scoring system was demanded for a second part of the assessment, which has not yet started. Still, this paragraph aims to briefly overview the planned evaluation strategy, drafting a description of the qualitative method imagined over the following lines.

The inquiry method selected for this optional assessment is a survey crafted to be short and usable only when required. The goal is to use this qualitative approach when the situation makes it applicable but on an optional modality. For instance, when a new practice has been developed and used for the first time, the innovation team could use the survey to gather additional data. Or it could be used once a year to check if there are substantial differences in the same practice over time. No matter when or how to use it, the aim is to employ it when the team need it, not to weigh down too much the assessment involving participant in time-consuming recurring evaluations.

The format, taking inspiration from the snapshot prompts tool (Royalty & Roth, 2016b), is a short Likert scale survey composed of five to ten questions. The prompt follows the assessment practice and could be divided or combined based on the topic to evaluate. We can distinguish between three assessment prompts. The first is about Knowledge creation, the second is social interaction, and the third is decision-making (Table 4.15). The qualitative evaluation could consider a virtually infinite number of metrics. This thesis does not aim to give a comprehensive overview of them. Here are sketched just a few exemplificative questions.

(1) Regarding knowledge creation, more qualitative data could focus on the reliability of the learnings acquired. For instance, by inquiring the researchers about the method, the sample, and the data analysis strategy, the evaluator could learn more about the reliability of the research or test approach employed. A second aspect could be the impact of the knowledge acquired. The innovation team could understand which strategy was more effective by asking the participants how they used the insights collected and which ones affected the project the most. Otherwise, the inquiry could focus on the ideas' creativity level by asking subject matter experts (such as the innovation team) to review the concepts on some key parameters, such as the one suggested in the creativity assessment tool (Hawthorne et al., 2016). (2) Qualitative data are precious for social interaction to assess the quality of the collaborative experience. For instance, after a participative workshop, a survey could determine the level of engagement, inquiry the level of motivation, satisfaction, involvement and contribution. Another impact could be the trust level, assessing the participants' openness, assistance and emotions. With this additional information, the amount of collaboration could be weight for its quality and social bounds that it creates, despite pure numbers. (3) Finally, in decision-making, there are many possible topics to deepen—for example, the people's buy-in, the level of alignment or the confidence in decisions.

While indicators should continuously be monitored, the qualitative and deep assessment of the practice could be run periodically when additional information is required to check and support the quantitative ones. In the next paragraph, the researcher put into practice the two approaches drafted, prototyping the first tool for the data collection.

Prototype Tool Development & Feedback

The previous section introduced the supplementary qualitative approach to overview the assessment process. In this paragraph, the focus returned to the indicator system, describing the prototype build to collect the data required for the monitoring process.

The prototype aims to build a recordkeeper to collect the information required using the Microsoft Excel application. The researcher organised the file into tables. The first one is a dashboard with the five indicators' values, representing the visual interface of the system (Figure 4.50). The others assess the five indicators for each project by calculating the information arranged in the tables. This part was the back end of the process, where data were compiled on columns, and automatically the math formula gave back the result on the dashboard. Once the prototype scaffold was built, the researcher filled the field with approximate data about the "warewashing project", running a solo playtesting session to understand if the computational part worked (Figure 4.51). Moreover, it contextualises the prototype with plausible data valuable to elicit feedback on the system.

The researcher presented the prototype to the innovation team to face a preliminary discussion about the tool. After a two-hour informal debate about the prototype, both positive and negative feedback emerged. The metrics and the computational system were appreciated for their simplicity and the clarity of the data gained. Still, the team had more doubts about the tool's applicability in the actual context. Indeed, the information required to feed the system on a multi-project scale was too broad and complex to be inserted manually into the system by only one or a few reviewers. The evaluators' effort required does not make the system implementable on a large scale. Even a shared system of online excel files did not match the expectation. Too much work to manage the system is needed, and the tool does not offer enough permissions settings to control the collaboration in a safe environment. If too many people have access to the whole system with the possibility of making errors that threaten the evaluation, some incidents are likely to occur. In summary, the indicators selection and the overall evaluation strategy seem to have the potential to work correctly. Still, the implementation of the system was hindered by the lack of a proper tool to collect data in a systematic, safe and collaborative way.

However, a new opportunity becomes more and more concrete by discussing with the innovation team the possibility of implementing the evaluation system in the brand-new company innovation platform.

Category	Snapshot Prompt	Sample	Question
Knowledge Creation	Research/Test Reliability	Research/Test Team	Which method did you use?
			How many people have been involved?
	Research/Test Impact	Team using knowledge	How useful did you find the research/test?
			Which insight did affect your thinking more?
	Ideas Creativity	Experts	How novelty is this idea? (1=existing, 5=new)
			How meaningful is this idea? (1=no value, 5=meaning)
			How synthetic is this idea? (1=liner, 5=synthesis)
Social Inter-action	Engagement	Activity Participants	How enthusiastic would you be to participate in another activity like this?
			Are you satisfied with this activity?
			Do you feel your opinion count?
			I know I will be recognised if I contribute to the organization's success.
	Collaboration	Activity partici-pants	Does the team have open, respectful, honest, yet chal-lenging conversations in meetings?
			Does everyone say what they want in the room, not after the meeting?
Decision Making	Decisiveness	Activity partici-pants	Are you confident about the decisions made?
			Are decisions communicated clearly?
			How are you buy-in the decision?
	Alignment	Activity par-tici-pants	I have the information I need to do my job well
			Are responsibilities clearly stated?
			Are there too many inconclusive mails
			How much do you agree with the decision?

Table 4.15 Qualitative assessment method.

At the beginning of 2020, the innovation team began the development of an internal platform to support and manage innovation in Electrolux Professional. The platform could offer the possibility to collect, visualise and manage the assessment with pre-build digital tools that were not possible in a "manual" environment such as the Excell one. Still, several development times are required to integrate the designed system into a pre-existing platform. After a prolonged debate, the team agreed to try to implement the evaluation system into the innovation platform, giving the researcher the responsibility to achieve this objective. The next and final paragraph discusses the latest development effort to build up the platform collection system and foresee the potentiality of the platform.

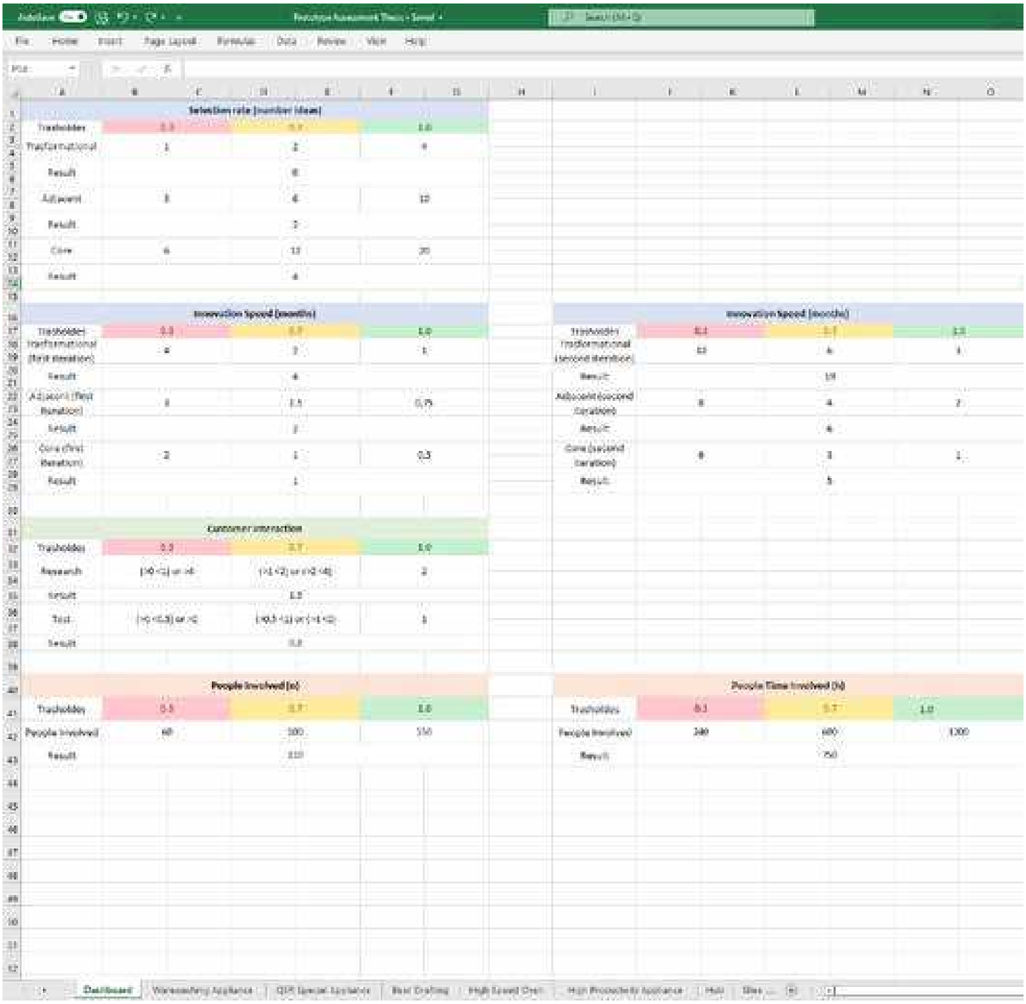


Figure 4.50 Prototype dashboard.

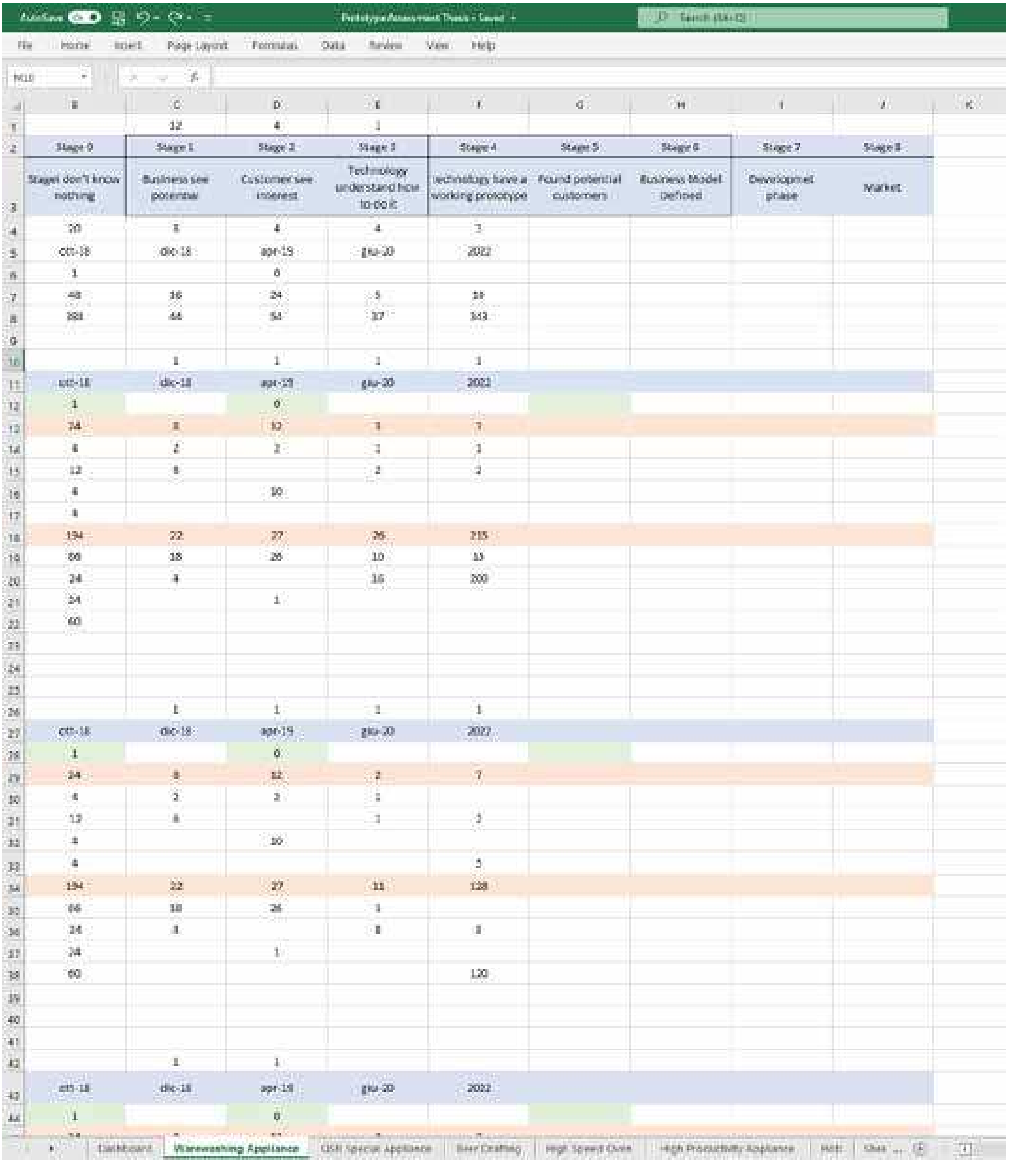


Figure 4.51 Prototype warewashing example.

Innovation Platform

The feedback from the innovation team prototype assessment highlighted usability as an essential factor for the practical applicability of the evaluation beyond pure academic intent. In response to this issue, the system was integrated into the new Electrolux Professional innovation platform to become more collaborative, automatic and capable of nudging best practices.

Before moving into the details of the integration and the collection mechanisms, the paragraph briefly introduces the platform history and the main development steps taken to make it adaptable to the system.

History & Goals

After the innovation audit research and the following strategy, Electrolux Professional decided to invest in an innovation platform (Figure 4.52). Indeed, as a critical action to support the process, community and culture pillars, the innovation team started to assess possible providers to select the most suited innovation platform.

With these aims in mind, the collaboration with the platform supplier began in the spring of 2021. During the first year, the innovation and the provider teams run a weekly meeting to explore the platform potentialities and adapt the platform structure to the Electrolux Professional innovation ecosystem. After almost one year of development, it was ready for the first activities involving people outside the innovation team. Three main steps marked the implementation of the platform in the organisation. At the beginning of 2022, it was used in a pilot challenge with a local group of users[282]. In spring, another pilot involved the R&D department extending the number of users. Finally, in June 2022, the platform was officially launched in the organisation with another challenge focused on crowdsourcing ideas in the sustainability topic.

The researcher got from the innovation team director ownership to manage and lead the platform in April 2022. From that point, some substantial new development tried redefining the platform according to the research findings. Building on the innovation strategy trajectory, the improvements focused on four goals. (1) Optimise and standardise the process. The ideas in the platform should follow a defined number of stages, becoming a repository of the knowledge acquired by each idea over

282 The challenge involved 30 IT team members in a crowdsourcing challenge event. They had to apply to the online challenge with innovative applications to improve the Electrolux Professional digital infrastructure.

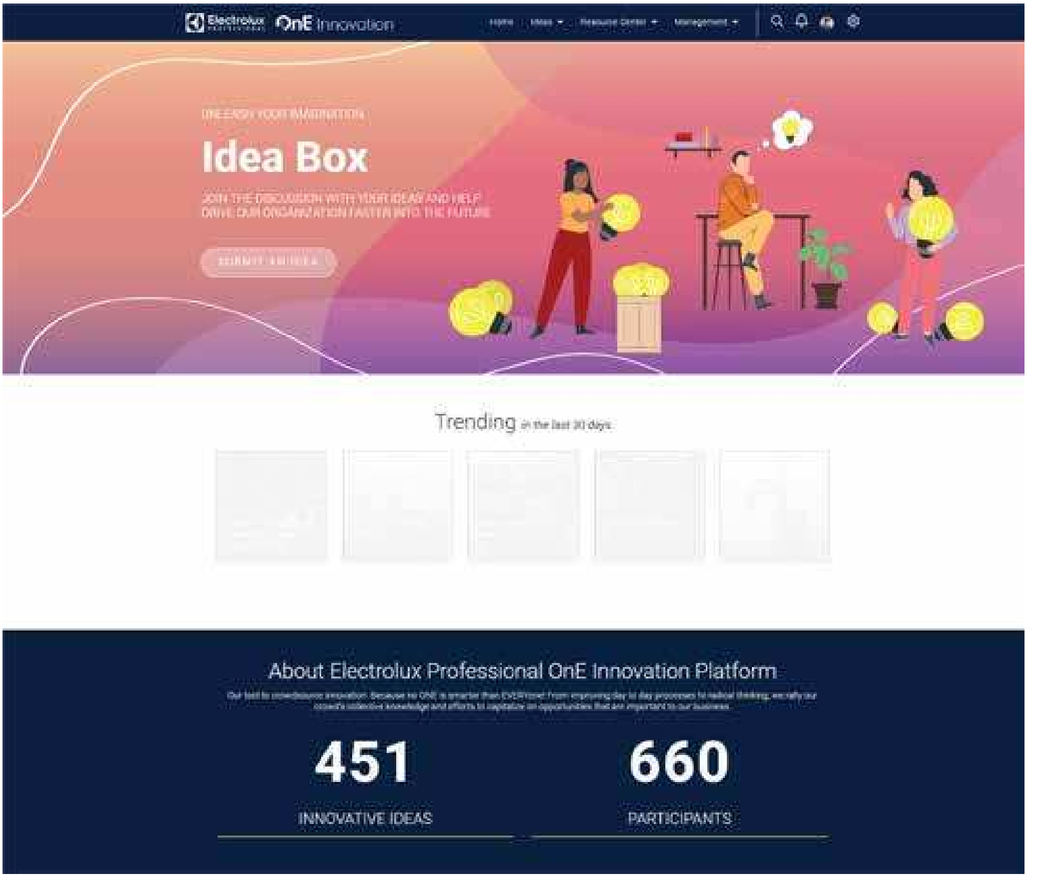


Figure 4.52 Innovation platform homepage.

the process. (2) Grow and spread an innovation community. The platform should be a digital agora where people from all over the organisation could meet, discuss and work together to develop and increase common knowledge. (3) Foster innovative cultural values in the organisation. People involved in the platform should not only give their contribution to the cause but even receive something back. The platform should offer interesting information about the most recent trends, startups, methodological approaches, case studies and stories about Electrolux Professional and other realities to create a portal to inspire the organisation. (4) Finally, measure and assess the organisation's innovation performances. The information and data the platform acquires should give a digital picture of the activities under development and give feedback on what is going on in the organisation about innovation.

Governance

To achieve these goals, the researcher redefined the platform's governance. The new structure's foundation lies in the theoretical framework of the "learning organisations" concept (Senge, 1994), already debated in the thesis discussing Martin's view of design thinking. Indeed, as Martin (2009) suggests, organisations usually have two strategies for planning new projects: exploitation and exploration (Figure 4.53). While exploitation uses existing assets to make them more profitable, exploration aims to research new opportunities. The first is especially suited for core and adjacent innovation, and the second for more transformational investigations. Following this structure, we can observe the decision-making chain at the strategic level theoretically split into two paths. The governance process discusses here aims to structure the explorative organisational process. Indeed, Electrolux Professional is well prepared to face exploitation activities. Still, it partially lacks a structured approach to managing the exploration path.

In the organisational process flow, this process should be set as an alternative path that some uncertain projects follow at the project strategy decision-making level to acquire more knowledge before the development phase. From this perspective, each idea is essentially an asset of knowledge that moves through a knowledge funnel. An idea gains more understanding as it moves toward the funnel's end, reducing its status of uncertainty and embedding new information after each developmental activity. The idea gets into the platform with almost no knowledge. Then, the innovation team and the innovation hub community work to acquire and embed new knowledge into the ideas that advance in the knowledge funnel.

Building on this theoretical structure, the researcher designed a funnel process that considers the contextual characteristics of the Electrolux Professional innovation (Figure 4.54). The source of the idea could come from two main streams: internal[283] or external[284] initiatives. Ideas at this stage are not still considered in the funnel[285]. At that point, a proper process supporting the decision-making act as the first filter to

283 The innovation hub team manages these initiatives. They could be internal crowdsourcing challenges such as the "IT" or the "Sustainability" challenge. Or strategic initiatives such as the "Automatic and robotics" or the "innovation day".

284 The open innovation function manages these initiatives. They could be ideas coming from startups, consultancies, or universities.

285 Considering the six steps of the knowledge funnel discussed before, they are at stage zero

select only the ideas that make sense to explore further.[286] The ideas that receive the funding or approval to proceed enter the exploration process. In this iterative loop, design thinking mechanisms are exploited to create and embed knowledge into the ideas and move them toward the funnel (Table 4.13). At the end of each iteration, another decision-making moment ratifies the decision until enough knowledge is acquired to decide whether to discard, stop or develop the idea.

Tools

The platform supports innovation governance with several tools. The main items of the system are ideas (Figure 4.55). They are customisable web pages where you can add different information such as text descriptions, images, and attachments files and categorise them with tags. Essential for the platform's governance are the labels that identify each idea for its status (Figure 4.56) and typology (Figure 4.57). It is possible to move the items toward the innovation process by modifying the status. While selecting the typology, you can set their innovation potential.

Ideas are organised in challenges (Figure 4.58): boxes that collect ideas from different sources. As previously discussed, we could have internal or external sources. For instance, in red, there are internal crowdsourcing challenges such as the "Sustainability Challenges", "Idea Box", or "Let's Reinvent IT." In purple, there are open innovation ideas and inspirations such as "trends" and "startups." Finally, in blue, there are innovation hub initiatives such as "Automation and Robotics." The challenges format is an excellent way to organise the ideas and the content produced ad stimulate collaboration. Indeed, for each challenge, there are powerful tools for collaboration. People involved could vote on the items by different metrics,[287]comment, mention users, build a collaborative canvas and submit ad-hok tasks to collect additional information. They are various tools to foster and leverage collaboration and participation in innovation.

Other valuable tools are the evaluation ones. The platform could support decision-making by assigning review tasks to a defined pool of stakeholders. There are two approaches for evaluating ideas: ad hock-survey or the head-to-head review. In the platform, any survey can be designed and sent to colleagues to review a certain number of ideas.

286 Usually, this first filter is done through dedicated design thinking activities, such as in the "automatic and Robotics" case. Or using collaborative approaches such as in the challenges case. Or in dedicated periodical meetings with the business area stakeholders called "Innovation Hub Meetings".

287 For instance, using likes, virtual currency, ups and down or ratings.

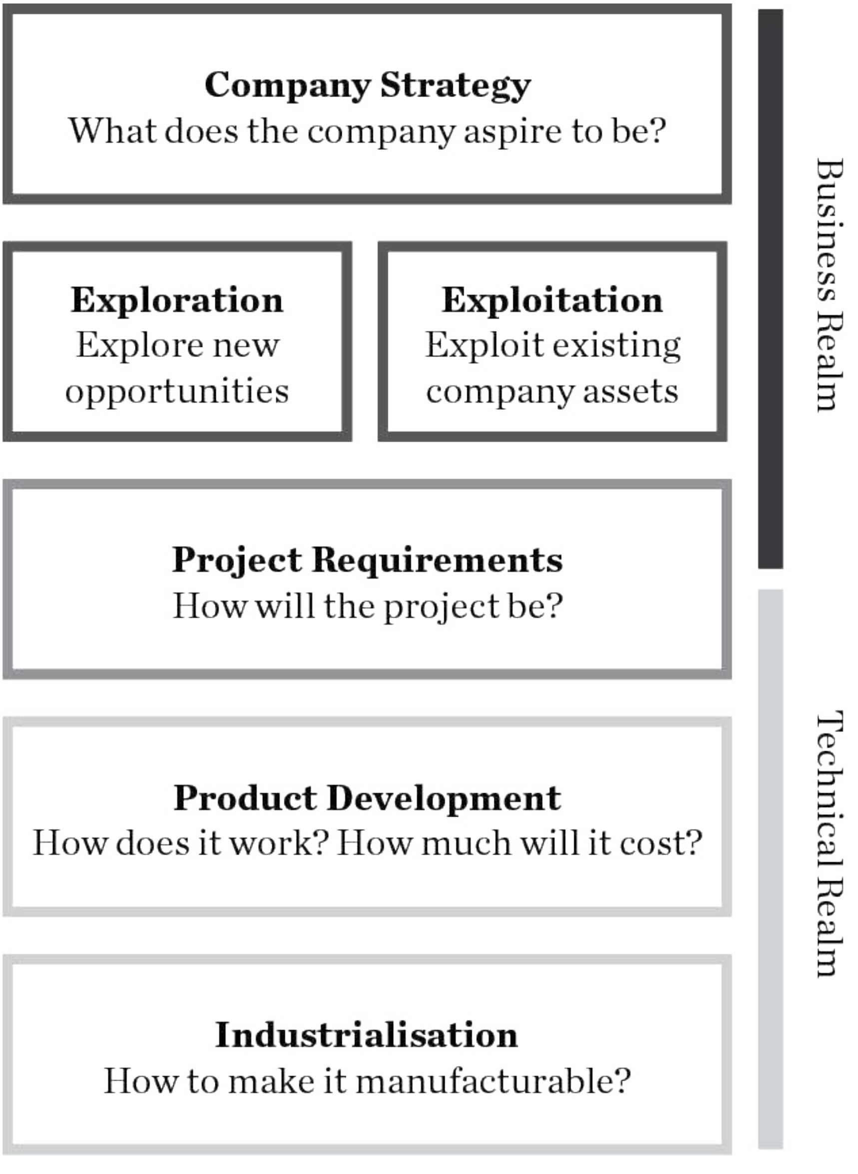


Figure 4.53 Decision-making chain: exploration vs exploitation.

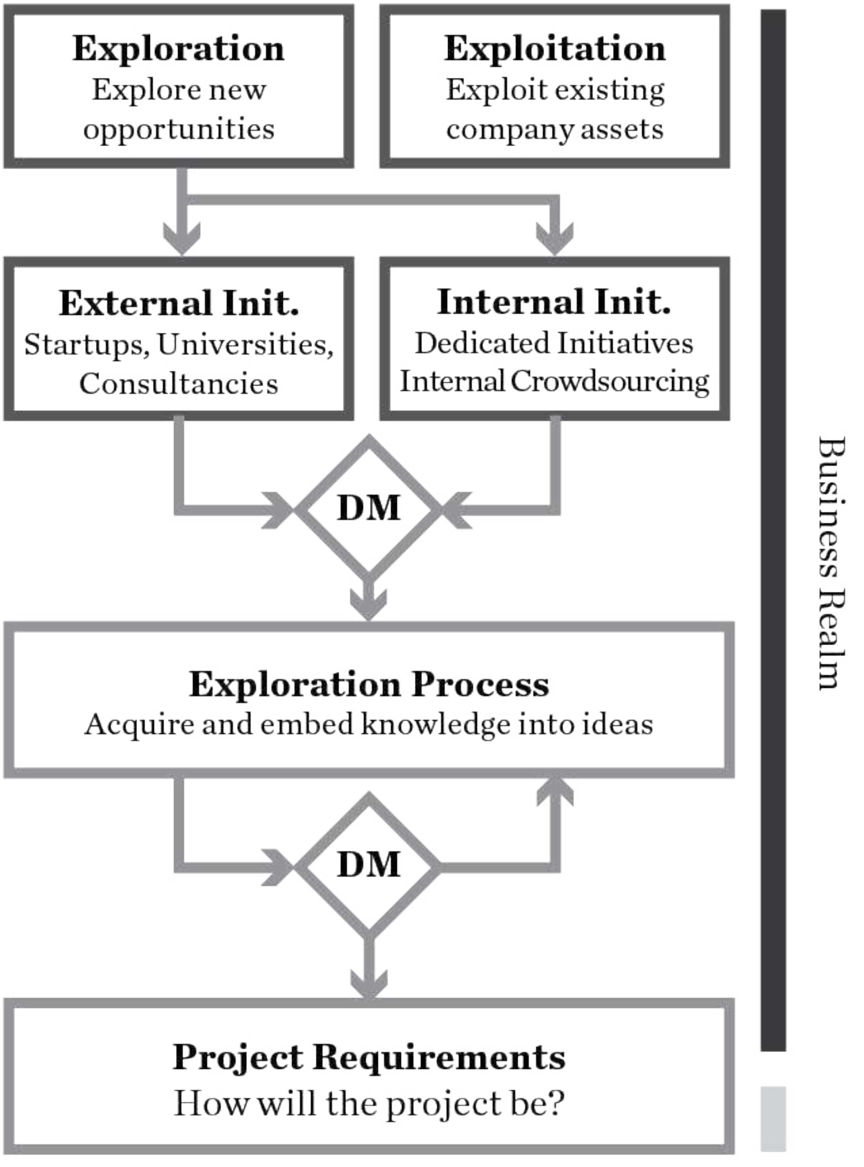


Figure 4.54 Decision-making chain: exploration stream.

For instance, you can ask two people for feedback about ten ideas and collect qualitative information (Figure 4.59). Or you can use a quantitative approach using a comparison strategy to define a ranking. For example, evaluating a challenge's ideas by comparing them based on three criteria (Figure 4.60). These tools can be used anytime and anywhere in the platform to collect feedback or additional data. Compared to other tools, these are directly integrated into the platform and connected to the ideas, giving the final user direct access to all the information stored in the items.

When an idea overtakes the first decision-making stage entering the exploration process, it is automatically redirected into a repository of ideas. In the platform, there are two portfolios. The first, called "Idea portfolio" (Figure 4.63), is a collection of all the ideas that overtake the first filter process divided by business area. Indeed, due to the limited energies of the innovation team to explore and support new ideas, they are parked in these areas till a budget or enough time is assigned to run a dedicated explorative activity. When the process is activated and the innovation team takes responsibility for an idea, it enters a second and more action-oriented area called "Innovation Portfolio" (Figure 4.64). It is an innovation project management tool that offers the freedom to build a flexible format to collect and store different kinds of files, information and contents. This tool is the online point of reference of the team that is working on the project.

Finally, the platform offers valuable tools for managing users and governance. There are tools to manage accessibility giving permissions to a different groups of people. There is a dashboard to visualise data about the platform usage (Figure 4.61). A gamification system that rewards users with points and badges by completing specific actions (Figure 4.62). Finally, automatic tasks could be set to manage the platform processes straightforwardly. For instance, automated rules could be nested to build up a complex system that sends emails to users, moves ideas in the process, assigns points, and send tasks and rewards.

These are only the primary tools the platform could offer to manage innovation. They are instrumental in assessing innovation activities and supporting the evaluation of design thinking. Still, they must be appropriately set and designed to capture the data required.

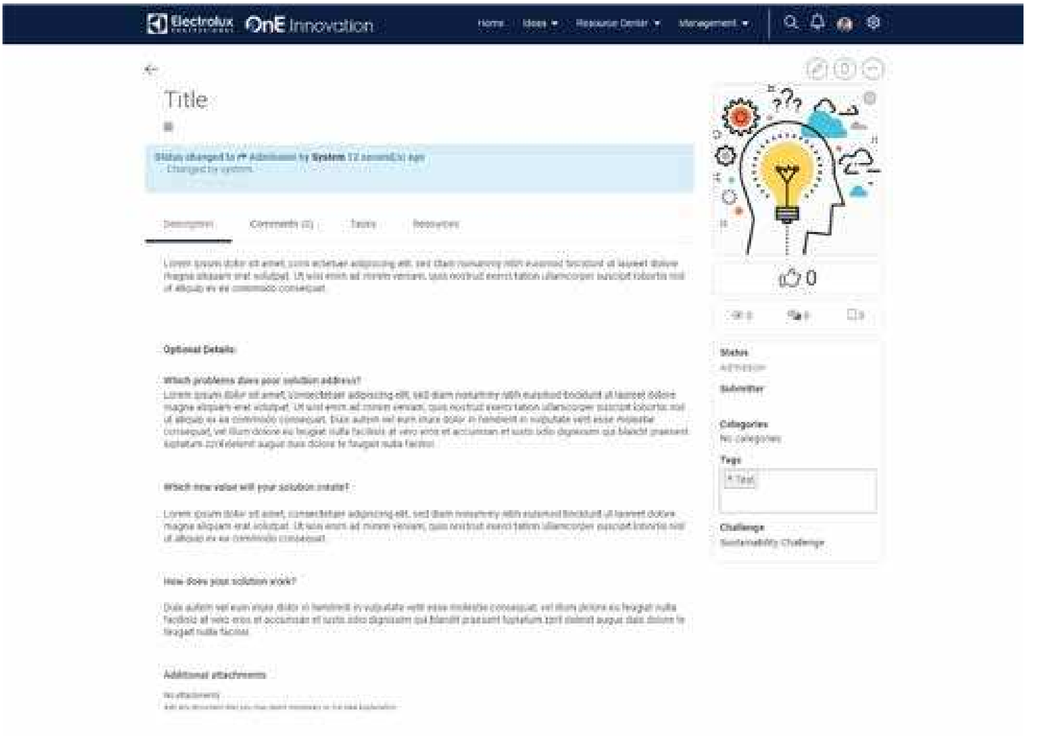


Figure 4.55 Idea example.

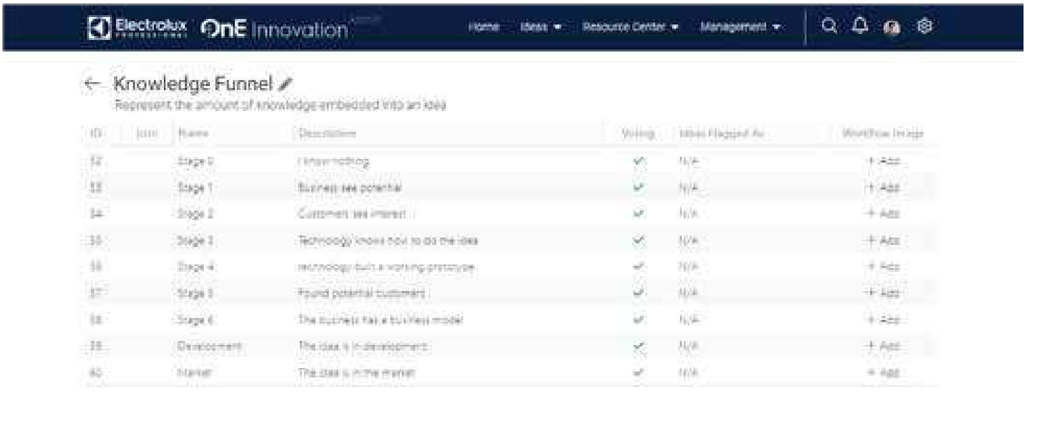


Figure 4.56 Knowledge funnel process.

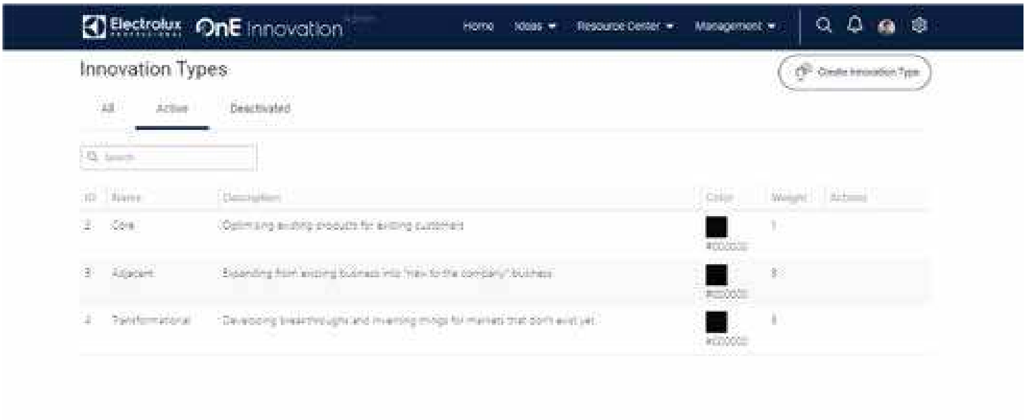


Figure 4.57 Innovation types.

Figure 4.58 Challenges.

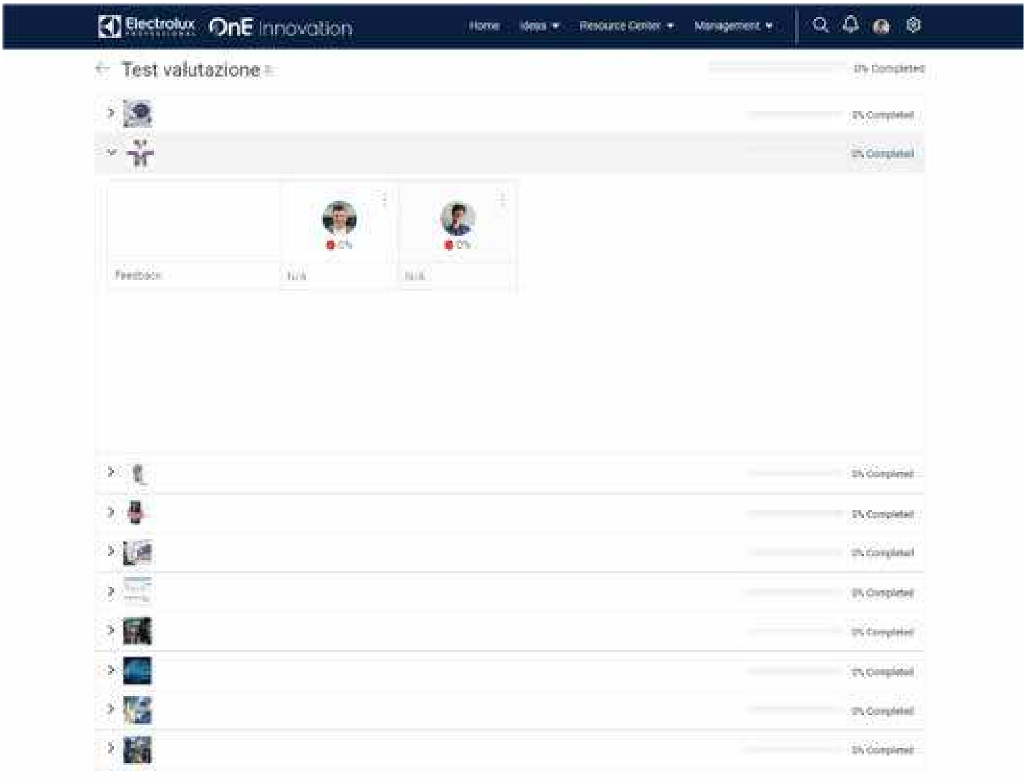


Figure 4.59 Ad-hoc survey example.

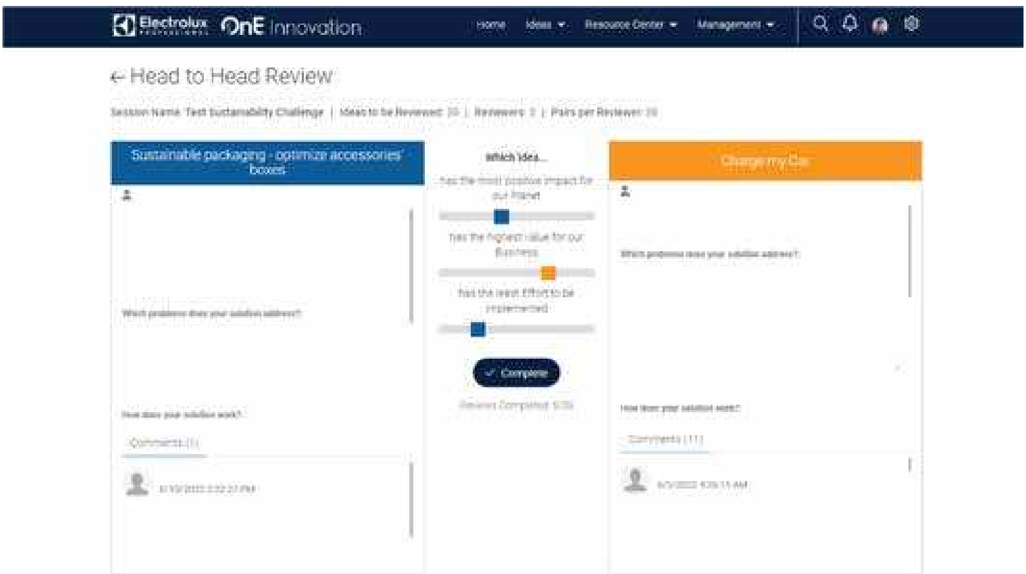


Figure 4.60 Head-to-head review.

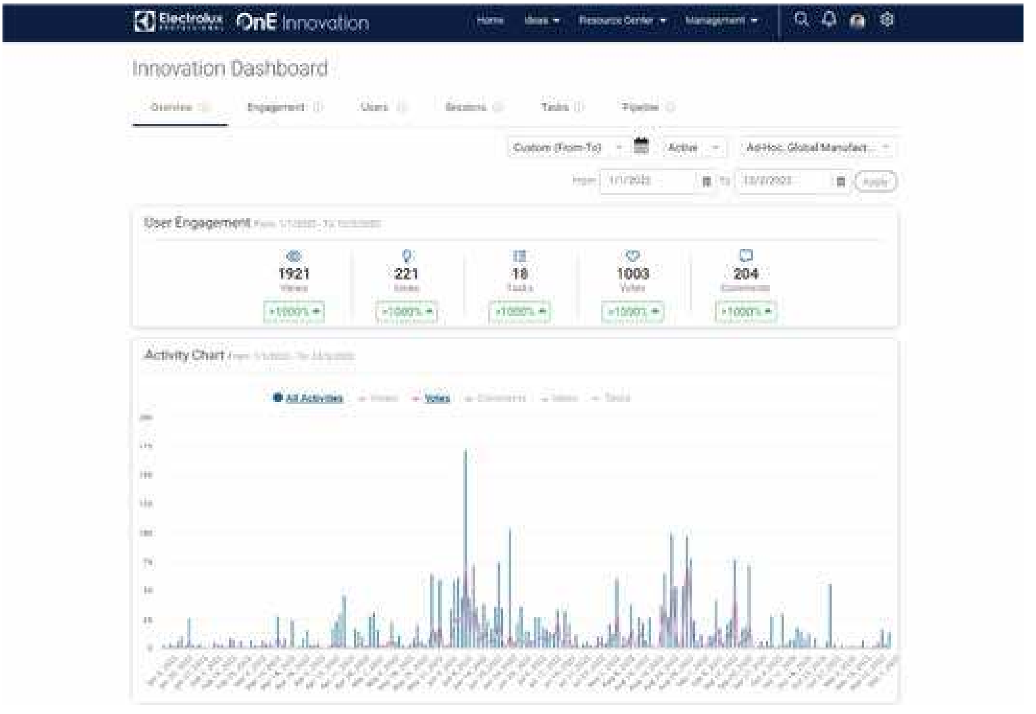


Figure 4.61 Dashboard example.

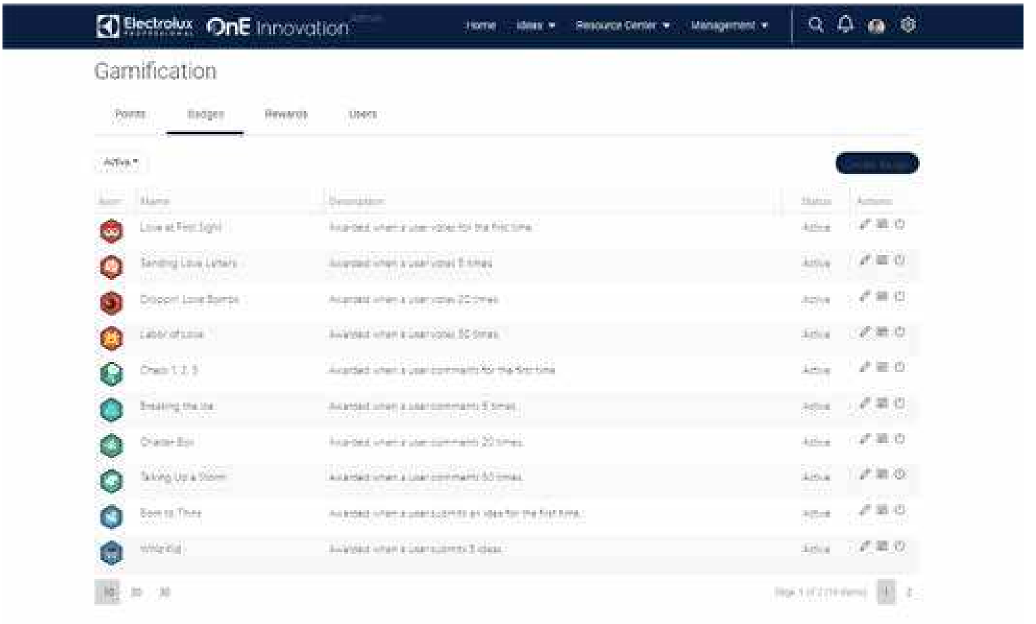


Figure 4.62 Gamification system.

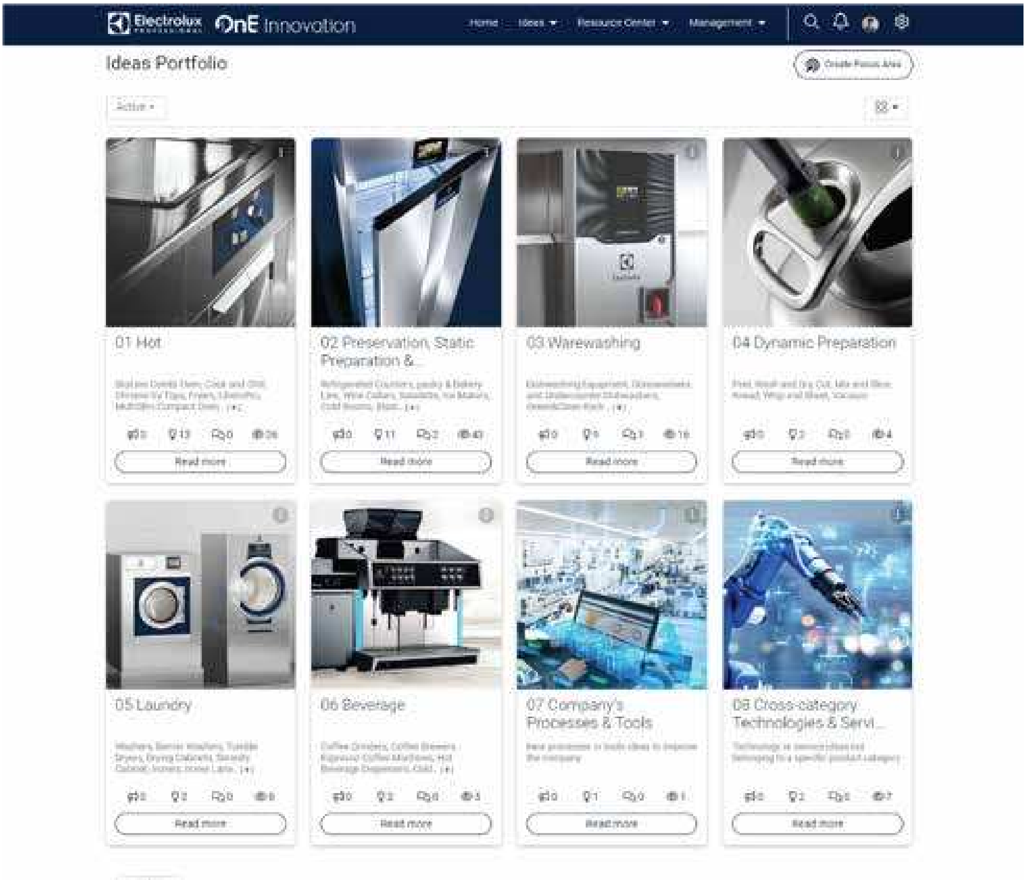


Figure 4.63 Ideas portfolio.

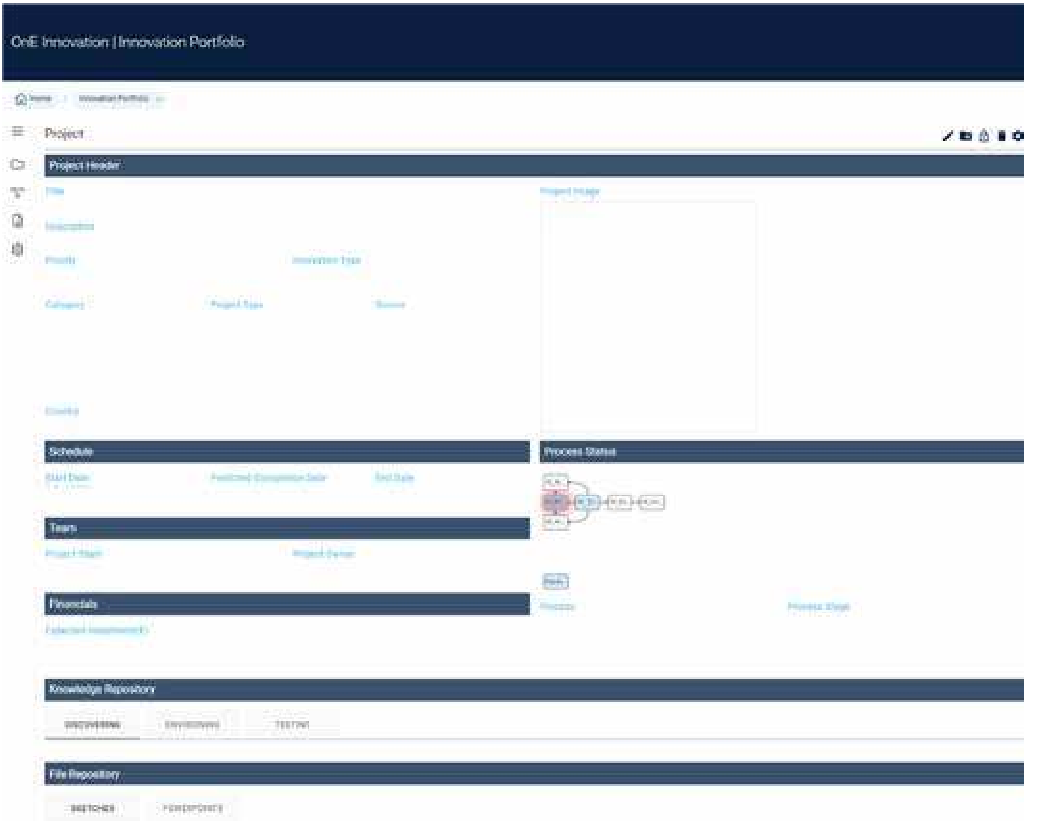


Figure 4.64 Innovation portfolio.

Data Collection

The previous paragraph introduced the tool's potentiality and the main adjustments to align the platform according to the theoretical framework of the evaluation. However, where is design thinking in this system?

Design thinking is not the system. Still, its practices influence and impact the processes managed on the platform (Figure 4.65). There are three main areas where design thinking practices affect innovation governance. (1) Participative workshops and envisioning-testing activities are the leading practices guiding knowledge acquisition in the exploration process. (2) Among the internal initiatives, research activities and participative strategic practices are a source of ideas creation and selection, such as in the "Automaton and Robotics" case. (3) Finally, participative activities are usually the primary approach to support decision-making moments. All these practices are the backbones of the process, but how could we collect helpful information about them from the platform?

Recordkeeping System

The platform automatically collects generic data about different aspects, such as collaboration, user engagement, and ideas status, visualising them in the dashboard. Still, they are not discrete. To assess the design thinking impact on innovation, we could not use ready-made information from the platform. However, its row data could be used to get the information needed.

Supported by the platform development team, the researcher tried to figure out a way to manage and analyse the information from the platform. A possible solution seems to be using Power Business Intelligent[288] (Power BI) tools to access the row dataflow to collect, categorise, calculate and visualise information. Such as for the Excel prototype, the device can manage data in a dynamic dashboard ad-hoc designed to visualise the information required and generate a report about them. However, more than Excell, Power BI have direct access to the platform data to update the score daily. In this way, the duty of updating the information is delegated to the platform interface that partially automatically monitors these data and partly could get them through the proper tool and security access that the platform provides. The platform monitors

288 The power BI tool selected for this scope was from the Microsoft system due to the company's availability and system compatibility.

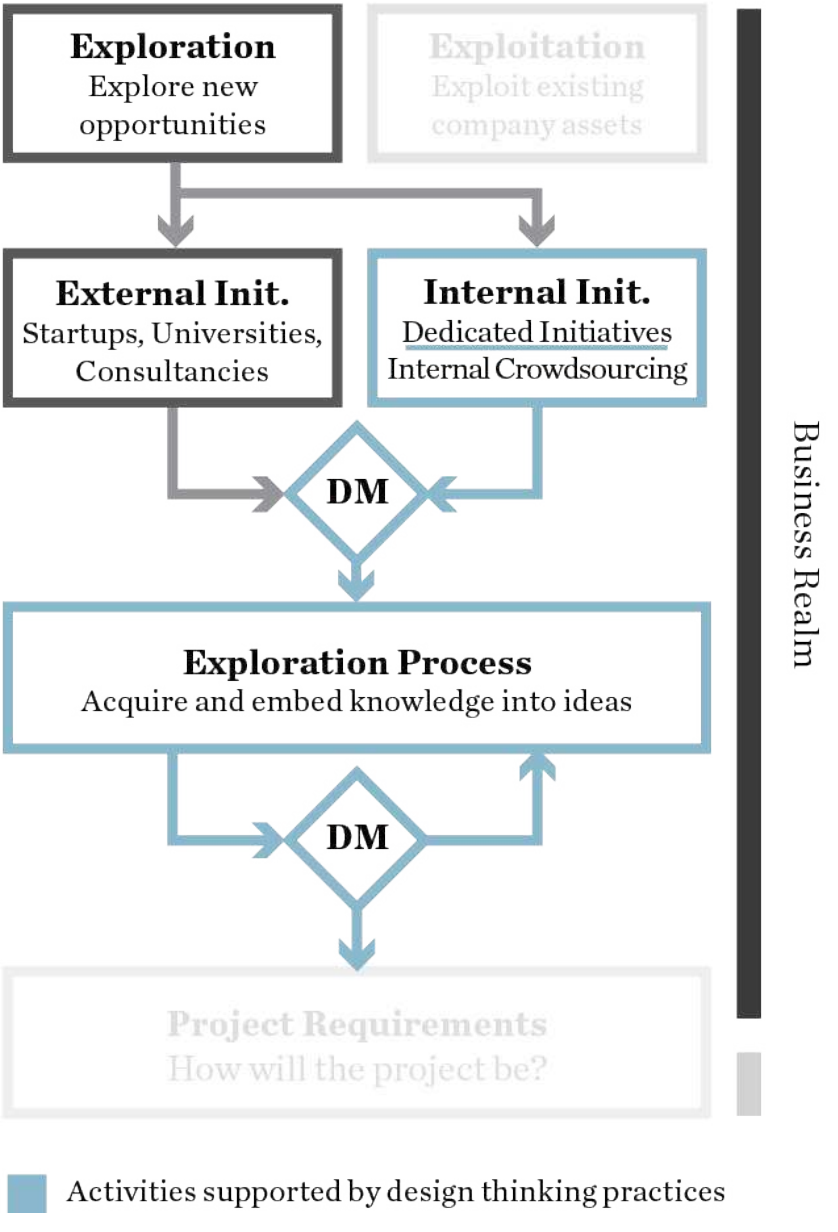


Figure 4.65 Design thinking in the exploration decision-making stream.

and collects information from the users involved in the design thinking activities. At the same time, the Power BI tool analyses them to return a visual dashboard representation of the indicators needed[289].

Indicators Monitoring Strategy

The data required for monitoring the design thinking indicators are easily accessible by exploiting the management tools designed for the platform's governance.

To assess the selection rate, we need to map the number of ideas in the funnel and their status, considering the type of potential innovation analysed. These data are available by default, thanks to the label assigned to each idea that establishes its process status and innovation typology. A visual model could be reproduced to highlight how many ideas are present at each step and the selection rate for each decision-making moment, distinguishing between core, adjacent and transformational ideas.

To assess the customer interaction rate, we need to monitor the number of customer interaction activities done per idea and their effect on the knowledge funnel advancement. This data is not directly available in the platform by default. Still, it could be collected through the innovation portfolio interface. The innovation project manager has to fill the different fields of the format providing answers to the customer interaction questions. For instance, a field could be added asking for the number of research activities and tests done and even a short qualitative description of the activity output. Knowing that information and the idea' status, we can visualise how many research and test activities have been done for each project.

To assess the innovation speed, we need to know the time it takes for any idea to move through the knowledge funnel, considering the type of potential innovation analysed. In the innovation portfolio, we can estimate the speed of each activity by setting the date of the beginning of a project and analysing the time it employs to move from one status to another[290]. This way, we can visualise the average time ideas take to move in the funnel, distinguishing between core, adjacent and transformational ideas.

To assess the people's involvement, we can monitor the number

289 This process is still in the developmental phase. At this moment, the IT team of Electrolux Professionals and the platform providers are working to establish the data flow connection with all the security systems of the case.

290 The statuses in the knowledge funnel identified are six, as discussed in the previous paragraph. Therefore, they consider and potentially could distinguish between the first and second iteration cycles to return data coherent with the goal set.

of people involved in each initiative or exploration process. The system already analyses the number of people and the activities run on the platform. Still, we have to consider that not all the activities on the platform concern design thinking and not all the design thinking activities are run into the platform. To get discrete data, we can use the innovation portfolio form to set the team for each project distinguishing between different categories, such as innovation team, innovation hub, innovation community or external collaborators. The great advantage of this system is that it is interconnected with the company server that catalogues each company user base on their working information[291]. Thus, by assigning people to an activity, we can use the people involvement data with some additional and automatic qualifiers that can support the filtering of the dataset base on the needs.

Finally, to assess the time invested, we should exploit the people involvement indicator and multiply it by the time spent by each people in the project. This data is probably the most complex and time-consuming to assess due to the different people involved at different levels. However, the format could be arranged in the innovation portfolio to let every participant esteem the time invested in this activity. Suppose the hours invested by the participant are collected. The system could combine the previous indicator with the time, returning the time invested by people in innovation.

Qualitative surveying Strategy

The platform can facilitate the recordkeeping of the quantitative indicator to monitor the innovation impact of design thinking. Still, it could help even the optional qualitative data collection, automating the process.

Even if not thoroughly developed, the qualitative assessment could be highly simplified and automated thanks to the platform system. Indeed, the reviewers could design a set of ad hoc survey prompt formats to send to people when needed. Moreover, automatic rules defined in the system could send the survey task to a predefined set of people when a specific action happens. For instance, if an idea moves from one step to another, the system could send a survey task to a group of people,[292] asking them for some information. With these strategies, we can easily collect qualitative knowledge about the research or test reliability, the social interaction quality or the decision-making process.

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291 For instance, it understands its hierarchical role, its belonging to a department, gender, age, and so on.

292 In the system, the admin could define groups of people with different levels of accessibility to the contents to facilitate the design of automatic processes.

Currently, the monitoring and surveying strategies exist only on paper. Indeed, the platform infrastructure is still under development. The platform is ready and running for the crowdsourcing events but requires some additional actions and time investment by the innovation team to make it the core infrastructure for the company's innovation management. From the beginning of 2023, the researcher will become part of the innovation team, and the development of the platform and the evaluative assessment will become part of its work objectives. Still, additional spoilers on the next possible steps could be discussed before concluding the essay.

Next steps

Following the ROI methodology process, after the data collection part, there are two additional phases: the data analysis and the optimisation of the results.

Analyse data

We have already discussed the possible use of the Microsoft Power BI tool to analyse the data collected. Still, that information should be isolated with an appropriate method to make them credible. The approach identified in the "evaluation strategy" paragraph pinpointed the "management estimation" as the most suitable method to balance the final results with other possible influential factors. The estimation is helpful, especially for those data that do not track a single indicator, such as the number of ideas in a certain status or the number of hours people spend on a project. Indeed, they are valuable for detecting other variables affecting the information collected and estimating their impacts on the phenomenon analysed. Not all data should always be isolated, but when it is needed, the management estimation technique could be a practical strategy.

After the isolation phase, the data conversion to monetary value should be the following step. However, design thinking, as described in this thesis, has mainly intangible assets that, by definition, are complex to translate into economic value. Thus, in this case, the researcher does not expect to transform the data collected in monetary value and consequently calculate the return on investment of the design thinking for the organisation. Still, other possible strategies exist to exploit the data collected to optimise and communicate the design thinking impacts to the organisation and make them beneficial.

Optimise results

Once analysed the data, the last phase of the evaluation process concerns using the information to advertise the result and take corrective actions. Data are meaningless if not properly communicated and contextualised into a story that sustains them. As suggested by the Intuit example (Schmiedgen et al., 2016), an excellent strategy could be to storytelling the design thinking impact exploiting the data into a case-base report that combines the specific quantitative indicators with the health metrics the organisation care about and some qualitative insights that help emphasise the story.

More than mere communication, the platform could even leverage more action-oriented strategies. For instance, the data collected and analysed could offer numerous indications to the innovation team about which practice works better and why. Data could nudge actions from the management and user side. Indeed, by combining the information tracked by the evaluation system with the gamification and automation tools of the platform, the innovation team could imagine using advanced strategies to nudge the user to act toward specific objectives. For instance, if the data suggest certain projects have low customer interaction, the system could automatically send mail to the project leader alerting them beforehand. Alternatively, if people are reluctant to participate in innovation, some points could be assigned to the people involved for every hour spent supporting an innovation project. Reaching a certain amount points, the person could convert them into gifts or get publicly recognised for their work by the management.

Many possible strategies exist for exploiting the data collected into a platform. Automation, gamification, and rewards are all possible ways to nudge better action in supporting innovation practices. However, combining them produces a more robust system capable of evaluating and proactively improving innovation. In summary, this is the future vision expected for this line of research in the Electrolux Professional context. It is an incomplete investigation. Still, in the future, hopefully, the proper condition will allow a better dissertation of the result of the evaluation of the design thinking impacts on innovation.

Conclusion

This last chapter does not lead to a definitive result about the evaluation of the design thinking impacts on innovation. It set the foundation for the assessment without having time to conclude it. Even if the research is not finished yet, this chapter presents a promising strategy for evaluating design thinking in an organisational environment.

After developing a framework to study the practices labelled as design thinking, the researcher began the assessment by analysing the innovation team activities. The inquiry pinpointed two primary considerations about Electrolux Professional practices. On the one hand, they adopt similar mechanisms and produce coherent impacts on the organisation. On the other hand, the case base narration showed their dynamics and innovation potential change in relationship to the decisions the practice aims to support.

In the second part of the chapter, taking a clue from the ROI methodology and OKRs approach, the researcher sketched the evaluative strategy. In the first phase, the analysis of the design thinking practices, combined with the innovation strategy research, supports the identification of the impact of design thinking on innovation. For each impact, the researcher and the innovation team identified objectives, key metrics and a proper threshold score system to collect and make sense of the data. However, after a first recordkeeping test with a draft prototype, the researcher understood that a more automated system was needed to make the data collection effective and sustainable, even in a practitioner's world. The opportunity came with OnE Innovation: an online platform aimed at supporting and fostering innovation in the organisation. To combine platform management with a proper evaluation system, the researcher adjusted the platform governance to make it akin to the theoretical infrastructure of the planned evaluation. Currently, the platform and the evaluation process are aligned and ready to cooperate in the data collection. Still, the two infrastructures are not yet prepared from the technical side.

The thesis journey leads directly to the evaluation moment without reaching it. Without quantitative data to support the design thinking impacts on innovation, no definitive conclusion could be stated. Still, some critical evidence could already be discussed. In the closure of this thesis, the design thinking effects on innovation are debated, examining the achievements of this work from the academic and practitioner perspectives.

Conclusions

This thesis started with a distinct objective: understand the return on investment (ROI) of design thinking. However, the more the inquiry delved into the topic, the more the emerging findings and issues addressed the investigation toward other propaedeutic subjects. Over this journey, several questions hindered the direct achievement of the thesis's primary objective. Queries that required most of the PhD time to be faced. Still, without this preliminary work, no design thinking assessment on innovation would be possible.

Contributions to the research

The first big concert to deal with was: what is design thinking? Design thinking is a label assigned to a vast phenomenon that assumes different meanings in different times and contexts. In the first chapter, we discussed that the topic had broad appeal, especially in two discourses: one within the design and the other in the management discipline. From the design side, the design thinking phenomenon arose in the academic discussion in the 90s as a line of research studying designers' cognitive and social characteristics. While from the management perspective, the design thinking concept developed among several parallel sub-discourses, emphasising the design thinking practices' role for the organisations. In both discourses, the design thinking assumed slightly different interpretations. Today the label's meanings seem to coexist in everyday organisational practices. This plurality is an added value for the phenomenon that can rely on diversified pools of knowledge to enrich its meaning. Still, it is essential to be aware of contextual differences to interpret and use design thinking correctly and avoid misunderstandings. Assessing the design thinking meaning for Electrolux Professional has been the first premise for its correct evaluation.

The second issue focused on: what is innovation? Moreover, what are the variables that affect it? By definition, innovation is any invention in use that has reached the market. Thus, two elements make a solution an innovation: its degree of novelty and market success. Despite the straightforward definition, understanding how organisations can successfully develop innovative solutions is not trivial. In the second chapter, we observed that the word innovation is used for different goals in Electrolux Professional. It is a way to create added value for the customers, a competitive advantage, gives market visibility, and is a cultural aspect. Still, finding a unique meaning is not a priority. The important is to reach innovative results in the markets. Thus, prepare the proper company ecosystem to accept and foster innovative initiatives. In this regard, the development of the Electrolux Professional innovation strategy supported the research by acknowledging a holistic set of actions that could positively affect innovation. Understanding the variables influencing the organisational innovation ecosystem has been the second crucial aspect to analyse for a proper evaluation.

The third question concerned the design thinking practices in context. How is design thinking employed in Electrolux Professional? Moreover, what are its organisational effects? Design thinking seems to have diverse implications for the organisation. Still, only a few studies address this topic with fragmented results. The difficulty in assessing design thinking seems to reflect its definition ambiguity. There is no unique way to interpret the phenomenon and, therefore, to evaluate it. In the third chapter, to face this issue, the researchers developed a framework and a connected card tool to explore Electrolux Professional's design thinking practices and study their impacts on the organisation. As a result, in the fourth chapter, we discussed three models that describe the design thinking practices in Electrolux Professional. (1) Design thinking is an interconnected series of strategies to face different situations. They are identifiable because they used routinised activities but have a resilient character that makes them adaptable to the problem they must respond to. Indeed, we can observe that design thinking is essentially a learning path that adjusts the problem and solution according to the inquiry's findings. (2) Design thinking is both a managerial and design practice simultaneously. Observing its impacts on the organisation, we can find that design thinking generates valuable assets of knowledge further developed in participative social practices that support organisational decision-making. These decisions address both the design process informing the development of the solution and the corporate management supporting strategy making. (3) Finally, design thinking changes in response to the type of decision that supports. Design thinking could impact product development, project requirements or strategic decisions, influencing the organisation at different levels. The higher the decisions the design thinking practices work for, the higher the potential degree of innovativeness for its practices. Modelling design thinking characteristics, impacts and innovation potential was the last essential ingredient collected before moving on to the evaluation topic.

Therefore, finally, once we debated what design thinking is, what innovation means for Electrolux Professional and what effects design thinking has on the organisation, the question came back to the beginning. How could we assess the impact of design thinking? Moreover, which are its effect on innovation? Even with a clearer view of the issue and the related subjects, this is not a trivial question. The interconnection between the design thinking impact model and the Electrolux Professional innovation strategy pinpointed various aspects affecting the innovation ecosystem. Still, these impacts are complex to assess and collect due to their intangible nature. Thus, the strategy adopted for the evaluation tried to define a two-level monitoring system integrated into the organisational innovation platform. The primary level capture five leading indicators, measuring the critical aspect of the effect of design thinking on innovation. The second level assesses qualitative data by surveying the stakeholders on an optional basis when the situation requires it. Finally, defined the model of impact, the methods, and the metrics to assess, the last development focus on implementing the collection system into the organisational innovation platform that acts as an interface to collect the data required for the impact analysis.

The work is still going on, and in the future, a first pilot test of the assessment should give its first results. This assessment is the last incomplete answer the PhD inquiry tried to address. Still, over the research, several other questions and doubts come out that do not have the opportunity to gain the necessary attention.

Future Research

Several subjects have been analysed and discussed in this thesis considering the time and the dual nature of the industrial PhD. Still, many others would require time and attention to be explored.

The framework has been validated only in the Electrolux Professional environment. A broader validation process should test the framework in other contexts and explore different design thinking practices to give proof of its value. Moreover, the application of the tool connected to the framework is only at its first stage of development. Today it is employed to analyse and map the design thinking through a coherent frame, explore the perceived impacts and critically reflect on its practices to improve them. However, other exercises could be designed. For instance, the card could be exploited to teach and explain design thinking, support the design of new practices and methodologically introduce their application.

Another interesting topic to address is the shortcomings of design thinking. We discussed the positive impacts of design thinking on the organisation, but what are the side effects? Some studies (Liedtka, 2015) pinpointed the positive effect of cognitive biases on design thinking practices, but are they only positive? Elicit the main cognitive biases affecting the design thinking prac-tices negatively would be essential to be aware of these aspects and find out possible strategies to mitigate them. In this regard, from the playtesting activities, the users express their interest in a new set of cards, highlighting the variables that could hinder a correct application of the design thinking practices. Cognitive biases could be a key to interpreting this topic, but many others may be identified.

These are just a few lines of research that could arise from this thesis. The researcher is already working on moving forward with some of them. Still, any contribution to the development of others or the current investigations is more than welcome.

Final Comments

A complete design thinking assessment is not yet completed. Nevertheless, some preliminary conclusions could be laid out at the end of this research. What is the value of design thinking? In trying to answer this question, two perspectives should be emphasised, considering the industrial nature of this PhD: the design thinking value for practitioners and the design discipline.

Design Thinking Value for Practitioners

Even if this thesis could not generalise its results, we can use the Electrolux Professional analysis as a case to speculate on the impacts identified till now.

Before the design thinking concept was introduced, the design department mainly supported and influenced the organisation from a project development perspective. The design activity primarily focused on aesthetical and functional aspects distinguishing between ergonomics, usability, user experience, product design, and user interaction. It worked in the R&D department, supporting the design of the final products. Still, it had a limited role in innovation. After introducing design thinking, the department started getting more involved in new organisational dynamics. Firstly, working as a facilitator of the project requirements decisions and then in the project strategy activities of the organisation, enlarging its potentiality to affect innovation and the organisation as a whole. Finally, it gained the official mandate in innovation, becoming the design and innovation department. During these five years, the department acquired a new company role, grew its team, increased its allocation of resources and multiplied its responsibilities.

However, what has been the role of design thinking in this shift? Was it all about its credit? No, it was not. The willingness of the team to get involved more in innovation activities, the lack of a leading actor in this role, the historical company reorganisation and the unexpected global sanitary situation set the basic foundation for this change. Still, design thinking played its part. It gave the team credibility before the practices proved their intrinsic value. It suggested functional methods and tools efficiently working outside the typical design context. It provided the design team with the awareness, confidence and bravery that they could play a different role in the organisation, empowering their actions.

Design thinking is not a magic process but is a powerful concept that, if used with wisdom, can make designers and non-designers rethink the role of design in the organisation.

Design Thinking Value for the Design Discipline

Design thinking in the design discipline has both sponsors and detractors. Design thinking seems to trivialise the design practice. Design thinking is something designers have always done. Design thinking is something that does not belong to designers. These are only some common critiques about design thinking coming from academic design discussions.

Usually, all these observations are equally valid and false depending on how design thinking is interpreted and applied. For instance, design thinking indeed simplifies the designer's practices in a processual way. Still, this is not effective only if used for the wrong purpose. Using partici-pative practices to develop a solution among skilled designers does not make sense. While using them to involve a larger group of stakeholders could produce significant advantages from the crea-tive and managerial perspectives.

It is even true that designers have always used design thinking. Indeed, all the fundamental mechanisms were inspired by the designer's cognitive and social characteristics. Still, before design thinking, the communication of the value of these attitudes was not always effective in the organisational realm. Designers today seldom have the opportunity to play a strategic role in the company. Design thinking could leverage design in more influential positions, efficiently communicating its potential value to the organisation and design practitioners.

However, designers should move beyond their pure creative expertise to get credibility in this role. Design thinking is not only about abductive logic and mechanisms of framing, exploring and reframing. It is about research, collecting and synthesising information, evaluating with inductive approaches, managing participative situations, facilitating, mediating and supporting collaboration. Design courses that focus too much on the creative side of design thinking could underestimate the value of the other mechanisms. To reach an organisational role outside the pure creative operational work, designers must get expertise in other skills areas, capable of supporting the crea-tive process with all its organisational dynamics. Otherwise, other practitioners from different disciplines will take over.

Designers are not solo actors in design thinking, and this is good. Still, today, they seem to be the exception rather than the rule. Designers could and should have the opportunity to work in strategic organisational roles such as innovation, even outside the design-centric sectors. To work in such a context, designers should get skilled in all aspects of the design thinking mechanisms and become more used to business topics and jargon. As seen in the Electrolux Professional case, the more the design thinking practices involve strategy and innovation, the more they get into the business realm of the organisation. Designers must recognise the importance of business notions and techniques, use them if necessary and be able to dialogue with the many other disciplines involved in innovation. Otherwise, designers trying to work in this context will hardly fulfil the expectations.

Organisations need design thinking. If designers and the design discipline will not move toward design thinking, other people will do. Management students will be, in any case, ready to bring forward the innovation conversation without designers, theoretically educated in design-driven approaches in their MBA courses. The design discipline has a crucial role in this decision. The design has a plurality of expressions and unlimited subject matters to address. Designers working with innovation can capitalise on the knowledge of design thinking to get credibility in this subject. We do not be afraid to hybridise our identity as designers. A designer could be a design thinker working in an innovation management role and still be a designer. Design thinking indeed comes from design, but it does not have to create a dichotomy. Design and design thinking do not have to be mutually exclusive; they could even be complementary.

Design thinking is already straightening design in the innovation role inside many organisations. If the proper support arrives from the academic and educational side, design thinking could be of great value to the discipline opening future designers new opportunities in the organisational realm.

Thesis Value

Design thinking is a valuable concept both for the design discipline and practitioners. Still, the collaboration between practitioners and the profession around design thinking does not seem to get the best from the two worlds yet. Sometimes they seem to speak different languages, but a reconciliation on design thinking would be worth the effort. Practitioners without a proper education in design thinking will struggle to work in an innovation context compared to other disciplines. Without practitioners effectively working and learning from the practice, the discipline will struggle to succeed in innovation behind pure theory.

This thesis and this work aim to build a bridge between these two worlds, acting as an interface to discuss design thinking. The framework is a concrete expression of this aim. It acknowledges the academic design discipline research with the attitude level moving toward the practitioner realm with the mechanism's structure that finally arrives at the impacts touching upon the organisations. This thesis and the framework could be the beginning of a new discussion around design thinking, bringing contributions from design and management, academic and practice and reconciling them for a more successful role of design in the organisation.

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Figures

Tables