Received: 9 January 2021 | Revised: 11 May 2022 | Accepted: 12 August 2022

DOI: 10.1111/caim.12519

ARTICLE

WILEY

The perceived relevance of design thinking in achieving innovation goals: The individual microfoundations perspective

Stefano Magistretti | Emilio Bellini | Cabirio Cautela | Claudio Dell'Era | Luca Gastaldi | Sina Lessanibahri

Politecnico di Milano, Milan, Italy

Correspondence
Stefano Magistretti, Politecnico di Milano, Milan, Italy.
Email: stefano.magistretti@polimi.it

Numerous studies highlight that design thinking is being elevated to the strategic level, on the one hand, propelling designers to the top hierarchical level of the organization, on the other hand, making non-design functions part of design-based processes. The increasing adoption of design thinking has transformed how firms implement the related processes and techniques, opening areas of research on how managers differently perceive the relevance of design thinking in achieving innovation goals. In considering the individual dimension as our unit of analysis (i.e. managers), our study relies on the microfoundations theoretical lens to delve deeper into the individual design thinking perceptions of leaders/managers/employees. To do so, we conducted a survey of 197 Italian managers to investigate their different perceptions of the potential of design thinking in achieving innovation goals. The findings show that managers associate a new set of goals with design thinking against the paradigmatic view of a user-centred practice to generate creative solutions. Indeed, market innovation, organizational change and strategic direction are recognized as goals achievable with design thinking. Moreover, as individuals, managers characterized by (i) different organizational functions, (ii) distinct organizational hierarchy and (iii) diverse organizational experiences differently perceive design thinking in terms of its pertinence to achieving specific innovation goals. By deepening the individual microfoundations dimension, this article contributes to the growing design thinking literature.

KEYWORDS
creativity, design, design management, design thinking, innovation, microfoundations, organizational function, organizational hierarchy, professional experience, strategy

1 | INTRODUCTION

The role of design as a driver of innovation has been acknowledged by scholars and practitioners over the last decades (e.g. Gemser & Barczak, 2020). Design itself is a vast discipline, and in terms of its contribution to the innovation management literature, many frameworks and approaches have emerged (Elsbach & Stigliani, 2018). To mention just few, human-centred design (Buchanan, 2001), participatory design (Sanders & Stappers, 2008) and design thinking (Brown, 2008; Martin, 2009) have marked the renewed and transformed role that design can play in innovation. As defined by Verganti et al. (2021), design is a practice, whereas design thinking is a

paradigm, that is, a set of specific principles, methods and tools to practice design. Obviously, design and design thinking are strictly related one each other, but design thinking represents just one of the many paradigms can be adopted to design. Thus, design thinking is one of the many possible ways to practice design. It implies assumptions and especially a constellation of beliefs, values and techniques that coalesce around three very specific principles: user-centeredness, ideation and iterative prototyping (Liedtka, 2015; Micheli et al., 2019; Seidel & Fixson, 2013). Indeed, design thinking is conceived as a formal method of leveraging creativity in problem solving with the intent of fostering innovation (Brown, 2008; Kolko, 2015; Liedtka, 2015; Martin, 2009). The academic relevance of this approach is demonstrated by recent review articles highlighting the value of design thinking and the need to better understand and study it (Magistretti, Ardito, & Messeni Petruzzelli, 2021; Magistretti, Bianchi, et al., 2021; Micheli et al., 2019). In the last two decades, design thinking has boomed among practitioners to the point that today it is widely recognized as a valuable creative problem-solving approach (Carlgren et al., 2016; Kolko, 2015; Martin, 2009) that enables dealing with wicked problems, namely complex and ill-defined issues that do not have a single solution (Buchanan, 1992). Relying on an empirical study in six large organizations, Carlgren et al. (2016) identifies five themes characterizing design thinking and the associated principles/mindsets, practices and techniques: user focus, problem framing, visualization, experimentation and diversity. In their systematic review of the design thinking literature, Micheli et al. (2019) identify 10 principal attributes and eight tools and methods. Magistretti, Ardito, and Messeni Petruzzelli (2021) conceptualize design thinking as a dynamic capability for innovation rooted in microfoundational aspects, finding that design thinking studies are more entrenched in practice than in theory-driven research. Thus, these multiple interpretations of design thinking call for further investigations.

Recent studies advocate the evolving and emerging interpretations of design thinking, expanding the consolidated application beyond the product and service innovation realm (Gruber et al., 2015; Knight et al., 2020; Micheli et al., 2018; Verganti et al., 2021). As such, design thinking is gaining a new strategic role: from designing novel products and services to delivering innovative strategies and supporting organizational transformations. Indeed, a wide variety of interpretations emerge not only across different literature streams or industries, but also on how firms adopt design thinking to face a wide range of challenges, broadening its multifaceted nature (Dell'Era et al., 2020; Magistretti et al., 2022; Magistretti, Bianchi, et al., 2021). In this evolving context, individual perceptions of the role of design thinking can lead to different mental models and hence issues in dealing with innovation challenges. Mental models can be defined as internal schemas and task representations that individuals use to evaluate, understand and interpret new knowledge and make decisions (Cannon-Bowers et al., 1993; Casakin & Badke-Schaub, 2013; Klimoski & Mohammed, 1994). These mental representations reflect individuals' perceptions, beliefs and unspoken assumptions about a problem or challenge they face (Cronin & Weingart, 2007; Paletz & Schunn, 2010). Relying on significant overlap in task representations, individuals share the same mental model and face the innovation challenge in a coordinated fashion (Cronin & Weingart, 2007; Paletz & Schunn, 2010). When the 'sharedness' of individuals' mental models is low, the different task interpretations cannot be effectively integrated (Aggarwal & Woolley, 2019; Cronin & Weingart, 2007). Moreover, delving deeper into the design thinking literature highlights that most studies focus on a process or practice-oriented perspective (Carlgren et al., 2016; Johansson-Sköldberg et al., 2013; Micheli et al., 2019) rather that the individual dimension, such as managers and designers' view of adopting this methodology (Magistretti, Ardito, & Messeni Petruzzelli, 2021). Although some studies attempt to unpack the different perceptions of design thinking in marketing (Beverland et al., 2015), strategy (Wrigley et al., 2020) and technology development (Liedtka, 2020), little evidence is reported on the different perceptions of design thinking of managers according to their organizational function, hierarchical level and professional experience.

The relevance of studying perception is motivated by the fact that different academic articles (Felin et al., 2015; Shea & Hawn, 2019) have been proven that different individuals see and enact models differently due to their understanding of the context (Helfat & Peteraf, 2015), leveraging their backgrounds (Barney & Felin, 2013) and valuing their experiences (Tasselli et al., 2015). Despite this, little is known about the different perceptions of managers regarding design thinking. As claimed by Magistretti, Ardito, & Messeni Petruzzelli, 2021 it is becoming 'increasingly relevant to understanding the traits of individuals' that takes part in design thinking. The growing relevance of such a perspective is evident also if other articles on design thinking literature are considered. Just to mention a few of them, Dong et al., 2016 framed the differentiating role of individuals in influencing synthesis and sensing capabilities in design-related initiatives. Garbuio & Lin, 2021 studied the role of individual cognition in problem finding and thus the relationship with the initial phase of design thinking. Cautela and colleagues, in 2022, propose an investigation of the individual designer's capability differences in achieving different innovations. Thus, the first set of evidence on the relevance of adopting an individual perspective in design thinking is emerging (Cautela et al., 2022; Garbuio & Lin, 2021; Magistretti, Ardito, & Messeni Petruzzelli, 2021). Thus, more knowledge is needed on the different perceptions that managers at the individual levels have on design thinking as a practice. Indeed, unfolding this view might inform the literature on design thinking on the different individual perceptions reinforcing the multifaceted nature of this approach (Magistretti et al., 2022) and informing the individual perception by showing which are the underpinning elements influencing the perception at the organizational level (Shea & Hawn, 2019).

To bridge this gap in the literature, we adopt the microfoundations theoretical lens (Barney & Felin, 2013; Felin et al., 2015; Foss & Pederson, 2016) to further explore the role of individuals in design thinking. Indeed, the management literature denotes the process, structure and individual dimensions as the

microfoundations of organizational routines and capabilities (Felin et al., 2015). Microfoundations are defined as a theoretical explanation, supported by empirical examination, of a phenomenon occurring at a higher level (i.e. design thinking in our case), which can only be understood by studying its constituents at a lower level (i.e. process, structure and individual) (Felin et al., 2012). Specifically, individuals are defined as the micro-level element of organizations who through their choices, agency, characteristics, abilities and cognition influence how organizations work. Processes are defined as sequences of interdependent events. The structure enables or constrains individuals in their actions and establishes the interaction context (Felin et al., 2012). The management literature argues that to understand and implement innovation, organizations need to grasp its microfoundations (Barney & Felin, 2013). Thus, we aim to investigate how individuals, as a neglected microfoundational dimension, perceive the relevance of design thinking in achieving innovation goals. Perceived and actual relevance are intrinsically different. Several studies have shown that shared mental models positively affect the performance of individuals facing a common task: they not only better anticipate their colleagues' behaviour, but also communicate more effectively (DeChurch & Mesmer-Magnus, 2010). Consequently, having a common perception of the role of design thinking in addressing challenges can influence innovation performance. Specifically, we investigate the following research question: *How do individuals differently perceive the relevance of design thinking in achieving innovation goals*? By considering the different characteristics of individuals (e.g. employees or managers in firms adopting design thinking) according to their organizational function, hierarchy and professional experience of design thinking, we investigate how these differences might affect the perceived relevance of design thinking.

2 | THEORETICAL BACKGROUND

To address our research question, the theoretical background is organized in two main subsections: the first summarizes the recent evolution of design thinking, and specifically its relationship with innovation goals; the second reports scholarly design thinking contributions across different organizational roles (hereafter defined as organizational function, organizational hierarchy, and organizational experience) according to the microfoundations theoretical lens adopted (Barney & Felin, 2013; Felin et al., 2012).

2.1 | Design thinking and innovation goals

In view of the different design thinking conceptualizations and frameworks, Liedtka (2015) identifies distinct principles and practices consistent with the theoretical contributions and management applications. She suggests that design thinking generally entails three different stages during which a variety of techniques are used: 'An initial exploratory phase focused on data gathering to identify user needs and define the problem, followed by a second stage of idea generation, followed by a final phase of prototyping and testing' (Liedtka, 2015). Junginger (2007) more emotively defines the distinctive design thinking elements as developing with the *heart*, *mind* and *hand*. Developing with the *heart* means observing, understanding, involving, focusing and empathizing with users, the basis of human-centred design, that is, an approach that might integrate technology and economics, but begins with and aims at what humans need or might need (Buchanan, 2001; Leonard & Rayport, 1997; Norman, 2005; Patnaik & Becker, 1999; Thomke & Von Hippel, 2002). A curious *mind* interprets the reality, develops personal assumptions and generates creative ideas through abductive reasoning and reframing (Buchanan, 1992; Dorst & Cross, 2001). Rather than exclusively leveraging deductive (how things are) and inductive reasoning (how things likely are), design thinking aims at creating new knowledge and fostering creativity thanks to abductive reasoning (how things might be) (Buchanan, 1992; Dew, 2007; Kolko, 2010; Liedtka et al., 2007). Reframing is an activity that applies creativity not only in developing new solutions, but also in interpreting and defining the problem addressed (Boland & Collopy, 2004; Dorst, 2011; Dorst & Cross, 2001; Roth et al., 2020; Sato et al., 2010). The *hand* recalls the aspects of acting, sketching, prototyping and building. These activities translate ideas into tangible and concrete matters, essential to allowing ideas to be shared and discussed (BenMahmoud-Jouini & Midler, 2020; Carlgren et al., 2016; Liedtka, 2020; Micheli et al., 2019). Visualization is a process of mentally constructing, shaping and understanding information that might stimulate creativity and ideation (Calabretta & Gemser, 2017).

The growing debate around design thinking has shown how this approach can be differently interpreted and adopted to address various innovation goals. Although traditionally design thinking has been utilized to foster product and service innovation (Brown, 2009; Martin, 2009), it is progressively adopted in different domains to identify new market opportunities, renew the organizational culture and define new strategies (Knight et al., 2020). As Gruber et al. (2015) note, the design discipline has gone beyond product appearance, and design thinking has helped create compelling consumer and user experiences able to strategically impact businesses. Liedtka (2015) underlines that design thinking is expanding, and its application is moving from traditional product development to public services, strategies and even education. Micheli et al. (2018) discuss the opportunity of elevating design to a strategic level for an organization's long-term sustainability and competitiveness. Moreover, a recent publication, Magistretti, Bianchi, et al. (2021) address how design thinking applications are differently framed when addressing diverse innovation purposes comparing innovation of *solutions* (encompassing product and service development projects) and innovation of *direction* (encompassing strategic and organizational renewal projects). Despite these attempts to open the design thinking debate in fields other than product innovation, knowledge is still lacking, and a better understanding of the role of design thinking beyond innovation management requires additional efforts.

2.2 | Organizational roles and the perceived relevance of design thinking

In addition to the role of design thinking in achieving different innovation goals, the literature has neglected the different managerial perceptions of this approach. Indeed, most studies have been conducted at the process or organizational level, and little is known of the individual perspectives of managers towards this approach (Cautela et al., 2022; Magistretti, Ardito, & Messeni Petruzzelli, 2021). As the literature defines the individual, process and structure dimensions as the microfoundations of a phenomenon (Felin et al., 2012), we adopt this lens to gain a deeper the understanding of design thinking in the innovation realm. We focus on the individual dimension, namely organizational function (i.e. different job titles and organizational units of individuals), organizational hierarchy (i.e. the position covered by individuals in the organizational chain of command), and organizational experience (i.e. longevity in the adoption of an approach, in our case, design thinking).

2.2.1 | Design thinking and organizational function

Design thinking is recognized as an innovation approach that can be adopted in different types of organizations: from large corporations to small- and medium-sized enterprises (SMEs), from new ventures to incumbents (Gobble, 2014; Magistretti et al., 2020; Mansoori & Lackeus, 2019). The academic debate highlights how different organizational cultures impact design thinking (Elsbach & Stigliani, 2018), and conversely, that design thinking tends to forge the organizational culture according to co-evolutionary dynamics. Specifically, different design thinking tools support the development of specific organizational cultures (Micheli et al., 2019). Idea generation tools, for instance, foster a culture of openness and experimentation crucial in the front end of design thinking projects (Rauth et al., 2015). A culture of openness is also strongly associated with the diversity principle where the presence of different backgrounds and cultural frames in design thinking activities is expected to enrich the opportunity space of innovation (Carlgren et al., 2016; Kelley & Kelley, 2013; Micheli et al., 2019). From an organizational viewpoint, this principle takes shape with breaking the culture of silos, and the formation of multidisciplinary teams from different functions and business departments, each with its own viewpoint with respect to the innovation dynamics and potential opportunities (Carlgren et al., 2014; Seidel & Fixson, 2013). The open participation of a rich diversity of individuals from different organizational functions has begun to pave the way for studies focused on the biases and interpretations that different functions attribute to and expect of design thinking (Cousins, 2018; Liedtka, 2020).

For instance, in marketing functions, design thinking is typically associated with the ability to craft advertising and promotions that hit the target by matching their needs and wants, hence considered a useful branding and communication process (Beverland et al., 2015). Conversely, in operational functions, design thinking is seen more as a process to better design the human-machine interface, enabling digital transformations (Wattanasupachoke, 2012). In innovation functions, design thinking is a process not limited to the thinking dimension, but also embracing the doing dimension, thus a combination of strategy and action (Micheli et al., 2019). In human resources functions, design thinking is considered a system of activities that enables unleashing the creative potential of people, innovating the way they collaborate and respond to changing market demands (Clark & Smith, 2008; Kelley & Kelley, 2013; Liedtka, 2014; Liedtka et al., 2013). Moreover, design thinking is gaining relevance in consultancies with external teams supporting firms in their innovation endeavors. In fact, design thinking may be adopted for several reasons, but mainly to mediate critical reflection and foster innovation (Berglund et al., 2020; Strike & Rerup, 2016). Acknowledging that consulting firms can propose and apply different kinds of design thinking (Dell'Era et al., 2020), the decision to engage a consulting firm is variously made by the marketing, engineering, or IT functions (Liedtka, 2014), depending on the aim and scope, and why design thinking is adopted in the organization. Notwithstanding the emergence of consultancy firms facilitating the design thinking approach, recent studies show that organizational functions dedicated to the diffusion of the design culture and design thinking methodology are increasing (Ignatius, 2015; Rae, 2016). The participation of individuals from different organizational functions and the heterogeneity of design thinking 'buyers' or trigging departments highlight a jagged and incomplete picture of the different interpretations that underlie design thinking adoption and implementation. These diverse interpretations of design thinking across different organizational functions call for new evidence-based explanations that untangle why different functions adopt this methodology.

2.2.2 | Design thinking and organizational hierarchy

A crucial role of design thinking in innovation management is untying the 'locus of innovation' from R&D departments, always considered the privileged and exclusive organization arena to conceive and shape the innovation trajectories (Chesbrough et al., 2006; Hagedoorn & Wang, 2012; Powell et al., 1996). In its traditional framing, where the main activities and resources were driven by R&D and a technocentric view, design was conceived as an operating activity impacting the product aesthetics domain (Candi, 2010; Cooper, 1990; Ulrich, 2003), and the operational cost structure (Ulrich & Pearson, 1998). Progressively, the emergence of design as a source of innovation has permitted framing design and design thinking as the driving forces of the organization's innovation dynamics (Dell'Era et al., 2020; Magistretti et al., 2022). In leveraging the principles of framing and reframing through the inclusion and diversity of different perspectives, stakeholders, mindsets, and cultural backgrounds (Carlgren et al., 2016; Dorst, 2011), in doing so design thinking has been perceived more as an approach valuable in all hierarchical level promoting the view of a 'flat hierarchy' (Kelley & Kelley, 2013). Leveraging this value of design thinking at different hierarchical levels in an organization started to see the value of design for different and diverse scopes from product

to business model to strategic direction (Dell'Era et al., 2020), ennobling the perception of design thinking and putting design at the centre of strategic reflection (Micheli et al., 2018). Design has thus become in the mind of C-level a strategic activity—that is, 'strategic design'—where design thinking and the design culture influence the long-term sustainability and competitiveness of brands (Micheli et al., 2018).

The interpretation of design thinking as a creative confidence method shows how design thinking is acknowledged as embracing a more strategic role in its evolution (Dell'Era et al., 2020). This approach requires the participation of different hierarchical levels. That sees different scopes form a means to involve internal employees for C-level (Ignatius, 2015) to solve technical problems and communicate with colleagues for R&D managers (Magistretti et al., 2022). This evolution of design thinking sees interpretations depending on the hierarchical level of the managers: (i) external usage of design thinkers, mainly at the managers and operational level, as an approach to impact strategic issues, such as branding, innovation, and differentiation in a human-centred view (Brown, 2008; Liedtka, 2015; Verganti, 2017); (ii) internal usage of design thinking, mainly at the C-level, as methods and tools that design thinking brings, providing different insights to forge the organization culture (Best et al., 2010; Elsbach & Stigliani, 2018; Luchs et al., 2016; Micheli et al., 2018). At the same time, the higher hierarchical level reports to question the strategic rationale of design thinking applications or the 'reason why' of new products and services (Verganti, 2017), and managers and operatives are asked to leverage their capabilities to connect the business identity, strategic brand values, and new design thinking output in an integrated system (Karjalainen, 2007). Similarly, Micheli et al. (2018) highlight that the progressive elevation of design—from a 'service' in support of other functions to a 'dominant perspective' where the innovation design culture is infused in the top hierarchical levels—requires a new interpretation of design thinking as a strategic tool. These conditions may be at the base of the plurality of interpretations that can be recognized in design thinking, raising interpretative differences between the more managerial levels—typically linked to the intrinsic goals of the single project—and the higher hierarchical levels—in charge of harmonizing and scaling certain principles derived from the project to the overall corporate level.

2.2.3 | Design thinking and organizational experience

In management studies generally, individual-level analyses investigate professional experience and maturity as an independent or control variable linked to the organization's performance, strategic approach, or specific decision-making (Hamori & Koyuncu, 2015; Reed & Reed, 1989; Rodenbach & Brettel, 2012). The experience of design thinking participants is here considered to shed light on whether the years of organizational experience with this innovation approach contribute to different interpretations of design thinking in terms of the goals it allows the organization to achieve. Although there are scarce studies specifically related to this topic, several contributions emphasize that individual age and professional design experience—mainly in key roles—affect the degree of maturity and extent to which design thinking takes place in an organization (Lindberg et al., 2012). In their recent study framing the use of design according to the design ladder model, Björklund et al. (2018) state that the 'seniority' and 'rank of design positions within the organization' are fundamental metrics to assess an organization's level of design maturity. Additionally, Miller and Moultrie (2013) distinguish the different roles of design leaders and design managers based on their different attitude towards the design process and adoption. According to a common orientation in the design leadership literature (Topalian, 2011), design managers are non-design experts whose tasks include communicating, protecting, coordinating, optimizing, understanding, planning, integrating, evaluating, and selecting. Instead, the role of design leaders entails envisioning, communicating, empowering and driving (Miller & Moultrie, 2013). Moreover, the McKinsey study (Dalrymple et al., 2020) reports that design leaders—those with the greatest design experience in the organization—go beyond the boundaries of specific design applications, providing unique user insights, framing the strategic direction in a user-experience perspective. In other words, having considerable design thinking experience could prompt participants from different functions and/or hierarchical levels to explore alternative application scopes and logics (Nagaraj et al., 2020). Although beginner participants might be more inclined to apply the traditional and consolidated view, long design thinking experience—having achieved several successes with the original version—could turn into an established routine that inhibits exploration and application in new areas (Mosely et al., 2018). Therefore, this duality between organizational experience in design thinking and the interpretation of its main goals calls for further empirical verification.

3 | RESEARCH METHODOLOGY

The foregoing theoretical background suggests that design thinking can be differently perceived in distinct organizational functions, across various hierarchical levels, and according to organizational experience. To investigate different possible interpretations of the relevance of design thinking in achieving innovation goals, we conducted a survey on a sample of Italian managers. We refer to them as design thinkers, as they adopt the design thinking approach in their organizations and belong to different organizational functions (i.e. information and communication, R&D, innovation, human resources). Although their common trait, despite different organizational functions, is the adoption of design thinking, the real differentiating factor is the reason behind adopting this paradigm.

The authors work in a research centre that since 2017 research design thinking through engaging a wide community of Italian design thinkers in workshops (roughly four per year with 150+ participants each) and public events (one per year with 500+ participants). Relying on this wide empirical base, in September 2018 we sent out a questionnaire to a database of design thinkers gathered over the years.

The questionnaire was composed of four main sections (described in the Appendix A). We collected the following data using several variables to answer to our research question:

- A categorical variable for 9 organizational functions (*Organizational Function*): (1) design, (2) R&D, (3) business development, (4) marketing, (5) sales, (6) information technology (IT), (7) operations, and (8) human resources (HR), (9) other. If the 'other' option was selected and the informants provided their name and surname according to GDPR, we checked their LinkedIn and organizational profile to allocate their response to one of the first 8 categories.
- A categorical variable to extrapolate the hierarchical level of respondents (*Organizational Hierarchy*) categorized as leaders, managers, or employees (the job titles included Account Manager, Business Analyst, Business Designer, Business Development Manager, Chief Design Officer (CDO), Chief Executive Officer (CEO), Chief Information Officer (CIO), Chief Marketing Officer (CMO), Chief Operating Officer (COO), Chief Technology Officer (CTO), Client Manager, Data Scientist, Experience Designer, Human Resources Manager, Junior Consultant, Marketing Manager, Operations Manager, Product Manager, Production Manager, Project Manager, R&D Manager, Service Designer, Senior Consultant, Software Engineer, UI Designer, UX Designer, other).
- A binary variable corresponding to the respondents' years of organizational experience with design thinking separated into two groups:
  - *High Organizational Experience*: respondents with significant professional experience in the adoption of design thinking (equal to or more than 3 years)
  - *Low Organizational Experience*: respondents without (or with marginal) professional experience in the adoption of design thinking (less than 3 years).
- An integer variable corresponding to the respondents' age used as a control variable in our model (*Age*).
- A dichotomous variable corresponding to the respondents' gender used as a control variable in our model (*Gender*).
- 18 items corresponding to innovation goals (Liedtka, 2015, 2020; Magistretti, Bianchi, et al., 2021) that can be achieved through the application of the design thinking approach (we asked respondents to reflect on their organizational experience and the relevance of design thinking in achieving innovation goals; 1 = *Not at all relevant*, 7 = *Extremely relevant*).

We conducted two preliminary analyses of the questionnaire in the fall of 2018. First, we submitted it for review to four academics in the design thinking field. Specifically, we checked the validity and

TABLE 1 Descriptive statistics of the variables included in the analysis

Innovation goals	Mean	SD	Min	Max
IG_1. Identifying emerging scenarios	5.00	1.75	1	7
IG_2. Predicting technological trends	4.51	1.89	1	7
IG_3. Predicting market trends	4.54	1.78	1	7
IG_4. Understanding changes in user behaviours	5.21	1.61	1	7
IG_5. Devising a new long-term strategy	4.93	1.83	1	7
IG_6. Changing corporate culture	5.28	1.72	1	7
IG_7. Improving organizational structure	4.49	1.93	1	7
IG_8. Fostering new values, attitudes, behaviours	5.30	1.60	1	7
IG_9. Engaging and motivating employees	4.80	1.75	1	7
IG_{10}. Developing a new product or service	5.34	1.75	1	7
IG_{11}. Creating a new business model	4.77	1.98	1	7
IG_{12}. Introducing new product/service lines	4.78	1.96	1	7
IG_{13}. Developing new brands	3.55	2.05	1	7
IG_{14}. Solving a specific problem	4.46	1.81	1	7
IG_{15}. Addressing a specific user need	4.80	1.84	1	7
IG_{16}. Identifying and formulating a new vision	4.59	1.96	1	7
IG_{17}. Revitalizing an existing product/service line	4.63	1.86	1	7
IG_{18}. Entering new markets	3.97	1.89	1	7
Respondent age	46.51	9.90	26	77
Organizational function	Design 12%; R&D 9%; business development 12%; marketing 20%; sales 5%; IT 25%; operations 10%; HR 7%			
Organizational hierarchy	Leaders 25%; managers 42%; employees 33%			
Organizational experience	High 28%; low 72%			
Respondent gender	Male 65%; female 35%			

comprehensiveness of the 18 items related to the innovation goals listed in Table 1. They then validated our choices and suggested further scales to consider, together with references for our measurements (see Table 2). We cycled among the literature and the expert's views until no additional changes added value (theoretical saturation). Next, we pre-tested the questionnaire with five practitioners. Three of these are consultants with more than 10 years' experience in applying design thinking. The remaining two are innovators in big firms (with over 2000 employees) that had applied design thinking in the previous 3 years. Based on their feedback, we modified the wording of some questions and added or deleted others to ensure the items were understandable and relevant to respondents. In December 2018, of the 900+ design thinkers contacted, 197 from different Italian companies completed the questionnaire. We carried out a t-test between early and late respondents without finding any statistically significant difference (Armstrong & Overton, 1977). As to data pre-processing, we first checked the responses to ensure there were no outliers. Then, the observations with missing values were omitted from the analysis (21 responses). Table 1 shows the descriptive statistic of the variables included.

To answer our research question on how organizational roles affect the perceived relevance of design thinking in achieving innovation goals, we conducted a four-step statistical analysis. First, an exploratory factor analysis to detect the underlying constructs of the innovation goals. We performed a principal component analysis (PCA), including items with factor loadings of absolute value greater than 0.5. Item IG_{17} (revitalizing an existing product/service line) was eliminated, as its factor loading was below the 0.5 threshold. Items IG_{16} (identifying and formulating a new vision) and IG_{18} (entering new markets) were also eliminated after the initial analysis, as they cross-loaded on more than one factor. We used Cronbach's α of the principal components to assess the internal consistency of the constructs. Following Kim et al. (2016), Cronbach's α values greater than .7 are considered acceptable.

Table 2 shows the results of the exploratory factor analysis and the 4 identified constructs. All factor loadings are greater than the 0.4 threshold, with the smallest factor loading equal to 0.53. Similarly, all the Cronbach α values are above the .7 threshold, confirming the internal consistency of the constructs. To verify the sampling adequacy of the data for the factor analysis, we conducted a Kaiser-Meyer-Olkin (KMO) test (Cerny & Kaiser, 1977) for each variable and the complete model, commonly used to verify that the data is well suited to the factor analysis. All the values are greater than 0.6, demonstrating sampling adequacy (Hair et al., 2006).

Next, we performed a confirmatory factor analysis considering four nested models with various factors. In particular, we considered (a) a single-factor model with 15 items that incorporates all four constructs; (b) a two-factor model considering the combination of organizational change and user innovation (factor 1), and the combination of strategic direction and market innovation (factor 2); (c) a three-factor model considering the combination of strategic direction and market innovation (factor 1), organizational change (factor 2), and user innovation (factor 3); and finally (d) a model that considers each of the constructs presented in Table 2 as a separate factor. The fit indices of

TABLE 2 Results of the exploratory factor analysis

Construct	Key references	Measure	Factor loading	Cronbach'sα
Strategic direction	Cooper et al., 2009; Verganti, 2017	IG_1. Identifying emerging scenarios	0.78	.83
		IG_2. Predicting technological trends	0.78	
		IG_3. Predicting market trends	0.88	
		IG_4. Understanding changes in user behaviours	0.53	
		IG_5. Devising a new long-term strategy	0.61	
Organizational change	Micheli et al., 2018; Elsbach & Stigliani, 2018	IG_6. Changing corporate culture	0.80	.81
		IG_7. Improving organizational structure	0.81	
		IG_8. Fostering new values, attitudes, behaviours	0.83	
		IG_9. Engaging and motivating employees	0.69	
Market innovation	Kumar & Holloway, 2009; Mansoori & Lackeus, 2019	IG_{10}. Developing a new product or service	0.78	.76
		IG_{11}. Creating a new business model	0.57	
		IG_{12}. Introducing new product/service lines	0.74	
		IG_{13}. Developing new brands	0.69	
User-centred innovation	Thomke & Von Hippel, 2002; Norman, 2005	IG_{14}. Solving a specific problem	0.78	.72
		IG_{15}. Addressing a specific user need	0.84	

TABLE 3 Results of the exploratory factor analysis

Model	CFI	RMSEA	SRMR	χ^2	*df*	Difference
1 factor	0.629	0.165	0.131	450.853	81	
2 factors	0.802	0.121	0.099	277.71	80	173.143***
3 factors	0.858	0.104	0.083	219.20	78	58.51***
4 factors	0.895	0.091	0.080	179.445	75	39.755***

Abbreviations: CFI, comparative fit index; RMSEA, root mean square error of approximation; SRMR, standardized root mean squared residual; Difference, difference in χ^2 between the consecutive models.
***Significant at $p < .01$.

TABLE 4 Composite reliability (CR), average variance extracted (AVE) and correlations among the latent variables

Construct	CR	AVE	Strategic direction	Organizational change	Market innovation	User-centred innovation
Strategic direction	0.83	0.50	1			
Organizational change	0.83	0.54	0.33	1		
Market innovation	0.79	0.51	0.68	0.26	1	
User-centred innovation	0.80	0.60	0.11	0.17	0.23	1

the models are presented in Table 3. The results confirm that the 4-factor model is the only one with a good fit for all the indices, hence selected as the final measurement model. The factor loadings of all items are significant at $p < .01$.

Table 4 shows the Composite Reliability (CR) and Average Variance Extracted (AVE) of the constructs as well as their correlations. All the constructs have an AVE greater than 0.5, confirming convergent validity. The CR of the constructs is also greater than the 0.7 threshold, indicating no problems with the consistency of factors. To further test the discriminant validity of the measures, we followed Fornell and Larcker (1981), checking that the average variance extracted of each latent construct is greater than the squared correlation of the same latent construct with any other construct. Results confirm that each latent variable has more common variance with its own items than with any of the other three latent constructs in the model.

Next, we ran multivariate analysis of covariance (MANCOVA) to test whether there were significant differences in the interpretation of innovation goals across organizational functions, organizational hierarchy and organizational experience with design thinking. The dependent variables are those from the factor analysis, whereas the predictor variables are organizational function, hierarchy, and experience with design thinking, and respondents' gender. Age is the covariate in the model. Finally, we conducted multivariate regressions to highlight the differences across organizational functions, hierarchy and experience with design thinking. We performed all the reported analyses with the Stata 14 software.

4 | EMPIRICAL RESULTS

Pillai's trace of the MANCOVA test is 0.469 with $F(48.0) = 1.74$ and $p < .05$. Thus, the results indicate that the overall model is significant, and that there are statistically significant differences in the interpretation of innovation goals that can be achieved through the application of the design thinking approach across the organizational functions, hierarchy, experience and respondents' gender.

Tables 5 and 6 show the results of the multivariate regressions and significant differences across the functions in strategic direction, organizational change, market innovation and user-centred innovation goals. For instance, the coefficient of the marketing function in strategic direction in Table 5 is 1.13, statistically significant at the 0.95 confidence level. This affirms that respondents in the marketing function attribute higher relevance to design thinking in achieving strategic direction goals compared with respondents in the design function (the reference category). As Table 6 shows, respondents in the marketing function give an average relevance score of 5.33[1] (on a 7-point Likert-type scale) to the relevance of design thinking in achieving strategic direction goals. On the other hand, respondents in the design function give an average relevance score of 4.19 to design thinking in achieving the same goals. A coefficient of 1.13 is in fact the difference between these two average scores.[2] Similarly, respondents in the sales function significantly value design thinking more in achieving strategic direction goals ($p < .05$) compared with respondents in the reference category (design). Respondents active in business development, IT and operations value design thinking significantly less ($p < .05$) in achieving organizational change goals than respondents in the design function. Considering the 0.90 confidence level ($p < .10$), the R&D and marketing function coefficients are significantly lower than the reference category (design). Respondents in the sales function tend to significantly value design thinking more ($p < .05$) in achieving market innovation goals than respondents in the design function.

As Tables 5 and 6 show, there are fewer statistically significant differences across the various hierarchical levels. Compared with

TABLE 5 Results of the analysis

Construct	Strategic direction	Organizational change	Market innovation	User-centred innovation
Organizational function (reference category: Design)				
• *R&D*	0.31 (0.61)	−1.03* (0.61)	0.57 (0.63)	0.16 (0.74)
• *Business development*	0.85 (0.54)	−1.52** (0.54)	0.76 (0.55)	0.23 (0.65)
• *Marketing*	1.13** (0.52)	−0.90* (0.52)	0.44 (0.54)	0.42 (0.62)
• *Sales*	1.30** (0.63)	−0.54 (0.63)	1.30** (0.55)	1.20 (0.76)
• *IT*	0.24 (0.51)	−1.32** (0.51)	−0.35 (0.52)	−0.34 (0.62)
• *Operations*	0.82 (0.59)	−1.49** (0.60)	0.87 (0.62)	0.40 (0.72)
• *HR*	0.47 (0.59)	−0.75 (0.60)	0.13 (0.62)	0.13 (0.72)
Organizational hierarchy (reference category: Leaders)				
• *Managers*	−0.43 (0.27)	−0.20 (0.27)	−0.70** (0.28)	−0.08 (0.33)
• *Employees*	−0.13 (0.30)	−0.49 (0.30)	−0.32 (0.31))	0.37 (0.36)
Organizational experience (reference category: High)				
• *Low*	0.57** (0.25)	0.32 (0.25)	0.54** (0.26)	0.23 (0.30)
Gender (reference category: Female)				
• *Male*	0.46 (0.23)	−0.00 (0.23)	0.25 (0.24)	0.23 (0.27)
Age	0.01 (0.01)	0.03* (0.01)	−0.01 (0.01)	−0.03** (0.01)
Constant	3.72*** (0.73)	4.69*** (0.74)	4.52*** (0.76)	5.42*** (0.89)
R^2	.13	.12	.16	.10

Notes: Coefficients and standard errors of the multivariate regression; standard errors in parentheses. Sample size = 168.
*$p < .10$.
**$p < .05$.
***$p < .01$.

TABLE 6 Results of the analysis

Construct	Strategic direction	Organizational change	Market innovation	User-centred innovation
All	4.86	5.06	4.72	4.70
Organizational function				
• *Design*	4.20	6.14	4.40	4.53
• *R&D*	4.50	5.11	4.96	4.69
• *Business development*	5.05	4.62	5.16	4.76
• *Marketing*	5.33	5.24	4.84	4.95
• *Sales*	5.50	5.61	5.70	5.73
• *IT*	4.44	4.82	4.05	4.19
• *Operations*	5.02	4.65	5.27	4.93
• *HR*	6.66	5.38	4.53	4.66
Organizational hierarchy				
• *Leaders*	5.08	5.26	5.11	4.65
• *Managers*	4.65	5.06	4.41	4.57
• *Employees*	4.95	4.77	4.79	5.02
Organizational experience				
• *High*	4.43	4.81	4.31	4.53
• *Low*	5.00	5.14	4.86	4.75

Note: Adjusted predicted mean for the constructs across functions, hierarchical levels, professional experience, and gender.

leaders, managers find design thinking less relevant ($p < .05$) in achieving market innovation goals. Regarding organizational experience in the adoption of design thinking, respondents without any or with marginal experience consider design thinking more relevant in achieving strategic direction and market innovation goals than experienced respondents.

5 | DISCUSSION

Design thinking is making the headlines, with an extremely rapid diffusion in practice and in organizations (Dell'Era et al., 2020). Coherently with the emerging literature on the transformative role of design thinking (Dell'Era et al., 2020; Gruber et al., 2015; Liedtka, 2015, 2020; Micheli et al., 2018), the empirical results, and especially the exploratory factor analysis, show that design thinking tends to cover a broad variety of innovation goals: from more traditional user-centred innovation to market innovation, organizational change, and strategic direction. This is the first theoretical contribution emerging from our study. Indeed, expanding current understanding that design thinking is not solely an innovation user-centred approach but can inspire strategic direction and organizational change, reinforces the value of this approach in the broader innovation management field.

As mentioned, the main aim of our study is investigating the individual perceptions of the relevance of design thinking in achieving innovation goals. All the organizational functions deem user-centred innovation pertinent as a goal (with no statistical differences). However, the other three innovation goals achievable through design thinking show differences depending on the individual dimensions. Indeed, the organizational function (e.g. marketing professionals consider design thinking more relevant compared with designers for strategic direction; 1.13^{**}), organizational hierarchy (e.g. managers see market innovation as less relevant than leaders: -70^{**}), and organizational experience (e.g. low-experienced individuals see more value in adopting design thinking to pursue a strategic direction compared with high-experienced individuals; 0.57^{**}), influence the interpretation of the goals achievable. Thus, the individual dimensions, such as organizational function or organizational experience, impact the interpretation of the relevance of design thinking in achieving one or the other innovation goals. These different perceptions of individuals are a relevant result, as several studies have shown that shared mental models positively affect the performance of individuals facing a common task (DeChurch & Mesmer-Magnus, 2010). Different perceptions of the role of design thinking in achieving innovation goals can generate misalignments, and therefore negatively affect performance associated with its adoption (Cronin & Weingart, 2007; Paletz & Schunn, 2010).

In unpacking the different innovation goals achievable through design thinking, and the different interpretations according to organizational function, organizational hierarchy, and organizational experience, our study empirically demonstrates the kaleidoscopic nature of design thinking (Magistretti, Bianchi, et al., 2021). In accordance with the strategy and organization management literature, to understand innovation and how it is adopted in organizations, investigations should be conducted at not only the macro level (Coleman, 1987), but also the micro-level. Thus, based on the growing debate on the microfoundations of routines and capabilities (Barney & Felin, 2013; Felin et al., 2012, 2015), our study shows that this microfoundational view can also be of value to better understand the heterogeneity of design thinking (Cautela et al., 2022). As Magistretti, Ardito, and Messeni Petruzzelli's (2021) recent literature review shows, we need more studies going beyond the processes and structures, looking at pivotal individual roles. To our best knowledge, this study is one of the first to do so.

The lack of statistical significance of user-centred innovation goals achievable through design thinking in the perceptions of different individuals in the organization supports the established interpretation of design thinking as a creative problem-solving approach based on user-centeredness (Brown, 2009; Martin, 2009). In other words, the adoption of design thinking to achieve user-centred innovation goals does not create different perceptions across the categorial variables under investigation. Being the most diffused and consolidated goal addressed by design thinking, user-centred innovation does not generate alternative perceptions in individuals. Thus, differentiating the analysis and looking at the individual microfoundations dimension when the scope is user-centred innovation would not seem to be beneficial due to similar interpretations regardless of organizational function or experience. The statistical significance of the strategic direction, organizational change, and market innovation goals shows that individual perceptions differ in assessing the relevance of design thinking in achieving these goals.

Considering the organizational functions, marketing (1.13^{**}) and sales (1.30^{**}), compared with design, consider design thinking more relevant in pursuing strategic direction innovation goals. A possible explanation is that marketing and sales see a new reason to adopt design thinking. As the literature reports, users are a powerful source of innovation (Baldassarre et al., 2017; Beverland et al., 2015), but the turbulence and growing need to foster innovation (Magistretti et al., 2020) sometimes requires changing strategy and being more visionary (Stigliani & Ravasi, 2012; Verganti, 2017) in proposing innovation through design thinking. As organizational units dedicated to sensing the market and users, marketing and sales might recognize this more than other units. Further evidence of the value of considering the microfoundational view of organizational function is that individuals in design units believe that design thinking is more relevant to achieving organizational change goals compared with R&D, business development, marketing, IT and operations. The principles of visualizing knowledge, experimenting, the relevance of users at the centre of every decision, linked to the tendency to prototype products, as well as user experience are seen by design units as relevant and changing principles of the way organizations operate. Even admitting a type of self-promotion, the design unit seems to be aware of a new potential of its own role, namely not only new product development or innovation but invading the organizational culture, aspects that practitioners recognize as crucial (Wrigley et al., 2020).

Finally, our study shows that the sales function, compared with design, interprets design thinking as relevant for market innovation goals. One possible explanation is that through constant interactions with users, the sales function might see the potential of design thinking in crafting marketing innovations independently of user needs, potentially reflecting the role of design thinking in marketing (Beverland et al., 2015).

Regarding organizational hierarchy, our study shows that leaders, on average, have a higher consideration of the relevance of design

thinking. This is in line with Micheli et al.'s (2018) view of elevating design thinking to a more strategic level. The only statistically significant value detected is that managers consider the adoption of design thinking in pursuing market innovations less relevant than leaders. This might indicate that leaders—looking at the contribution at a higher corporate level—see the real potential of design thinking in changing market elements (e.g. new business model, new brands). Instead, managers applying design thinking in specific projects, thus more focused on particular aspects of the design brief, tend to capture less of the overall potential related to market changes.

Finally, the individual microfoundation dimension of organizational experience shows that individuals with low professional experience, compared with highly experienced people, deem design thinking more relevant in achieving strategic direction and market innovation goals. The statistically significant values might imply a sort of enthusiasm of low-experienced individuals towards this innovation approach. Nevertheless, the positive perspective of design thinking of low-experienced people is in line with the academic literature (e.g. Liedtka, 2018; Micheli et al., 2019).

By unveiling three individual microfoundation dimensions of design thinking (i.e. organizational function, hierarchical level and professional experience), we show that it is differently perceived by individuals in different organizational roles. The microfoundational analysis seems to provide fertile and insightful contributions on two levels. On the one hand, at the intermediate micro-level of analysis, the study unveils those different organizational composite factors (function or hierarchical level) influence the perceptions of an innovation approach, thus affecting the potential impact at the corporate level. Second, our study complements an emerging innovation management research stream (e.g. Cautela et al., 2022; Dong et al., 2016; Magistretti, Ardito, & Messeni Petruzzelli, 2021) revealing that corporate design thinking behaviour tends to be explained at the micro-level of analysis.

6 | CONCLUSIONS, LIMITATIONS AND FUTURE RESEARCH

As highlighted, our study has different implications for design thinking theory and practice. The three innovation goals analysed—in addition to user-centred innovation—call for deepening the specific contributions of design thinking to building strategic direction, forging the organization culture and generating market innovation. Our study also highlights those different organizational roles that influence the perception of the relevance of design thinking in achieving innovation goals.

With regard to the theoretical implications, in adopting the individual microfoundations perspective, our study contributes knowledge to how organizational function, organizational hierarchy, and organizational experience differently influence the perception of the relevance of design thinking in achieving specific innovation goals. Our study also has some managerial implications. The plurality of interpretations of design thinking suggests that managers in different functions and at different hierarchical levels create internal alignment on the real goals expected from the application of design thinking. The coexistence of numerous goals achievable with design thinking could create, especially for organizations that are newer to adopting design thinking, disillusionment, frustration and conflict in different functions or organizational levels. Early alignment on the potential of design thinking, in view of the organizational culture and level of internal maturity, should allow organizations to manage undesirable consequences linked to rejecting design thinking or distortive applications. Additionally, the differences in interpreting the design thinking goals depend on the level of organizational experience in adopting this approach. Thus, managers willing to adopt this methodology must assess *ex-ante* the experience and team composition to set the appropriate goal and enable the methodology to be embraced.

Last, our study also has some limitations. One of these is the generalizability of the results, as all the firms in our sample are from the same geographic (Italy) and industrial context characterized by a strong design culture that might influence the way they perceive and exploit design thinking. In fact, more than half the firms in our sample have a design department. Even if this allows a more reliable comparison with other organizational functions, it might also bias our results. Nevertheless, this first evidence of the Italian market calls for a broader view of the organizational and hierarchical interpretation of design thinking across the globe. Therefore, future studies should consider firms in different countries and settings, as well as their organizational function (e.g. design-based, service-oriented, production-grounded, etc.). In addition, our investigation looks at individuals adopting design thinking without exploring the different design thinking processes debated in the literature, such as adopting design thinking as a general problem-solving approach.

However, our study paves the way for future research relevant to the design thinking and microfoundations literature; indeed, the individual perspective should not be neglected in future design thinking research. Moreover, further studies on the microfoundational dimensions of design thinking are needed to unpack the relations between individuals, processes and structures. Future research might also look at how different individuals employ the processes and structures in achieving different goals. Finally, our study shows that the microfoundational dimensions should be studied by looking at the constituent sub-elements, such as function, hierarchical level, and professional experience, thereby enriching the microfoundations literature.

DATA AVAILABILITY STATEMENT

Research data are not shared.

ORCID

Stefano Magistretti https://orcid.org/0000-0001-9968-7030
Cabirio Cautela https://orcid.org/0000-0002-5171-2935
Claudio Dell'Era https://orcid.org/0000-0002-4930-2208
Luca Gastaldi https://orcid.org/0000-0003-1997-8423

ENDNOTES

[1] The reported average scores are adjusted for the effects of hierarchical level, organizational experience with design thinking, age and gender.

[2] The small differences are due to rounding errors.

REFERENCES

Aggarwal, I., & Woolley, A. W. (2019). Team creativity, cognition, and cognitive style diversity. *Management Science*, *65*(4), 1586–1599. https://doi.org/10.1287/mnsc.2017.3001

Armstrong, J. S., & Overton, T. S. (1977). Estimating nonresponse bias in mail surveys. *Journal of Marketing Research*, *14*(2), 396–402. https://doi.org/10.1177/002224377701400320

Baldassarre, B., Calabretta, G., Bocken, N. M. P., & Jaskiewicz, T. (2017). Bridging sustainable business model innovation and user-driven innovation: A process for sustainable value proposition design. *Journal of Cleaner Production*, *147*(2), 175–186. https://doi.org/10.1016/j.jclepro.2017.01.081

Barney, J. A. Y., & Felin, T. (2013). What are microfoundations? *Academy of Management Perspectives*, *27*(2), 138–155. https://doi.org/10.5465/amp.2012.0107

BenMahmoud-Jouini, S., & Midler, C. (2020). Unpacking the notion of prototype archetypes in the early phase of an innovation process. *Creativity and Innovation Management*, *29*(1), 49–71. https://doi.org/10.1111/caim.12358

Berglund, H., Bousfiha, M., & Mansoori, Y. (2020). Opportunities as artifacts and entrepreneurship as design. *Academy of Management Review*, *45*(4), 825–846. https://doi.org/10.5465/amr.2018.0285

Best, K., Kootstra, G., & Murphy, D. (2010). Design management and business in Europe: A closer look. *Design Management Review*, *21*(2), 26–35. https://doi.org/10.1111/j.1948-7169.2010.00062.x

Beverland, M. B., Wilner, S. J., & Micheli, P. (2015). Reconciling the tension between consistency and relevance: Design thinking as a mechanism for brand ambidexterity. *Journal of the Academy of Marketing Science*, *43*(5), 589–609. https://doi.org/10.1007/s11747-015-0443-8

Björklund, T., Hannukainen, P., & Manninen, T. (2018). Measuring the impact of design, service design and design thinking in organizations on different maturity levels. In A. Meroni, A. M. Ospina Medina, & B. Villari (Eds.), *Proceedings of the ServDes2018 conference (pp. 500–511). Linköping electronic conference proceedings; no. 150*. Linköping University Electronic Press.

Boland, R. J., & Collopy, F. (2004). *Design matters for management*. Managing as Designing. Stanford University Press.

Brown, T. (2008). Design thinking. *Harvard Business Review*, *86*(6), 84–86.

Brown, T. (2009). *Change by design. How design thinking transforms organizations and inspires innovation*. Harper Collins Publishers.

Buchanan, R. (1992). Wicked problems in design thinking. *Design Issues*, *8*(2), 5–21. https://doi.org/10.2307/1511637

Buchanan, R. (2001). Human dignity and human rights: Thoughts on the principles of human-centered design. *Design Issues*, *17*(3), 35–39. https://doi.org/10.1162/074793601750357178

Calabretta, G., & Gemser, G. (2017). Building blocks for effective strategic design. *Journal of Design, Business & Society*, *3*(2), 109–124. https://doi.org/10.1386/dbs.3.2.109_1

Candi, M. (2010). Benefits of aesthetic design as an element of new service development. *Journal of Product Innovation Management*, *27*(7), 1047–1064. https://doi.org/10.1111/j.1540-5885.2010.00770.x

Cannon-Bowers, J. A., Salas, E., & Converse, S. (1993). Shared mental models in expert team decision making. In N. J. Castellan (Ed.), *Individual and group decision making: Current issues* (pp. 221–246). Psychology Press.

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. https://doi.org/10.2752/175630614X13982745783000

Carlgren, L., Rauth, I., & Elmquist, M. (2016). Framing design thinking: The concept in idea & enactment. *Creativity and Innovation Management*, *25*(1), 38–57. https://doi.org/10.1111/caim.12153

Casakin, H., & Badke-Schaub, P. (2013). The psychology of creativity: Mental models in design teams. In A. Antonietti, B. Colombo, & D. Memmert (Eds.), *Psychology of creativity: Advances in theory, research and application* (pp. 167–180). Nova Publishers.

Cautela, C., Simoni, M., & Moran, P. (2022). Microfoundations of dynamic design capabilities: An empirical analysis of "excellent" Italian design firms. *Journal of Product Innovation Management*, *39*, 3–23. https://doi.org/10.1111/jpim.12592

Cerny, B. A., & Kaiser, H. F. (1977). A study of a measure of sampling adequacy for factor-analytic correlation matrices. *Multivariate Behavioral Research*, *12*(1), 43–47. https://doi.org/10.1207/s15327906mbr1201_3

Chesbrough, H., Vanhaverbeke, W., & West, J. (2006). *Open innovation: Researching a new paradigm*. Oxford University Press on Demand.

Clark, K., & Smith, R. (2008). Unleashing the power of design thinking. *Design Management Review*, *19*(3), 8–15. https://doi.org/10.1111/j.1948-7169.2008.tb00123.x

Coleman, J. S. (1987). Microfoundations and macrosocial behavior. In J. C. Alexander (Ed.), *The micro-macro link* (pp. 153–173). University of California Press.

Cooper, R., Junginger, S., & Lockwood, T. (2009). Design thinking and design management: A research and practice perspective. *Design Management Review*, *20*(2), 46–55. https://doi.org/10.1111/j.1948-7169.2009.00007.x

Cooper, R. G. (1990). Stage-gate systems: A new tool for managing new products. *Business Horizons*, *33*(3), 44–54. https://doi.org/10.1016/0007-6813(90)90040-I

Cousins, B. (2018). Design thinking: Organizational learning in VUCA environments. *Academy of Strategic Management Journal*, *17*(2), 1–18.

Cronin, M. A., & Weingart, L. R. (2007). Representational gaps, information processing, and conflict in functionally diverse teams. *Academy of Management Review*, *32*(3), 761–773. https://doi.org/10.5465/amr.2007.25275511

Dalrymple, M., Pickover, S., & Sheppard, B. (2020). Are you asking enough from your design leaders? Retrieved from https://www.mckinsey.com/business-functions/mckinsey-design/our-insights/are-you-asking-enough-from-your-design-leaders

DeChurch, L. A., & Mesmer-Magnus, J. R. (2010). Measuring shared team mental models: A meta-analysis. *Group Dynamics: Theory, Research, and Practice*, *14*(1), 1–14. https://doi.org/10.1037/a0017455

Dell'Era, C., Magistretti, S., Cautela, C., Verganti, R., & Zurlo, F. (2020). Four kinds of design thinking: From ideating to making, engaging, and criticizing. *Creativity and Innovation Management*, *29*(2), 324–344. https://doi.org/10.1111/caim.12353

Dew, N. (2007). Abduction: A pre-condition for the intelligent design of strategy. *Journal of Business Strategy*, *28*(1), 38–45. https://doi.org/10.1108/02756660710760935

Dong, A., Garbuio, M., & Lovallo, D. (2016). Generative sensing: A design perspective on the microfoundations of sensing capabilities. *California Management Review*, *58*(4), 97–117. https://doi.org/10.1525/cmr.2016.58.4.97

Dorst, K. (2011). The core of 'design thinking' and its application. *Design Studies*, *32*(3), 521–532. https://doi.org/10.1016/j.destud.2011.07.006

Dorst, K., & Cross, N. (2001). Creativity in the design process: Co-evolution of problem-solution. *Design Studies*, *22*(5), 425–437. https://doi.org/10.1016/S0142-694X(01)00009-6

Elsbach, K. D., & Stigliani, I. (2018). Design thinking and organizational culture: A review and framework for future research. *Journal of*

Management, *44*(6), 2274–2306. https://doi.org/10.1177/0149206317744252

Felin, T., Foss, N. J., Heimeriks, K. H., & Madsen, T. L. (2012). Microfoundations of routines and capabilities: Individuals, processes, and structure. *Journal of Management Studies*, *49*(8), 1351–1374. https://doi.org/10.1111/j.1467-6486.2012.01052.x

Felin, T., Foss, N. J., & Ployhart, R. E. (2015). The microfoundations movement in strategy and organization theory. *Academy of Management Annals*, *9*(1), 575–632. https://doi.org/10.5465/19416520.2015.1007651

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, *18*(1), 39–50. https://doi.org/10.1177/002224378101800104

Foss, N. J., & Pederson, T. (2016). Microfoundations in strategy. *Strategic Management Journal*, *37*(13), 22–34. https://doi.org/10.1002/smj.2362

Garbuio, M., & Lin, N. (2021). Innovative idea generation in problem finding: Abductive reasoning, cognitive impediments, and the promise of artificial intelligence. *Journal of Product Innovation Management.*, *38*, 701–725. https://doi.org/10.1111/jpim.12602

Gemser, G., & Barczak, G. (2020). Designing the future: Past and future trajectories for design innovation research. *Journal of Product Innovation Management*, *37*(5), 454–471. https://doi.org/10.1111/jpim.12543

Gobble, M. M. (2014). Design thinking. *Research Technology Management*, *57*(3), 59–62. https://doi.org/10.1080/08956308.2018.1445391

Gruber, M., De Leon, N., George, G., & Thompson, P. (2015). Managing by design. *Academy of Management Journal*, *58*(1), 1–7. https://doi.org/10.5465/amj.2015.4001

Hagedoorn, J., & Wang, N. (2012). Is there complementarity or substitutability between internal and external R&D strategies? *Research Policy*, *41*(6), 1072–1083. https://doi.org/10.1016/j.respol.2012.02.012

Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2006). *Multivariate data analysis*. Prentice hall Upper Saddle River.

Hamori, M., & Koyuncu, B. (2015). Experience matters? The impact of prior CEO experience on firm performance. *Human Resource Management*, *54*(1), 23–44. https://doi.org/10.1002/hrm.21617

Helfat, C. E., & Peteraf, M. A. (2015). Managerial cognitive capabilities and the microfoundations of dynamic capabilities. *Strategic Management Journal*, *36*(6), 831–850. https://doi.org/10.1002/smj.2247

Ignatius, A. (2015). Design as strategy. *Harvard Business Review*, *93*(1), 12.

Johansson-Sköldberg, U., Woodilla, J., & Çetinkaya, M. (2013). Design thinking: Past, present and possible futures. *Creativity and Innovation Management*, *22*(2), 121–146. https://doi.org/10.1111/caim.12023

Junginger, S. (2007). Learning to design: Giving purpose to heart, hand and mind. *Journal of Business Strategy*, *28*(4), 59–65. https://doi.org/10.1108/02756660710760953

Karjalainen, T.-M. (2007). It looks like a Toyota: Educational approaches to designing for visual brand recognition. *International Journal of Design*, *1*(1), 67–81.

Kelley, T., & Kelley, D. (2013). Creative confidence: Unleashing the creative potential within us all. *Currency*.

Kim, H., Ku, B., Kim, J. Y., Park, Y. J., & Park, Y. B. (2016). Confirmatory and exploratory factor analysis for validating the phlegm pattern questionnaire for healthy subjects. *Evidence Based Complementary and Alternative Medicine*, *2016*, 1–8. https://doi.org/10.1155/2016/2696019

Klimoski, R., & Mohammed, S. (1994). Team mental model: Construct or metaphor? *Journal of Management*, *20*(2), 403–437. https://doi.org/10.1177/014920639402000206

Knight, E., Daymond, J., & Paroutis, S. (2020). Design-led strategy: How to bring design thinking into the art of strategic management. *California Management Review*, *62*(2), 30–52. https://doi.org/10.1177/0008125619897594

Kolko, J. (2010). Abductive thinking and sensemaking: The drivers of design synthesis. *Design Issues*, *26*(1), 15–28. https://doi.org/10.1162/desi.2010.26.1.15

Kolko, J. (2015). Design thinking comes of age. *Harvard Business Review*, *93*(2), 66–71.

Kumar, V., & Holloway, M. (2009). How tangible is your strategy? How design thinking can turn your strategy into reality. *Journal of Business Strategy*, *30*(2/3), 50–56. https://doi.org/10.1108/02756660910942463

Leonard, D., & Rayport, J. F. (1997). Spark innovation through empathic design. *Harvard Business Review*, *75*, 102–113. https://hbr.org/1997/11/spark-innovation-through-empathic-design

Liedtka, J. (2014). Innovative ways companies are using design thinking. *Strategy and Leadership*, *42*(2), 40–45. https://doi.org/10.1108/SL-01-2014-0004

Liedtka, J. (2015). Perspective: Linking design thinking with innovation outcomes through cognitive bias reduction. *Journal of Product Innovation Management*, *32*(6), 925–938. https://doi.org/10.1111/jpim.12163

Liedtka, J. (2018). Why design thinking works. *Harvard Business Review*, *96*(5), 72–79.

Liedtka, J. (2020). Putting technology in its place: Design thinking's social technology at work. *California Management Review*, *62*(2), 53–83. https://doi.org/10.1177/0008125619897391

Liedtka, J., King, A., & Bennett, K. (2013). *Solving problems with design thinking: Ten stories of what works*. Columbia University Press.

Liedtka, J., Martin, R., & Dew, N. (2007). Abduction: A pre-condition for the intelligent design of strategy. *Journal of Business Strategy*, *28*(1), 38–45.

Lindberg, T., Köppen, E., Rauth, I., & Meinel, C. (2012). On the perception, adoption and implementation of design thinking in the IT industry. In H. Plattner, C. Meinel, & L. Leifer (Eds.), *Design thinking research. Understanding innovation* (pp. 229–240). Springer. https://doi.org/10.1007/978-3-642-21643-5_13

Luchs, M. G., Swan, K. S., & Creusen, M. E. H. (2016). Perspective: A review of marketing research on product design with directions for future research. *Journal of Product Innovation Management*, *33*(3), 320–341. https://doi.org/10.1111/jpim.12276

Magistretti, S., Ardito, L., & Messeni Petruzzelli, A. (2021). Framing the microfoundations of design thinking as a dynamic capability for innovation: Reconciling theory and practice. *Journal of Product Innovation Management*, in Press, *38*, 645–667. https://doi.org/10.1111/jpim.12586

Magistretti, S., Bianchi, M., Calabretta, G., Candi, M., Dell'Era, C., Stigliani, I., & Verganti, R. (2021). Framing the multifaceted nature of design thinking in addressing different innovation purposes. *Long Range Planning*, 102163. https://doi.org/10.1016/j.lrp.2021.102163

Magistretti, S., Dell'Era, C., & Doppio, N. (2020). Design sprint for SMEs: An organizational taxonomy based on configuration theory. *Management Decision*, *58*(9), 1803–1817. https://doi.org/10.1108/MD-10-2019-1501

Magistretti, S., Dell'Era, C., Verganti, R., & Bianchi, M. (2022). The contribution of design thinking to the R of R&D in technological innovation. *R&D Management*, *52*(1), 108–125. https://doi.org/10.1111/radm.12478

Mansoori, Y., & Lackeus, M. (2019). Comparing effectuation to discovery-driven planning, prescriptive entrepreneurship, business planning, lean startup, and design thinking. *Small Business Economics*, *54*(2), 791–818.

Martin, R. L. (2009). *The design of business: Why design thinking is the next competitive advantage*. Harvard Business Review Press.

Micheli, P., Perks, H., & Beverland, M. B. (2018). Elevating design in the organization. *Journal of Product Innovation Management*, *35*(4), 629–651. https://doi.org/10.1111/jpim.12434

Micheli, P., Wilner, S. J., Bhatti, S. H., Mura, M., & Beverland, M. B. (2019). Doing design thinking: Conceptual review, synthesis, and research

agenda. *Journal of Product Innovation Management*, *36*(2), 124–148. https://doi.org/10.1111/jpim.12466

Miller, K., & Moultrie, J. (2013). Delineating design leaders: A framework of design management roles in fashion retail. *Creativity and Innovation Management*, *22*(2), 161–176. https://doi.org/10.1111/caim.12024

Mosely, G., Wright, N., & Wrigley, C. (2018). Facilitating design thinking: A comparison of design expertise. *Thinking Skills and Creativity*, *27*(2), 177–189. https://doi.org/10.1016/j.tsc.2018.02.004

Nagaraj, V., Berente, N., Lyytinen, K., & Gaskin, J. (2020). Team design thinking, product innovativeness, and the moderating role of problem unfamiliarity. *Journal of Product Innovation Management*, *37*(4), 297–323. https://doi.org/10.1111/jpim.12528

Norman, D. (2005). Human-centered design considered harmful. *Interactions*, *12*(4), 14–19. https://doi.org/10.1145/1070960.1070976

Paletz, S. B., & Schunn, C. D. (2010). A social-cognitive framework of multidisciplinary team innovation. *Topics in Cognitive Science*, *2*(1), 73–95. https://doi.org/10.1111/j.1756-8765.2009.01029.x

Patnaik, D., & Becker, R. (1999). Needfinding: The why and how of uncovering people's needs. *Design Management Journal (Former Series)*, *10*, 37–43. https://doi.org/10.1111/j.1948-7169.1999.tb00250.x

Powell, W. W., Koput, K. W., & Smith-Doerr, L. (1996). Interorganizational collaboration and the locus of innovation: Networks of learning in biotechnology. *Administrative Science Quarterly*, *41*(1), 116–145. https://doi.org/10.2307/2393988

Rae, J. (2016). Design value index exemplars outperform the S&P 500 index (again) and a new crop of design leaders emerge. *Design Management Review*, *27*(4), 4–11.

Rauth, I., Carlgren, L., & Elmquist, M. (2015). Making it happen: Legitimizing design thinking in large organizations. *Design Management Journal*, *9*(1), 47–60. https://doi.org/10.1111/dmj.12015

Reed, R., & Reed, M. (1989). CEO experience and diversification strategy fit. *Journal of Management Studies*, *26*(3), 251–270. https://doi.org/10.1111/j.1467-6486.1989.tb00727.x

Rodenbach, M., & Brettel, M. (2012). CEO experience as micro-level origin of dynamic capabilities. *Management Decision*, *50*(4), 611–634. https://doi.org/10.1108/00251741211220174

Roth, K., Globocnik, D., Rau, C., & Neyer, A. (2020). Living up to the expectations: The effect of design thinking on project success. *Creativity and Innovation Management*, *29*(4), 667–684. https://doi.org/10.1111/caim.12408

Sanders, E. B. N., & Stappers, P. J. (2008). Co-creation and the new landscapes of design. *CoDesign*, *4*(1), 5–18. https://doi.org/10.1080/15710880701875068

Sato, S., Lucente, S., Meyer, D., & Mrazek, D. (2010). Design thinking to make organization change and development more responsive. *Design Management Review*, *21*(1), 44–52. https://doi.org/10.1111/j.1948-7169.2010.00064.x

Seidel, V. P., & Fixson, S. K. (2013). Adopting design thinking in novice multidisciplinary teams: The application and limits of design methods and reflexive practices. *Journal of Product Innovation Management*, *30*(S1), 19–33. https://doi.org/10.1111/jpim.12061

Shea, C. T., & Hawn, O. V. (2019). Microfoundations of corporate social responsibility and irresponsibility. *Academy of Management Journal*, *62*(5), 1609–1642. https://doi.org/10.5465/amj.2014.0795

Stigliani, I., & Ravasi, D. (2012). Organizing thoughts and connecting brains: Material practices and the transition from individual to group-level prospective sensemaking. *Academy of Management Journal*, *55*(5), 1232–1259. https://doi.org/10.5465/amj.2010.0890

Strike, V. M., & Rerup, C. (2016). Mediated sensemaking. *Academy of Management Journal*, *59*(3), 880–905. https://doi.org/10.5465/amj.2012.0665

Tasselli, S., Kilduff, M., & Menges, J. I. (2015). The microfoundations of organizational social networks: A review and an agenda for future research. *Journal of Management*, *41*(5), 1361–1387.

Thomke, S., & Von Hippel, E. (2002). Customers as innovators: A new way to create value. *Harvard Business Review*, *80*(4), 74–85.

Topalian, A. (2011). Major challenges for design leaders over the next decade. In R. Cooper, S. Junginger, & T. Lockwood (Eds.), *The handbook of design management* (pp. 379–397). Berg. https://doi.org/10.5040/9781474294126.ch-024

Ulrich, K. T. (2003). *Product design and development*. McGraw-Hill Education.

Ulrich, K. T., & Pearson, S. (1998). Assessing the importance of design through product archaeology. *Management Science*, *44*(3), 352–369. https://doi.org/10.1287/mnsc.44.3.352

Verganti, R. (2017). *Overcrowded: Designing meaningful products in a world awash with ideas*. MIT Press. https://doi.org/10.7551/mitpress/9780262035361.001.0001

Verganti, R., Dell'Era, C., & Swan, S. (2021). Design thinking: Critical analysis and future evolution. *Journal of Product Innovation Management*, *38*, 603–622. https://doi.org/10.1111/jpim.12610

Wattanasupachoke, T. (2012). Design thinking, innovativeness and performance: An empirical examination. *International Journal of Management & Innovation*, *4*(1), 1–11.

Wrigley, C., Nusem, E., & Straker, K. (2020). Implementing design thinking: Understanding organizational conditions. *California Management Review*, *62*(2), 125–143. https://doi.org/10.1177/0008125619897606

AUTHOR BIOGRAPHIES

Stefano Magistretti is Assistant Professor of Agile Innovation at the School of Management, Politecnico di Milano and a senior researcher in the LEADIN'Lab, the Laboratory of LEAdership, Design, and INnovation. Within the School of Management, he also serves as Research Platform Development for the Observatory Design Thinking for Business. He has published conference articles and chapters in edited books, as well as articles in journals such as *Journal of Product Innovation Management*, *Industrial Marketing Management*, *Long Range Planning*, *Technological Forecasting and Social Change*, *Industry & Innovation*, *Business Horizons*, *Creativity and Innovation Management*, *Journal of Knowledge Management*, *Research Technology Management*, *and Technology Analysis and Strategic Management Journal*.

Emilio Bellini is Assistant Professor at Politecnico di Milano, where he serves also as Co-Founder of LEADIN'Lab, the Laboratory of LEAdership, Design and INnovation in the School of Management and Scientific Officer of the Observatory for Digital Innovation in Retail. His main research areas are innovation, design and new service development in the context of retail services. On these topics, he has published in journals such as *Journal of Technology Transfer*, *Creativity and Innovation Management*, *International Journal of Project Management*, *Research Technology Management*, *International Journal of Innovation Management*.

Cabirio Cautela is Full Professor of Strategic Design at Politecnico di Milano – Design Department and is a PhD in Business Management. He was a Visiting Scholar at Stanford University – CDR (Centre for Design Research) in 2012. His research topics deal with the strategic role of design, design management processes

and how design generates new business models and new ventures. His last articles were published by journals such as *Technovation*, *Creativity and Innovation Management*, *International Entrepreneurship and Management Journal*, *Design Issues*, *International Journal of Entrepreneurship and Innovation Management*, *Design Management Review*.

Claudio Dell'Era is Professor in Design Thinking for Business at the School of Management, Politecnico di Milano, where he serves also as Co-Founder of LEADIN'Lab, the Laboratory of LEAdership, Design and INnovation. He is also Director of the Observatory 'Design Thinking for Business' of the School of Management, Politecnico di Milano. Research activities developed by Claudio Dell'Era are concentrated in the areas of design thinking and design strategy. He has published more than 100 chapters in edited books and papers published in conference proceedings and leading international journals such as *Entrepreneurship Theory and Practice*, *Journal of Product Innovation Management*, *Long Range Planning*, *Industrial Marketing Management*, *Technology Forecasting and Social Change*, *R&D Management*, *International Journal of Operations & Production Management*, *Industry & Innovation*, *Creativity and Innovation Management*, *Business Horizons* and many others.

Luca Gastaldi is Associate Professor at the School of Management of Politecnico di Milano. He teaches 'Firms and Strategic Decisions' at the MSc of Management and Information Engineering, and he is part of the core faculty of the MIP Graduate School of Business, where he teaches Business Process Management, Change Management and Organization Theory and Design. Since 2013, he is a board member of CINet, an international research network on continuous innovation. Over the years, he promoted research and consulting projects in the area of digital innovation, with a peculiar emphasis on public entities. He is the director of the 'Digital Agenda' and 'Design Thinking for Business' Observatories.

Sina Lessanibahri, PhD, is a post-doctoral research fellow at the School of Management of Politecnico di Milano where he works on the application of data science and big data methods for management and policy research especially, in public sector. He holds an Erasmus Mundus double-degree PhD (Politecnico di Milano and Universidad Politecnica de Madrid) in management, Master of Engineering (University Technology Malaysia) in industrial engineering and an Erasmus Mundus Joint Master of Science (University of L'Aquila, University of Hamburg and Universitat Autònoma de Barcelona) in mathematical modelling. Having a versatile educational background, he is highly interested in interdisciplinary research topics. Sina actively performs research and consultancy projects in the fields of data mining, machine learning, econometrics, optimization and healthcare informatics.

How to cite this article: Magistretti, S., Bellini, E., Cautela, C., Dell'Era, C., Gastaldi, L., & Lessanibahri, S. (2022). The perceived relevance of design thinking in achieving innovation goals: The individual microfoundations perspective. *Creativity and Innovation Management*, 1–15. https://doi.org/10.1111/caim.12519

APPENDIX A

The questionnaire had four sections:

Introduction: Reporting the research aims and the structure of the questionnaire.

Respondent Profile: This section aimed to collect overall data on respondents (educational background, job title and years of experience in the firm), the company they work for (industry, number of employees, revenues in 2018 and innovation budget), the company's design thinking experience and the unit they work for.

Innovation Goals: This section contained questions aimed at measuring respondents' interpretation of the relevance of design thinking in achieving innovation goals (see Table 1 for the items). Respondents expressed their perspective by using a 7-point Likert-type scale (1 = *Not at all relevant*; 7 = *Extremely relevant*). The topics concerned different aspects of the analysis of users, the organizational culture, the development of a product line and cost reduction.

Conclusion: Although declaring their name and surname was optional, the data usage and GDPR information were reiterating prior to concluding the survey.