Nicolas Rösch | Victor Tiberius | Sascha Kraus

# Design thinking for innovation: Context factors, process, and outcomes

**Suggested citation referring to the original publication:**
**European journal of innovation management 26 (2023) 7, pp. 160 - 176**
**DOI: https://doi.org/10.1108/EJIM-03-2022-0164**
**ISSN: 1460-1060, 1758-7115**

**Journal article | Version of record**

**Secondary publication archived on the Publication Server of the University of Potsdam:**
**Zweitveröffentlichungen der Universität Potsdam : Wirtschafts- und Sozialwissenschaftliche Reihe 176**
**ISSN: 1867-5808**
**URN: https://nbn-resolving.org/urn:nbn:de:kobv:517-opus4-608341**
**DOI: https://doi.org/10.25932/publishup-60834**

Received 26 March 2022
Revised 19 June 2022
5 January 2023
Accepted 22 February 2023

# Design thinking for innovation: context factors, process, and outcomes

Nicolas Rösch and Victor Tiberius
*Faculty of Economics and Social Sciences, University of Potsdam, Potsdam, Germany, and*
Sascha Kraus
*Faculty of Economics and Management, Free University of Bozen-Bolzano, Bolzano, Italy and*
*Department of Business Management, University of Johannesburg, Johannesburg, South Africa*

## Abstract

**Purpose** – Design thinking has become an omnipresent process to foster innovativeness in various fields. Due to its popularity in both practice and theory, the number of publications has been growing rapidly. The authors aim to develop a research framework that reflects the current state of research and allows for the identification of research gaps.

**Design/methodology/approach** – The authors conduct a systematic literature review based on 164 scholarly articles on design thinking.

**Findings** – This study proposes a framework, which identifies individual and organizational context factors, the stages of a typical design thinking process with its underlying principles and tools, and the individual as well as organizational outcomes of a design thinking project.

**Originality/value** – Whereas previous reviews focused on particular aspects of design thinking, such as its characteristics, the organizational culture as a context factor or its role on new product development, the authors provide a holistic overview of the current state of research.

**Keywords** Context factors, Design thinking, Outcomes, Process, Systematic literature review

**Paper type** Research paper

## 1. Introduction

Design thinking (DT) is an established process used in organizations, which aims to solve problems and promote innovation (Brown, 2008). By its creative und intuitive nature, DT can be distinguished from other processes, which are purely analytical (Mansoori and Lackéus, 2020; Nakata, 2020). Advantages for product or service innovations are promised through DT by a strong focus on the users' needs (Brown, 2008). Immersion in the user situation is considered to enable the discovery of (future) user needs. Other benefits include better decision-making by reducing cognitive biases (Liedtka, 2015), promoting learning effects (Beckman and Barry, 2007), and transforming the organizational culture toward innovation (Elsbach and Stigliani, 2018; Kolko, 2015). In the long term, case studies demonstrate that competitive advantages can be generated by applying DT practices (Appleyard *et al.*, 2020).

Although design research dates back to the 1960s, the notion of applying design principles in the business context is still relatively young (Johansson-Sköldberg *et al.*, 2013).

European Journal of Innovation Management
Vol. 26 No. 7, 2023
pp. 160-176
Emerald Publishing Limited
1460-1060
DOI 10.1108/EJIM-03-2022-0164

Consequently, the emphasis of research has long been on defining characteristics to link the realm of design with business and management (Carlgren *et al.*, 2016b; Micheli *et al.*, 2019). More research has then been conducted on the possible uses, conditions, and effects in recent years (Chouki *et al.*, 2021). For a long time, findings were primarily based on case studies describing practical applications (Holloway, 2009; Liedtka, 2015). Recently, researchers have started to use quantitative methodologies to measure the impact of DT (Suci *et al.*, 2021; Nakata and Hwang, 2020; Nagaraj *et al.*, 2020).

Due to its popularity in practice, scholarly attention on DT has increased over the years, leading to a growing number of publications on DT. However, the wide literature landscape can be characterized as complex and fragmented. As a consequence, we aim to provide an overview of the DT field and propose a research framework. For this purpose, we conduct a systematic literature review.

Our review complements previous reviews by a more holistic approach. Previous reviews focused on the characteristics of DT (Micheli *et al.*, 2019), on DT and organizational culture (Elsbach and Stigliani, 2018), and recently on DT and new product development (De Paula *et al.*, 2022).

Our review contributes to the DT literature by providing a holistic and systematic overview of DT as an established problem-solving and innovation process in organizations. In particular, we propose (1) an umbrella definition, which highlights the focal cornerstones of this specific process, and (2) a research framework, which organizes the findings of previous and future research. The framework comprises context factors, a basic three-stage process model unifying previous process conceptualizations, and typical outcomes of DT processes.

## 2. Methodology

### *2.1 Sample*

This paper aims to provide an overview of the current findings of DT by analyzing the current literature on this topic. Definitions, characteristics, influencing factors, and impacts are elaborated based on the literature to create a research framework for DT. For this purpose, we conduct a systematic literature review (Kraus *et al.*, 2020, 2022; Linnenluecke *et al.*, 2020; Tranfield *et al.*, 2003) (Figure 1).

The literature sample was retrieved from the databases Web of Science (WoS) and Scopus. In particular, the search was focused on publications with "design thinking" in the title to ensure that they deal with DT at their core and not as a side-aspect. The search yielded 794 documents on the WoS and 5,036 on Scopus, which shows that DT can be considered as a mature research field (Kraus *et al.*, 2020).

Due to our thematic focus, we limited the search to the categories "business" and "management". Following the recommendation by Kraus *et al.* (2020), we included research articles only. Furthermore, only articles written in English, the standard scholarly language, were considered. In terms of time, all texts published up until August 27th, 2021 are included in the review. After applying these filters, the number of articles decreased to 129 papers from WoS and 184 papers from Scopus.

We then further reduced the literature sample by screening the articles for their thematic relevance and minimum quality. Different quality thresholds can be applied, such as using journal rankings or minimum average citation rates of journals (Kraus *et al.*, 2020) or minimum citation numbers of the articles in the sample, as often used in bibliometric reviews (Deyanova *et al.*, 2022; Glinyanova *et al.*, 2021; Tiberius *et al.*, 2021). Considering the sample size and aiming for a rather broad overview of the field, we decided to apply a not too strict threshold. In particular, we removed articles published in journals with an Impact Factor or CiteScore smaller than one, which means that each article published in a journal had to be cited at least once, on average, showing a minimum relevance of the journal. In the next step,

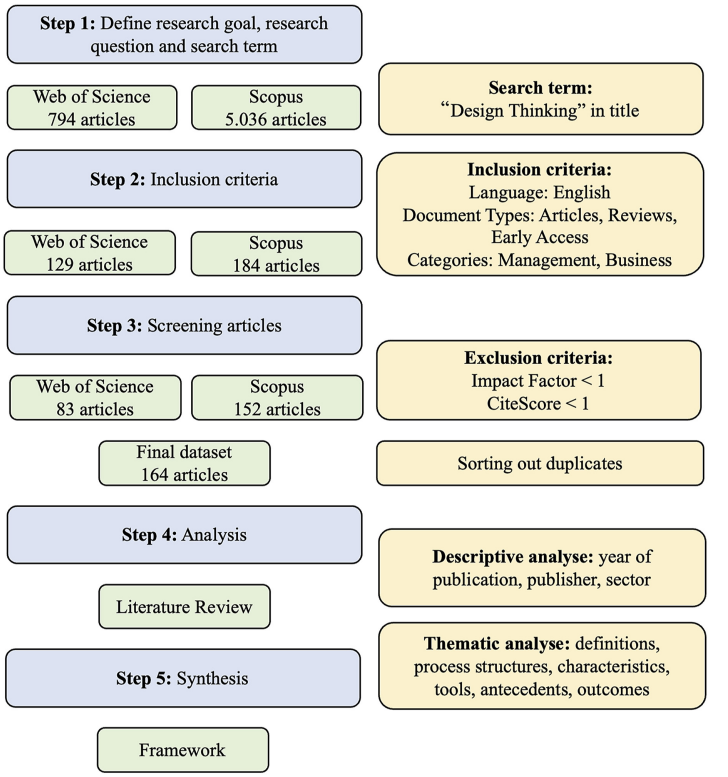



**Figure 1.**
Review process

**Source(s):** Author's own creation

the merged dataset was checked for duplicates (Linnenluecke *et al.*, 2020), removing another 71 documents. The final dataset contains 164 articles.

### *2.2 Analysis*

As suggested by Kraus *et al.* (2020), we synthesized the data in a concept-centric manner. For this purpose, we read the titles and abstracts to obtain an initial overview. Subsequently, we read the texts completely for a deeper analysis (Denyer and Tranfield, 2009). We used Ma *et al.* (2019)'s model for our research framework structure, consisting of context factors, process, and outcome, to guide our review, and to categorize our findings. We added definitions as a further basic category. We used Excel to document the findings from the data analysis. In this process, we summarized the main statements of the articles in tabular form. Finally, we searched for relationships between the found insights and compiled them into a framework, which was then used to identify research gaps for future research.

## 3. Results

### *3.1 Defining design thinking*

Today's understanding of DT originates from early design research in the 1960s (Elsbach and Stigliani, 2018), which aimed to disentangle complex unstructured problems into smaller,

well-defined issues to develop better solutions (Beckman and Barry, 2007). Johansson-Sköldberg *et al.* (2013) distinguish between designerly thinking, i.e. the practices and competencies of designers applied within the design field, and design thinking, where non-designers adopt these design practices and competencies to solve particular problems. In this regard, Brown (2008) made a push toward the current understanding of DT in a management context by publishing his experiences with the consulting firm IDEO. According to this understanding, DT is a human-centered process that combines design methods with a business view (Brown, 2008; Henseler *et al.*, 2021). Martin (2010) describes this as the balanced blending of analytical and intuitive thinking, which is expected to lead to a competitive advantage.

Due to different foci and perspectives, a uniform definition is lacking (Liedtka, 2015; Nakata and Hwang, 2020). Several definitions are listed in Table 1. The definitions show a wide spectrum of conceptualizations of DT. Some see DT as a discipline (Brown, 2008), an approach (Elsbach and Stigliani, 2018), attitudes/principles (Kolko, 2015; Shapira *et al.*, 2017), thinking modes (Martin, 2010), a process (Beckman and Barry, 2007; Beverland *et al.*, 2015; Glen *et al.*, 2014; Liedtka, 2015; Shapira *et al.*, 2017) or the application of methods (Seidel and Fixson, 2013). Whereas no understanding can be clearly declared as wrong, the different authors look at DT from different perspectives and with different foci. While the process perspective is predominant, the other conceptualizations should also be taken into account. To consolidate the different views, we propose the following definition:

| Author(s) | Definition |
|---|---|
| Beckman and Barry (2007, p. 25) | A generic innovation process, grounded in models of how people learn |
| Brown (2008, p. 2) | 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 |
| Martin (2010, p. 38) | A balanced dynamic interplay between analytical thinking and intuitive thinking |
| Seidel and Fixson (2013, p. 19) | The application of design methods by multidisciplinary teams to a broad range of innovation challenges |
| Glen *et al.* (2014, p. 653) | An iterative, exploratory process involving visualizing, experimenting, creating, and prototyping of models, and gathering feedback |
| Beverland *et al.* (2015, p. 593) | A creative and strategic process characterized by the following hallmarks: abductive reasoning, iterative thinking and experimentation, holistic perspective, and human-centeredness |
| Kolko (2015, p. 4) | A set of principles collectively known as design thinking—empathy with users, a discipline of prototyping, and tolerance for failure chief among them—is a tool for creating simple, intuitive and pleasurable interactions and developing a responsive, flexible organizational culture |
| Liedtka (2015, p. 927) | A hypothesis-driven process, that is problem and solution focused, best suited to decision context in which uncertainty and ambiguity are high, composed of empathy, abduction, cocreation and collaboration, visualization and prototyping, and iteration |
| Shapira *et al.* (2017, p. 286) | A process and attitude that harnesses creative problem-solving by focusing on the discovery of root causes and needs, collaborating across disciplines, cultivating optimism, and experimenting with solutions in order to learn and adapt more quickly |
| Elsbach and Stigliani (2018, p. 2274) | Design thinking comprises an approach to problem-solving that uses tools traditionally utilized by designers of commercial products, processes, and environments |

**Source(s):** Authors' own creation

**Table 1.**
Definitions of design thinking

Design Thinking is an iterative problem-solving and innovation process in organizations, which is based on specific principles (such as a focus on user needs, multidisciplinarity, etc.) and uses specific methods (such as creative thinking, visualization, experimentation, etc.).

### *3.2 Design thinking process*

Several types of structures of the DT process have been proposed in the literature ranging from three to six stages (Table 2). However, the basic idea of the different process models is the same. Models with more stages only show a finer subdivision. Three basic stages can be considered as the fundamental stages of every DT process. They are: (1) acquisition of data about the problem, (2) idea generation, and (3) testing the ideas (Brown, 2008; Liedtka, 2015). In the other models with more stages, some stages are split up into sub-stages (Beverland *et al.*, 2015; Liedtka, 2015; Brown, 2008). The IDEO process model with five stages (Shapira *et al.*, 2017) and the D.School model with six stages (Da Silva *et al.*, 2020) are frequently used in practice. The processes are usually iterative making it possible to go back and forth between individual stages (Brown, 2008). In the following, we focus on the three-stage conceptualization (Liedtka, 2015) as the least common denominator and relate the stages to the principles and applicable methods, also referring to the three types of design tools according to Seidel and Fixson (2013).

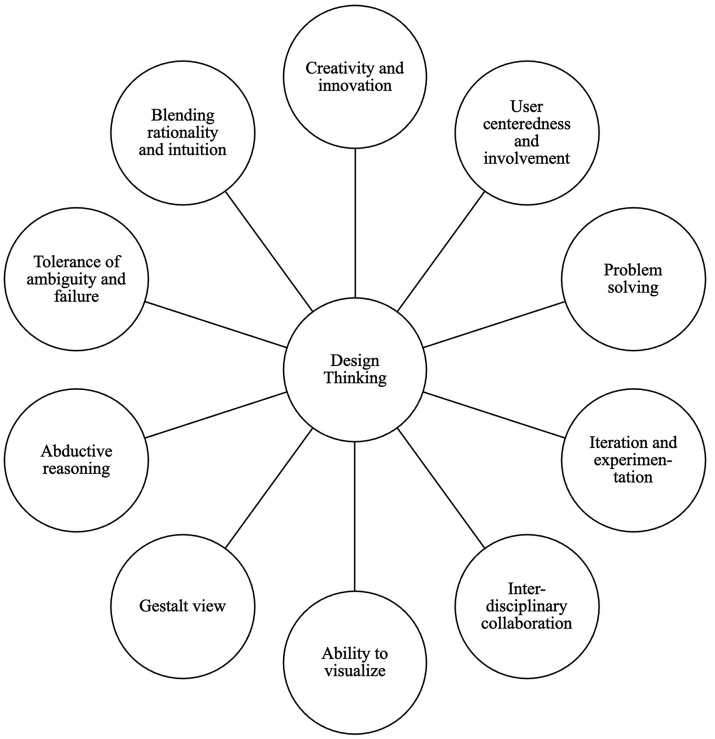
*3.2.1 Data gathering.* The starting point of DT is the observation and analysis of the situation with a focus on the user (Brown, 2008). It is about understanding the identity of the user and their hidden needs (Furue and Washida, 2017; Nagaraj *et al.*, 2020). A key in this is building empathy, which means recognizing and understanding of other persons' sensations, emotions, thoughts, motives, and personality traits (Brown, 2008; Carlgren *et al.*, 2016b; Glen *et al.*, 2015). This immersion allows to recognize new possibilities and opportunities (Liedtka, 2020). The information is used to create so-called personas, which depict the typical user and their characteristics, actions, and needs (Welsh and Dehler, 2013). DT strives for a holistic view also called gestalt view (Figure 2), a comprehensive understanding of the problem that includes environmental factors, relationships, background, trends, and user needs (Holloway, 2009). The notion of exploring the whole situation by dividing it into parts and analyzing connections and patterns stems from system thinking (Buchanan, 2019). With this knowledge, designers are able to derive the latent user needs (Liedtka, 2015).

Some of the "needfinding tools" (Elsbach and Stigliani, 2018; Seidel and Fixson, 2013) used in this stage stem from ethnography (Beckman and Barry, 2007) and seek direct contact with the user, such as participant observation, interviewing, journey mapping or job-to-be-done

| Authors | Process stages | | | | | |
|---|---|---|---|---|---|---|
| Beckman and Barry (2007) | Observe and Notice | | Frame and Reframe | Imagine and Design | Make and experiment | |
| Beverland *et al.* (2015) | Destabilization | | Define and Develop | | Transformation | |
| Brown (2008) | Inspiration | | | Ideation | Implementation | |
| Glen *et al.* (2015) | Problem finding | Observation | Visualization/ sensemaking | Ideation | Prototype and testing | Viability testing |
| Da Silva *et al.* (2020) | Understand | Observe | Define | Ideate | Prototype | Test |
| Shapira *et al.* (2017) | Discovery | | Interpretation | Ideation | Experimentation | Evolution |
| Liedtka (2015) | Data gathering about user needs | | | Idea generation | Testing | |

**Source(s):** Authors' own creation

**Table 2.** Overview of different design thinking process structures




**Source(s):** Adapted from Micheli *et al*, 2019

**Figure 2.**
Attributes of design thinking

analysis (Liedtka, 2015). Consumers can also be actively involved in the process through co-creation (Leavy, 2012; Luotola *et al*., 2017). Rather than observing users individually, crowdsourcing allows to observe groups (Macdonald and Elahee, 2016; Mount *et al*., 2020). Stephens and Boland (2015) emphasize the importance of aesthetic knowledge and active involvement of the bodily senses for immersion and understanding of a situation.

*3.2.2 Idea generation.* In essence, ideation is about developing hypotheses of possible solutions to a problem or user needs (Liedtka, 2020). Framing and reframing the previously collected data helps identify patterns and generate ideas (Beckman and Barry, 2007). It involves looking for hidden problems to better understand the composition of the problem and target points for solutions (Carlgren *et al*., 2016b). Collaboration among multidisciplinary teams can be a critical success factor when developing ideas by including multiple perspectives and complementary knowledge (Brown, 2008; Li, 2002; Seidel and Fixson, 2013). To generate ideas, teams first use divergent thinking to develop an extensive range of ideas and, second, convergent thinking to analyze and narrow down these ideas (Carlgren *et al*., 2016b). New solutions emerge from the development of diverse ideas from large stakeholder groups, which are used in the confluence of analysis and intuition to develop new solutions (Nagaraj *et al*., 2020). Abductive reasoning is key to connecting intuitive and analytical thinking (Martin, 2010) by asking "what if?" (Liedtka, 2015) and "what might be?" (Martin, 2010). As a result of diverse ideas and abductive reasoning, curiosity and openness within DT teams are increased, and ingrained behavioral patterns are broken (Liedtka, 2015).

Typical idea generating tools are associated with brainstorming and visualization (Seidel and Fixson, 2013). Brainstorming requires high team reflexivity by regular discussions about the ideas

within the team (Seidel and Fixson, 2013). For brainwriting, concepts are first written down individually and then discussed in a group, whereas speedstorming is inspired by speed dating (Thompson and Schonthal, 2020). Visualization allows presenting the ideas and detecting unnoticed possibilities by making the ideas tangible through illustration by diagrams, drawings, Post-it notes or scribbles on whiteboards (Carlgren *et al.*, 2016b). Mind mapping can connect the mass of information and get a common understanding within the team (Liedtka, 2015). Narratives and storytelling (Liedtka, 2015) or sociodrama (Wyman *et al.*, 2012) are further tools in this stage.

*3.2.3 Testing.* In the testing stage, the previously developed and selected ideas and assumptions are subsequently converted into prototypes and tested with experiments iteratively by repeating them several times with additional new adjustments until the ideal solution is found (Carlgren *et al.*, 2016b). A principle within this phase is learning in action (Liedtka and Kaplan, 2019). In contrast to prototyping in engineering where a technically advanced test model is created, prototyping represents ideas by creating a product with minimal input to obtain feedback for the concept (Glen *et al.*, 2015). The generate-test cycles allow for quick feedback and new knowledge that is directly reintroduced into new combinations to obtain the best fit between user-need, environment, and product characteristics (Nagaraj *et al.*, 2020). Admitting mistakes offers valuable insights in this regard (Carlgren *et al.*, 2016b).

Idea-testing tools are intended to assess the solutions on three dimensions: the level of desirability for users, the technical feasibility, and the business viability (Elsbach and Stigliani, 2018). Success on these three dimensions provides the opportunity for innovation. Rapid prototyping makes ideas tangible by building small models with little effort and minimal cost (Brown, 2008). In this regard, there are connections to pragmatism by observing which solution works and using the reflections to test new possibilities (Dalsgaard, 2014). A popular tool to test the formulated assumptions from the previous phase with external stakeholders is field experiments (Liedtka, 2015; Micheli *et al.*, 2019).

### *3.3 Context factors*

*3.3.1 Application context.* The application areas of DT are predominantly in problem-solving and innovation (Dell'Era *et al.*, 2020). The three stages of data acquisition, ideation, and testing allow DT to be used for problems that are particularly difficult to define (Liedtka, 2015). In addition, the application fields can be characterized by uncertainty and ambiguity (Elsbach and Stigliani, 2018; Luotola *et al.*, 2017). Therefore, DT is also used within crises to find innovative solutions (Cankurtaran and Beverland, 2020). Nevertheless, the problem does not necessarily have to be challenging (Nakata and Hwang, 2020). Within research and development, DT can be used in both phases (Magistretti *et al.*, 2021b). Nakata (2020) suggests that DT can be used as a part of product development to be applied in the front-end of the process (Brand *et al.*, 2021), and in the back-end to apply another approach like Stage Gate, which, in contrast, is based on analytical decision-making and milestone planning. DT can also be used to transform an organizational culture by integrating its principles and values, such as user focus, norms of collaboration, risk-taking, ambiguity, experimentation, learning from failure, and design-led strategic thinking (Elsbach and Stigliani, 2018). Case studies demonstrate that DT is applicable in many ways, regardless of the industry, such as in topics like promoting sustainability (Buhl *et al.*, 2019; Geissdoerfer *et al.*, 2016; Shapira *et al.*, 2017), financial services (Vetterli *et al.*, 2016) or in the digital context (Przybilla *et al.*, 2020; Shafiee *et al.*, 2021). At the management level, it can support strategy development (Cagnin, 2018; Knight *et al.*, 2020; Ben Mahmoud-Jouini *et al.*, 2016). In areas such as the commodity industry, which usually has little innovation potential, DT can be applied to develop better service offerings for users (Rau *et al.*, 2017).

*3.3.2 Organizational factors.* For the implementation of DT, non-designers need to learn the design skills and principles of dealing with ambiguity and uncertainty, developing a holistic view, and collaboration in teams among divergent thinking and convergent thinking (Dym *et al.*, 2006).

Therefore, participants must train to overcome cognitive obstacles when conducting the process (Butler and Roberto, 2018). It can take some time for the innovative capabilities of DT to be fully utilized (Ben Mahmoud-Jouini *et al.*, 2019). For the implementation in existing structures, scholars recommended using a facilitator who teaches the design methods, moderates through the stages, and when necessary, mediates between the design process and barriers within the organization (Daniel, 2016; Hölzle and Rhinow, 2019; Starostka *et al.*, 2021; Wrigley *et al.*, 2018). At the organizational level, conflicts can arise when DT interferes with existing processes and structures or does not go hand in hand with the organizational culture (Carlgren *et al.*, 2016a; Coco *et al.*, 2020). Therefore, the organization should have a strategic vision and clear goals known among employees and linked to the DT process (Dunne, 2018; Wrigley *et al.*, 2020). In addition, it is necessary to define precisely the guidelines and responsibilities previously (Carlgren *et al.*, 2016a; Wrigley *et al.*, 2020). When introducing DT into existing projects defined by strict metric goal achievement and efficiency, conflicts may arise between the design process and previous project work (Dijksterhuis and Silvius, 2017; Hölzle and Rhinow, 2019; Nakata, 2020). Nevertheless, scholars suggest not to apply DT as a rigid process but rather as an agile method that provides a variety of tools for different situations and can be applied in different ways (Chen and Venkatesh, 2013). In order to use the full capacity of DT, the majority of employees can be authorized to participate in opportunity finding and should be familiarized with the DT process and tools (Appleyard *et al.*, 2020; Liedtka and Kaplan, 2019).

### *3.4 Outcomes*

*3.4.1 Organizational Level.* The use of DT can improve the performance of firms (Suci *et al.*, 2021). Regarding the development of products, due to the user-focus, products can be developed that have high utility and meet the needs of users (Chen *et al.*, 2018). In doing so, radical innovations can be encouraged (Radnejad *et al.*, 2020; Tiberius *et al.*, 2021). Furthermore, DT can be used to develop the ability of company's brand ambidexterity (Zheng, 2018), helps with the strategy development (Liedtka and Kaplan, 2019; Holloway, 2009), and strengthens the organizational culture (Snyder *et al.*, 2018), and the formation of dynamic capabilities (Magistretti *et al.*, 2021a). Beverland *et al.* (2015) showed how DT supports brand ambidexterity, the ability to pursue two different strategic paths, consistency and relevance, simultaneously. This is about exploiting the existing resources available to a company, which can lead to incremental innovations. On the other hand, exploring new possibilities through new knowledge and experimentation can lead to radical innovations (Beverland *et al.*, 2015; Zheng, 2018). Moreover, recent studies indicate the elements of DT can be categorized as dynamic capabilities for innovation, by sensing opportunities, seizing them, and transforming or reconfiguring the resources (Kurtmollaiev *et al.*, 2018; Liedtka, 2020; Magistretti *et al.*, 2021a). At the team level, DT promotes a team's overall performance (Nakata and Hwang, 2020; Suci *et al.*, 2021). In addition, DT team outcomes demonstrate high levels of creativity (Lee *et al.*, 2019; Meinel *et al.*, 2020).

*3.4.2 Individual level.* On an individual level, the DT process enhances participants' creativity (Lee *et al.*, 2019; Kim, 2020; Cummings and Yur-Austin, 2021; Sándorová *et al.*, 2020). In addition, cognitive biases are released, and inertia is broken, allowing for new directions to be taken (Liedtka, 2015; Nagaraj *et al.*, 2020). It also results in higher levels of psychological empowerment (Roth *et al.*, 2020) and self-confidence (Rao *et al.*, 2021; Liedtka, 2020). Moreover, DT can be helpful to build entrepreneurial skills (Lynch *et al.*, 2021; Sarooghi *et al.*, 2019).

## 4. Discussion

### *4.1 Research framework*

The systematic literature review provides an organized outline of the growing number of publications on the still evolving DT field. Based on the current literature, we propose a

framework that includes the process stages, principles and tools, and that also reflects the context factors and outcomes (Figure 3). Furthermore, the framework can be used to identify research gaps.

*4.1.1 Context factors.* Several organizational factors can foster the DT process. On the one hand, the necessary equipment has to be provided in physical form with rooms and resources required for the application of DT (Wrigley *et al.*, 2020). On the other hand, DT should not collide with existing processes and align with the organizational culture (Carlgren *et al.*, 2016a). A decisive factor for the conditions that need to be created is how DT is implemented and on which levels it is applied (Starostka *et al.*, 2021). In the case of DT's application as a method for a specific project, the organizational conditions need to be created to prevent DT from colliding with existing guidelines (Hölzle and Rhinow, 2019). Adopting DT as a mindset in an organization affects the strategic vision and organizational culture in addition to structural conditions (Wrigley *et al.*, 2020). The principles need to be in line with the organizational culture. For example, in organizations that focus mainly on efficiency, the culture would have to be adapted to the principles of DT or an independent environment for the design mindset must be created (Dunne, 2018). In addition, elements such as empathy, user focus, creativity, willingness to experiment, openness to failure can enrich the organizational culture and encourage employees to actively seek innovation together (Coco *et al.*, 2020; Elsbach and Stigliani, 2018; Kolko, 2015). The type of leadership style plays a vital role in the implementation of processes. Here, the need for research has not yet been met. An impetus for research on leadership styles is offered by Nakata (2020). She recommends a leadership committed to coaching for DT, which does not restrict employees but encourages them to be creative and supports them. Until now, the factors for the composition of teams and the individual factors have been largely disregarded. Diversity and multidisciplinarity within design teams are essential components for defining problems and generating ideas (Seidel and Fixson, 2013). It is assumed that too large teams will have adverse effects (Thompson and Schonthal, 2020). Here, studies could provide insights into how design teams should be composed.

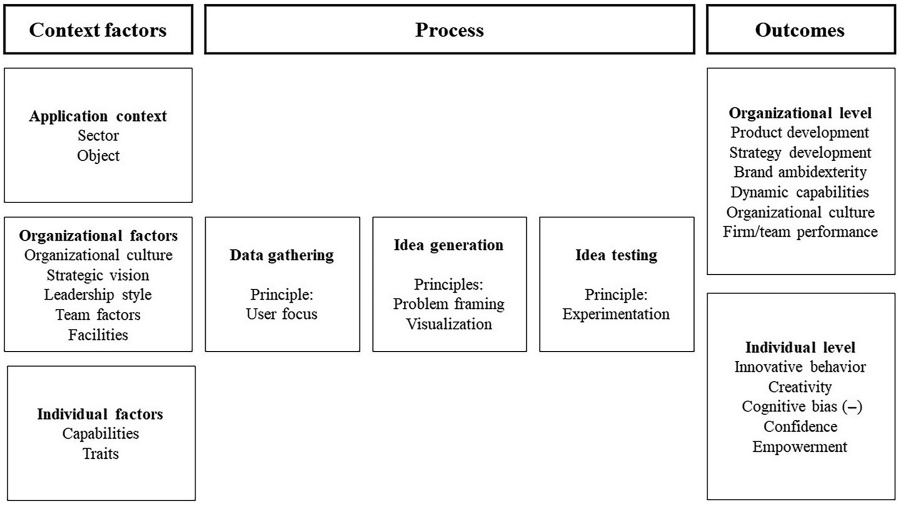



**Figure 3.**
Design thinking framework

**Source(s):** Author's own creation

In contrast to the organizational perspective, research is stall scarce on which characteristics individual participants must have before the DT process, which attributes potentially interfere with design principles, and how this affects the outcome. Participants are expected to build empathy, present their ideas in physical or rhetorical form, and work together in teams (Micheli *et al.*, 2019). Thereby, the question could be explored whether people need specific capabilities to participate in the process and how individual characteristics that are not compatible with DT's mindset can be better integrated.

*4.1.2 Design thinking process.* The center of the framework describes the DT process. The analysis showed the different interpretations of the individual process steps, which have a creative process for problem-solving in common. Differences are more in the structure and wording than in the actual content. For the framework, a three-stage categorization of the process steps according to Liedtka (2015) was chosen, consisting of the stages of data gathering about user needs, idea generation, and testing. However, the choice of three higher-level stages is not meant to exclude models with multiple sub-steps. Subsequently, the frequently quoted elements of Carlgren *et al.* (2016b) user focus, problem framing, visualization, experimentation and diversity were classified to the three stages as fundamental principles. The categorization of management tools in this article was adopted from Seidel and Fixson (2013) and Elsbach and Stigliani (2018). The search for a definition indicates three different perspectives on DT in research. This framework combines all three views: (1) process, in a general three-step process structure; (2) mindset, i.e. the principles that form the basis for DT mindset; and (3) tools, which are used to carry out the individual steps. Extensive research exists in determining the characteristics and attributes of DT (Carlgren *et al.*, 2016b; Elsbach and Stigliani, 2018; Liedtka, 2015; Micheli *et al.*, 2019). To better determine the selection of design tools, research is needed on the individual effects of the tools. The possibilities of combinations and connections of methods and tools have also not yet been considered in studies. Here, critical insights for practitioners can emerge. In addition, research could be conducted to answer which tools are most effective in specific situations or industries. Early studies on emerging tools should proceed, including using new technologies, such as augmented and virtual reality (Earle and Leyva-de la Hiz, 2020) or netnography, a digital derivative of ethnography for application in social media (Ashman *et al.*, 2021).

The focus of research on the impact of DT has increased, showing benefits at both the organizational and individual level. In the early years, research often discussed the use and impact of DT through case studies describing its implementation in practice (Beverland *et al.*, 2015; Clune and Lockrey, 2014; Holloway, 2009; Leavy, 2010; Liedtka, 2014; Vetterli *et al.*, 2016). Case studies are still the most commonly used research method in current DT research (Knight *et al.*, 2020; Magistretti *et al.*, 2021b; Mount *et al.*, 2020; Pham *et al.*, 2022; Wrigley *et al.*, 2020). Nevertheless, there was a lack of studies that empirically measured the impact and benefits of DT to give it a firm place as a tool for innovation management (Micheli *et al.*, 2019). This research gap has been initially addressed in past studies. Recent empirical studies were able to confirm the effects previously assumed merely based on case studies. DT has been shown to significantly impact new product development and innovation (Chen *et al.*, 2018; Nagaraj *et al.*, 2020; Nakata and Hwang, 2020). Moreover, it promotes teams' overall performance (Nakata and Hwang, 2020; Suci *et al.*, 2021). Performing DT leads to increased creativity on the group level (Lee *et al.*, 2019) and individual level (Cummings and Yur-Austin, 2021; Kim, 2020). Kim (2020) also showed that the individual creative potential influences the level of innovation. Other individual-level outcomes include increased motivation and empowerment, which is a mediator for project performance (Roth *et al.*, 2020) and increased levels of self-confidence (Liedtka, 2020; Rao *et al.*, 2021). In addition to solving problems, the findings at the individual level indicate that DT is also a means of empowering employees and developing skills, which leads to a better performance.

DT can be integrated into the organization's strategy (Coco *et al.*, 2020) and it can transform the organizational culture based on the characteristics of each stage in terms of user focus, collaboration, risk-taking, ambiguity, experimentation, learning from failure, and design-led strategic thinking (Elsbach and Stigliani, 2018; Kolko, 2015). Moreover, DT can reduce hierarchies and foster better decision-making (Liedtka, 2015). Combining analytical and intuitive thinking can be challenging in organizations that previously relied only on analytical thinking. When introducing DT, persuasion may also be needed to justify its use and opportunities. For this purpose, Dunne (2018) mentioned harvesting the "low-hanging fruits" first by application in projects where DT shows quick success and offers a way to train the participants. During implementation, it is beneficial to introduce a facilitator who can guide the team through the design process and intervene when necessary (Wrigley *et al.*, 2018). Here, it is important to give the participants the confidence and free space to develop new creative ways. In order to take full advantage of the design capabilities, training and time are needed, but this should not be a deterrent because even inexperienced teams can make progress (Seidel and Fixson, 2013).

### *4.2 Limitations and future research*

As with every research, this work comes with several limitations. The basis of the systematic literature review is the dataset of literature on the topic. Here, the inclusion criteria were limited to articles with "design thinking" in the title. The dataset could be extended by including other keywords, such as specific design tools. However, the additional screening of articles with different keywords would have increased the number of articles and thus probably limited the quality of the analysis. For future research with a more specific focus on one of the dimensions of DT, additional keywords would be recommended.

In addition, in the sector analysis, only articles with a direct thematic reference to a particular sector were included. Another approach could be to evaluate all case studies from the articles and determine the industry distribution. The framework provides a very general overview of the context factors, process, and outcome. Additionally, effects due to mediators and moderators within DT should be observed. In the future, it is necessary to explore the interrelationships more precisely in quantitative terms.

DT continues to offer much scope for future research. In general, the versatility of DT should be preserved in the future (Beckman, 2020; Johansson-Sköldberg *et al.*, 2013). Research has started to explore the application of DT in diverse industries. Whereas DT seems to be applicable in many contexts, it is still unclear if differences exist. Additionally, the process and principles of DT could be transferred to other firm activities, such as entrepreneurial marketing (Eggers *et al.*, 2020), which can also be a specific vehicle to market innovative, design-driven products or services.

In his article, Brown (2008) described the characteristics of the design thinker with the five properties empathy, integrative thinking, optimism, willingness to experiment, and collaboration. New research could explore which additional traits are necessary and what weightings the characteristics have for the outcome. This ties into the call for research on how to compose design teams. The insights can help in planning and assembling DT teams. Case studies are often used in research to investigate how DT is applied in practice. Thus, research usually follows an inductive process. Researching more abductively by asking "what might be" could help develop new potentials for DT.

## 5. Conclusion

In this paper, the DT literature is analyzed. Based on the dataset, it can be concluded that DT has gained increased relevance in research in recent years. We propose a consolidated definition for DT as an iterative innovation and problem-solving process, which is based on

specific principles (such as a focus on user needs, multidisciplinarity, etc.) and uses specific methods (such as creative thinking, visualization, experimentation, etc.).

Our proposed framework provides a holistic overview of the context factors, the process, and the outcomes. DT promotes the development of product innovations and the development of innovative behavior and capabilities at the organizational and individual levels. It requires and promotes a culture that allows participants to be creative and considers failures to be important insights. In addition, at the team level, collaboration should be possible, allowing for different opinions and breaking down cognitive biases.

Several research gaps remain. The effectiveness and efficiency of the DT process and its distinct methods should further be tested in empirical studies. Regarding the organizational factors, an urgent need exists for research on leadership styles useful for DT. Research could provide valuable insights related to the composition of teams in terms of team size and degree of interdisciplinarity. Besides, no research was found on individual characteristics that have an influence on the implementation of DT. Although great strides are being made toward DT becoming a respected process in the management literature, there is still a need for future research to unleash its full potential.

## References

Appleyard, M.M., Enders, A.H. and Velazquez, H. (2020), "Regaining R&D leadership: the role of design thinking and creative forbearance", *California Management Review*, Vol. 62 No. 2, pp. 12-29, doi: 10.1177/0008125619897395.

Ashman, R., Patterson, A. and Kozinets, R.V. (2021), "Netnography and design thinking: development and illustration in the vegan food industry", *European Journal of Marketing*, Vol. 55 No. 9, pp. 2491-2514, doi: 10.1108/EJM-02-2020-0155.

Beckman, S.L. (2020), "To frame or reframe: where might design thinking research go next?", *California Management Review*, Vol. 62 No. 2, pp. 144-162, doi: 10.1177/0008125620906620.

Beckman, S.L. and Barry, M. (2007), "Innovation as a learning process: embedding design thinking", *California Management Review*, Vol. 50 No. 1, pp. 25-56, doi: 10.2307/41166415.

Ben Mahmoud-Jouini, S., Midler, C. and Silberzahn, P. (2016), "Contributions of design thinking to project management in an innovation context", *Project Management Journal*, Vol. 47 No. 2, pp. 144-156, doi: 10.1002/pmj.21577.

Ben Mahmoud-Jouini, S., Fixson, S.K. and Boulet, D. (2019), "Making design thinking work: adapting an innovation approach to fit a large technology-driven firm", *Research Technology Management*, Vol. 62 No. 5, pp. 50-58, doi: 10.1080/08956308.2019.1638485.

Beverland, M.B., Wilner, S.J.S. and 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*, Vol. 43 No. 5, pp. 589-609, doi: 10.1007/s11747-015-0443-8.

Brand, M, Tiberius, V, Bican, P.M. and Brem, A. (2021), "Agility as an innovation driver: towards an agile front-end of innovation framework", *Review of Managerial Science*, Vol. 15 No. 1, pp. 157-187, doi: 10.1007/s11846-019-00373-0.

Brown, T. (2008), "Design thinking", *Harvard Business Review*, Vol. 86 No. 6, pp. 84-92.

Buchanan, R. (2019), "Systems thinking and design thinking: the search for principles in the world we are making", *She Ji*, Vol. 5 No. 2, pp. 85-104, doi: 10.1016/j.sheji.2019.04.001.

Buhl, A., Schmidt-Keilich, M., Muster, V., Blazejewski, S., Schrader, U., Harrach, C., Schäfer, M. and Süßbauer, E. (2019), "Design thinking for sustainability: why and how design thinking can foster sustainability-oriented innovation development", *Journal of Cleaner Production*, Vol. 231, pp. 1248-1257, doi: 10.1016/j.jclepro.2019.05.259.

Butler, A.G. and Roberto, M.A. (2018), "When cognition interferes with innovation: overcoming cognitive obstacles to design thinking: design thinking can fail when cognitive obstacles

interfere; appropriate cognitive countermeasures can help disarm the traps", *Research Technology Management*, Vol. 61 No. 4, pp. 45-51, doi: 10.1080/08956308.2018.1471276.

Cagnin, C. (2018), "Developing a transformative business strategy through the combination of design thinking and futures literacy", *Technology Analysis and Strategic Management*, Vol. 30 No. 5, pp. 524-539, doi: 10.1080/09537325.2017.1340638.

Cankurtaran, P. and Beverland, M.B. (2020), "Using design thinking to respond to crises: B2B lessons from the 2020 COVID-19 pandemic", *Industrial Marketing Management*, Vol. 88, pp. 255-260, doi: 10.1016/j.indmarman.2020.05.030.

Carlgren, L., Elmquist, M. and Rauth, I. (2016a), "The challenges of using design thinking in industry – experiences from five large firms", *Creativity and Innovation Management*, Vol. 25 No. 3, pp. 344-362, doi: 10.1111/caim.12176.

Carlgren, L., Rauth, I. and Elmquist, M. (2016b), "Framing design thinking: the concept in idea and enactment", *Creativity and Innovation Management*, Vol. 25 No. 1, pp. 38-57, doi: 10.1111/caim.12153.

Chen, S. and Venkatesh, A. (2013), "An investigation of how design-oriented organisations implement design thinking", *Journal of Marketing Management*, Vol. 29 Nos 15-16, pp. 1680-1700, doi: 10.1080/0267257X.2013.800898.

Chen, S., Benedicktus, R., Kim, Y. and Shih, E. (2018), "Teaching design thinking in marketing: linking product design and marketing strategy in a product development class", *Journal of Marketing Education*, Vol. 40 No. 3, pp. 176-187, doi: 10.1177/0273475317753678.

Chouki, M., de Mozota, B.B., Kallmuenzer, A., Kraus, S. and Dabic, M. (2021), "Design thinking and agility in digital production: the key role of user experience design", *IEEE Transactions on Engineering Management*, in press, doi: 10.1109/TEM.2021.3099094.

Clune, S.J. and Lockrey, S. (2014), "Developing environmental sustainability strategies, the double diamond method of LCA and design thinking: a case study from aged care", *Journal of Cleaner Production*, Vol. 85, pp. 67-82, doi: 10.1016/j.jclepro.2014.02.003.

Coco, N., Calcagno, M. and Lusiani, M. (2020), "Struggles as triggers in a design-thinking journey", *Creativity and Innovation Management*, Vol. 29 No. S1, pp. 103-115, doi: 10.1111/caim.12384.

Cummings, C. and Yur-Austin, J. (2021), "Design thinking and community impact: a case study of project-based learning in an MBA capstone course", *Journal of Education for Business*, Vol. 97 No. 2, pp. 126-132, doi: 10.1080/08832323.2021.1887795.

Da Silva, R.H., Kaminski, P.C. and Armellini, F. (2020), "Improving new product development innovation effectiveness by using problem solving tools during the conceptual development phase: integrating design thinking and TRIZ", *Creativity and Innovation Management*, Vol. 29 No. 4, pp. 685-700, doi: 10.1111/caim.12399.

Dalsgaard, P. (2014), "Pragmatism and design thinking", *International Journal of Design*, Vol. 8 No. 1, pp. 143-155.

Daniel, A.D. (2016), "Fostering an entrepreneurial mindset by using a design thinking approach in entrepreneurship education", *Industry and Higher Education*, Vol. 30 No. 3, pp. 215-223, doi: 10.1177/0950422216653195.

De Paula, D., Cormican, K. and Dobrigkeit, F. (2022), "From acquaintances to partners in innovation: an analysis of 20 years of design thinking's contribution to new product development", *IEEE Transactions on Engineering Management*, Vol. 69 No. 4, pp. 1664-1677, doi: 10.1109/TEM.2021.3084884.

Dell'Era, C., Magistretti, S., Cautela, C., Verganti, R. and Zurlo, F. (2020), "Four kinds of design thinking: from ideating to making, engaging, and criticizing", *Creativity and Innovation Management*, Vol. 29 No. 2, pp. 324-344, doi: 10.1111/caim.12353.

Denyer, D. and Tranfield, D. (2009), "Producing a systematic review", in Buchanan, D.A. and Bryman, A. (Eds), *The Sage Handbook of Organizational Research Methods*, Sage Publications, pp. 671-689.

Deyanova, K., Brehmer, N., Lapidus, A., Tiberius, V. and Walsh, S. (2022), "Hatching start-ups for sustainable growth: a bibliometric review on business incubators", *Review of Managerial Science*, Vol. 16 No. 7, pp. 2083-2109, doi: 10.1007/s11846-022-00525-9.

Dijksterhuis, E. and Silvius, G. (2017), "The design thinking approach to projects", *Journal of Modern Project Management*, Vol. 4 No. 3, pp. 32-41.

Dunne, D. (2018), "Implementing design thinking in organizations: an exploratory study", *Journal of Organization Design*, Vol. 7 No. 1, doi: 10.1186/s41469-018-0040-7.

Dym, C.L., Agogino, A.M., Eris, O., Frey, D.D. and Leifer, L.J. (2006), "Engineering design thinking, teaching, and learning", *Journal of Engineering Education*, Vol. 94 No. 1, pp. 103-120, doi: 10.1002/j.2168-9830.2005.tb00832.x.

Earle, A.G. and Leyva-de la Hiz, D.I. (2020), "The wicked problem of teaching about wicked problems: design thinking and emerging technologies in sustainability education", *Management Learning*, Vol. 52 No. 5, doi: 10.1177/1350507620974857.

Eggers, F., Niemand, T., Kraus, S. and Breier, M. (2020), "Developing a scale for entrepreneurial marketing: revealing its inner frame and prediction of performance", *Journal of Business Research*, Vol. 113, pp. 72-82, doi: 10.1016/j.jbusres.2018.11.051.

Elsbach, K.D. and Stigliani, I. (2018), "Design thinking and organizational culture: a review and framework for future research", *Journal of Management*, Vol. 44 No. 6, pp. 2274-2306, doi: 10.1177/0149206317744252.

Furue, N. and Washida, Y. (2017), "Scanning and design thinking: organizational roles for innovation", *Foresight*, Vol. 19 No. 4, pp. 337-353, doi: 10.1108/FS-11-2016-0051.

Geissdoerfer, M., Bocken, N.M.P. and Hultink, E.J. (2016), "Design thinking to enhance the sustainable business modelling process – a workshop based on a value mapping process", *Journal of Cleaner Production*, Vol. 135, pp. 1218-1232, doi: 10.1016/j.jclepro.2016.07.020.

Glen, R., Suciu, C. and Baughn, C. (2014), "The need for design thinking in business schools", *Academy of Management Learning and Education*, Vol. 13 No. 4, pp. 653-667, doi: 10.5465/amle.2012.0308.

Glen, R., Suciu, C., Baughn, C.C. and Anson, R. (2015), "Teaching design thinking in business schools", *International Journal of Management Education*, Vol. 13 No. 2, pp. 182-192, doi: 10.1016/j.ijme.2015.05.001.

Glinyanova, M., Bouncken, R.B., Tiberius, V. and Cuenca Ballester, A.C. (2021), "Five decades of corporate entrepreneurship research: measuring and mapping the field", *International Entrepreneurship and Management Journal*, Vol. 17 No. 4, pp. 1731-1757, doi: 10.1007/s11365-020-00711-9.

Henseler, J., Guerreiro, M. and de Matos, N. (2021), "The interplay of marketing and design", *Review of Managerial Science*, Vol. 15 No. 5, pp. 1129-1137, doi: 10.1007/s11846-021-00470-z.

Hölzle, K. and Rhinow, H. (2019), "The dilemmas of design thinking in innovation projects", *Project Management Journal*, Vol. 50 No. 4, pp. 418-430, doi: 10.1177/8756972819853129.

Holloway, M. (2009), "How tangible is your strategy? How design thinking can turn your strategy into reality", *Journal of Business Strategy*, Vol. 30 Nos 2/3, pp. 50-56, doi: 10.1108/02756660910942463.

Johansson-Sköldberg, U., Woodilla, J. and Çetinkaya, M. (2013), "Design thinking: past, present and possible futures", *Creativity and Innovation Management*, Vol. 22 No. 2, pp. 121-146, doi: 10.1111/caim.12023.

Kim, T. (2020), "The effect of creative potential on innovation behavior: focusing on design thinking", *Journal of Distribution Science*, Vol. 18 No. 8, pp. 65-74, doi: 10.15722/jds.18.8.202008.65.

Knight, E., Daymond, J. and Paroutis, S. (2020), "Design-led strategy: how to bring design thinking into the art of strategic management", *California Management Review*, Vol. 62 No. 2, pp. 30-52, doi: 10.1177/0008125619897594.

Kolko, J. (2015), "Design thinking comes of age", *Harvard Business Review*, Vol. 93 No. 9, pp. 66-71.

Kraus, S., Breier, M. and Dasí-Rodríguez, S. (2020), "The art of crafting a systematic literature review in entrepreneurship research", *International Entrepreneurship and Management Journal*, Vol. 16 No. 3, pp. 1023-1042.

Kraus, S., Breier, M., Lim, W.M., Dabić, M., Kumar, S., Kanbach, D., Mukherjee, D., Corvello, V., Piñeiro-Chousa, J., Liguori, E., Palacios-Marqués, D., Schiavone, F., Ferraris, A., Fernandes, C. and Ferreira, J.J. (2022), "Literature reviews as independent studies: guidelines for academic practice", *Review of Managerial Science*, Vol. 16 No. 8, pp. 2577-2595.

Kurtmollaiev, S., Pedersen, P.E., Fjuk, A. and Kvale, K. (2018), "Developing managerial dynamic capabilities: a quasi-experimental field study of the effects of design thinking training", *Academy of Management Learning and Education*, Vol. 17 No. 2, pp. 184-202, doi: 10.5465/amle.2016.0187.

Leavy, B. (2010), "Design thinking – a new mental model of value innovation", *Strategy and Leadership*, Vol. 38 No. 3, pp. 5-14, doi: 10.1108/10878571011042050.

Leavy, B. (2012), "Masterclass collaborative innovation as the new imperative - design thinking, value co-creation and the power of 'pull'", *Strategy and Leadership*, Vol. 40 No. 2, pp. 25-34, doi: 10.1108/10878571211209323.

Lee, J., Jung, Y. and Yoon, S. (2019), "Fostering group creativity through design thinking projects", *Knowledge Management and E-Learning*, Vol. 11 No. 3, pp. 378-392, doi: 10.34105/j.kmel.2019.11.020.

Li, M. (2002), "Fostering design culture through cultivating the user-designers' design thinking and systems thinking", *Systemic Practice and Action Research*, Vol. 15 No. 5, pp. 385-410, doi: 10.1023/A:1019933410857.

Liedtka, J. (2014), "Innovative ways companies are using design thinking", *Strategy and Leadership*, Vol. 42 No. 2, pp. 40-45, doi: 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*, Vol. 32 No. 6, pp. 925-938, doi: 10.1111/jpim.12163.

Liedtka, J. (2020), "Putting technology in its place: design thinking's social technology at work", *California Management Review*, Vol. 62 No. 2, pp. 53-83, doi: 10.1177/0008125619897391.

Liedtka, J. and Kaplan, S. (2019), "How design thinking opens new frontiers for strategy development", *Strategy and Leadership*, Vol. 47 No. 2, pp. 3-10, doi: 10.1108/SL-01-2019-0007.

Linnenluecke, M.K., Marrone, M. and Singh, A.K. (2020), "Conducting systematic literature reviews and bibliometric analyses", *Australian Journal of Management*, Vol. 45 No. 2, pp. 175-194, doi: 10.1177/0312896219877678.

Luotola, H., Hellström, M., Gustafsson, M. and Perminova-Harikoski, O. (2017), "Embracing uncertainty in value-based selling by means of design thinking", *Industrial Marketing Management*, Vol. 65, pp. 59-75, doi: 10.1016/j.indmarman.2017.05.004.

Lynch, M., Kamovich, U., Longva, K.K. and Steinert, M. (2021), "Combining technology and entrepreneurial education through design thinking: students' reflections on the learning process", *Technological Forecasting and Social Change*, Vol. 164, doi: 10.1016/j.techfore.2019.06.015.

Ma, S., Kor, Y.Y. and Seidl, D. (2019), "CEO advice seeking: an integrative framework and future research agenda", *Journal of Management*, Vol. 46 No. 6, pp. 771-805, doi: 10.1177/0149206319885430.

Macdonald, J.B. and Elahee, M.N. (2016), "Design thinking in online communities: suggestions for overcoming crowdsourcing issues", *International Journal of Innovation and Learning*, Vol. 19 No. 3, pp. 286-298, doi: 10.1504/IJIL.2016.075655.

Magistretti, S., Ardito, L. and Messeni Petruzzelli, A. (2021a), "Framing the microfoundations of design thinking as a dynamic capability for innovation: reconciling theory and practice", *Journal of Product Innovation Management*, Vol. 38 No. 6, pp. 645-667, doi: 10.1111/jpim.12586.

Magistretti, S., Dell'Era, C., Verganti, R. and Bianchi, M. (2021b), "The contribution of design thinking to the R of R&D in technological innovation", *R&D Management*, Vol. 52 No 1, pp. 108-125, doi: 10.1111/radm.12478.

Mansoori, Y. and Lackéus, M. (2020), "Comparing effectuation to discovery-driven planning, prescriptive entrepreneurship, business planning, lean startup, and design thinking", *Small Business Economics*, Vol. 54 No. 3, pp. 791-818, doi: 10.1007/s11187-019-00153-w.

Martin, R. (2010), "Design thinking: achieving insights via the 'knowledge funnel'", *Strategy and Leadership*, Vol. 38 No. 2, pp. 37-41, doi: 10.1108/10878571011029046.

Meinel, M., Eismann, T.T., Baccarella, C.V., Fixson, S.K. and Voigt, K.I. (2020), "Does applying design thinking result in better new product concepts than a traditional innovation approach? An experimental comparison study", *European Management Journal*, Vol. 38 No. 4, pp. 661-671, doi: 10.1016/j.emj.2020.02.002.

Micheli, P., Wilner, S.J.S., Bhatti, S.H., Mura, M. and Beverland, M.B. (2019), "Doing design thinking: conceptual review, synthesis, and research agenda", *Journal of Product Innovation Management*, Vol. 36 No. 2, pp. 124-148, doi: 10.1111/jpim.12466.

Mount, M., Round, H. and Pitsis, T.S. (2020), "Design thinking inspired crowdsourcing: toward a generative model of complex problem solving", *California Management Review*, Vol. 62 No. 3, pp. 103-120, doi: 10.1177/0008125620918626.

Nagaraj, V., Berente, N., Lyytinen, K. and Gaskin, J. (2020), "Team design thinking, product innovativeness, and the moderating role of problem unfamiliarity", *Journal of Product Innovation Management*, Vol. 37 No. 4, pp. 297-323, doi: 10.1111/jpim.12528.

Nakata, C. (2020), "Design thinking for innovation: considering distinctions, fit, and use in firms", *Business Horizons*, Vol. 63 No. 6, pp. 763-772, doi: 10.1016/j.bushor.2020.07.008.

Nakata, C. and Hwang, J. (2020), "Design thinking for innovation: composition, consequence, and contingency", *Journal of Business Research*, Vol. 118, pp. 117-128, doi: 10.1016/j.jbusres.2020.06.038.

Pham, C.T.A., Magistretti, S. and Dell'Era, C. (2022), "The role of design thinking in big data innovations", *Innovation*, Vol. 24 No. 2, pp. 290-314, doi: 10.1080/14479338.2021.1894942.

Przybilla, L., Klinker, K., Lang, M., Schreieck, M., Wiesche, M. and Krcmar, H. (2020), "Design thinking in digital innovation Projects—exploring the effects of intangibility", *IEEE Transactions on Engineering Management*, Vol. 69 No. 4, pp. 1635-1649, doi: 10.1109/tem.2020.3036818.

Radnejad, A.B., Ziolkowski, M.F. and Osiyevskyy, O. (2020), "Design thinking and radical innovation: enter the smartwatch", *Journal of Business Strategy*, Vol. 42 No. 5, pp. 332-342, doi: 10.1108/JBS-02-2020-0044.

Rao, H., Puranam, P. and Singh, J. (2021), "Does design thinking training increase creativity? Results from a field experiment with middle-school students", *Innovation: Organization and Management*. doi: 10.1080/14479338.2021.1897468.

Rau, C., Zbiek, A. and Jonas, J.M. (2017), "Creating competitive advantage from services: a design thinking case study from the commodities industry service design thinking can provide the tools to help companies design value propositions that meet customer needs and sustain competitive advantage", *Research Technology Management*, Vol. 60 No. 3, pp. 48-56, doi: 10.1080/08956308.2017.1301003.

Roth, K., Globocnik, D., Rau, C. and Neyer, A.K. (2020), "Living up to the expectations: the effect of design thinking on project success", *Creativity and Innovation Management*, Vol. 29 No. 4, pp. 667-684, doi: 10.1111/caim.12408.

Sándorová, Z., Repáňová, T., Palenčíková, Z. and Beták, N. (2020), "Design thinking - a revolutionary new approach in tourism education?", *Journal of Hospitality, Leisure, Sport and Tourism Education*, Vol. 26, doi: 10.1016/j.jhlste.2019.100238.

Sarooghi, H., Sunny, S., Hornsby, J. and Fernhaber, S. (2019), "Design thinking and entrepreneurship education: where are we, and what are the possibilities?", *Journal of Small Business Management*, Vol. 57 No. S1, pp. 78-93, doi: 10.1111/jsbm.12541.

Seidel, V.P. and 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*, Vol. 30 No. S1, pp. 19-33, doi: 10.1111/jpim.12061.

Shafiee, S., Haug, A., Shafiee Kristensen, S. and Hvam, L. (2021), "Application of design thinking to product-configuration projects", *Journal of Manufacturing Technology Management*, Vol. 32 No. 1, pp. 219-241, doi: 10.1108/JMTM-04-2020-0137.

Shapira, H., Ketchie, A. and Nehe, M. (2017), "The integration of design thinking and strategic sustainable development", *Journal of Cleaner Production*, Vol. 140 No. 1, pp. 277-287, doi: 10.1016/j.jclepro.2015.10.092.

Snyder, K., Ingelsson, P. and Bäckström, I. (2018), "Using design thinking to support value-based leadership for sustainable quality development", *Business Process Management Journal*, Vol. 24 No. 6, pp. 1289-1301, doi: 10.1108/BPMJ-02-2018-0045.

Starostka, J., Evald, M.R., Clarke, A.H. and Hansen, P.R. (2021), "Taxonomy of design thinking facilitation", *Creativity and Innovation Management*. doi: 10.1111/caim.12451.

Stephens, J.P. and Boland, B.J. (2015), "The aesthetic knowledge problem of problem-solving with design thinking", *Journal of Management Inquiry*, Vol. 24 No. 3, pp. 219-232, doi: 10.1177/1056492614564677.

Suci, A., Maryanti, S., Hardi, H. and Sudiar, N. (2021), "Embedding design thinking paradigm in a University's business assistance to small business", *Systemic Practice and Action Research*. doi: 10.1007/s11213-021-09565-w.

Thompson, L. and Schonthal, D. (2020), "The social psychology of design thinking", *California Management Review*, Vol. 62 No. 2, pp. 84-99, doi: 10.1177/0008125619897636.

Tiberius, V., Schwarzer, H. and Roig-Dobón, S. (2021), "Radical innovations: between established knowledge and future research opportunities", *Journal of Innovation and Knowledge*, Vol. 6 No. 3, pp. 145-153, doi: 10.1016/j.jik.2020.09.001.

Tranfield, D., Denyer, D. and Smart, P. (2003), "Towards a methodology for developing evidence-informed management knowledge by means of systematic review", *British Journal of Management*, Vol. 14, pp. 207-222, doi: 10.1111/1467-8551.00375.

Vetterli, C., Uebernickel, F., Brenner, W., Petrie, C. and Stermann, D. (2016), "How deutsche bank's IT division used design thinking to achieve customer proximity", *MIS Quarterly Executive*, Vol. 15 No. 1, pp. 37-53.

Welsh, M.A. and Dehler, G.E. (2013), "Combining critical reflection and design thinking to develop integrative learners", *Journal of Management Education*, Vol. 37 No. 6, pp. 771-802, doi: 10.1177/1052562912470107.

Wrigley, C., Mosely, G. and Tomitsch, M. (2018), "Design thinking education: a comparison of massive open online courses", *She Ji*, Vol. 4 No. 3, pp. 275-292, doi: 10.1016/j.sheji.2018.06.002.

Wrigley, C., Nusem, E. and Straker, K. (2020), "Implementing design thinking: understanding organizational conditions", *California Management Review*, Vol. 62 No. 2, pp. 125-143, doi: 10.1177/0008125619897606.

Wyman, G., Holland, V.M. and Yates, S. (2012), "Conversations with the marketplace: an application of design thinking and sociodrama action methods in an innovation workshop", *International Journal of Innovation Science*, Vol. 4 No. 2, pp. 77-87, doi: 10.1260/1757-2223.4.2.77.

Zheng, D.L. (2018), "Design thinking is ambidextrous", *Management Decision*, Vol. 56 No. 4, pp. 736-756, doi: 10.1108/MD-04-2017-0295.

**Corresponding author**
Sascha Kraus can be contacted at: sascha.kraus@zfke.de