ICIEMC 2021
International Conference on Innovation and Entrepreneurship in Marketing and Consumer Behavior
July 1 - 2, Aveiro, Portugal (virtual format)

Design Thinking and Innovation strategy by SMEs for competitiveness: a review

Fatma Demir, Irina Saur-Amaral, Daniel Polónia

All at Universidade de Aveiro

Abstract

All over the world, SMEs are considered as a key part of the economic fabric. Once limited to their domestic markets, since the late 1990´s they have been exposed to a globalized marketplace, with more demanding customers and fierce competition. This exposure has become a significant challenge to SMEs, since most of them have limited resources and capabilities that frequently lack the ability to create and maintain a structured innovation management system. With this background, this paper performs a systematic literature review on the relationship between the Design Thinking, innovation and competitiveness in SMEs. 308 papers published between 1998 and 2021 were obtained after searching ISI Web of Science – Current Contents, and they were analysed using Endnote 20 and NVivo 20 from the bibliometric and content perspective. A final sample of 70 papers directly linked to the research question were obtained after applying all exclusion criteria. Results point to the need to develop an innovation framework for SMEs, integrating Design Thinking processes and aligned with corporate strategy.

Keywords

Design Thinking, SME, Innovation, Systematic literature review, Innovation strategy

1. INTRODUCTION

New technologies and changing markets are creating new challenges and opportunities for companies. In the search for new solutions, the importance of corporate innovation management is increasing - even for small and medium-sized enterprises (SMEs), that often lack resources to face these new challenges, even though they play a key role in the economic fabric of nations and will remain so in the expected near future (van de Vrande, de Jong, Vanhaverbek, & de Rochemont, 2009).

There are three main motivations for choosing a literature review: the kind of research interest, the characteristics and coverage of previous reviews, and the information explosion (Williams, Clark, Clark, & Raffo, 2020). Maintaining an overview in specialized fields proves difficult given today's information explosion; necessary information is often hard to find. The identified research gap addresses a growing interest but a lack of overview of the field of Design Thinking in SMEs, as well as the innovation capacity (van de Vrande, de Jong, Vanhaverbek, & de Rochemont, 2009). A research interest in this regard can in principle be answered with literature reviews, as they create an orientation service, show connections and disputes of previous works, and create an understanding of theoretical phenomena and terminology of the field (Williams, Clark, Clark, & Raffo, 2020). Previous literature reviews do not adequately fill this research gap, as demonstrated by the corresponding systematic literature review results in the following section.

The selection of a specific systematic review methodology, especially in terms of its complexity, depends on the principal research objective and the general restrictions of the research context (Crossan & Apaydin, 2010).

This insight will help researchers to have more realistic expectations of design thinking and innovation processes in SMEs through the systematic approach and will help mentors to guide newcomers through the phases of planning, implementation and documentation (Carver J. C., 2013). The most important initial considerations for the preparation of the systematic literature review relate to the formulation of a clear, focused research question, as all subsequent processes depend directly on its formulation. A broad research question can be chosen for the review, which corresponds to the overall aim of the review. (Wardati & M.., 2019). Since this work is interested in capturing the full scope of the research field, as well as specifically the developments in innovation strategy, the research questions are intentionally broad.

- *Which external sources of knowledge contribute to the definition of a Design Thinking innovation strategy and how can they be systematized?*
- *Which obstacles and barriers lead to the failure of implementing systematized innovation management systems in companies?*
- *How has the scientific output of the Design Thinking innovation strategy evolved in relation to SMEs?*

To answer the questions posed, the paper is structured as follows. First, we introduce the concept of design thinking in SMEs. Next, we present the methodology and results of the systematic literature review. Finally, we discuss the results and present the conclusions.

2. CREATIVE DEVELOPMENT APPROACH DESIGN THINKING IN SMES

In SMEs, the support of the entrepreneur(s) is the basis for the implementation of Design Thinking. This point is more crucial than in large companies or corporations, because it can be assumed that in SMEs the chance is smaller than Design Thinking can be introduced in a single department without the knowledge and approval of the entrepreneur. The entrepreneur in an SME is responsible about the successful implementation of innovation strategies, like Design Thinking (Mortati & Cruickshank, 2011).

This is not possible without any assistance and responsibility from the entrepreneur. While in a large company an implementation, especially at the beginning of the project, can be done on a small scale and with first project

results the support of top management can be gained (Judy & Savatore, 2011), in SMEs the strong focus and involvement of the entrepreneur in operations is a prerequisite for the implementation of design thinking (Geldermann, Lerche, & Sepulveda, 2018).
If, in addition to the operational business, there is little time for the creation and use of reflective Design Spaces (e.g. as a relocation of the design thinking space, into a cloud-based virtual space) (Lim, Kim, Kim, & Kim, 2019), it can be assumed that the willingness to deal with an approach that is probably unknown to the entrepreneur and does not correspond to regular business thinking is rather small (Moultrie, Clarkson, & Probert, 2006).
For the successful implementation of Design Thinking in SMEs, further success factors specifically tailored to SMEs are required. Time resources and budget are essential for successful innovation implementation (Acklin, 2013). But here, too, the prerequisites of SMEs and large companies differ: In large enterprises, there are often specific research and development departments (also creative spaces) as well as innovation managers or Design Thinking experts and thus places and people whose tasks include evaluating new approaches such as Design Thinking (Acklin, 2013).
In SMEs, employees usually do this at most besides their daily activities at work, and there are fewer specialized departments with experts. Also, SMEs are usually very cautious about implementing innovative strategies such as Design Thinking without knowing the exact benefits beforehand (Acklin, 2013). Large companies, on the other hand, are more likely to give the search for optimization and innovation the necessary space.

3. SYSTEMATIC LITERATURE REVIEW: INNOVATION STRATEGY DESIGN THINKING IN SMES

3.1. RESEARCH DESIGN

The basis for this work is a systematic literature review, a methodology that differs from classical reviews in that it aims to synthesize research in a systematic, transparent and in an iterative process (Crossan & Apaydin, 2010). The idea behind systematic reviews is characterized as follows: they are transparent, focused, equal and accessible, provide concreteness, perform homogeneity of research and practice communities. These lead wholly to a synthesis. It provides a manifesto for science and for practice, as the compilation of knowledge research is systematically managed.

The goal of our systematic review is to structure the field of research on Design Thinking and innovations in the context of SMEs, to identify researched topics, to list the most important research gaps and thus to contribute to theory development.

A systematic review includes both a quantitative, bibliographic analysis and a more qualitative, thematic analysis (Saur-Amaral, Reis Soares, & Proenca, 2018). Although systematic reviews can include other types of publications, we followed other researchers and focused on peer-reviewed academic journal articles in English to ensure quality and reduce the sample to a manageable amount. In terms of the time frame covered, we argue that Design Thinking has received considerable attention and strong interest in implementation from practitioners and international researchers since Brown published "Design Thinking" in the Harvard Business Review (Brown, 2008). Therefore, this review covers academic papers from 1998 to 2021.

3.2. DATA COLLECTION

In order to identify the relevant innovation literature on Design Thinking in SMEs, a systematic literature review was conducted. The first step was to define the search terms for this literature abstract and keywords. The exact search terms are listed in a structured review. The large database Web of Science for the years 1998 - 2021 is searched with the linked search term from the exact word sequences “Design Thinking” AND “Innov*” in title, manner (see Table 1). The language "English" is selected for the search. In order to ensure the quality of the literature contributions, only ISI/WoS indexed journals are included in the analysis.

Table 1 Exact search term for the systematic literature review

Web of Science – Current Contents Connect	"Design Thinking" AND "Innov*" in Topic	308

Note: All searches were conducted on April 4,2021

Search queries to the Web of Science database and initial hit lists were used to refine or, if necessary, extend the search terms used (see Table 2). This initially served to obtain a rough overview of the amount of literature available. Central works in the selected subject area and specific journals with complete table of contents and bibliographic information were then used as points of reference. As a consequence, the search terms were evaluated based on a cursory scan of the results.

Table 2 Preliminary search terms for the systematic literature review

	Search term	Results	Purpose	Criticism
Surface search	"Innov*" (Current Contents Connect)	169,307	Edition of all works that contain a combination of words all about "innovation", "innovate", "innovative" etc. included	Too many hits, not very specific, usually wrong context
	"Innov*" AND "SME*" (Current Contents Connect)	2,804	Restriction of the works from the first query to those containing the term "SME*"	Too general, context continues to vary greatly
	"Design Thinking" (Current Contents Connect)	602	Overview of the hits on the topic Design thinking in general	Consolidation of the topic of Design Thinking without direct reference to the topic of innovation
Advanced search	"Design Thinking" AND "Innov*" (Current Contents Connect)	308	Specification of the previously made request. Limitations to works that are explicit engage in Design Thinking in the field of innovation management.	Strongly limited search space
	"Design Thinking" AND "Innov*" – related to specific research areas	70	Sample of selected articles to analyse and import to NVivo	Very Strongly limited search space, for importing it to NVivo

It turned out that with a sufficient specification of the search queries, the result area could already be narrowed down to a manageable scope. However, the results still proved to be too general, which is why the queries were subsequently specified again. The investigation was finally limited to the results obtained by linking the terms "Design Thinking" and "Innov*". After eliminating the duplicates, 308 articles remained.

In the following analysis phase, the collected works were exported to Endnote and NVivo and examined them. In addition to extracting potential knowledge sources, specific content for SMEs was filtered out. Likewise,

barriers or failures of innovation were selected to show a powerful tool for elimination through failure analysis. These instruments were extracted from the articles using content-based data analysis.

The aim of this systematization was to synthesise the results and to identify differences, similarities and failure factors of the innovations and its need for research.

This was used to identify all 308 literature entries and transfer them to Endnote and also create an Excel list.

Afterward, the entries in Endnote were searched for duplicates and removed. Of the 308 papers, the title and abstract were checked for their content relevance and relevance to Design Thinking and innovation, and entries that did not match were removed.

The following exclusion criteria were applied: (1) contributions that considered Design as human-centred problem solving; (2) those that dealt with the specific design of things, methods, or products; (3) those that were purely located in Design Science, for example, advancing specific methods or dealing with the mindset of designers, and thus not concerned with the application of Design Methods for innovation; and (4) those that applied the term "Design Thinking" generically and especially in SMEs.

This left us with a final sample of 70 literature entries that were included in the analysis.

3.3. DESCRIPTIVE DATA ANALYSIS

A descriptive analysis of the 308 articles revealed that the first article from the sample the linked Design Thinking and innovation appeared in 2007 (see Figure 1). From 2008 onwards, an increase in the number of articles can be observed, which might be attributed, among other things, to the Special Issue of the *Harvard Business Review* from 2008 with the much-cited (1,060 citations) article *"Design Thinking: Thinking like a designer can transform the way you develop products, services, processes - and even strategy"* by IDEO CEO Tim Brown and the resulting increased interest in the topic (Brown, 2008). In 2020, there was a peak of 77 contributions.

Figure 1: Publications per year

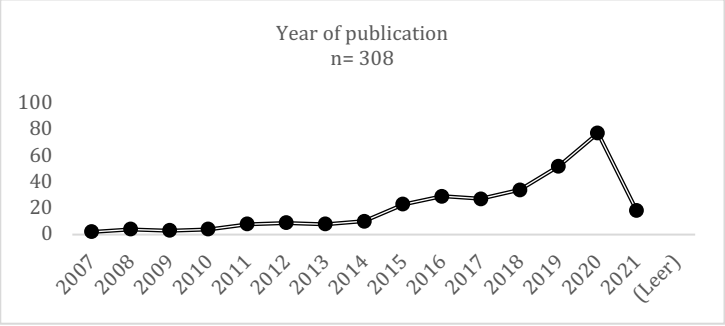
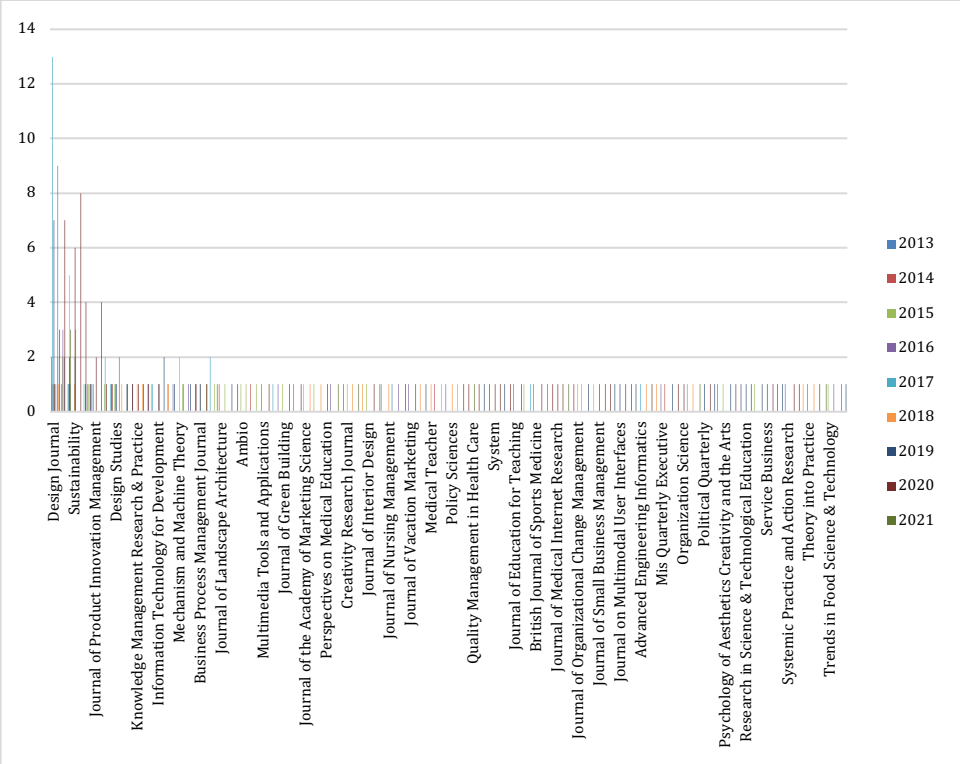


Figure 2 considers the 152 most frequently occurring journals. The journal with more publications is Design Journal, by far a regular in the publications associated to design thinking and innovation, followed by International Journal of Engineering Education, Creativity and Innovation Management, Journal of Cleaner Production and Sustainability.

Figure 2: Most important journals



3.4. CONTENT ANALYSIS

We read a total of 308 abstracts and excluded 238 papers that included the topics used in the search but did not address the innovation approach in terms of feasibility in different sizes of firms as a central topic area or as part of their theoretical innovation aspects. For a better illustration, an Excel file was created for the 308 articles and a graphical representation was realized for a better analysis (see figure 2).

The elaborated final selection contains 70 articles published between 1998 and 2021. Detailed content analysis in NVivo was conducted based on this final sample, which directly related to Design Thinking and innovation. The process included thematic coding to determine the main attributes of Design Thinking, looking in detail at the SMEs.

We chose the Design Thinking criteria for the development of the framework. First, we assessed the criteria and how they related to the topic, based on ambiguity. Our research team came to a common understanding that there was little or no talk about failure factors or failure of general innovation and Design Thinking projects. Therefore, criteria related to these aspects were further considered. We then identified two groups: failure of Design Thinking interventions as a parameter related to direct and indirect shortcomings in the articles (e.g., lack of understanding, lack of flexibility) and those that can be crystallized by notable successes (e.g., management support, customer-centric). --- this should relate directly to the two tables (4 and 5) – check that.

The factors for the analysis were specifically adapted to SME characteristics. Attention was paid to the following SME-typical characteristics.

(1) SMEs are characterized by the personality of the entrepreneur or the entrepreneurial family, who often combines management and entrepreneurship. Accordingly, SMEs are more dependent on the leader or the management body than a large company is on the board of executives (Kammerlander, Burger, Fust, & Fueglistaller, 2015).

(2) In SMEs, it can be observed more frequently than in large companies that the managing directors carry out operational activities and are thus less able to concentrate on management activities. Strategic instruments are rarely used in SMEs compared to corporations. The less intensive involvement with strategic activities is not necessarily a conscious choice. This poses a major challenge, as time is found for innovative topics or the intensive examination of the future of the company in addition to the varied tasks in day-to-day business (Gasda & Fueglistaller, 2015).

(3) Many employees in SMEs are skilled workers who are trained within the company itself. Both entrepreneurs and employees in SMEs are highly involved and often busy with their own work. Accordingly, innovations require additional capacities, which are rarely available in SMEs. But design thinking, which ideally involves people from several departments due to its interdisciplinarity and also challenges the usual analytical business thinking, could be particularly difficult to implement due to this SME characteristic (Liedtka & Ogilvie, 2011).

(4) Faster product lifecycles and constantly changing technologies require an agile approach that sometimes exceeds the flexibility that SMEs are granted. As a result, there is little time for implementing ideas alongside day-to-day business (Sarooghi, Sunny, Hornsby, & Fernhaber, 2019).

(5) In most cases, small and medium-sized enterprises are more limited in their financial possibilities than large companies, which is especially noticeable in investment projects. SMEs are heavily dependent on the invested capital of the business owner (Kammerlander, Burger, Fust, & Fueglistaller, 2015).

(6) In SMEs, the entrepreneur often knows all employees personally. The company structure is lean, the hierarchy levels are usually flat, and the degree of formalization is low (Durst & Edvardsson, 2012).

From this selection of SME characteristics, the criteria of Design Thinking in SMEs are formed and extracted in research papers.

Table 3 Specific needs for Design Thinking in SMEs

N.°	Mandatory Necessary	Explanation	References
1.	Management support for the DT team	In SMEs, the chances are smaller that Design Thinking can be introduced in a single department without the knowledge and approval of the entrepreneur. It is imperative to have the commitment and support of the entrepreneur for the project to be successful.	Appleyard, Enders, and Velazquez (2020) (Bason & Austin, 2019) (Crites & Rye, 2020) (Eppler & Kernbach, 2016; Lee & Ma, 2020; Snyder, Ingelsson, & Bäckström, 2018) (Vagal et al., 2020)
2.	Time Resources	In SMEs, employee involvement in the innovative process is usually developed on the side at most. There are fewer specialized departments. SMEs have to think twice whether they start a Design Thinking project without being able to calculate the exact benefits in advance.	(Agogino et al., 2016) (Ahn, Rundall, Shortell, Blodgett, & Reponen, 2021; Beltagui, 2018) (Bicen & Johnson, 2015) (Cagnin, 2018) (Carlgren, Elmquist, & Rauth, 2014) (Coco, Calcagno, & Lusiani, 2020) (Crites & Rye, 2020; de Carvalho, da Hora, & Fernandes, 2021)

N.°	Mandatory Necessary	Explanation	References
			(Ghajargar, Mangano, De Marco, & Giannantonio, 2017) (Kimbell, 2011; Nagaraj, Berente, Lyytinen, & Gaskin, 2020; Yu, Qu, & Hu, 2015)
3.	Budget for design thinking projects	Here the statement for Budget is the same as in "time resources"	(Baldassarre et al., 2020)
	Beneficial		
4.	Small projects and small teams	In SMEs, the implementation of innovations looks different than in large companies. Here, even small projects can achieve greater success.	(Baldassarre et al., 2020) (Manzini & Rizzo, 2011)
5.	DT team strategically well positioned (team selection)	SMEs are less able to give the search for optimization and innovation the necessary space.	(Beckman & Barry, 2007) (Brown, 2008) (Fleury, Stabile, & Carvalho, 2016) (Hölzle & Rhinow, 2019) (Kurtmollaiev, Pedersen, Fjuk, & Kvale, 2018) (Nagaraj et al., 2020) (Seidel & Fixson, 2013) (Vagal et al., 2020) (Yang & Hsu, 2020) (Yeoman & Carvalho, 2019)
6.	Customer or benefit orientation is strategically anchored	SMEs will think twice before starting a Design Thinking project without knowing the exact benefits beforehand.	(Diepenmaat, Kemp, & Velter, 2020) (Hankammer, Brenk, Fabry, Nordemann, & Piller, 2019) (Hölzle & Rhinow, 2019) (E. Knight, Daymond, & Paroutis, 2020) (Vetterli, Uebernickel, Brenner, Petrie, & Stermann, 2016) (Yan, 2018)
	Specific to SME		
7.	Potential benefits of DT project known in advance	Only if it can be seen early on that the initial investment has paid off will others follow.	(Carlgren et al., 2014)
8.	Design thinking	SMEs lack the financial resources to take bigger risks. Therefore, the	(Bairaktarova, Bernstein, Reid, & Ramani, 2016) (Carmel-Gilfilen & Portillo, 2016)

N.°	Mandatory Necessary	Explanation	References
	steps well defined	steps for innovation should be taken in smaller but safe steps.	(Hookway, Johansson, Svensson, & Heiden, 2019) (Pluchinotta, Kazakci, Giordano, & Tsoukias, 2019) (Shafiee, Haug, Kristensen, & Hvam, 2021)
9.	External design thinking experts to support the project	Due to the high involvement of employees in day-to-day business, it is usually unrealistic for SMEs to have the time, space and knowledge to implement design thinking internally, without external coaches.	(Ghajargar et al., 2017) (Jun, Morrison, & Clarkson, 2014) (Kozlowski, Searcy, & Bardecki, 2018) (Kulick, 2017) (Na, Choi, & Harrison, 2017) (Shapira, Ketchie, & Nehe, 2017)
10.	Design Thinking success is measured differently	Small steps lead to greater success.	(Brassett & O'Reilly, 2015) (Chandler & Ward, 2019) (Conforto, Amaral, da Silva, Di Felippo, & Kamikawachi, 2016) (J. Knight, Fitton, Phillips, & Price, 2019)
11.	Cross-departmental projects with DT	Due to the flat hierarchical levels in SMEs, communication within the team is much faster than in others.	(Seidel & Fixson, 2013)
12.	DT is also integrated and applied to existing projects	In SMEs, innovation approaches are often unconsciously applied in projects without being defined as such.	(Liem & Brangier, 2012) (Shafiee et al., 2021)
13.	First application to design affinity areas	The advantage for SMEs is that DT can be introduced even with a small budget.	(Agogino et al., 2016) (Beckman & Barry, 2007) (Chandler & Ward, 2019) (Lande, 2016) (Lim, Kim, Kim, & Kim, 2019)
14.	External experts are involved (almost indispensable for SMEs, but professionals may be available for corporations)	Outsourcing allows employees to focus on their own day-to-day work.	(Buhl et al., 2019) (Carlgren, Elmquist, & Rauth, 2016) (Eppler & Kernbach, 2016) (Fleury et al., 2016) (Glen, Suciu, & Baughn, 2014) (Kim & Strimel, 2020) (Liem & Brangier, 2012) (Olsen, 2015) (Yu et al., 2015)

N.°	Mandatory Necessary	Explanation	References
	General success factors independent of SMEs		
15.	DT is visually represented and communicated	Visual representation of DT is possible in both SMEs and large enterprises.	(Na et al., 2017)
16.	DT involved persons are professionally trained	Professional coaches can also be applied to all sizes of enterprises. However, this factor makes more sense and is more effective in SMEs.	(Na et al., 2017) (Shapira et al., 2017)
17.	Physical space for DT projects is available	This area appeals more to large companies than to SMEs.	(McGann, Blomkamp, & Lewis, 2018) (McGann, Wells, & Blomkamp, 2021)
18.	DT is easy to learn and use for company employees	DT is more practical to use and remains straightforward if you stick to the core steps. It is feasible in all sizes of companies.	(Souza et al., 2020)
19.	Internal employees involved in the project. Usually, no external experts necessary.	Large companies have their own innovation departments, so outsiders tend to be less represented.	(Brown, 2008) (Carlgren et al., 2014) (Roberts & Palmer, 2012) (Snyder et al., 2018)

In the context of this study, the specific key factors in Table 3 are divided into "Mandatory components", "Beneficial components", "Specific to SME" and "General factors".

As part of the systematic literature review, content-related criteria that can be specifically tailored to SMEs were analysed. Therefore, these benefit criteria were again weighted and divided. The first criteria under the category "Mandatory Necessary" are directly related and are more difficult to apply in SMEs due to their context than in larger companies.

The supporting or beneficial factors are assumed to be directly related to their underlying SME characteristics. They also have an SME-specific background.

The third category contains those benefits that do not seem to be influenced by SME characteristics and are generally applicable in all company sizes.

Table 4 Failure factors based on the nature of SMEs

N.º	Failure factors	Explanation (based on the nature of the SMEs)	Literature
1.	Lack of customer input in customer analysis (customer goals, personas, customer journeys, etc.) and prevalent misconceptions of already knowing customer needs and expectations	Understanding customer goals and the current customer experience as perceived by the customer form the central basis for the subsequent active design of the customer experience. Companies must develop a deep understanding of the customer's goals, needs, perceptions, and interactions	(Liu & Lu, 2020) (Rau, Zbiek, & Jonas, 2017) (Sohaib, Solanki, Dhaliwa, Hussain, & Asif, 2019) (Snyder, Ingelsson, & Backstrom, 2018)
2.	No comprehensive or incorrect survey of actual customer needs and expectations	A holistic and correct recording of the customer's needs and expectations require comprehensive ethnographic, qualitative and quantitative data collection and evaluation of internal and external information sources. Personal points of contact should be used for in-depth insights and feedback.	(Hankammer, Brenk, Fabry, Nordemann, & Piller, 2019)
3.	Qualitative survey methods with the customer (surveys, interviews, etc.) are designed to create negative customer experiences	The instrument of direct collection of customers input is overused or misused. Data collection must be prevented from provoking negative reactions from the customer and creating survey fatigue, which undermines the willingness to provide critical feedback.	(Andreassan, Kristensson, Lervik-Olsen, Parasuraman, McColl-Kennedy, & Edvardsson, 2016) (Lim, Kim, Kim, & Kim, 2019) (Pande & Bharathi, 2020)
4.	No complete coverage of all touch points and no Evaluation of the importance of individual touchpoints from the customer's point of view	The identification of relevant touchpoints for the customer serves as a basis for the subsequent design. All touchpoints must be captured, and an assessment of relevance made from the customer's perspective.	(Hankammer, Brenk, Fabry, Nordemann, & Piller, 2019)
5.	No linkage of the assessment of relevant touch points with entrepreneurial significance	The touchpoints deemed relevant by customers must also be assessed in terms of their economic significance for the company so that design priorities can be defined later.	(Martin, 2011)
6.	Insufficient analysis (resulting in a lack of understanding) of the customer's value-adding processes	Capturing the value creating processes are a key step for the subsequent alignment of the company's own processes and value proposition. A deep understanding of how the customer creates value for its own customers are therefore needed.	(Appleyard, Enders, & Velazquez, 2020) (Holzle & Rhinow, 2019)
7.	No identification of relevant stakeholders and decision makers as well as their holistic customer journeys, goals and pain	In order to create optimal experiences for all relevant customer stakeholder groups, the individual goals, pain points, and customer journeys must be captured holistically from start to finish.	(Bas & Guillo, 2015) (Geldermann, Lerche, & Sepulveda, 2018)

N.º	Failure factors	Explanation (based on the nature of the SMEs)	Literature
	points		(Magistretti, Dell`Era, & Doppio, 2020) (Pluchinotta, Kazakci, Giordano, & Tsoukias, 2019)
8.	Insufficient analysis of a customer's interactions with other service providers in the ecosystem as well as with other customers	A holistic understanding of the customer experience requires capturing the value creating ecosystem. Companies should analyze the experience ecosystem and understand how it generates added value and usage value for customers and how it shapes their expectations of the customer.	(Sorice & Donlan, 2015)
9.	No adequate recording of own value-adding processes as well as the current value proposition to customers	A shared understanding of the current value proposition and internal processes form the basis for subsequent design decisions and for aligning processes to deliver value for use to customers.	(Hankammer, Brenk, Fabry, Nordemann, & Piller, 2019) (Hirano, Ishizuka, & Sakaguchi, 2013)
10.	No situation analysis of the competencies and resources currently available in the company, related to customer experience and organizational performance	The subsequent implementation, monitoring and control of the customer experiences requires dedicated competencies and resources. Only on the basis of an analysis can any gaps be closed.	(Nagaraj, Berente, Lyytinen, & Gaskin, 2020)

Failures that are not accepted and shared lose their importance in the innovation world. As a result, you lose oodles of time, money and health to repeatedly making the same mistakes - because no one talks about it. Interest in failure of innovation projects is shown by entrepreneurs and managers in order to bring about the prevention of the problems and risks. Table 4 shows the failures elaborated from the articles. These were listed from direct and indirect context. Since, for reasons already mentioned, SMEs in particular cannot afford to make mistakes when implementing innovations in projects, it is advisable to take smaller steps and smaller projects.

It should also be kept in mind that SMEs often apply innovation approaches without labelling them as such. The integration of direct innovation strategies will lead to greater success.

4. FINDINGS & DISCUSSION

The results are divided into several sections: First, we provided an overview of the research agenda and literature on design thinking and innovation. Next, the papers were analysed descriptively and the availability of design thinking and innovation in the scientific field was examined. The analysis shown that design thinking research in the innovation context is still a relatively young field that has shown a steady development based on publications for about 15 years. A thematic analysis was then conducted to present a comprehensive overview of the design thinking parameter in relation to SME innovation practices.

Overall, the results show that our sample on design thinking and innovation is powerful, with 308 filtered articles explicitly addressing the topic. Narrowing it down even further, 70 articles deal directly with the topic of design thinking and innovation and your measurement factors.

The most important articles for design thinking research and innovation are those with a design focus, with the Design Journal playing a dominant role, as already mentioned. In addition, there are articles in mainstream innovation journals such as International Journal of Engineering Education, Creativity and Innovation Management, Journal of Cleaner Production, Sustainability and California Management Review, which are also well represented in this analysed topic area. This shows which subject areas also deal intensively with the innovation approach Design Thinking.

The purpose of the thematic content analysis was to identify essential elements and dimensions of design thinking practices in an SME context (focus on needs and failures – tables 3 and 4. These are concrete measures of the success and failure of design thinking and innovation approaches to increase innovation capability. As can also be seen in the previous tables, the identified two essential building blocks of Design Thinking in companies have been identified and explained (Na, Choi, & Harrison, 2017).

The analysis shows that science has dealt with the implementation of thinking approaches in SMEs, but not enough. Therefore, this topic is consequently not very well known even in small and medium-sized enterprises (Gasda & Fueglistaller, 2015). Because SMEs are not frequent users of Design Thinking the academia is very little interested in analysing the subject (Kammerlander, Burger, Fust, & Fueglistaller, 2015). Only a few SMEs do not come into contact with this approach. Moreover, SMEs are preoccupied with everyday business, which is why they are slow to integrate new approaches (Magistretti, Dell`Era, & Doppio, 2020). For this reason, SMEs do not provide themselves with the capacity to develop "new things" and thus run the risk of losing some of their competitive advantages in the medium to long term. It seems that design thinking is not suitable for SMEs because of their characteristics (Magistretti, Dell`Era, & Doppio, 2020). However, as already mentioned, there are also characteristics that indicate a sensitivity of SMEs to Design Thinking elements. The receptiveness for Design Thinking in small and medium-sized enterprises is greater than in large companies (Shapira, Ketchie, & Nehe, 2017), and due to flat hierarchies, SMEs can adapt changes more quickly than large companies.

As a basis for further research approaches, these factors can be used to further expand and strengthen the strategic sustainability behaviour of SMEs and the innovation approaches Design Thinking pursues (Magistretti, Dell`Era, & Doppio, 2020).

5. CONCLUSIONS

The aim of this study is to identify the Design Principles of Design Thinking and innovation approaches in SMEs by conducting a systematic literature review. Here, we focused on positive and negative implementation competencies. We contribute to the literature by showing that innovation approaches are, in principle, built on some unique Design Thinking parameters to deal with uncertainty at management level, adaptability, flexibility and understanding, speed, and integration. Our contribution implies that Design Thinking approaches related to well-known innovation approaches in our literature list and associated company size can be used to also test and improve innovation approaches in SMEs to respond to uncertainty and risks. This study can show companies the limitations in exploring and comparing different solutions with a well-defined list of design approaches and principles. It could also be a crucial research step in the current literature and practice in Design Thinking.

Our findings suggest a different theoretical path for the field. Stakeholders can now merge theoretical insight by using our categorized Design Thinking approaches not only to develop new solutions, but also to compare different solutions in terms of performance in managing uncertainty in SMEs.

In addition, our paper provides a fundamental comparison of management practices to advance the research field. In developing and elaborating solutions, researchers and practitioners can now use our research as an initial and preliminary reference. This new theoretical way to design new hybrid approaches can provide more options for dealing with uncertainty. Researchers and scientists can test, continuously elaborate, and improve our Design Thinking solution approaches for SMEs in different business situations (e.g., small and medium-sized enterprises and also start-ups). They can also apply such Design Thinking criteria and principles in different phases of the Design Thinking approach, with different practices and techniques, and study the impact on innovation performance.

One promising avenue of research is to examine the design principles in the innovation management literature, in relation to SMEs. Based on this, further studies and research can address other resource opportunities and their complexities. The research team notes, as well, that the presence of failures is seldom referenced in the literature.

This study has some limitations. First, we provide a preliminary list of failures and needs (link tables 3 and 4 tailored to SMEs, however we did not test these elements empirically, which is a future research direction.
Second, as this is a systematic literature review, the inherent limitation is related to the impossibility to generalize the results, or to provide managerial or policy implications. Third, the definition of SME encompasses a wide type of firms, from start-ups to incumbent firms, and failures and needs for these firms can be quite different. A specific analysis taking into account as control variables the size, the age, the industry and other characteristics that may account for the differences between SMEs is recommendable in future studies.

Also, the failure factors, on the basis of indirect and direct representations regarding the Design Thinking criteria were worked out here. Furthermore, we realized that the developed list based on the systematic literature review is not exhaustive. To this end, there is an opportunity to elaborate and investigate further research and additional Design Thinking criteria and principles tailored to SMEs in the future.
Ultimately, further research can be prepared, continuously improved and supplemented in further studies, in the area of implementation of the Design Thinking project. This leads to an iterative process, which is also typical for Design Thinking.

BIBLIOGRAPHICAL REFERENCES

Acklin, C. (2013). Design Management Absorption Model: A Framework to Describe and Measure the Absorption Process of Design Knowledge by SMEs with Little or no Prior Design Experience.

Andreassan, T., Kristensson, P., Lervik-Olsen, L., Parasuraman, A., McColl-Kennedy, J., & Edvardsson, B. (2016). Linking service design to value creation and service research. *Journal of Service Management*, 21-29.

Appleyard, M., Enders, A., & Velazquez, H. (2020). Regaining R&D Leadership: The Role of Design Thinking and Creative Forbearance. *California Management Review*, 12-29.

Bas, E., & Guillo, M. (2015). Participatory foresight for social innovation. FLUX-3D method (Forward Looking User Experience), a tool for evaluating innovations. *Technological Forecasting and Social Change* , 275-290.

Brown, T. (2008, 06 01). Design Thinking. *Harvard Business Review*.

Crossan, M., & Apaydin, M. (2010, 07 20). A Multi-Dimensional Framework of Organizational Innovation: A Systematic Review of the Literature. *Journal of Management studies*, pp. 1154-1191.

Durst, S., & Edvardsson, R. (2012, 05 01). Knowledge management in SMEs: a literature review. *Journal of Knowledge Management*, pp. 879-903.

Gasda, J., & Fueglistaller, U. (2015, 01 01). Fostering individual-level ambidexterity in SMEs : a relational-contract perspective on informal external drivers of employees' ambidextrous behaviour. *International Journal of Entrepreneurial Venturing*, pp. 217-236.

Geldermann, J., Lerche, N., & Sepulveda, J. (2018). Combining multi-criteria decision analysis and design thinking. *European Journal of Industrial Engineering*, pp. 708-739.

Geldermann, J., Lerche, N., & Sepulveda, J. (2018). Combining multi-criteria desicion analysis and design thinking. *European Journal of Industrial Engineering* , 708-739.

Hankammer, S., Brenk, S., Fabry, H., Nordemann, A., & Piller, F. (2019). Towards circular business models: Identifying consumer needs based on the jobs-to-be-done theory. *Journal of Cleaner Production* , 341-358.

Hirano, T., Ishizuka, A., & Sakaguchi, K. (2013). Innovation Activities by Co-creation Process. *Fujitsu Scientific & Technical Journal*, 391-396.

Holzle, K., & Rhinow, H. (2019). The Dilemma of Design Thinking in Innovation Projects. *Project Management Journal*, 418-430.

Judy, M., & Savatore, B. (2011). Continuous innovation in SMEs: how design innovation shapes business performance through doing more with less. *Proceedings of the 12th International CINet Conference - Continuous Innovation*, 696-708.

Kammerlander, N., Burger, D., Fust, A., & Fueglistaller, U. (2015, 07 01). Exploration and Exploitation in Established Small and Medium-sized Enterprises: The Effect of CEOs' Regulatory Focus. *Journal of Business Venturing*, pp. 582-602.

Liedtka, J., & Ogilvie, T. (2011, 07 27). Design for growth: A design thinking tool kit for managers. *Columbia Univers. Press*, p. 227.

Lim, C., Kim, K., Kim, M., & Kim, K. (2019). Multi-factor service design - identification and consideration of multiple factors of the service in its design process. *Service Business*, 51-74.

Lim, C., Kim, K., Kim, M., & Kim, K. (2019). Multi-factor service design: identification and consideration of multiple factors of the service in its design process. *Service Business*, pp. 51-74.

Liu, A., & Lu, S. (2020). Functional design framework for innovation design thinking in product development. *Cirp Journal of Manufacturing Science and Technology* , 105-117.

Magistretti, S., Dell`Era, C., & Doppio, N. (2020). Design sprint for SMEs: an organizational taxonomy based on configuration theory. *Management Decision*, 1803-1817.

Martin, R. (2011). The Innovation Catalysts. *Harvard Business Review*, 82.

Mortati, M., & Cruickshank, L. (2011). Design and SMEs: the trigger of creative ecosystems. *Conference on Designing Pleasurable Products and Interfaces*, 1-8.

Moultrie, J., Clarkson, J., & Probert, D. (2006). A tool to evaluate design performance in SMEs. *International Journal of Productivity and Performance Management*.

Na, J., Choi, Y., & Harrison, D. (2017). The Design Innovation Spectrum: An Overview of Design Influences on Innovation for Manufacturing Companies. *International Journal of Design*, pp. 13-24.

Pande, M., & Bharathi, S. (2020). Theoretical foundations of design thinking - A constructivism learning approach to design thinking. *Thinking Skills and Creativity*, 637-637.

Pluchinotta, I., Kazakci, A., Giordano, R., & Tsoukias, A. (2019). Design Theory for Generating Alternatives in Public Decision Making Processes. *Group Decision and Negotiation*, 341-375.

Proenca, J., & Jiménez-Sáez, F. (2020). Design of Services for the Incremental Innovation Management in SMEs. *Universidad & Empresa*, 1-20.

Rau, C., Zbiek, A., & Jonas, J. (2017). Creating Competitive Advantage from Services A Design Thinking Case Study from the Commodities Industry. *Research-Technology Management*, 48-56.

Sarooghi, H., Sunny, S., Hornsby, J., & Fernhaber, S. (2019, 07 22). Design Thinking and Entrepreneurship Education: Where Are We, and What Are the Possibilities? *Journal of Small Business Management*.

Saur-Amaral, I., Reis Soares, R., & Proenca, J. (2018). Business model innovation: towards a conceptual framework. *Tourism & Management Studies*, pp. 80-93.

Shapira, H., Ketchie, A., & Nehe, M. (2017). The Integration of Design Thinking and Strategic Sustainable Development. *Journal of Cleaner Production* , pp. 277-287.

Snyder, K., Ingelsson, P., & Backstrom, I. (2018). Using design thinking to support value-based leadership for sustainable quality development. *Business Process Management*, 1289-1301.

Sohaib, O., Solanki, H., Dhaliwa, N., Hussain, N., & Asif, M. (2019). Integrating design thinking into extreme programming. *Journal of Ambient Intelligence and Humanized Computing*, 2497-2504.

Sorice, M., & Donlan, C. (2015). A human-centered framework for innovation in conservation incentive programs. *Ambio*, 788-792.

van de Vrande, V., de Jong, J., Vanhaverbek, W., & de Rochemont, R. (2009). Open innovation in SMEs: Trends, motives and management challenges. *Technovation*, 423–437.

Williams, R., Clark, L., Clark, W., & Raffo, D. (2020, 09 17). Re-examining systematic literature review in management research: Additional benefits and execution protocols. *European Management Journal*, 13.

Appendix – List of References used for the analysis

Aagaard, A., Saari, U. A., & Makinen, S. J. (2021). Mapping the types of business experimentation in creating sustainable value: A case study of cleantech start-ups. *Journal of Cleaner Production, 279*, 23182-23182.

Abookire, S., Plover, C., Frasso, R., & Ku, B. (2020). Health Design Thinking: An Innovative Approach in Public Health to Defining Problems and Finding Solutions. *Frontiers in Public Health, 8*, 459-459.

Agogino, A. M., Beckman, S. L., Castanos, C., Kramer, J., Roschuni, C., & Yang, M. (2016). Design Practitioners' Perspectives on Methods for Ideation and Prototyping. *International Journal of Engineering Education, 32*(3), 1428-1437.

Ahn, C., Rundall, T. G., Shortell, S. M., Blodgett, J. C., & Reponen, E. (2021). Lean Management and Breakthrough Performance Improvement in Health Care. *Quality Management in Health Care, 30*(1), 6-12.

Andreassen, T. W., Kristensson, P., Lervik-Olsen, L., Parasuraman, A., McColl-Kennedy, J. R., Edvardsson, B., & Colurcio, M. (2016). Linking service design to value creation and service research. *Journal of Service Management, 27*(1), 21-29.

Appleyard, M. M., Enders, A. H., & Velazquez, H. (2020). Regaining R&D Leadership: The Role of Design Thinking and Creative Forbearance. *California Management Review, 62*(2), 12-29.

Bairaktarova, D., Bernstein, W. Z., Reid, T., & Ramani, K. (2016). Beyond Surface Knowledge: An Exploration of How Empathic Design Techniques Enhances Engineers Understanding of Users' Needs. *International Journal of Engineering Education, 32*(1), 111-122.

Baldassarre, B., Konietzko, J., Brown, P., Calabretta, G., Bocken, N., Karpen, I. O., & Hultink, E. J. (2020). Addressing the design-implementation gap of sustainable business models by prototyping: A tool for planning and executing small-scale pilots. *Journal of Cleaner Production, 255*, 20295-20295.

Ballie, J. (2019). Design Thinking for Progress. Initial insights from an evolving design-led business support programme for Scotland. *Design Journal, 22*, 981-995. doi:10.1080/14606925.2019.1595412

Bas, E., & Guillo, M. (2015). Participatory foresight for social innovation. FLUX-3D method (Forward Looking User Experience), a tool for evaluating innovations. *Technological Forecasting and Social Change, 101*, 275-290.

Bason, C., & Austin, R. D. (2019). THE RIGHT WAY TO LEAD DESIGN THINKING. *Harvard Business Review, 97*(2), 82-+.

Beltagui, A. (2018). A design-thinking perspective on capability development: The case of new product development for a service business model. *International Journal of Operations & Production Management, 38*(4), 1041-1060.

Bicen, P., & Johnson, W. H. A. (2015). Radical Innovation with Limited Resources in High-Turbulent Markets: The Role of Lean Innovation Capability. *Creativity and Innovation Management, 24*(2), 278-299.

Buhl, A., Schmidt-Keilich, M., Muster, V., Blazejewski, S., Schrader, U., Harrach, C., . . . Sussbauer, E. (2019). Design thinking for sustainability: Why and how design thinking can foster sustainability-oriented innovation development. *Journal of Cleaner Production, 231*, 1248-1257.

Cagnin, C. (2018). Developing a transformative business strategy through the combination of design thinking and futures literacy. *Technology Analysis & Strategic Management, 30*(5), 524-539.

Carlgren, L., Elmquist, M., & Rauth, I. (2014). Design Thinking: Exploring Values and Effects from an Innovation Capability Perspective. *Design Journal, 17*(3), 403-423.

Carlgren, L., Rauth, I., & Elmquist, M. (2016). Framing Design Thinking: The Concept in Idea and Enactment. *Creativity and Innovation Management, 25*(1), 38-57.

Chandler, L., & Ward, A. (2019). Immersed in Design: Using an Immersive Teaching Space to Visualise Design Solutions. *International Journal of Art & Design Education, 38*(2), 314-327.

Cheah, Y. H., Chai, C. S., & Toh, Y. (2019). Traversing the context of professional learning communities: development and implementation of Technological Pedagogical Content Knowledge of a primary science teacher. *Research in Science & Technological Education, 37*(2), 147-167.

Coco, N., Calcagno, M., & Lusiani, M. (2020). Struggles as triggers in a design-thinking journey. *Creativity and Innovation Management, 29*, 103-115.

Colombo, S., Cautela, C., & Rampino, L. (2017). New Design Thinking Tools for the Next Generation of Designer-Entrepreneurs. *Design Journal, 20*, S566-S580.

Conforto, E. C., Amaral, D. C., da Silva, S. L., Di Felippo, A., & Kamikawachi, D. S. L. (2016). The agility construct on project management theory. *International Journal of Project Management, 34*(4), 660-674.

Crites, K., & Rye, E. (2020). Innovating language curriculum design through design thinking: A case study of a blended learning course at a Colombian university. *System, 94*, 2334-2334.

de Carvalho, R. A., da Hora, H., & Fernandes, R. (2021). A process for designing innovative mechatronic products. *International Journal of Production Economics, 231*, 7887-7887.

Diepenmaat, H., Kemp, R., & Velter, M. (2020). Why Sustainable Development Requires Societal Innovation and Cannot Be Achieved without This. *Sustainability, 12*(3), 1270-1270.

Eines, T. F., & Vatne, S. (2018). Nurses and nurse assistants' experiences with using a design thinking approach to innovation in a nursing home. *Journal of Nursing Management, 26*(4), 425-431.

Eppler, M. J., & Kernbach, S. (2016). Dynagrams: Enhancing design thinking through dynamic diagrams. *Design Studies, 47*, 91-117.

Fleury, A. L., Stabile, H., & Carvalho, M. M. (2016). An Overview of the Literature on Design Thinking: Trends and Contributions. *International Journal of Engineering Education, 32*(4), 1704-1718.

Geissdoerfer, M., Bocken, N. M. P., & 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, 135*, 1218-1232.

Geldermann, J., Lerche, N., & Sepulveda, J. D. (2018). Combining multi-criteria decision analysis and design thinking. *European Journal of Industrial Engineering, 12*(5), 708-739.

Ghajargar, M., Mangano, G., De Marco, A., & Giannantonio, R. (2017). Design Thinking Applied to Data Storage Innovation: A Case Study. *Design Journal, 20*, S3776-S3788.

Glen, R., Suciu, C., & Baughn, C. (2014). The Need for Design Thinking in Business Schools. *Academy of Management Learning & Education, 13*(4), 653-667.

Hankammer, S., Brenk, S., Fabry, H., Nordemann, A., & Piller, F. T. (2019). Towards circular business models: Identifying consumer needs based on the jobs-to-be-done theory. *Journal of Cleaner Production, 231*, 341-358.

Hirano, T., Ishizuka, A., & Sakaguchi, K. (2013). Innovation Activities by Co-creation Process. *Fujitsu Scientific & Technical Journal, 49*(4), 391-396.

Holzle, K., & Rhinow, H. (2019). The Dilemmas of Design Thinking in Innovation Projects. *Project Management Journal, 50*(4), 418-430.

Jun, G. T., Morrison, C., & Clarkson, P. J. (2014). Articulating current service development practices: a qualitative analysis of eleven mental health projects. *Bmc Health Services Research, 14*, 20-20.

Kim, Y. S., Jeong, J., Hong, Y., & Hong, S. J. (2020). A Schema for Systematic Service Imagining: Context-Based Activity Modeling. *Sustainability, 12*(22), 9558-9558.

Kimbell, L. (2011). Rethinking Design Thinking: Part I. *Design and Culture, 3*(3), 285-306.

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.

Ko, Y. T., Chen, M. S., Yang, C. C., & Zheng, M. C. (2015). Modelling a contradiction-oriented design approach for innovative product design. *Proceedings of the Institution of Mechanical Engineers Part B-Journal of Engineering Manufacture, 229*, 199-211.

Kozlowski, A., Searcy, C., & Bardecki, M. (2018). The reDesign canvas: Fashion design as a tool for sustainability. *Journal of Cleaner Production, 183*, 194-207.

Kulick, G. (2017). Adding plus value to development aid projects through design strategy: experiences from Pakistan. *Design Journal, 20*, S411-S423.

Kummitha, R. K. R. (2019). Design thinking in social organizations: Understanding the role of user engagement. *Creativity and Innovation Management, 28*(1), 101-112.

Kurtmollaiev, S., Pedersen, P. E., Fjuk, A., & Kvale, K. (2018). DEVELOPING MANAGERIAL DYNAMIC CAPABILITIES: A QUASI-EXPERIMENTAL FIELD STUDY OF THE EFFECTS OF DESIGN THINKING TRAINING. *Academy of Management Learning & Education, 17*(2), 184-202.

Lee, C., & Ma, L. (2020). The Role of Policy Labs in Policy Experiment and Knowledge Transfer: A Comparison across the UK, Denmark, and Singapore. *Journal of Comparative Policy Analysis, 22*(4), 281-297.

Lim, C., Kim, K. H., Kim, M. J., & Kim, K. J. (2019). Multi-factor service design: identification and consideration of multiple factors of the service in its design process. *Service Business, 13*(1), 51-74.

Liu, A., & Lu, S. (2020). Functional design framework for innovative design thinking in product development. *Cirp Journal of Manufacturing Science and Technology, 30*, 105-117.

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.

Manzini, E., & Rizzo, F. (2011). Small projects/large changes: Participatory design as an open participated process. *Codesign-International Journal of Cocreation in Design and the Arts, 7*(3-4), 199-215.

Martin, R. L. (2011). The Innovation Catalysts. *Harvard Business Review, 89*(6), 82-+.

McGann, M., Blomkamp, E., & Lewis, J. M. (2018). The rise of public sector innovation labs: experiments in design thinking for policy. *Policy Sciences, 51*(3), 249-267.

McGann, M., Wells, T., & Blomkamp, E. (2021). Innovation labs and co-production in public problem solving. *Public Management Review, 23*(2), 297-316.

Na, J. H., Choi, Y., & Harrison, D. (2017). The Design Innovation Spectrum: An Overview of Design Influences on Innovation for Manufacturing Companies. *International Journal of Design, 11*(2), 13-24.

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.

Olsen, N. V. (2015). Design Thinking and food innovation. *Trends in Food Science & Technology, 41*(2), 182-187.

Pande, M., & Bharathi, S. V. (2020). Theoretical foundations of design thinking - A constructivism learning approach to design thinking. *Thinking Skills and Creativity, 36*, 637-637.

Pluchinotta, I., Kazakci, A. O., Giordano, R., & Tsoukias, A. (2019). Design Theory for Generating Alternatives in Public Decision Making Processes. *Group Decision and Negotiation, 28*(2), 341-375.

Rau, C., Zbiek, A., & Jonas, J. M. (2017). Creating Competitive Advantage from Services A Design Thinking Case Study from the Commodities Industry. *Research-Technology Management, 60*(3), 48-56.

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*, 19-33.

Shafiee, S., Haug, A., Kristensen, S. S., & Hvam, L. (2021). Application of design thinking to product-configuration projects. *Journal of Manufacturing Technology Management, 32*(1), 219-241.

Shapira, H., Ketchie, A., & Nehe, M. (2017). The integration of Design Thinking and Strategic Sustainable Development. *Journal of Cleaner Production, 140*, 277-287.

Snyder, K., Ingelsson, P., & Backstrom, I. (2018). Using design thinking to support value-based leadership for sustainable quality development. *Business Process Management Journal, 24*(6), 1289-1301.

Sohaib, O., Solanki, H., Dhaliwa, N., Hussain, W., & Asif, M. (2019). Integrating design thinking into extreme programming. *Journal of Ambient Intelligence and Humanized Computing, 10*(6), 2497-2504.

Sorice, M. G., & Donlan, C. J. (2015). A human-centered framework for innovation in conservation incentive programs. *Ambio, 44*(8), 788-792.

Vagal, A., Wahab, S. A., Butcher, B., Zettel, N., Kemper, E., Vogel, C., & Mahoney, M. (2020). Human-Centered Design Thinking in Radiology. *Journal of the American College of Radiology, 17*(5), 662-667.

Vetterli, C., Uebernickel, F., Brenner, W., Petrie, C., & Stermann, D. (2016). How Deutsche Bank's IT Division Used Design Thinking to Achieve Customer Proximity. *Mis Quarterly Executive, 15*(1), 37-53.

Yan, M. R. (2018). Improving entrepreneurial knowledge and business innovations by simulation-based strategic decision support system. *Knowledge Management Research & Practice, 16*(2), 173-182.

Yang, C. M., & Hsu, T. F. (2020). Integrating Design Thinking into a Packaging Design Course to Improve Students' Creative Self-Efficacy and Flow Experience. *Sustainability, 12*(15), 5929-5929.

Yeoman, P., & Carvalho, L. (2019). Moving between material and conceptual structure: Developing a card-based method to support design for learning. *Design Studies, 64*, 64-89.

Yu, M. J., Qu, M., & Hu, J. (2015). A research method to capture design state based on multi-fuzzy cognitive mapping. *Journal of Intelligent & Fuzzy Systems, 29*(6),