

# Mapping Study of Design Thinking on Product Development in The Last 10 Years

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## Abstract

**Purpose:** The availability of literature regarding design thinking concerning product development in recent years has not been able to be synthesized. So, this article is expected to be able to provide the development of a conceptual framework that can categorize how design thinking contributes to product development and provides a mapping presentation to visualize how research in the field of design thinking studies on product development has developed in the last 10 years.

**Methodology/approach:** A systematic analysis was carried out on articles published in the last 10 years.

**Results/findings:** Produce a conceptual framework that provides a typology to discuss the development of how design thinking contributes to the product development ecosystem and directs research for the future.

**Limitations:** This article has limitations, first regarding evidence from articles that provide different perspectives and also topic of discussion. Second, the result obtained from the literature review are greatly influenced by use of keywords. Third, this study did not carry out an analysis related to the impact of the article through citation analysis.

**Contribution:** This study responds to the increasing interest in design thinking and the rapid growth in the proliferation of studies by providing a review of design thinking and its relation to product development that has occurred over the last 10 years.

**Keywords:** *design thinking, product development, mapping study*

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## 1. Introduction

The topic of design thinking has become an interesting discussion and has also increased drastically among practitioners and academics, which has also expanded in practice (Carlgren, Rauth, & Elmquist, 2016; Knight, Daymond, & Paroutis, 2020; Magistretti, Ardito, & Messeni Petruzzelli, 2021). This raises the perception of how products can be specially developed in various parts of the world (de Paula, Cormican, & Dobrigkeit, 2021; de Paula et al., 2023; Veflen & Gonera, 2023). Talking about design thinking is a concept that gives assurance that in order to be able to improve the company's ability to innovate through the suggestion of an innovation approach with the user/user as the center or core of the activity (Granato, Fischer, & van Trijp, 2022; Manzke, 2022). Research conducted, reveals that design thinking provides an offer regarding the value and has a major impact on efforts to develop products within an organization/company. One example is that design thinking is empirically associated with the novelty and usability of a product (Lyu et al., 2022; Randhawa, Nikolova, Ahuja, & Schweitzer, 2021), leading to a level of trust and higher levels of collaboration with cross-functional teams within (Rylander Eklund, Navarro Aguiar, & Amacker, 2022), towards a higher level of empowering a team with the discovery of a positive impact on the performance of a project (Jaskyte & Liedtka, 2022) and the creation of a prototype as well as a business model (Chouki, de Mozota, Kallmuenzer, Kraus, & Dabic, 2021; Marx, 2022).

Until now, taking into account the existing findings regarding the role of design thinking in organizations, some literature emphasizes that a more systematic study is needed to find out how design thinking can provide support for new product development (Dell'Era, Magistretti, Cautela, Verganti, & Zurlo, 2020; Micheli, Wilner, Bhatti, Mura, & Beverland, 2019) due to praise for being able to provide more support to the next generation of research (Randhawa et al., 2021). Not only that, studies on design thinking related to product development have been carried out not only by researchers in the fields of engineering and design management but also in the field of education (Jaskyte & Liedtka, 2022; Veflen & Gonera, 2023). Looking at the overall support for design thinking for different fields of knowledge, support is needed to contribute to advancing the understanding of design thinking concerning product development. Therefore, reviewing these conditions, the purpose of this article is to develop a conceptual framework that can provide a thorough review of various extensive literature on how design thinking contributes to new product development, a direction that shows how the evolution of the literature over the past few last years and to mark which areas are required in research.

The research question in this article is that there are two questions, namely:

1. To examine what research topics are researched in the field of design thinking in new product development. This is intended to understand how design thinking influences and also supports the development of new products and to find out the themes and special categories for the type of research that has been carried out to date.
2. To identify what are the research trends and opportunities in the domain. This is done to be able to visualize how research on design thinking is related to new product development, and its development over the years to identify which research is more needed.

## 2. Literature review and hypothesis development

Based on the research questions above, this research seeks not only to be able to identify how design thinking influences and supports the development of new products, but also to find out how research in this midwifery is related to its development from year to year. Thus, this study uses research methods in the form of thematic analysis and systematic mapping (Nowell, Norris, White, & Moules, 2017; Petersen, Vakkalanka, & Kuzniarz, 2015) to analyze journal articles that are under the research objectives and published in the range of years between 2012 and 2022. Results analysis can inform the development of a framework and map directions for future research. While the framework can add value by defining and classifying research themes in the area, the map generates trends that can assist in orienting future research. By combining methods, namely systematic analysis and systematic mapping, this study aims to guide on how this method can be implemented jointly in a research process.

Table 1. Definitions of Design Thinking

Definitions of		
Design Thinking as Toolbox	Design Thinking as Problem Solver (Process)	Design Thinking as Tools for Reflection Activity (Mindset)
Design thinking is defined as the application of design methods by multidisciplinary teams to challenges in innovation (Micheli et al., 2019)	Design Thinking is primarily a process of innovation - the fuzzy part of the front end, and a great method for discovering unmet needs and for creating new product concepts, not to mention tackling those "bad" problems (Magistretti et al., 2022)	Design Thinking involves discovering unmet needs, and how to create new business models and new visions. Design Thinking is also concerned with the values, basic assumptions, norms, and beliefs that make an organization what it is. (Elsbach & Stigliani, 2018)

Source: processed by researchers, 2023

It will be discussed how previous researchers interpreted the term design thinking. Apart from that, it will also explain how the manifestation of design thinking itself is in practice in the field. Exploration of the new era of research in the study of design thinking and the importance of new product development.

## **2.1 Understanding of Design Thinking**

Design thinking is a concept that is quite difficult to understand and inherently difficult to explain. Even so, an understanding of design thinking that is capable of being generally accepted or in other words a standard understanding of design thinking has not yet been found (Loderer & Kock, 2021). Several definitions of design thinking were found that the authors tend to define according to their different perspectives. In the field of design research studies, when viewed from a cognitive theoretical perspective, design thinking explains how a designer works and thinks (Lawson, 2006), while in the field of management, practitioners and researchers think that design thinking offers an effective and powerful tool. to assist in solving problems, the use of which can be felt by a designer or not even a designer (Micheli et al., 2019; Velu, 2022). Table 1 has provided an overview of the meaning of design thinking chosen based on the design and management literature.

Other researchers, namely Seidel and Fixson, think that design thinking is defined as an application of design methods that are useful for responding to various challenges related to innovation (Dell'Era et al., 2020). In ethnographic research, methods include team support to search for what is needed, brainstorming techniques are useful for generating new ideas, and telling stories to create a prototype (Elsbach & Stigliani, 2018). A more descriptive understanding of design thinking was conveyed by Lockwood which means that design thinking is a process, especially as part of a fuzzy front-end activity concerning the new product development process (Lahiri, Cormican, & Sampaio, 2021). Another view, presented by Cooper et al, is that design thinking is seen as a reflective practice – that is, regarding mindset/mindset (Roth, Globocnik, Rau, & Neyer, 2020). Whereas in recent research it was found that design thinking is a tool to help a company create value and vision (de Paula et al., 2021). From this point of view, it means that design thinking helps organizations to find and apply the best user-centered mindset to find hidden needs that have not been touched as well as the creation of new business models.

## **2.2 Actualization of Design Thinking**

Referring to the three main definitions of design thinking, the authors (Nakata & Hwang, 2020; Parizi, Prestes, Marczak, & Conte, 2022) suggest that design thinking can also be applied to practice in three different ways, namely: as a tool (Micheli et al., 2019), as a process (Magistretti et al., 2022) and as a mindset (Elsbach & Stigliani, 2018). Presentation of design thinking as a process that is equipped with a toolkit. None other than the aim is to "make designers in practice able to provide access and can also be meaningful for managers" (Dell'Era et al., 2020). The tools presented are also different according to needs, namely for practitioners (Stickdorn, Hormess, Lawrence, & Schneider, 2018) and academics (Zidulka, 2016). One of the keys to the successful application of design thinking to projects is how the condition of the team relates to understanding and ability to apply it (Nakata & Hwang, 2020). The stages in design thinking tend three to six steps/stages in it. The concept presented by Brown regarding design thinking is the most well-known design thinking process today (Suresh & Kolluru, 2022). Brown explained that the design thinking cycle model has three phases in it, namely: inspiration, ideas, and implementation where problem-solving is the main focus and identification of existing opportunities.

While those who proposed six phases, namely Hasso Plattner's School of Design Thinking, consisting of understanding, observing, viewing, idealizing, prototyping, and testing, which has a main focus on teaching students as well as professionals about how to become a design thinker (Andreassen et al., 2016). Another suggestion was made by the Stanford School of Design Thinking that design thinking has five processes in it which consist of: empathizing, defining, ideating, prototyping, and testing (Konings, 2018). However, this condition shows that models that use terminology also have different process steps, that in their analysis efforts reveal similarities if design thinking is present as a problem-solving process in which there is a combination of divergent and convergent thinking. Often design thinking is seen as a systematic process, as stated by Johansson-Skoldberg (Micheli et al., 2019), namely the discussion of design thinking which has pure characteristics will focus on processes as well as tools that ignore how changes in culture and organizations are needed in application and adoption in practice. Therefore, the mindset of design thinking arises because there is an idea that is centered on design thinking itself.

### **2.3 The Latest of Design Thinking**

Discourses that support the use of design thinking as an organizational resource in recent years have gained a lot of traction, especially in the fields of design and management. The possibility that design thinking can do is expand the ability to innovate in organizations because that ability can encourage collaboration and the development of a user-centered mindset (de Paula et al., 2021). For the sake of creating innovation and economic growth, support is needed to investigate how design thinking can be used as an organizational resource to improve all product development processes (Magistretti et al., 2021; Neri, Cagno, Lepri, & Trianni, 2021). The use of design thinking provides many perceived benefits for product development, for example, the positive effect on idea generation, a stronger prototyping method, and reducing cognitive habits that can become an obstacle to idea generation (Trischler, Dietrich, & Rundle-Thiele, 2019).

## **3. Research methodology**

The combination of mapping studies with thematic analysis makes it possible not only to synthesize and understand the literature obtained but also to identify and classify appropriate research themes (Braun & Clarke, 2019; Zonta et al., 2020). Mapping studies assist researchers to determine what search criteria are needed in this study, while thematic analysis encourages researchers to answer several questions related to the specific research being conducted. Based on this analysis, the researchers created a framework (Figure 2) and a research evolution map related to design thinking in product development (Figure 3). Figure 1 illustrates the important process steps used to achieve our intent. In the next section, it will be explained in detail.

### **3.1 Research Questions and Objectives**

This research article aims to provide an analysis of how design thinking influences and supports product development as well as how research in this field has developed from 2012 to 2022. The design of the research questions is presented in Table 2. The questions and research objectives assist researchers to synthesize existing literature in the field of design thinking and product development studies, along with the identification of gaps as well as deficiencies in what is in the literature.

### **3.2 Define of Search Strings**

The main focus of this process is to determine the search string / Boundary. A thorough data search to find research articles that are following what is needed and ranging from 2012 to 2022 is carried out by selecting the following scientific databases: IEEE Xplore, ScienceDirect, Scopus, Emerald, and Wiley Online Library. The main keywords used are "Design Thinking" and "New Product Development". To increase the sensitivity of the search and to ensure that the coverage is higher, we consider the search string to be varied. The combined variation is "OR", and some sets of each term are "AND". The use of this search string with the keywords "Design Thinking" AND ("New Product Development" OR "Development of New Product") produces search data.

### **3.3 Screening Papers**

Inclusion and exclusion criteria were used (see Table 3) at this stage to select which studies were relevant during the search, as recommended by Arksey (Booth, Sutton, Martyn-St James, & Clowes, 2021). The research carried out is valid and also reliably included in the analysis, so it must also be ensured with the consideration that the selected articles have gone through a peer-review process. Inclusion criterion #2 was that only relevant studies were able to answer the two overarching research question frameworks that framed the review studies under consideration. For this purpose, the relevant parts of each article (see section 3-D) are scored. The researcher provides an assessment of whether the article directly discusses how design thinking is used in product development and also what are the research gaps in the article, so that researchers can identify research trends and what opportunities exist to guide research to be carried out in the future as well as help answer 2nd research question. In addition, based on what has been suggested by Vom Brocke, the exclusion criterion #4 of the conference article was not considered in this study because it has the goal of identifying more mature research (Sousa et al., 2019). Criterion #5 refers to articles obtained from more than one database.

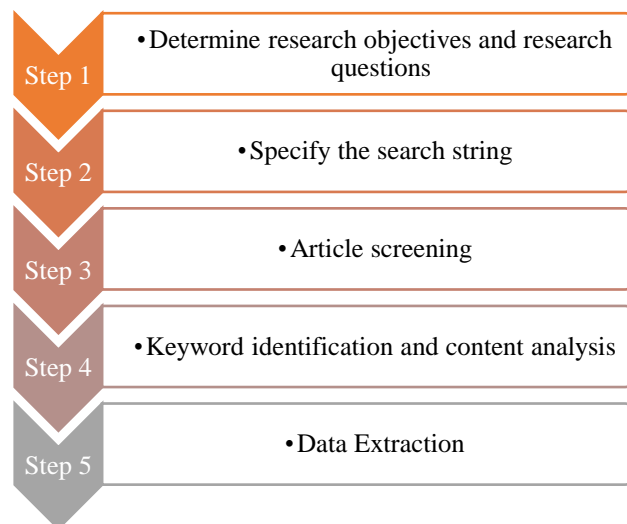


Figure 1. Review Process

### 3.4 Keyword Identification and Content Analysis

To answer the two research questions, the researcher conducted an analysis of the article keywords (J. Zhang et al., 2016) which provide an overview of the article content and the context of the research. In the absence of keywords, the researcher analyzed the contents of each article's abstract and introduction to be able to identify existing themes and gaps. If the abstract and introduction have deficiencies in terms of adequacy of information, then other parts of the article are also included for analysis. Classifying a large number of texts by describing the contents of the data through a coding process and by identifying themes or patterns is the goal (Singh & Thurman, 2019). A framework was created based on the themes identified in two different contexts, namely: the role of design thinking concerning product development in the context of business organizations and the context of education.

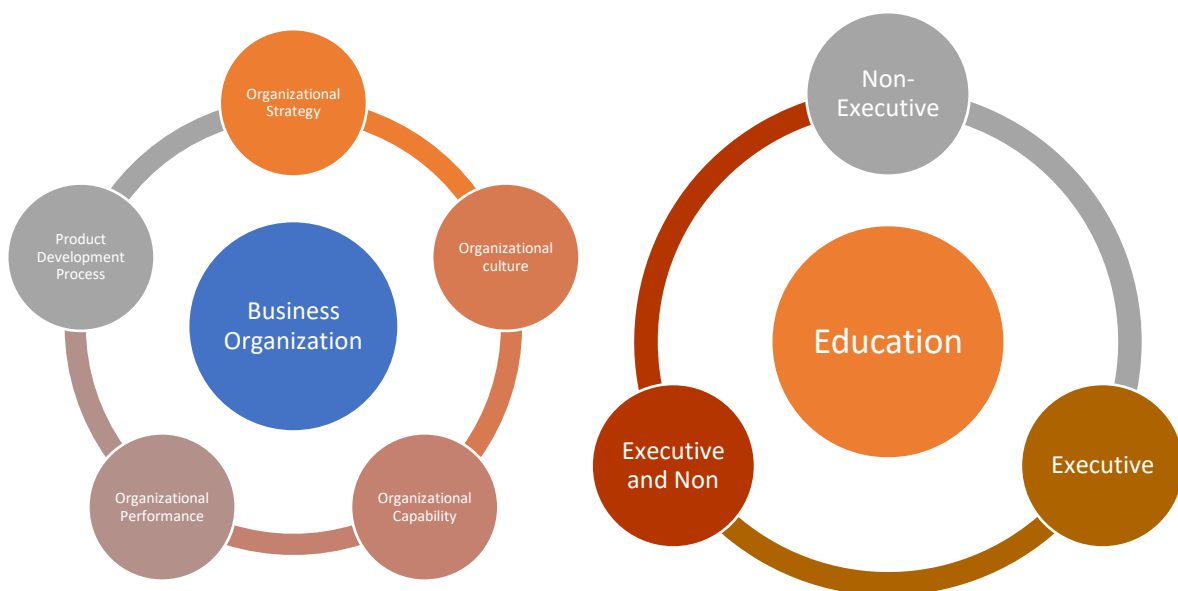


Figure 2. Research Conceptual Framework

Table 2. Research Questions

#	RQ 1	RQ 2
Research Questions	What research topics are studied in the field of design thinking studies with the relationship between product development?	What opportunities and trends exist for future research on the field of design thinking studies in relation to product development?
Description and Motivation	To expand how design thinking is used in product development according to a review of the scientific literature	To expand how research in the field of design thinking studies on new product development has experienced developments

Source: processed by researchers, 2023

However, we adopt a rigorous content analysis to classify all articles and thus ensure that each article is classified based on the most appropriate research theme.

### 3.5 Data Extraction

On each of the articles from 2012 to 2022. For the articles, we have extracted keywords, the year of publication, and also the research gaps, such as those in Table 4. Referring to the principles of thematic analysis (Centobelli, Cerchione, Chiaroni, Del Vecchio, & Urbinati, 2020). Articles are separated descriptively and thematically to derive research topics and themes.

Table 3. Inclusion and Exclusion Criteria

#	Inclusion Criteria
1	Peer-reviewed journal papers
2	Fields of study that are relevant to some of the research questions in this study
#	Exclusion Criteria
1	Not written in English
2	Key speakers, books, workshops, reports, editorials and conference papers
3	Duplicate studies

Source: processed by researchers, 2023

Table 4. Data Extraction Elements

Elements	Research Questions	Description
Key Words	RQ 1	Areas of knowledge where the research is published or presented
Years	RQ 2	The year that the study was published
Gap	RQ 2	Main problems/questions discussed by the study

Source: processed by researchers, 2023

By following a rigorous thematic analysis and a systematic approach to reviewing what studies were selected and revealing themes, a framework was developed to provide a holistic overview of the extensive literature on the contribution of design thinking to product development. Not only that, but researchers also develop maps that can visualize how then research in design thinking in product development develops, which has a function as a guide to identify opportunities from research.

## 4. Results and discussion

### 4.1 Design Thinking Search Framework in Product Development

The framework contained in Figure 2, provides a presentation of a combined research view based on design thinking in various product development themes and provides a structure for the next section. Table 5 contains examples of specific topics that are discussed in each category. The purpose of having a framework is to provide a typology for discussing, criticizing, and reflecting on the state of the art

that is developing on the topic of discussion. An overview of relevant studies is the aim of the framework, to investigate design thinking in product development in two different contexts, namely: business organizations and educational settings. In the context of discussing business organizations, researchers identify and organize five research themes related to the organizational typology framework, in line with the work of Luchs (Micheli et al., 2019). Meanwhile, in the context of education, researchers identified and organized them into three themes, all based on a policy perspective.

#### **4.2 Business Organization : The Role of Design Thinking in Product Development**

The discussion here will provide an understanding of how current design thinking is related to product development in organizations in the form of business. Research topics were obtained from the results of the selected articles, namely: organizational strategy, organizational capabilities, product development processes, organizational culture, and performance.

**Organizational Strategy:** when viewed from the point of view that design thinking is a mindset, it is useful to assist managers in dealing with even the most recent challenges (Liu, Liu, & Zhang, 2018) and there is also a need that proves to be effective for companies to be able to embrace and use design thinking in the business strategy used (Bongiovanni & Louis, 2021). This has the consequence that the focus of research on design thinking is moving from the direction of how to improve an innovation process carried out to how this can add value to organizational strategy (Ordieres-Meré, Prieto Remon, & Rubio, 2020). The findings that the researchers obtained were that in the first article published, a discussion regarding the importance of design thinking as a procedure in decision-making at a strategic level was conveyed by Sinha (Barata, Miguel, & Azevedo, 2018).

As well as finding a suitable approach for generating and sharing knowledge, it has the potential to be valuable for developing a knowledge management procedure (Ordieres-Meré et al., 2020). Not only that, other recommendations were made that design thinking has the potential to be more valuable in terms of helping to improve innovation outcomes through individual decision-making to reduce existing cognitive biases, for example, the empathetic and human-centered nature of design thinking itself by reducing the tendency of leaders to in projecting their world view onto others (Dell'Era et al., 2020). Recent studies discuss how design thinking contributes by focusing on how design thinking itself is upgraded to a more strategic level in organizations (Magistretti et al., 2021). Some of them are what was conveyed by Micheli that found six practices that can influence the design improvement process towards the strategy-making process, namely: how is the support provided by top management, leadership related to the design function, how to raise awareness of the role and contribution of design, inter-functional coordination, design evaluation and finally product formalization as well as the service development process provided (Björklund, Maula, Soule, & Maula, 2020). Another opinion was conveyed by Nakata that to help make decisions to identify the suitability of design thinking for the organizational environment concerned, a framework was developed that considered two relevant aspects in it, namely: related to organizational culture and leadership style possessed (Granato et al., 2022). Another view, by Chang, is that reviewing business cases in the real world and identifying several pathways that show how companies can create (or implement) strategies initiated by design thinking, which takes into account the unique environment of the organization (Eddington, Corple, Buzzanell, Zoltowski, & Brightman, 2020). Therefore, currently, the focus is on studying how design thinking can be used to develop innovation strategies, which have the goal of sustainable development (Di Vaio, Hassan, D'Amore, & Tiscini, 2022).

Table 5. Mapping References With Appropriate Research Themes

Research Themes	Product Development Process	Organizational Strategy	Organizational Capabilities
Source	(Açıkgöz, Demirkan, Latham, & Kuzey, 2021; de Paula et al., 2021; Hung & Liao,	(Barata et al., 2018; Björklund et al., 2020; Bongiovanni & Louis, 2021; Dell'Era et al.,	(Auernhammer & Roth, 2021; Calabrese, Castaldi, Forte, & Levialdi, 2018; Gliedt,

	2022; Kent, Snider, Gopsill, & Hicks, 2021; Lages, 2022; Laptev & Shaytan, 2022; Lichtenthaler, 2020; Magistretti et al., 2021; Nakata, 2020; Nylund, Brem, & Agarwal, 2021; Rudke, Zielinski, & Ferreira, 2023; Silva, Ghezzi, Aguiar, Cortimiglia, & ten Caten, 2020; C. Yang, Zhang, & Wei, 2022)	2020; Di Vaio et al., 2022; Eddington et al., 2020; Granato et al., 2022; Liu et al., 2018; Magistretti et al., 2021; Ordieres-Meré et al., 2020)	Hoicka, & Jackson, 2018; Hao, Liu, & Goh, 2021; Kamal, Sivarajah, Bigdeli, Missi, & Kolioussis, 2020; Li et al., 2020; Meinel, Eismann, Baccarella, Fixson, & Voigt, 2020; Mikalef, Pateli, & van de Wetering, 2021; Ravanello, Wolff, & Capra, 2017; Robbins & Fu, 2022; Sameti, Koslow, & Mashhady, 2022; Ünal, Urbinati, Chiaroni, & Manzini, 2019; F. Zhang, Sun, Liu, & Chang, 2020)
Research Themes	Organizational Performance	Organizational Culture	
Source	(Magistretti et al., 2021; Mansur & Djaelani, 2023; Meinel et al., 2020; Randhawa et al., 2021)	(Auernhammer & Roth, 2021; Baker III & Moukhliiss, 2020; Buhl et al., 2019; Kent et al., 2021; Komatsu, Salgado, Deserti, & Rizzo, 2021; Leon, 2021; Nguyen, Hoang, Nguyen, & Thi Pham, 2022)	
Research Themes	Non-Executive Education	Executive Education	Executive and Non Education
Source	(Arik & Topçu, 2020; Elsbach & Stigliani, 2018; Gerardou, Meriton, Brown, Moran, & Bhandal, 2022; Huang, Tao, Shi, & Wu, 2022; Jaskyte & Liedtka, 2022; Lundberg & Öberg, 2021; Manna, Rombach, Dean, & Rennie, 2022; Seidel, Marion, & Fixson, 2020)	(de Paula et al., 2021; Kujala, Nyström, Wendelin, & Brännback, 2022; McNally et al., 2020)	(Aminoff & Sundqvist-Andberg, 2021; Bakırhoğlu & McMahon, 2021; Lahti, Kangas, Härkki, & Seitamaa-Hakkarainen, 2022; Omwami, Lahti, & Seitamaa-Hakkarainen, 2020)

Source: processed by researchers, 2023

**Organizational Capability:** the ability to design thinking is developed by companies because of the notion that design thinking is a tool to encourage innovation due to its particularity, namely a focus on users (Mikalef et al., 2021) also can spark the emergence of new ideas that lead to innovation in an organization (F. Zhang et al., 2020). Human-Centric is an approach adopted for characteristics that describe the capability of design thinking (Mikalef et al., 2021) with the ability to work in cross-



disciplinary teams (F. Zhang et al., 2020), even both of which are considered suitable for carrying out innovation. Due to the desired uniqueness related to design thinking skills, several researchers are currently planning to increase research to understand how design thinking actually can be developed (Auernhammer & Roth, 2021; Kamal et al., 2020; Meinel et al., 2020; Ravanello et al., 2017; Sameti et al., 2022). A model was developed by Acklin regarding the design management absorption model which aims to provide support to SMEs with or without previous design experience to develop a mindset regarding design thinking as well as an indicator to measure the progress of absorption (Ravanello et al., 2017). Another opinion was conveyed by Mahmoud-Jouini that how managers should be able to develop design thinking skills in dealing with challenges faced by project management in corporate strategy and market exploration (Auernhammer & Roth, 2021). The results of a recent study presented by Appleyard that the relationship between design thinking and dynamic capabilities to examine how Siemens incorporates design thinking values into the R&D team aims to gain the title of leader in the market (Robbins & Fu, 2022).

**Product Development Process :** As explained in Table I, about the application of design thinking it is useful for realizing itself as a multifunctional tool that can also be used for making artifacts as a problem-solving activity (process) or also for reflective practice (mindset) (de Paula et al., 2021). Studies that are in line with the theme of this discussion provide a statement that the implementation of different design thinking can have the potential to be useful in the process of various product development methods (Lages, 2022; Laptev & Shaytan, 2022; Lichtenthaler, 2020; Silva et al., 2020; C. Yang et al., 2022; M. Yang, Fu, & Zhang, 2021). One of them is the use of design thinking in the concept development phase of product development in the automotive industry. A finding revealed that design thinking has proven to be very effective in the ability to capture what the users need and be able to communicate it to team members (Hung & Liao, 2022). Likewise, Wenngren said that design thinking can also be used as a support for the Engineering team to help overcome bad problems as well as develop impactful solutions during the concept development stage (Açıkgöz et al., 2021). Another suggestion was made by Bagno that design thinking has a positive effect on the idea-generation phase of an innovation process by providing a mechanism for structuring a process (Nakata, 2020). According to Micheli, several things must be highlighted regarding how design thinking can create a common language in the innovation process so that the designer as well as the product development manager can easily discuss and criticize ideas (Magistretti et al., 2021).

**Organizational Culture:** design thinking has a role in business, not just a tool that can provide support during the process, it becomes a fundamental mechanism for changing organizational culture (Baker III & Moukhliiss, 2020; Buhl et al., 2019). Organizational learning is also affected by cultural changes caused by the application of design thinking as a tool. As it has been found that the principles of design thinking and practice can also be used to reduce silos and encourage cultural change to help reduce the challenges faced in product implementation (Nguyen et al., 2022). The human-centered nature of design thinking will be seen to play a role in efforts to support companies to research effective users presented by Junginger (Kent et al., 2021). To create an organizational culture capable of exploiting the full potential of design thinking itself, scholars must be able to suggest new types of leadership (Leon, 2021), because leadership determines what important role it plays in providing support for companies to adopt design thinking for not only solving only a problem but also plays a role as an asset to the culture as a whole (Leon, 2021). To assist in framing the application of design thinking, a leader must have several characteristics, namely: having sense-making, being able to build relationships, creating a convincing vision for the future as well as being able to create something (Auernhammer & Roth, 2021).

### **Education : The Role of Design Thinking in Product Development**

Some evidence has been collected about how educational organizations can make changes in program aspects to meet industry needs. Emphasizing the importance of educating engineers about how to use and what design thinking is capable of and how to educate designers about what issues are related to the product development process itself (de Paula et al., 2021). The categorization of these areas is non-executive studies (for undergraduate and masters students), executive studies (for professionals), and

the combination of executive and non-executive studies, which provides a comparison of various strategies as well as student and professional behavior.

**Non-Executive Education:** it is a matter of debate that a design student must be able to teach related to how to manage all product development processes and how important design thinking is for strategic innovation processes because the main survival skills for students are precisely for the ability to enter the business world (Elsbach & Stigiani, 2018). Although there are many types of product design training, it is important that the teaching of design thinking is increasingly recognized in business schools (Seidel et al., 2020). Researchers found other things that teach design thinking to students with a marketing concentration can produce products that are more impactful and provide offers related to unique value during the job search process (Manna et al., 2022). This has impacted the interest of researchers to examine what pedagogical models are suitable for use in efforts to improve how design thinking is conveyed to Engineering students (Arik & Topçu, 2020).

**Executive Education:** not only improving the curriculum for students, but researchers have also conducted studies on MBA program students (de Paula et al., 2021; Kujala et al., 2022). An example is scholars identifying how the curriculum in the MBA program can have an increasing impact by using design thinking (Kujala et al., 2022). An interesting thing was found when researching what was taught in innovation courses, the researchers found that even though the syllabus of the courses provided differed substantially, more than half stated that they included design thinking in their curriculum (McNally et al., 2020).

**Executive and Non-Executive Education:** studies that make student and professional targets also appear in the data analysis conducted by researchers. There are only three articles found in this category. One of them is identifying professionals and students to understand differences in creative behavior when design thinking is applied (Lahti et al., 2022). Comparing the behavior between students and professionals, Eckert said that professional designers use more sustainability-type strategies in the innovation projects they carry out (Omwami et al., 2020). Two other articles reveal issues related to sustainability in the innovation project itself.

From an individual cognitive perspective, Roth suggested that design thinking would make it possible for teams to feel more motivated and empowered, while Liedtka suggested that design thinking would assist one's leadership to reduce bias from their own cognitive (Jaskyte & Liedtka, 2022; Magistretti et al., 2021). Another perspective, namely innovation, design thinking itself is seen as an approach that offers to conduct research on users that is more effective and has its strengths (Lauff, Knight, Kotys-Schwartz, & Rentschler, 2020; Mikalef et al., 2021; Qiu, Cano-Kollmann, & Mudambi, 2022) and promotes how is the involvement of policy owners on a larger scale and collaboration carried out across existing functions (Baker III & Moukhliiss, 2020; Niesten & Stefan, 2019; J. Zhang et al., 2016). Not only that, but several researchers also pay close attention to design thinking providing a construction so that it does not just capture existing knowledge (for example, research on users (Hung & Liao, 2022) and idea generation (Nakata, 2020) but also about how to transfer knowledge to appropriate policy owners (Ordieres-Meré et al., 2020). Scholars have also shown that the capability and dynamic nature of design thinking itself can offer deep support to companies in being able to rewire themselves to better navigate unpredictable and volatile markets (Magistretti et al., 2021; Roth et al., 2020; Rylander Eklund et al., 2022).

In summary, the contribution of the conceptual framework to this discussion by interpreting, classifying, and presenting existing research themes has used design thinking to address challenges related to product development in educational organizations and scenarios. This of course has the potential to offer in-depth knowledge of how to deal with complex conditions in the process of creating innovative solutions. To be able to provide a complementary analysis of the relationship between the two approaches, the next section will discuss how research in the field of design thinking in product development has developed over time and propose more detailed ideas that can inspire and initiate research furthermore.

## **4.2 Opportunities for Further Research**

### **4.2.1 Journey of Research Topic**

Reviewing coherence, it seems that the adoption of design thinking at a strategic level within a company must have a clear concept regarding what definitions, principles, and tools are used in the main process indicating that this is design thinking. Also, determine what will be the strategic goals behind the implementation of the design thinking itself. Not only that, management's ability to develop unique characteristics such as "reducing the level of control" to create an ecosystem where design thinking just can develop (Elsbach & Stigliani, 2018; Knight et al., 2020; Randhawa et al., 2021). Reviewing what is in Figure 3, most of the study studies are related to design thinking and the product development process. The discussion on this theme is related to the potential of tools and techniques used in design thinking (for example, prototyping, and brainstorming) to increase the chances of successful product development being carried out (Idris & Durmuşoğlu, 2021). The challenge in this area is focused on the need to guide how to strategically incorporate design thinking into the product development process (Magistretti et al., 2021; Zheng, Xiong, Chen, & Li, 2021).

The interesting thing that was found was that there were only five articles related to "organizational performance" that was selected for this analysis; of these five articles, four articles were published in 2020. While the remainder were published in 2014 which is a literature review and focuses on the effects of strategy when design thinking is used (Lybæk, Christensen, & Thomsen, 2021), four other articles were published in 2020 discuss what indicators are used to assess how the impact is given by design thinking (Canto Primo, Gil-Saura, & Frassetto-Deltoro, 2021; Meinel et al., 2020; Nagaraj, Berente, Lyytinen, & Gaskin, 2020; Nakata & Hwang, 2020) which has published in 2020 with a focus on discussing what indicators are used in assessing the impact of design thinking on company performance which has shown that researchers are now far more interested in measuring that impact. For future researchers, it is recommended to dig deeper into opportunities and explore how the role of design thinking can improve performance in organizations in depth.

### **4.2.2 Deficiencies and Gaps in the Literature**

First, there is still a lack of guidance on how to use design thinking strategically as one of the resources owned in business (Govindan, Shaw, & Majumdar, 2021; Hull, Millette, & Williams, 2021; Hung & Liao, 2022; Lyu et al., 2022; Magistretti et al., 2021; Micheli et al., 2019; Rylander Eklund et al., 2022). The analysis that the researchers carried out based on the findings is that management is one of the things that must be considered for the potential use of design thinking in efforts to increase the success of product development carried out. The result is that today's scholars are more interested in understanding how to integrate design thinking itself more strategically in organizations (de Paula et al., 2021; Niesten & Stefan, 2019). Most of the other research focuses on how to strategically insert design thinking into the product development process, there is a tendency that in research that identifies organizational factors that can influence how design thinking is implemented, such as leadership characteristics (Baldassarre, Keskin, Diehl, Bocken, & Calabretta, 2020; Dell'Era et al., 2020), skill development (Gheitarani, Nawaser, Hanifah, & Vafaei-Zadeh, 2023), performance systems (Ali & Anwar, 2021), and changing culture (Elsbach & Stigliani, 2018).

Second, there is still a lack of guidance on how to measure the impact provided by the use of design thinking as an integral part of syllabus courses at University/Higher Education on student learning and development (Lundberg & Öberg, 2021). The analysis made by the researcher is to show that the discussion that occurs is motivated based on whether students should be educated about design thinking for product development towards how to empirically measure the impact of having a product design course on student learning (Gerardou et al., 2022; Lundberg & Öberg, 2021). Specifically, there is a tendency to promote collaboration between universities and industry (Gerardou et al., 2022; Lundberg & Öberg, 2021), not only about giving students opportunities for practical experience but also how professionals are trained through the opportunities that exist. to learn from young minds.

## 5. Conclusion

This study responds to the increasing interest in design thinking and the rapid growth in the proliferation of studies by providing a review of design thinking and its relation to product development that has occurred over the last 10 years. Specifically, this study reveals 1) articulates the scope of research studies in the field of design thinking concerning product development; 2) investigates research gaps and challenges encountered; and 3) ensures that the theoretical and practical implications of the findings are obtained. In particular, the current study investigates the importance of design thinking for organizations, synthesizes how design thinking can be interpreted and understood in the existing literature, and develops a framework that can offer an overview of what has been learned so far.

### Limitations and advanced study

Apart from the contributions made, this research of course still has limitations in it. First, regarding evidence from articles that provide different perspectives and also limitations on the topic of discussion, the researcher suggests further research to complement what has been done in this study with empirical evidence that arises from collaborations carried out between researchers and industry. Second, the results obtained from the literature review are greatly influenced by the use of keywords. Future research should be carried out by ensuring that the research parameters carried out must reflect all possible search strings to be used by scholars when focusing on design thinking. This research article may be an exception, based on the use of keywords, considered to have content that is under a complete text review. Third, this study did not carry out an analysis related to the impact of the article through citation analysis.

In this research, the focus is also on the number of fields that are needed for further investigation. First, as has been explained that there is a need for an in-depth understanding of strategic choices that can facilitate the integration of design thinking concerning the product development process. Second, the researcher's opinion that identifying the impact of including design thinking in the University program syllabus on student learning in product design requires further attention. This of course will provide support to educators to better prepare students to become professionals who can develop in any company that has leadership by design. Finally, an exploration of the concepts and theories discussed in this study in industry-specific scenarios will also help.

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