

# Unraveling the Threads of Design Thinking, Innovation, and Business Growth: A Holistic Review and Analysis

Sanjeev Singh<sup>1</sup>, Chhabi Sinha Chavan<sup>2</sup>

<sup>1</sup>MIT ADT University: MIT Art Design and Technology University, Email: sanjeevrajput@aim.com

<sup>2</sup>MIT ADT University: MIT Art Design and Technology University,  
Email: chhabi.chavan@mituniversity.edu.in

---

Received: 08.04.2024

Revised : 17.05.2024

Accepted: 29.05.2024

---

## ABSTRACT

In the dynamic landscape of business, commonly used terms such as "Design Thinking," "Innovation," and "Research and Development" are often disregarded as mere trendy jargon. Nevertheless, many case studies have demonstrated that implementing these concepts can bring new life into struggling companies and ensure their triumph. In a fiercely competitive market fueled by customer satisfaction and innovation, enterprises must infuse captivating and emotive elements into their products and services, profoundly impacting customers' lives. Integrating Design Thinking-led Innovation is indispensable for enterprises aiming to stay relevant and gain a competitive edge. Unfortunately, numerous organizations lack the necessary integration and collaboration across various functions, impeding the promotion of innovative ideas. Through an extensive literature review, the paper explores the history, principles, frameworks, and tools of Design Thinking while analyzing the measurement metrics used to assess its impact on innovation initiatives. Moreover, by extensively reviewing 111 leading publications, journals, and authoritative sources, we investigate the interconnected realms of Design Thinking, Innovation, and Business Growth.

**Keywords:** Design Thinking, Innovation, Business Growth, Research and Development.

## 1. INTRODUCTION

In our increasingly interconnected world, the market exhibits a remarkable level of connectivity. This interconnectedness presents a continuous stream of fresh challenges and opportunities that can propel enterprises to flourish or, in extreme cases, lead them toward extinction. Customers' loyalty hangs in the balance, urging companies to reinforce their innovation strategies to ensure customer satisfaction and the sustained success of their businesses. Enterprises recognize that exceptional Design has the potential to be a significant factor in problem-solving and the development of innovative products and services, setting them apart from competitors. Design thinking has played a decisive protagonist in the growth and success of numerous Fortune 500 companies, including Apple, Microsoft, Disney, and IBM. These industry giants have embraced the principles of Design Thinking to craft innovative products and services, paving the way for their remarkable achievements in the business world. (PIKOVER, 2023). In the age of profound digital transformation, the requirements, desires, and aspirations of end-users undergo constant evolution.

Furthermore, with many options available in the market, end-users have abundant choices when purchasing products or services. Consequently, the competition in the market is fierce. To enhance revenue and secure a competitive advantage, relying solely on price and features to entice and fulfill customers is no longer sufficient. Companies actively strive to incorporate a captivating and vibrant element into their offerings, aiming to create a profound impact and establish a strong customer bond. (Magids et al., 2015).

### 1.1 Design Thinking

Design Thinking has emerged as a pivotal approach for enterprises seeking to stay ahead in the market and satisfy their customers. Design thinking has become crucial in this pursuit, acting as a catalyst or booster for Innovation (Crossan & Apaydin, 2010). Design Thinking is widely embraced across various sectors, including both public and private enterprises, to propel innovation endeavors (Rauth et al., 2014) (Liedtka et al., 2020). With an impressive boost in efficiency of nearly 75%, enterprises employing design thinking witnessed a remarkable surge of over 300% in return on investment (ROI) (Bhragu Haritas, 2019). Design thinking has a rich and impactful history, with its roots traced back to the

1960s when it was initially referred to as design science (Cross, 2001). Back in 2008, Tim Brown, the widely recognized CEO of IDEO, emphasized in his article for the Harvard Business Review that adopting a designer's mindset has the potential to revolutionize the approach to product development, service delivery, process improvement, and even strategic decision-making (Tim Brown, 2008). Through insight, observation, and empathy, design thinking is indispensable in discovering and understanding these needs and wants. (Tim Brown, 2008). Design Thinking subjects are taught at universities worldwide, such as Stanford, MIT (Massachusetts Institute of Technology), and Harvard.

Moreover, many educational and professional organizations collaborate with industry experts to teach Design Thinking. The school asserts its commitment to nurturing and fostering creative abilities among individuals and groups through various courses and workshops. (Hasso Plattner Institute of Design, 2023) (d.school, 2023). Udemy offers a comprehensive five-step design thinking process that empowers individuals to tackle problems through a human-centered approach (udemy, 2021). Within an organization, teams and problem dimensions often possess intricate complexities. To address these challenges, the renowned computer giant IBM advocates adopting a human-centered Design Thinking approach to solve problems effectively (IBM, 2019a). LinkedIn, a well-known professional social networking company, offers various courses that delve into the intricacies of design thinking and its practical applications. (LinkedIn, 2023). The Batten Institute for Entrepreneurship, in partnership with the University of Virginia, focuses on imparting knowledge of the Design Thinking approach, primarily emphasizing its application in the realm of the Social Sector (Batten Institute, 2023; Liedtka, J.; Salzman, R.; Azer, 2017). Organizations constantly seek suitable tools and improved techniques to create innovative products catering to end-user's needs. As part of this endeavor, Coursera collaborates with the University of Sydney to educate students and corporate professionals on the principles of the Design Thinking approach (Coursera, 2023).

Furthermore, the University of Sydney provides an array of Master of Design courses (University Of Sydney, 2023). IDEO, the iconic pioneer of design thinking, offers comprehensive instruction in the fundamentals of this transformative methodology and grants official certifications (IDEO U, 2020). MIT, the renowned institution, presents Mastering Design Thinking for individuals dedicated to propelling innovation, fostering growth, and enhancing the customer experience within their business endeavors (MIT, 2023). The Design Thinking certificate program at Cornell University equips students with the skills and knowledge to create and enhance products, experiences, and systems using a human-centered approach (Cornell, 2023). Enterprises focus on human-centric products and solutions with customer experience at the core. Harvard teaches Design thinking to enhance customer experience (Harvard, 2023). Design thinking is making strides across academia, corporations, and among professionals of varying experience levels, including C-level executives. Nearly everyone acknowledges that Design thinking revolves around a human-centric problem-solving approach. The design thinking approach has made significant inroads into major global enterprises, including GE, Google, Apple, and GE, and is being actively implemented across various organizations (Dam Friis & Siang Yu, 2020). Design thinking is an iterative process that uses the "Why, what, and how" questions to grasp users' needs, identify challenges, and generate innovative solutions that are not readily apparent due to limited knowledge (Pusca & Northwood, 2018). Various global companies and academic institutions adhere to distinct Design Thinking (DT) principles, rituals, and artifacts, each with unique approaches.

Moreover, creativity is vital in the Design Thinking methodology, which emphasizes generating, selecting, and retaining ideas (Müller & Thoring, 2011). The Design Thinking approach was compared and analyzed in academic settings using students from three disciplines: industrial design undergraduates, architecture undergraduates, and design Ph.D. candidates. Gabriela Goldschmidt and Paul A. Rodgers discovered differences and essential similarities among these students, indicating that many aspects of design thinking are universal across domains (Goldschmidt & Rodgers, 2013). Design Thinking is an iterative process with stages like empathizing with users, defining needs and problems, generating ideas, creating prototypes, and testing. It leads to innovative solutions and fosters creativity (Mummah et al., 2016). The design field is complex and sometimes confusing. In the realm of design practices, the incorporation of "Abduction" and "Reasoning" concepts holds immense significance, contributing substantially to the overall success of the design process (Owen, 2011). In his insightful analysis, Charles L. Owen emphasizes the paramount importance of innovations within Business. He astutely recognizes the inherent intricacies associated with innovations and the various approaches and characteristics encompassed by Design Thinking (DT); Mr. Owen effectively delineates fifteen attributes encapsulating the essence of design thinking, an invaluable methodology for tackling problems, addressing issues, and embracing opportunities, ultimately propelling us toward success in Innovation. (Owen, 2006).

### 1.2 Various Frameworks and Tools for Design Thinking

The d.school at Stanford University provides a succinct framework for understanding design thinking, encapsulated in five core steps: Empathize, Ideate, Prototype, and Test (d.school, 2018). Tim Brown introduces the Design Thinking process as a fluid progression comprising three essential stages: Inspiration, Ideation, and Implementation. It is crucial to understand that these stages do not strictly follow a linear sequence but instead embrace an iterative approach, enabling adaptability in their utilization (Tim Brown, 2008). Inspiration leads to interactive learning, ideation involves generating and testing ideas, and implementation entails building and promoting solutions for user adoption (Tim Brown, 2008). The Design Thinking process model, presented by the HPI School of Design Thinking, comprises six iterative steps. These steps include Understanding, Observing, Establishing a Point of View, Ideating, Prototyping, and Testing (Thoring & Müller, 2011). Fostering innovation initiatives through integrating Design Thinking (DT) and various complementary methodologies and tools, including lean startup, places a central emphasis on the Customer (Thoring & Müller, 2011). Hence, it plays a vital role in formulating a comprehensive innovation strategy. The double-diamond design process model embraces both divergent Thinking and convergent Thinking approaches. This framework is for designers and non-designers and consists of four stages, all beginning with the letter "D." These stages are as follows: Discover, Define, Develop, and Deliver (Council, 2005). The IBM enterprise design thinking model, known as the "Loop," follows a three-stage iterative process: Observing, Reflecting, and Making (IBM, 2019b). An amalgamation of the Design Thinking framework and VIRO (business analysis framework) (Barney & Hesterly, 2015) explores the potential advantages that innovation initiatives can bring to small and medium-sized enterprises (Seo et al., 2016). DivingBoard's inception embraces a fusion of participatory Design, design thinking, and agile methodologies, converging to tackle social and environmental challenges (Newman et al., 2015). Sara L. Beckman and Michael Barry's approach to design innovation centers around end-users and consists of four key stages: Observations, Frameworks, Imperatives, and Solutions (Beckman & Barry, 2007).

### 1.3 Innovation

Generally, an Innovation initiative encompasses a wide range of activities, encompassing the development, implementation, and integration of fresh ideas, products, approaches, or technologies (Ferreira et al., 2020). Innovation capability includes the capacity and expertise to improve current products and technologies while creating fresh and original solutions through the practical application of knowledge, resulting in tangible products and processes (Romijn & Albaladejo, 2002). A study indicates that knowledge plays a fundamental and central role in fostering Innovation and digital transformation, which drives enterprise growth and enhances competitive advantage (Durst et al., 2024; Feng et al., 2024; Usai et al., 2018). A study highlights the critical role of knowledge-based innovations in enhancing law enforcement practices, focusing on strengthening public security. It further presents a detailed framework for implementing knowledge-driven professional management within this domain (Lin & Wu, 2023). A company's capacity to foster Innovation reflects its potential to create groundbreaking tools and products to drive remarkable financial outcomes (Andrea Rangone, 1999). Moreover, it enhances a company's resources and capabilities, strategically harnessed to seize opportunities and generate new and groundbreaking outcomes (Koc, 2007). The company's intangible assets play a vital role in fostering such progress while harnessing these assets is equally essential for the company's capacity to innovate (Saunila & Ukko, 2012). Innovation is a vital driver of overall business success, enabling companies to navigate external challenges and thrive in a volatile market (Darroch & Mcnaughton, 2002; Keiningham et al., 2020).

The capacity to innovate is crucial in meeting market needs, as innovation capabilities are the decisive element in attaining a competitive edge (Rajapathirana & Hui, 2018). Building innovation capability requires a significant commitment to research and development, which showcases an organization's capacity to generate groundbreaking tools and products, ultimately resulting in outstanding financial achievements (Andrea Rangone, 1999). Moreover, it enhances a company's assets and capabilities, which are leveraged to seize opportunities and generate groundbreaking and inventive products or services (Koc, 2007). The intangible assets owned by an organization serve as the key driving force behind its development, playing a vital role in shaping its innovation capacity (Saunila & Ukko, 2012). Innovation plays a pivotal role in enabling companies to navigate the ever-changing landscape of external influences, serving as a vital catalyst for overall business success, especially in unpredictable markets (Darroch & Mcnaughton, 2002; Keiningham et al., 2020). Exploring Innovation Capability (IC) has encompassed numerous perspectives, revealing its intricate and multifaceted nature (Saunila, 2016). Innovation can be broadly classified into two main categories: radical and incremental (Pascual-Fernández et al., 2021; Quintane et al., 2011). Radical Innovation entails generating novel knowledge and

constructing something unprecedented while introducing disruptive changes to established technological trajectories, rendering existing products or services obsolete (FARIBORZ DAMANPOUR, 1991; Mendoza-Silva, 2020).

On the other hand, incremental Innovation involves enhancing the effectiveness of current products by incorporating feedback from end-users and creating fresh, captivating solutions that generate substantial profits (Acemoglu et al., 2020; Lee, 2011; Mendoza-Silva, 2020). The dual-core innovation theory divides Innovation into two distinct components: management innovation and technical Innovation (Kalay, 2016). Technological Innovation encompasses developing an organization's products, services, or production processes, whereas administrative Innovation focuses on improving production/business processes (Kalay, 2016; Lee, 2011). Indirectly, technical innovations are stimulated by administrative innovations, and thus, it is crucial to have both management and technological innovations as they complement each other (FARIBORZ DAMANPOUR, 1991). According to a recent study, innovation capability comprises five key components. These components are product innovation, which involves modifying or improving existing products; market innovation, which aims to identify new market opportunities and develop innovative advertising and promotion strategies; service innovation, which focuses on enhancing the effectiveness of service processes; process Innovation, which involves expanding or improving production or delivery methods; and organizational Innovation, which pertains to the development of new techniques for everyday tasks, work environment, or external relations. (Mendoza-Silva, 2021).

#### 1.4 Measurement and Metrics

The DMI Design-Centric Index demonstrates that organizations focused on design-centric approaches flourish by implementing design thinking-led innovations (Design Management Institute, 2013) (Rauth et al., 2014). While some success stories have limited evidence to support the effectiveness of DT-led innovations, most enterprises still face significant challenges when implementing DT (Carlgren et al., 2016). Every organization possesses unique characteristics and tends to adopt distinct approaches when leading innovations in design thinking (DT). Consequently, measuring the impact of Design, service design, and overall design thinking within organizations becomes complex, lacking a standardized and universally applicable method (Meinel & Leifer, 2012). Despite the abundance of research and widespread adoption of Design Thinking in driving Innovation, there remains a challenge in identifying suitable metrics for measuring the effectiveness of Design Thinking or its impact on innovative outcomes (Björklund et al., 2018).

Organizations employ a variety of metrics to monitor and evaluate innovations. The innovation process unfolds across multiple stages, requiring corresponding indicators and metrics at each step to facilitate accurate measurement. Research demonstrates that although theoretically sound, numerous indicators often fail to be implemented in practical settings, and actualizing them appears complex. Moreover, most indicators and metrics introduced during the initial phases of innovations seem inadequate (Dziallas & Blind, 2019). Digital Innovation Units (DIUs) have effectively propelled organizations' digital transformation. However, research indicates numerous companies are falling behind or lacking tangible evidence to assess their success. This situation primarily arises from DIUs not completely aligning with the leading company, thereby prompting concerns about the overall setup of the DIU (J. P. Raabe et al., 2020; J.-P. Raabe et al., 2021). Many businesses use measurement metrics to evaluate their digital innovation efforts. Some critical metrics employed in practice include the number of patents, internal metrics such as profitability, risk assessment, risk mitigation, and productivity, and market-facing metrics like time-to-market and market share (Kohli & Melville, 2019). The significance of innovations and digital transformation (DT)-led advancements is demonstrated through extensive research and studies. Various frameworks, measurement metrics, tools, and processes exist regarding DT and D.T.-led innovations. Evaluating whether one framework is superior to others or if organizations can effectively quantify their impact remains controversial (Carlgren et al., 2016) (Micheli et al., 2019).

#### 1.5 Role Patents in Business Growth

When companies generate patents, they commit substantial resources to Innovation, including dedicating funds to research and development initiatives. According to Gautam & Curba, Innovation can be defined as the process of transforming solutions into marketable products or services (Ahuja & Lampert, 2001). Generally speaking, research and development (R&D) expenditures and patents are commonly acknowledged as indicators of Innovation (Kleinknecht et al., 2002). The act of seeking a patent arises from involvement in research and development endeavors. The patent documentation contains credible information about the innovative procedure that has undergone thorough examination by an official patent authority (Kang & Motohashi, 2014). Although patents do not serve as an absolute gauge of Innovation, a company's commitment to research and development and the number of patents it files can

provide insights into its overall level of innovative practices. According to John Adams, the former Executive Vice President of Honda of America Manufacturing, numerous companies neglect to promptly patent their novel ideas or solutions, inadvertently keeping the world unaware of their groundbreaking endeavors (Sam Heller, 2022).

## **2. Literature Review regarding R&D, Patents, and Potential Impacts on Innovation**

### **2.1 Design Thinking Revisited (McCausland, 2020)**

Numerous research papers and articles discussing "Design Thinking" have been published, with many citations available in the public domain. These works cover various topics, including success stories, personal experiences, valuable suggestions, constructive critiques, and academic certifications. However, the prevalent notion surrounding "Designs, Innovations, solutions, problem-solving, etc." often creates an illusion that these subjects solely target designers or individuals engaged in hands-on work within organizations. Sometimes, organizations adopt the "Design Thinking" framework for Innovation, but unfortunately, it is treated merely as a checkbox or a formality to fulfill. (Ketterman, 2019) As a result, it fails to yield any tangible innovation outcomes within the company. Some organizations appear to lack a strong commitment to design thinking, opting to take shortcuts and disregard the fundamental principles of the approach.

Consequently, this results in a shortage of genuine Innovation within these organizations. According to Michael Hendrix, the Global Design Director of IDEO, there is a concept he refers to as the "theater of innovation." He suggests enterprises often exhibit a superficial approach to Innovation and design thinking, producing minimal tangible outcomes (Schwab Katharine, 2018). The underlying cause may stem from DT being potentially disconnected from the enterprise strategy and lacking the necessary stakeholder commitments. Achieving innovative outcomes through design thinking necessitates a strategic approach encompassing the entire organization's dedication and buy-in rather than relying solely on a few individuals or departments. Whether delving into the past or examining the present, a recurring theme arises: Digital Transformation (DT) is dedicated to resolving complex challenges and maintaining a steady pace of innovative advancements, all in pursuit of delivering the utmost user experience. In essence, DT is a vital conduit for value and expansion within companies (PIKOVER, 2023).

### **2.2 Design Thinking: How To Thrive In A Vuca World (Krawchuk, 2018)**

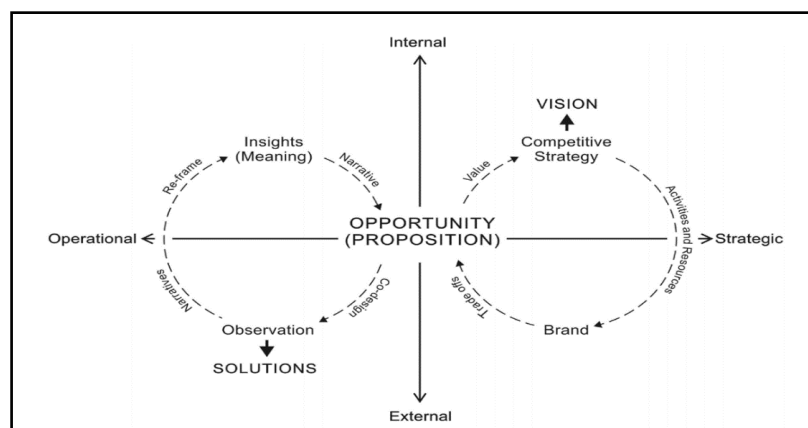
Due to VUCA (volatile, uncertain, complex, and ambiguous) market conditions, businesses face significant challenges. These VUCA market conditions will probably continue to manifest as customer desires, wants, and a plethora of options in the market persistently entices aspirations. Incorporating a connected approach in Design Thinking involves establishing a profound bond with customers and fostering an emotional connection through continuous availability and engagement, operating at an accelerated pace, such as nearly round-the-clock connectivity (Siggelkow & Tarwiesch, 2019). A cohesive and interconnected approach can propel customer-focused innovations, bestowing a competitive edge and delivering exceptional experiences to an enterprise's end customers (McCausland, 2020). The term "VUCA," coined in 1987 (wikipedia, 2019), aligns perfectly with the globalized world in which business leaders strive to ensure the relevance and profitability of their enterprises. Disruptions arise from many factors, encompassing technological advancements, political unrest, emerging competitors, shifting customer preferences, and more. The customers ultimately determine the acceptance or rejection of products and services in a business.

Therefore, the "Customer" factor significantly influences all disruptive elements, leading to disruptions (Teixeira, 2019). The design thinking approach offers a compelling prospect for fostering Innovation in the dynamic and uncertain VUCA market conditions. The incorporation of design thinking at the heart of the US Army's operations not only strengthens their own Business but also catalyzes other companies worldwide, showcasing the viability of this approach (Roger Martin, 2010). Whether knowingly or unknowingly, directly or indirectly, the majority of products and services serve to address human problems. Therefore, adopting a human-centered design approach appears to be the most effective approach for navigating VUCA (volatile, uncertain, complex, and ambiguous) conditions. The success of innovation hinges upon the identification of problems or challenges from the very beginning. To define the problem statement, designers must immerse themselves and engage with stakeholders. Among these stakeholders, the customer plays a pivotal role as a key influencer within the innovation ecosystem. In Innovation, designers and teams should closely monitor the environment, including market threats, emerging technologies, socio-economic changes, competition, market trends, opportunities, and more. A comprehensive understanding and the sharing of information form an integral part of the broader strategy underpinning Design Thinking-led Innovation. Even our armed forces continue to leverage the principles of Design Thinking in problem-solving. They employ a process encompassing inspiration,

ideation, feasibility, viability, customer engagement, prototyping, pilot project testing, and feedback to reinforce the business community's faith in Design Thinking. The US Army, for instance, began by observing Afghanistan's local customs to address on-the-ground challenges. Subsequently, they developed a comprehensive strategy rooted in the fundamentals of Design Thinking, with "empathy" occupying a central position. A meticulous design process avoids assumptions and actively encourages input and ideas from key stakeholders across the innovation value chain. Innovation thrives through collaborative teamwork, guided by design leadership, where every individual brings unique ideas and skill sets and participates in collective action (Caroline Perry, 2012). It is essential for our organization's key executives, along with relevant stakeholders, to actively participate in shaping the innovation strategy and doctrine. This approach should foster a culture of continuous learning from successes and failures while promoting increased experimentation, prototyping, and the initiation of pilot projects (Streitfeld David, 2017). Encouraging and empowering the design team to engage in experiments and prototyping is essential, as it can pave the way for successes and failures that ultimately lead to refined ideas and solutions. It is crucial to facilitate rapid and cost-effective development of early prototypes and experimentation to gain a practical understanding of the proposed solution.

### 2.3 Three Narrative Techniques for Engagement and Action in Design-Led Innovation (Price et al., 2018)

Innovation is an ongoing journey that empowers organizations to maintain a competitive edge in the marketplace. The Design Thinking approach integrates creativity and Innovation on equal grounds, emphasizing the need for a holistic culture of Innovation as the critical success parameter in developing sustainable and marketable products or solutions (Worktech Academy & Johnson Beck, 2016) (Emprechtinger, 2018). In light of the intricate market dynamics, businesses are compelled to deviate from conventional strategies and seek innovative approaches to generate distinct value for the market. Design thinking-driven innovation paves the way for future-focused value creation that surpasses customer desires or demands (Harvard Business School & Verganti Roberto, 2023). Based on 18-month action research, it has been suggested that incorporating narratives, including low-fidelity, realistic, and strategy narratives, can be an effective tool for driving successful and sustainable design-thinking-led innovations. In the study, a team of researchers introduced a design thinking-led innovation framework within an Australian Airport Corporation. Figure no: 1 illustrates the framework's validation through action research, highlighting its effectiveness in supporting essential stages of the creative innovation process. Moreover, the study effectively persuades managers to embrace design-led Innovation and offers valuable practical guidance. Developed by Sam Bucolo, Cara Wrigley, and Judy Matthews, the design-led innovation framework considers a comprehensive 360-degree perspective of the organizational ecosystem, encompassing external stakeholders like customers.



**Figure 1.** Design-led innovation framework (Bucolo et al., 2012)

The team employs diverse methods to coordinate and collaborate, effectively reducing occupational disparities. The overarching objective of the enterprise strategy is to advocate for the company's collective interests. Consequently, integrating "Design Thinking-led Innovation" into the enterprise strategy fosters a culture of Innovation, ensuring the organization maintains a competitive advantage in the market. This study focuses solely on the Australian Airport Corporation, examining three narrative techniques. Future research should investigate the application of these narrative techniques in various

companies to enhance the framework's validity. Furthermore, additional research can contribute valuable insights into the practical implementation and benefits of Design Thinking-led innovations.

#### **2.4 Can Design Thinking Mitigate Critical Strategy Implementation Risks? (Lund Strøm et al., 2018)**

Developing, formulating, and executing a strategy within an organization poses considerable challenges. Extensive literature review and exploratory research have identified numerous notable risks associated with strategy implementation, which can be addressed by applying design thinking methodology. The research study delves into strategy implementation risks, aiming to establish correlations between these risks and the foundational principles of design thinking. The study implies that Design Thinking is crucial in successfully implementing strategies and fostering enterprise success. Moreover, the initial assessment of identified risks is carried out in collaboration with practitioners. Essentially, the research demonstrates that employing design thinking aids in mitigating the risks associated with strategy implementation. However, the proposed solution has undergone minimal validation, rendering the overall approach somewhat conceptual. A more comprehensive investigation involving diverse practitioners could yield novel findings. Furthermore, thoroughly examining effective strategy implementation practices could offer valuable insights for developing additional design thinking tools. The validation of identified risks has been rudimentary and limited, involving only practitioners. Consequently, the suggested solution through design thinking appears to have conceptual shortcomings, representing a gap in the current research.

#### **2.5 Capturing the value of Design thinking in different innovation practices (Kleinsmann et al., 2017).**

Continuous Innovation within an organization's products or services provides additional value to its customer base and the enterprise. Therefore, companies must incorporate continuous Innovation as an essential component to remain relevant (Steve Banker, 2021). In the realm of Innovation, Design Thinking finds its application, albeit with varied perspectives from different stakeholders involved. However, an evident gap exists between the theoretical knowledge of Design Thinking and its practical implementation. This disconnect poses a challenge in fully harnessing the actual value and benefits of Design Thinking within the domain of Innovation. The disparity between management and designers further fuels the discourse surrounding the roles of Design Thinking in the early stages of Innovation.

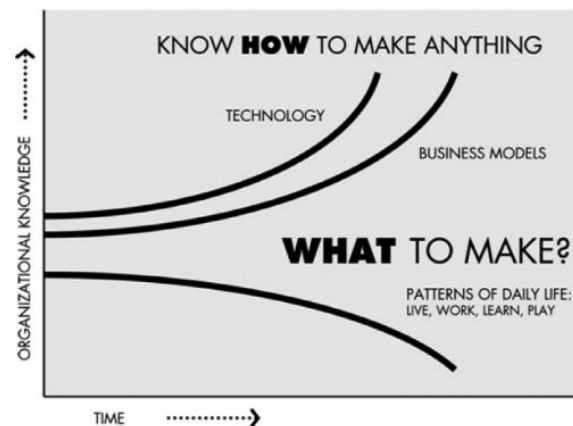
Consequently, Design Thinking is often applied ambiguously, leading to a decline in the quality of innovative outcomes. It is essential to recognize that Innovation strongly correlates with overall enterprise value and growth. This research explores the significance of design thinking in early-stage innovation practices while acknowledging the gap between theory and practical implementation. In order to bridge this gap, the study endeavors to connect academic theory with the practical aspect of design thinking. A card deck has been developed to achieve this, drawing inspiration from the literature on design expertise. This card deck aims to serve as a means to unite theoretical knowledge of Design thinking with its practical application.

Furthermore, it can function as a common language and tool to capture the value of design thinking in early-stage Innovation effectively. It is important to note that the study primarily focuses on utilizing Design thinking during the early stages of the innovation process, and its applicability to Design thinking-led Innovation may not be conclusive. Ultimately, the card deck is designed to facilitate communication and bridge the gap between theoretical knowledge and practical implementation of Design Thinking in various innovation endeavors. Furthermore, an examination was conducted on the card deck to assess its acceptance among scholars and innovators. This deck can be valuable for training and educating individuals on design thinking principles. Data was collected primarily through interviews with scholars from Design and Management, encompassing regions such as Western Europe (NL, DE, SE, GB, DK) and the United States. It is worth noting that the validation of the card deck was predominantly carried out by senior individuals, such as managers, and did not include direct involvement from individuals engaged in hands-on Design Thinking-led innovation activities. Nevertheless, an additional study considering subsequent phases of Design Thinking involving extensive participation from individuals engaged in actual hands-on activities could yield fascinating results. Such a study has the potential to establish the credibility and potential of the card deck more convincingly.

#### **2.6 Design thinking as a business tool to ensure continuous value generation (Volkova & Jäkobsone, 2016)**

In an era of globalization, the market has become fiercely competitive, reducing customer loyalties. Customers' needs, demands, and desires are evolving rapidly, leading to confusion amidst the vast array of choices available in the market. Enterprises commonly encounter and endeavor to overcome many

prominent challenges, such as competition, customer loyalty, uncertainty, resources, and globalization (Conner, 2013). A study was conducted using a survey research method to determine the level of Design Thinking awareness among selected Latvia companies. The research also investigated whether these companies were actively involved in Design Thinking-led innovations. Of 1600 randomly selected respondents from companies in Latvia, 374 responses were received. The findings indicate that most respondents (over 60%) perceive Design Thinking as a trendy concept rather than a valuable addition to Innovation. Most companies prioritize short-term business decisions and cost reduction rather than embracing Design Thinking to unlock Innovation and ensure continuous value creation. The study recognizes that corporate leaders face challenges in fostering Innovation, as evident from the "Innovation knowledge gap" illustrated in Figure 2. It highlights the difficulties leaders encounter when implementing innovative practices within their organizations.



**Figure 2.** Innovation knowledge gap (Kumar & Whitney, 2007)

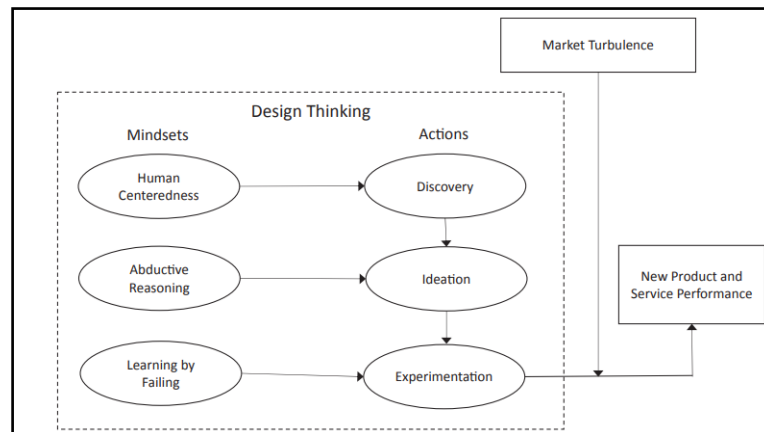
Design thinking can significantly impact enterprise value creation, ultimately driving business growth. As a result, this research emphasizes understanding the awareness of design thinking, its potential advantages, and how it can benefit businesses within the county of Latvia. Regarding the study, the data was collected through the responses from a randomly selected sample of real businesses. Design thinking is driving growth and profitability for companies in the UK. However, there is still a significant need for both private and public sectors to undertake substantial efforts in the realm of Design (European Commission, 2015). The general conclusion reveals a significant lack of awareness regarding Design thinking within enterprises. Incorporating design thinking as a catalyst for Innovation is crucial, ultimately creating customer value. The extent of value generated by a company directly correlates with its growth. We possess abundant data to analyze and predict consumer behaviors in the present era. Consequently, when designing any product or service, it is imperative to consider consumers' needs, behaviors, and aspirations. By doing so, businesses can pave the way for success. The study pertains explicitly to Latvia, a Northern European country, where most companies adhere to traditional business practices without much emphasis on value addition. Conducting a similar study encompassing other countries of comparable size to Latvia would be beneficial in validating the findings and potentially providing further insights.

### 2.7 Design thinking for Innovation: Composition, consequence, and contingency (Nakata & Hwang, 2020a).

Organizations are embracing the design thinking approach more than ever in pursuing Innovation. To tackle complex problems, they recognize the importance of employing creative solutions that can be achieved by applying design thinking principles (MIT Sloan Rebecca Linke, 2017). Design thinking has proven to be a powerful approach for fostering Innovation and problem-solving within large enterprises, leading to significant advancements and overall company growth across countless narratives (Namdarian, 2019). Visionary CEOs' application of Design Thinking revolutionized the enterprise, propelling it toward unprecedented transformation (BrainStation, 2020). The study employs a nomological network of design thinking to explore the behavior of broad Design thinking in market turbulence situations. The objective is to explore broad Design thinking in challenging market conditions (Prof William M.K. Trochim, 2023). The construction of the model and conceptual framework takes place against the backdrop of market turbulence. Managerial design surveys validate their efficacy,



incorporating Design Thinking to offer a comprehensive perspective on innovations, as depicted in Figure 3.



**Figure 3.** Conceptual framework(Nakata & Hwang, 2020b)

This study centers on investigating the structure, effects, and adaptability of Design thinking within enterprises through the development and empirical examination of a research framework. Specifically, it aims to explore the behavior of design thinking in situations characterized by market turbulence. The investigation employs a comprehensive nomological network of design thinking, constructing a model and conceptual framework tailored to market turbulence conditions. Managerial design surveys are conducted to evaluate these constructs, providing a holistic perspective on innovations within Design thinking. The primary objective of this study is to examine the structure, impact, and adaptability of Design thinking within enterprises through the development and empirical testing of a research framework. The study collaborated with a market survey company to gather the necessary data. The research focused exclusively on the United States, specifically within industry sectors such as retail, agriculture, construction, manufacturing, transportation, telecommunications, and financial services. It is important to note that this research is confined to the US region and limited to a specific business domain. Therefore, further investigations by expanding the data collection beyond the United States may yield different findings and insights.

### **2.8 The Challenges of Using Design Thinking in Industry- Experiences from Five Large Firms**(Rauth et al., 2014)

A research investigation focused on five prominent companies with a five-year history of utilizing Design Thinking acknowledges the valuable role of Design Thinking in driving Innovation but could not establish conclusive evidence of complete success. The data for this study was obtained through 31 interviews. The study identifies and examines seven challenges that act as barriers to implementing Design Thinking in two software companies, one healthcare service company, and two consumer product companies. However, selecting only five companies for this study appears limited and fails to represent diverse business domains. Furthermore, the reliance on 31 interviews may be insufficient to thoroughly analyze the patterns of specific challenges associated with each industry.

Further research is necessary for a more comprehensive understanding, incorporating a mix of large and mid-size companies and including a broader representation of product manufacturing companies. This additional research will enable a more profound investigation into the various ways of implementing Design Thinking, such as adopting it as a cultural aspect, utilizing it as a support function, or integrating it as a vital part of incremental development processes. By delving into these specific implementations, the research can establish clear links between Design Thinking and the challenges encountered, providing insights into how companies have effectively addressed them.

### **2.9 The Use of Design Thinking in the US Federal Government**(Liedtka et al., 2020)

A collaboration between the University of Virginia's Darden Business School and The MITRE Corporation was established to explore the efficacy and significance of Design Thinking in driving Innovation within US Federal agencies, aiming to address challenges and enhance the well-being of citizens. The study employed surveys and interviews to gather data from various government design-thinking practitioners. However, it is worth noting that most of these individuals possessed limited experience in Design Thinking, although many had received training from the Office of Personnel Management (OPM). The

study encompassed various sectors of the US Federal agencies, including civilian, defense, healthcare, and legal domains. Findings from the study indicate that design-thinking initiatives offer tangible benefits to federal agencies and citizens.

Nonetheless, the study recognizes the difficulties associated with measuring the success or impact of innovations driven by Design Thinking. It should be acknowledged that the study's scope was limited to US federal agencies and data collection predominantly relied on practitioners with relatively less experience in Design Thinking. Expanding the study to include a combination of other developed nations, such as Germany, Canada, and Russia, for data collection purposes would enhance the robustness and conclusiveness of the study's findings. Such an approach would facilitate a broader understanding of the role and impact of Design Thinking in public sector organizations across diverse contexts.

### **2.10 Making It Happen: Legitimizing Design Thinking in Large Organizations (Rauth et al., 2014)**

A qualitative, exploratory investigation conducted on six prominent American and German companies explores the initial hurdles encountered during the implementation of Design Thinking. The findings of this study highlight a significant obstacle to the perceived legitimacy of Design Thinking within organizations. Moreover, the research reveals a general skepticism regarding the value of Design Thinking and its ability to yield measurable outcomes. Ultimately, the study suggests that Design Thinking should be integrated into a comprehensive strategy to facilitate socialization and establish its legitimacy among organizational managers. While this study acknowledges implementation challenges within the selected large-scale organizations, it recognizes that these challenges may not be universally applicable to all types of organizations.

Consequently, it is imperative to conduct further investigations encompassing mid-sized organizations or a combination of mid-sized and large companies. Such studies could potentially uncover additional implementation challenges or even entirely different ones. Future research should also encompass companies from countries other than the United States and Germany to understand the subject matter better.

### **2.11 Innovation indicators throughout the innovation process: An extensive literature analysis (Dziallas & Blind, 2019)**

A study conducted to explore the evaluation of innovations draws upon several scientific papers published between 1980 and 2015. The primary focus of this study revolves around the initial stages of the innovation process. The findings suggest the presence of various indicators that can complement each other throughout the entire innovation journey. However, it is noted that there is a greater emphasis on process indicators compared to product indicators within the available literature. Additionally, more indicators are found in the later stages of the innovation process rather than in the early stages.

Consequently, researchers express uncertainty regarding identifying precise indicators to evaluate innovations effectively. The conclusions of the current study are primarily derived from academic sources and the information publicly accessible. It is recommended that future research considers real-world product manufacturing companies to gain further insights. Such studies can aid in identifying additional indicators of Innovation. Moreover, further analysis can help uncover more indicators relevant to the innovation journey's early stages. These indicators can be validated by collecting real-time data from various companies. It becomes possible to consolidate a comprehensive set of indicators commonly utilized by organizations throughout the Innovation process by conducting extensive research.

### **2.12 Digital Innovation Units: Exploring Types, Linking Mechanisms and Evolution Strategies in Bimodal IT Setups. P. Raabe et al., 2020**

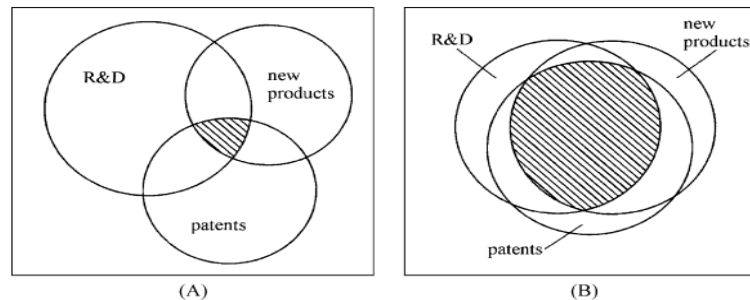
A recent study highlights the importance of Innovation for companies in response to customers' ever-changing needs. It entails a dual approach: discovering and developing digital innovations as part of a Digital Innovation Unit (DIU). The study recommends the establishment of a dedicated DIU connected to the core innovation work within the primary organization. Based on qualitative research conducted in nine organizations, the study reveals that many companies have implemented a DIU to support and facilitate innovation initiatives. However, it also acknowledges specific challenges and conflicts between the DIU and the primary organization responsible for executing the work. Consequently, questions arise regarding the practicality and actual benefits of the DIU.

Furthermore, it is essential to note that the study primarily focuses on digital and information technology innovations, which may not directly apply to non-digital innovation initiatives. Additionally, the data collection process relied heavily on interviews with leaders from DIUs, potentially introducing bias and raising concerns about the study's outcomes. Therefore, conducting further research that includes cross-industry analysis, in-depth case studies, and interviews involving individuals in non-leading positions and

those from the central organization directly engaged in innovation activities is necessary to obtain more conclusive results.

### 2.13 Measuring innovative performance: is there an advantage in using multiple indicators? Hagedoorn & Cloudt, 2003)

The study examines various innovation indicators, including research and development (R&D) inputs, patent counts, and patent citations toward new products. Data is collected from a sample of 1200 prominent companies, predominantly operating in high-tech sectors, to gather empirical evidence.



**Figure 4.** Venn diagrams representing the relationship between R&D, patents, and new products in two hypothetical industries

The study presented in Figure 4 recognizes the validity and utility of the composite construct formed by these four indicators. However, it also highlights a certain degree of statistical overlap among them. Future investigations should therefore examine each of these indicators independently rather than relying solely on a blended approach to potentially reveal new insights. Additionally, it is advisable for further research to explore industries beyond the high-tech sectors to assess the applicability of the current indicators in a broader context.

### 2.14 Tracking US biofuel innovation through patents (Kessler & Sperling, 2016)

This research delves into Innovation and its correlation with patents as a measure, focusing specifically on the biofuel industry in the United States. The findings of this study reveal noteworthy levels of innovation activities within the biofuel sector, with a notable decline in such activities as the number of patents decreases. Moreover, the research shows that patents indicate technological shifts and overall Innovation within a given industry. Furthermore, the study proposes that suitable investments in research and development (R&D) activities have the potential to foster overall growth. However, it is essential to note that this study solely focuses on the biofuel industry within the United States, thus limiting the scope of its analysis of patent data concerning Innovation. Consequently, it is crucial for future investigations to explore the connection between R&D expenditures and filed patents across sectors beyond biofuels and in countries other than the United States.

### 2.15 The innovation process of Huawei and ZTE: Patent data analysis (Kang, 2015)

A research analysis was conducted on patent data from two prominent Chinese companies, namely Huawei and ZTE, aiming to evaluate their levels of Innovation. Based on empirical data, the study findings indicate that Huawei is innovative. However, the patent data reveals inconsistencies, casting doubts on ZTE's claim as an innovative company. Moreover, the study suggests that Huawei primarily leverages the research and development (R&D) outcomes of ZTE. It is worth noting that as a communist country, China exerts control and influence over companies like ZTE and Huawei. Given the specific conditions under which these companies operate, this factor adds a unique context to the study.

Consequently, the research scope is limited to two telecom companies within the boundaries of a communist country, namely China. To obtain a more comprehensive understanding of the role of R&D expenditure and patent filing in overall company growth, conducting a similar study on a global scale would be beneficial. A broader perspective can be gained by considering data from telecom companies worldwide rather than restricting the analysis to a single country.

### 2.16 Relation of R&D expense to turnover and number of listed companies in all industrial fields (Park et al., 2018)

According to the research study, it has been found that the top ten listed companies in the world, which allocate a more significant portion of their budget towards research and development (R&D) in industrial

fields, have experienced substantial financial growth. The study employed correlation and linear regression analyses for analyzing the data and drawing meaningful conclusions.

The study's findings indicate a positive relationship between R&D expenditure and financial performance, suggesting that companies that invest significantly in R&D are more likely to witness an increase in their turnover and ultimately become publicly listed. This correlation highlights the potential benefits of prioritizing research and development activities within the industrial sector.

However, it is essential to note that the study's scope was limited to industrial companies and listed entities only. Therefore, it is crucial to consider the limitations of these findings. Additional research should be conducted to examine companies operating in other sectors or those that are not publicly listed. Such studies may provide a more comprehensive understanding of the association between R&D spending and financial growth, revealing potential variations or contrasting outcomes across different industries and company types.

### 2.17 Sustainable business modeling: The need for innovative design thinking(He & Ortiz, 2021)

By reviewing relevant literature and analyzing a real-world case, this research study investigates the impact of Design Thinking on developing sustainable business models within organizations. Examining Figure 5 reveals that while a limited number of methods may demonstrate effectiveness in this area, the majority do not yield comparable outcomes.

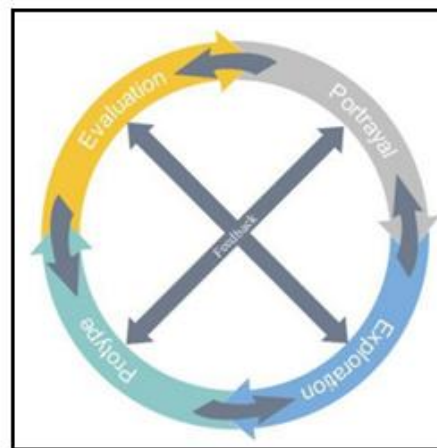


Figure 5. Design thinking framework

This paper introduces a validated framework driven by Design Thinking, highlighting the importance of applying this approach to foster sustainable business model innovation. A real-time case study supports the framework's effectiveness, while the research draws upon publicly available literature. It is important to note that the validation process solely focuses on one case study. Nevertheless, conducting additional research that evaluates multiple case studies is expected to yield intriguing results, providing a more comprehensive understanding of the topic.

### 2.18 The perceived relevance of design thinking in achieving innovation goals The individual micro foundations perspective(Magistretti et al., 2022)

In this research study, the perspectives of 197 Italian managers were examined to investigate the role of Design Thinking in attaining innovation objectives. The results indicate that managers associate a fresh set of goals with Design Thinking, deviating from the traditional notion of a user-centered practice aimed at generating creative solutions. The diverse interpretations of Design Thinking suggest that managers from various organizational functions and hierarchical levels establish internal consensus regarding the goals expected from implementing design thinking. It is important to note that the coexistence of multiple goals achievable through design thinking may lead to disillusionment, frustration, and conflict within different functions or levels of newer organizations that adopt this approach. The understanding and interpreting Design Thinking goals are contingent upon each company and its experience with adopting Design Thinking. It is worth mentioning that this research solely focused on data gathered from Italy, a country known for its robust design culture. Therefore, future studies should encompass firms from different countries and settings, considering their specific organizational functions (e.g., design-based, service-oriented, production-grounded, etc.). By doing so, a broader perspective can be gained on the implications and outcomes of implementing Design Thinking across diverse organizational contexts.

### **2.19 Sustaining Thai Government Agency Innovation through Design Thinking Learning Effectiveness**(Promsiri et al., 2022)

By implementing action research, this research delves into the effectiveness of Design Thinking-led innovations in the Thai public sector. The study applies the Design Thinking model developed by the HassoPlattner Institute of Design at Stanford University, known as the Stanford d.school. By addressing the existing gap between knowledge and practice with the efficacy of the Design Thinking methodology for fostering Innovation within the public sector, the study aims to shed light on its potential benefits. The research recognizes that while Design Thinking education has shown promising results in promoting government innovation, its application and impact have primarily been explored within a limited scope. Specifically, the study examines ten agencies within the public sector, highlighting the need for future investigations to encompass a broader range of government organizations. Expanding the research scope can give a more comprehensive understanding of the effectiveness of Design Thinking across different public agencies.

Furthermore, it is crucial to acknowledge that the Stanford University model is just one among many Design Thinking frameworks available. While this study concentrates on the Stanford d.school model, future studies need to explore the effectiveness of Design Thinking by considering a diverse array of alternative models. By investigating and comparing various Design Thinking approaches, a more nuanced understanding of their relative strengths and weaknesses can be obtained, providing valuable insights for future applications in the public sector.

### **2.20 Design Thinking Applied to Home Textiles Innovation: A Case Study in an Elderly Centre in Hong Kong**(Yao & Li, 2022)

This research study focuses on a case study of the TWGHs (Tung Wah Group of Hospitals), which is recognized as the largest charitable non-governmental organization in Hong Kong. The primary objective of this case study is to showcase how design thinking can be effectively applied to design and develop an innovative solution for elderly care in elderly centers.

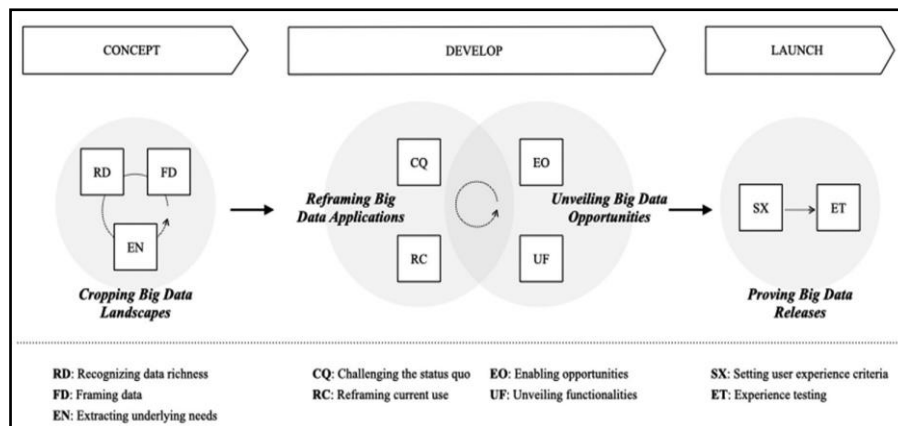
By employing the design thinking methodology, this study highlights the significance of understanding the needs and perspectives of older people. It highlights the significance of empathy in the design process, allowing researchers and designers to gain deep insights into the experiences and challenges faced by elderly individuals. By adopting this empathetic stance, researchers can discover solutions that are more likely to meet the unique requirements of the target users. The case study conducted at TWGHs demonstrates the successful application of the design thinking approach in designing a solution specifically focused on textiles. The positive outcome of this study suggests that design thinking can effectively address the needs of older individuals in the context of textile-related products. Future research should consider exploring multiple product categories beyond textiles to enhance further the applicability and generalizability of the design thinking approach. By expanding the focus to include various aspects of elderly care, researchers can uncover exciting results that may lead to innovative solutions in other domains. Additionally, while the case study at TWGHs provides valuable insights, it is essential to conduct similar research involving multiple organizations, thus ensuring a more comprehensive understanding of the potential applications and benefits of Design thinking in elderly care.

### **2.21 The contribution of Design Thinking to the R of R&D in technological Innovation**

The study centers around an electronics company that adopts a design approach called Proxemics. The research conducted at the company's design center aims to visualize the emerging connections between individuals (people), technology (objects), and the surrounding environment (spaces). While emphasizing the importance of a human-centered and experimental approach in Design Thinking, the study acknowledges that the Proxemics logic and tools differ slightly from the traditional methods commonly employed in Design Thinking. Nevertheless, the selected company for this study has demonstrated remarkable achievements and secured significant patents through its innovative endeavors. The data for this study were derived from interviews conducted with internal customers of the design center rather than end users. However, it is essential to recognize that using a single case study introduces limitations regarding the reliability and validity of the findings. It would be intriguing to validate its appropriateness and usefulness in other research projects beyond technology, to broaden the scope and enhance the credibility of Design Thinking. For instance, One explores how the Proxemics approach, which focuses on interactions and human sensory experiences, can contribute to product innovation in diverse domains. Further research endeavors can shed additional light on how integrating human-centeredness and experimentation augments the value of Design Thinking in various research domains.

**2.22 The role of design thinking in Big Data innovations**(Pham et al., 2022)

The qualitative research in this study focuses on three specific company cases: TIM & Olivetti Solutions, Maths&Sport, and Neosperience. The primary objective is to investigate the role of Design Thinking in driving innovations related to Big Data within these companies. By examining these cases, the paper aims to shed light on the potential impact of Design Thinking on Big Data innovations. The paper introduces a process model that combines Design Thinking with a Big Data-based innovation process to understand the subject matter comprehensively. The model, depicted in Figure 6, demonstrates how integrating Design Thinking can enhance innovation efforts, cultivate agile mindsets, and inspire managers to foster a culture of Innovation. Ultimately, the paper asserts that Design Thinking is instrumental in unlocking the potential of digital technologies, particularly Big Data, within organizations.

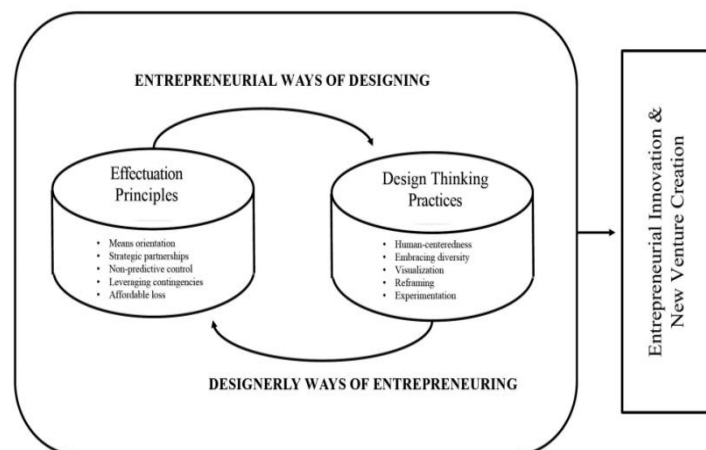


**Figure 5.** A process model combining big data-based innovation process with design thinking

It is important to note that the study solely focuses on companies in Italy, specifically targeting small companies. While the findings offer valuable insights into the part of Design Thinking in the context of Big Data innovation, further research is necessary to validate the authenticity of the process model and the significance of Design Thinking across a broader range of global companies. Future research endeavors can corroborate and enhance our understanding of the relationship between Design Thinking and Big Data-driven innovations by conducting a detailed analysis involving numerous multinational organizations.

**2.23 Entrepreneurial ways of designing and designerly ways of entrepreneurship: Exploring the relationship between design thinking and effectuation theory**(Klenner et al., 2022)

This qualitative study conducted in-depth interviews with 41 designer founders to explore and shed light on the intricate relationship between the behavioral practices of design thinking and its cognitive principles of effectuation. The study's primary objective was to provide empirical insights and develop a theoretical perspective regarding this relationship. Figure 7 depicts the graphical representation of the research findings and the connections between effectuation principles and design thinking.



**Figure 6.** Relationships between design thinking practices and effectuation principles

The study's findings emphasize the significant role of Design thinking in facilitating high-uncertainty innovations. It demonstrates that design thinking is particularly effective in driving entrepreneurial Innovation and fostering the creation of new ventures. The research also proposes a reciprocal relationship between design thinking and effectuation theory, suggesting that they mutually influence and reinforce each other in the entrepreneurial process. The research data in this study is limited to designer founders who are experts in the domain of Design Thinking. Consequently, individuals from non-design backgrounds were excluded from the current study scope. However, it is worth acknowledging that non-designers possess unique perspectives and thinking patterns that may differ from those of designers. Therefore, conducting further research that includes non-designers data on new venture creation could yield intriguing and valuable insights. Expanding the study to include a mix of designers and non-designers would provide a more comprehensive understanding of the relationship between design thinking and effectuation theory.

#### 2.24 Innovation in the Era of IoT and Industry 5.0: Absolute Innovation Management (AIM) Framework (Aslam et al., 2020)

This study employed an integrated literature review methodology to examine existing literature on innovation management systematically. The objective was to develop and propose an "Absolute innovation management" framework tailored to the IoT and Industry 5.0 era. Industry 5.0 envisions the dissolution of barriers between the physical and virtual realms.

The "Absolute innovation management" framework, as illustrated in Figure 8, places significant emphasis on integrating Design Thinking principles. By adopting this approach, the proposed framework establishes a strong connection between the innovation ecosystem and corporate strategy. The aim is to make Innovation more user-centered, aligning it with human needs and preferences while ensuring its viability for businesses and technical feasibility.

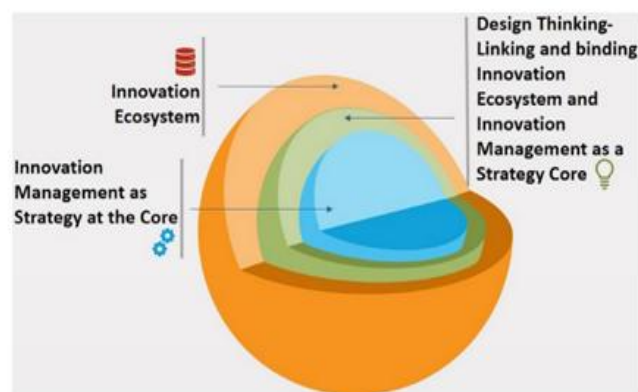
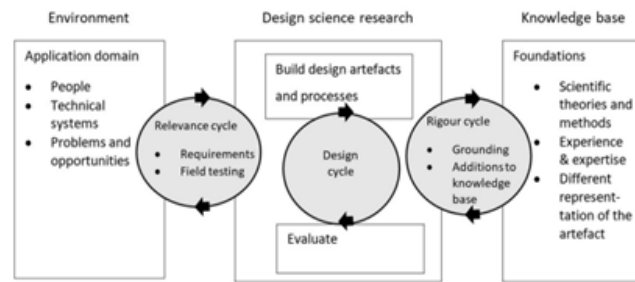


Figure 8. Absolute Innovation Management Framework

While the "Absolute innovation management" framework addresses the gaps in most publicly available innovation frameworks, its practical applicability remains uncertain. An empirical study involving multiple organizations and their innovation activities is advisable to gain further insights into its real-world adoption. Such a study would shed light on the actual utilization and effectiveness of the framework in practice.

#### 2.25 A user-centred design framework for mHealth (Farao et al., 2020)

The proposed study introduces an "adapted framework" that integrates the Information Systems Research (ISR) framework and design thinking. Figure 9 illustrates the ISR framework, which draws upon the principles of Design and behavioral science and is a valuable tool in information systems for promoting Innovation. The study combines two existing user-centered design methods to enhance the design process of mHealth apps. As a practical demonstration of the framework, a mobile application (mHealth app) is redesigned to interpret the results of a skin test for latent tuberculosis infection. This app redesign not only aids in tuberculosis detection but also reduces the need for potential patients to make multiple visits to healthcare facilities.



**Figure 9.** The Information Systems Research Framework(Hevner, 2007)

It is important to note that this study focuses solely on South African countries and involves a limited number of participants: ten students and ten healthcare workers. Because of the busy schedules of healthcare workers in their routine work, their involvement in the study was minimal. The relatively small sample size and limited engagement of participants highlighted the need for further validation of the adapted framework and its practical implementation. It would be intriguing to explore the framework's effectiveness by involving larger audiences and encouraging active participation from healthcare workers across multiple countries beyond South Africa. Such an expanded scope would provide valuable insights into the framework's broader applicability and utility.

### **2.26 Patent statistics: A good indicator for Innovation in China? Patent subsidy program impacts on patent quality(Dang &Motohashi, 2015)**

A study conducted in China has revealed a correlation between patent count, research and development (R&D) investment, and financial output, indicating that patent statistics can serve as an informative indicator of Innovation in China. However, it is essential to note that the quality of patents has shown signs of deterioration, leading to numerous questions. This decline in patent quality can be attributed to a significant 30% increase in patent counts, driven primarily by government policies. The study highlights that the government's subsidy programs have boosted the number of patents filed and increased R&D expenditures among large and medium-sized Chinese enterprises. It indicates that government support has had a tangible impact on stimulating innovation activities. However, the study does not delve into the broader implications of these policies on overall Innovation.

Further research is required to gain a more comprehensive understanding of the effects of government subsidies on Innovation. This research should expand its focus beyond local patent subsidy programs and examine the global context. By exploring data from different regions and countries, a more nuanced picture may emerge, shedding light on whether the observed trends hold universally or are specific to China's unique circumstances.

### **2.27 Innovation Driven Enterprise, Sustainable Business and Firm Financial Performance(Rijanto, 2018)**

A comprehensive study investigated the relationship between Research and Development (R&D) spending and Innovation among Indonesian companies. The research focused on companies that had been actively operating in the business sector for a minimum of 34 years and had maintained low levels of debt. By examining Indonesia's emerging market, the study uncovered a positive correlation between the R&D expenses of innovation-driven companies and their financial performance. The research findings highlighted the significance of R&D investments in driving Innovation and subsequently impacting a company's financial performance. The positive correlation between R&D expenses and financial performance implies that companies that allocate resources to R&D initiatives are more likely to experience improved growth and profitability. It suggests that R&D activities play a crucial role in stimulating Innovation, enhancing competitiveness, and ultimately contributing to the overall success of Indonesian businesses operating in the emerging market. To further enrich our understanding, it would be valuable to expand the scope of research to include a broader range of developing countries. By examining data from various developing nations or even combining datasets from developed and developing nations, we can gain additional insights into the impact of R&D spending on a company's growth trajectory.



### **2.28 Monopoly capital and Innovation: an exploratory assessment of R&D effectiveness(Lambert, 2020)**

According to the research findings, it has been observed that prominent companies in the United States allocate substantial financial resources towards research and development (R&D) endeavors. This proactive approach to Innovation favors these corporate entities' share prices and overall profits. Investing in R&D allows companies to develop new products, technologies, and processes, enhancing their competitiveness and generating positive returns for their shareholders.

However, the research also reveals a contrasting or potentially negative impact regarding job creation and the nurturing of small businesses. Despite the positive influence on corporate performance, the findings indicate that there might be challenges or limitations regarding employment opportunities and the formation of small enterprises. It could be due to various factors, such as the nature of R&D activities that may require specialized skills or automation, resulting in reduced demand for labor. Additionally, the financial resources allocated to R&D by large companies might divert funding away from other areas, potentially hindering the growth of small businesses that heavily rely on external financing. It would be valuable to conduct similar research in other developed countries, developing countries, or a combination of both to gain a more comprehensive understanding of this phenomenon. By examining diverse contexts, we can uncover nuances and identify potential factors contributing to differing outcomes. These comparative analyses may help policymakers, investors, and businesses make informed decisions regarding R&D investments, considering the potential trade-offs and implications for job creation and small business development in different regions and economic environments.

### **2.29 Assessing the Status of Autonomous Vehicles Innovation Using Patent Data(Traore, 2020)**

The primary objective of this study is to thoroughly evaluate the existing state of autonomous vehicle (AV) innovations within the US market. Transportation companies are undergoing a remarkable transformation fueled by the anticipated adoption of autonomous vehicles. This paradigm shift has led to a significant surge in autonomous automobile patents approved by the United States Patent and Trademark Office (USPTO) since 2010. Remarkably, the number of approved patents in this field has witnessed a staggering growth rate. Between 2010 and 2018, the number of patents increased nearly eighteenfold, soaring from a mere 27 to an impressive 516. These numbers underscore the rapid pace of technological advancements and the increasing focus on AV innovations in recent years. However, it is crucial to acknowledge that this study aims to delve beyond the realm of autonomous vehicles and explore the correlation between Innovation and patents in industries beyond this specific domain. The research will extend its investigation to encompass various sectors and countries, recognizing the broader landscape of intellectual property and its relationship with Innovation worldwide. This comprehensive analysis seeks to understand patent's broader impact and significance on innovative activities across different industries and countries. This broader perspective will provide valuable insights into the evolving dynamics of technological advancements and the role of intellectual property in driving Innovation globally.

## **3. CONCLUSION**

The evolution of design thinking has transformed its role from a mere stylistic approach to a critical component of business processes, ultimately leading to business transformation. The ever-changing external landscape, characterized by market demands, intense competition, product differentiation, evolving financial requirements, economic cycles, global competitiveness, and shifting social and environmental awareness, necessitates continuously exploring new methods and tools. Design thinking-led innovation has emerged as a crucial factor for organizations to maintain competitiveness in today's rapidly changing business environment. Industry leaders such as Apple, Microsoft, Disney, and IBM have witnessed firsthand the power of Design thinking-driven innovation and its holistic application, enabling them to succeed and gain a competitive edge. Its impact extends beyond the corporate sector to academia and nonprofit organizations, leading to the establishment of various courses and certifications. Successful case studies validate the effectiveness of design thinking, Innovation, and research and development strategies in revitalizing market position and driving profitability.

Nevertheless, organizational barriers pose challenges to collaboration and Innovation. To remain profitable, enterprises must embrace Innovation and integrate it with design-led approaches. This literature review underscores the importance of integrating Design thinking-led Innovation in enterprises to secure a competitive advantage. It identifies research gaps related to collaboration and integration, highlights the impact on business growth and profitability, explores different approaches and frameworks, and calls for standardized methods to measure effectiveness. The capability for Innovation plays a pivotal role in overall business success and adapting to market challenges. Design thinking-led

innovation is a powerful tool for fostering creativity, driving growth, and navigating the dynamic business landscape. This paper contributes to understanding its significance and highlights areas for future research.

### Conflict of Interest and Funding Statements

I, Sanjeev Singh, hereby declare unequivocally that I have no conflicts of interest regarding the research work carried out for this paper. I affirm that I have not received any form of funding, financial support, or sponsorship from any individual, organization, or any other source.

### REFERENCES

- [1] Acemoglu, D., Akcigit Z Murat, U., & Celik, A. (2020). *Radical and Incremental Innovation: The Roles of Firms, Managers and Innovators*.
- [2] Ahuja, G., & Lampert, C. M. (2001). Entrepreneurship in the large corporation: A longitudinal study of how established firms create breakthrough inventions. *Strategic Management Journal*, 22(6–7), 521–543. <https://doi.org/10.1002/smj.176>
- [3] Andrea Rangone. (1999). *A Resource-Based Approach to Strategy Analysis in Small-Medium Sized Enterprises*. Kluwer Academic Publishers. <https://doi.org/https://doi.org/10.1023/A:1008046917465>
- [4] Aslam, F., Aimin, W., Li, M., & Rehman, K. U. (2020). Innovation in the era of IoT and industry 5.0: Absolute innovation management (AIM) framework. *Information (Switzerland)*, 11(2). <https://doi.org/10.3390/info11020124>
- [5] Barney, J. B., & Hesterly, W. S. (2015). *Strategic Management and Competitive Advantage (5th ed., Vol. 5)*. Pearson Education. [http://students.aiu.edu/submissions/profiles/resources/onlineBook/P7p5f5\\_Strategic%20Management%20and%20Competitive%20Advantage.pdf](http://students.aiu.edu/submissions/profiles/resources/onlineBook/P7p5f5_Strategic%20Management%20and%20Competitive%20Advantage.pdf)
- [6] Batten Institute. (2023). Batten Institute | UVA Darden School of Business. Darden School of Business. <https://www.darden.virginia.edu/batten-institute>
- [7] Beckman, S. L., & Barry, M. (2007). Innovation As A Learning Process: Embedding. *Review*, 50(1).
- [8] BhraguHaritas. (2019). Design thinking\_ Design thinking can boost efficiencies by 75%, RoI by 300%, IT News, ET CIO. ET CIO.Com.
- [9] Björklund, T. A., Hannukainen, P., & Manninen, T. (2018). Measuring the impact of design, service design and design thinking in organizations on different maturity levels. *ServDes2018 - Service Design Proof of Concept*, June 2018, 500–511.
- [10] BrainStation. (2020). How 5 CEOs Used Design Thinking to Transform Their Companies.
- [11] Bucolo, S., Wrigley, C., & Matthews, J. (2012). Gaps in Organizational Leadership: Linking Strategic and Operational Activities through Design-Led Propositions. <https://doi.org/https://doi.org/10.1111/j.1948-7177.2012.00030.x>
- [12] Carlgren, L., Elmquist, M., & Rauth, I. (2016). The Challenges of Using Design Thinking in Industry – Experiences from Five Large Firms. *Creativity and Innovation Management*, 25(3), 344–362. <https://doi.org/10.1111/caim.12176>
- [13] Caroline Perry. (2012). Design Solutions Workshop emphasizes teamwork, process, and context. Harvard.
- [14] Conner, S. (2013). The “8 Great” Challenges Every Business Faces (And How To Master Them All). In *Forbes* (pp. 1–58).
- [15] Cornell. (2023). Online Design Thinking Certificate Program \_ eCornell. Cornell. <https://ecornell.cornell.edu/certificates/technology/design-thinking/?creative=301752192917&keyword=%2Bcourse%2Bdesign%2Bthinking&matchtype=b&network=g&device=c>
- [16] Council, D. (2005). What is the framework for innovation? Design Council’s evolved Double Diamond | Design Council. In *Design Council*.
- [17] Coursera. (2023). Design-Led Strategy\_ Design thinking for business strategy and entrepreneurship – Coursera. Coursera. [https://www.coursera.org/learn/design-strategy?ranMID=40328&ranEAID=KCWgjpGqTUg&ranSiteID=KCWgjpGqTUg-BfvmVm5yN3Ym5uqRXx3ilg&siteID=KCWgjpGqTUg-BfvmVm5yN3Ym5uqRXx3ilg&utm\\_content=10&utm\\_medium=partners&utm\\_source=linkshare&utm\\_campaign=KCWgjpGqTUg](https://www.coursera.org/learn/design-strategy?ranMID=40328&ranEAID=KCWgjpGqTUg&ranSiteID=KCWgjpGqTUg-BfvmVm5yN3Ym5uqRXx3ilg&siteID=KCWgjpGqTUg-BfvmVm5yN3Ym5uqRXx3ilg&utm_content=10&utm_medium=partners&utm_source=linkshare&utm_campaign=KCWgjpGqTUg)
- [18] Cross, N. (2001). Designerly Ways of Knowing: Design Discipline Versus Design Science. *Design Issues*, 17(3), 49–55. <https://doi.org/10.1162/074793601750357196>

- [19] Crossan, M. M., & Apaydin, M. (2010). A multi-dimensional framework of organizational innovation: A systematic review of the literature. *Journal of Management Studies*, 47(6), 1154–1191. <https://doi.org/10.1111/j.1467-6486.2009.00880.x>
- [20] Dam Friis, R., & Siang Yu, T. (2020). What is design thinking and why is it so popular? In *Interaction Design Foundation*. Interaction design Foundation.
- [21] Dang, J., & Motohashi, K. (2015). Patent statistics: A good indicator for innovation in China? Patent subsidy program impacts on patent quality. *China Economic Review*, 35, 137–155. <https://doi.org/10.1016/j.chieco.2015.03.012>
- [22] Darroch, J., & Mcnaughton, R. (2002). Examining the link between knowledge management practices and types of innovation. *Journal of Intellectual Capital*, 3(3), 210–222. <https://doi.org/10.1108/14691930210435570>
- [23] Design Management Institute. (2013). The Value of Design - Design Management Institute. Design Management Institute. <https://www.dmi.org/page/DesignValue>
- [24] d.school. (2018). An introduction to Design Thinking. Institute of Design at Stanford, 6.
- [25] d.school. (2023). Start with design — Stanford d. HassoPlattner Institute of Design at Stanford University.
- [26] Durst, S., Foli, S., & Edvardsson, I. R. (2024). A systematic literature review on knowledge management in SMEs: current trends and future directions. *Management Review Quarterly*, 74(1). <https://doi.org/10.1007/s11301-022-00299-0>
- [27] Dziallas, M., & Blind, K. (2019). Innovation indicators throughout the innovation process: An extensive literature analysis. *Technovation*, 80–81(May), 3–29. <https://doi.org/10.1016/j.technovation.2018.05.005>
- [28] Emprechtinger, F. (2018). How a structured innovation process creates creative ideas. *Lead Innovation Management*. <https://www.lead-innovation.com/english-blog/structured-innovation-process>
- [29] European Commission, T. (2015). Innobarometer 2015 - the Innovation Trends At Eu Enterprises. In *Flash Eurobarometer 415 - TNS Political & Social (Vol. 1, Issue September)*.
- [30] Farao, J., Malila, B., Conrad, N., Mutsvangwa, T., Rangaka, M. X., & Douglas, T. S. (2020). A user-centred design framework for mHealth. *PLoS ONE*, 15(8 August). <https://doi.org/10.1371/journal.pone.0237910>
- [31] FARIBORZ DAMANPOUR. (1991). Organizational Innovation: A Meta-Analysis of Effects of Determinants and Moderators Author(s): Fariborz Damanpour Reviewed work. *The Academy of Management Journal*. <https://doi.org/https://doi.org/10.2307/256406>
- [32] Feng, Y., Zhang, Z., & Zhang, J. (2024). Navigating the Digital Transformation Terrain: Insights into the Interplay of Compensation, Incentives, and Managerial Behavior. *Journal of the Knowledge Economy*. <https://doi.org/10.1007/s13132-024-01751-0>
- [33] Ferreira, J., Coelho, A., & Moutinho, L. (2020). Dynamic capabilities, creativity and innovation capability and their impact on competitive advantage and firm performance: The moderating role of entrepreneurial orientation. *Technovation*, 92–93. <https://doi.org/10.1016/j.technovation.2018.11.004>
- [34] Goldschmidt, G., & Rodgers, P. A. (2013). The design thinking approaches of three different groups of designers based on self-reports. *Design Studies*, 34(4), 454–471. <https://doi.org/10.1016/j.destud.2013.01.004>
- [35] Hagedoorn, J., & Cloudt, M. (2003). Measuring innovative performance: is there an advantage in using multiple indicators? In *Research Policy (Vol. 32)*.
- [36] Harvard. (2023). Design Thinking Creating Better Customer Experiences - Professional Development \_ Harvard DCE. Harvard Division of Continuing Education; Harvard. <https://professional.dce.harvard.edu/programs/design-thinking-creating-better-customer-experiences/#outcomes>
- [37] Harvard Business School, & Verganti Roberto. (2023). Design Driven Innovation - Research Summary - Faculty & Research - Harvard Business School. Harvard Business School. <https://www.hbs.edu/faculty/Pages/item.aspx?research=7465>
- [38] HassoPlattner Institute of Design. (2023). A place for explorers & experimenters at Stanford University. HassoPlattner Institute of Design at Stanford University. <https://dschool.stanford.edu/about/>
- [39] He, J., & Ortiz, J. (2021). Sustainable business modeling: The need for innovative design thinking. *Journal of Cleaner Production*, 298. <https://doi.org/10.1016/j.jclepro.2021.126751>
- [40] Hevner, A. (2007). A Three Cycle View of Design Science Research. <https://www.researchgate.net/publication/254804390>

- [41] IBM. (2019a). Design thinking courses and certifications - Enterprise Design Thinking. In IBM.com.
- [42] IBM. (2019b). Learn the Enterprise Design Thinking Framework - Enterprise Design Thinking.
- [43] IDEO U. (2020). Foundations in Design Thinking Certificate. In Ideo (pp. 1–21).
- [44] Kalay, F. (2016). The impact of organizational structure on management innovation: an empirical research in Turkey. *Pressacademia*, 5(1), 125–125. <https://doi.org/10.17261/pressacademia.2016116656>
- [45] Kang, B. (2015). The innovation process of Huawei and ZTE: Patent data analysis. *China Economic Review*, 36, 378–393. <https://doi.org/10.1016/j.chieco.2014.12.003>
- [46] Kang, B., & Motohashi, K. (2014). The role of essential patents as knowledge input for future R&D. *World Patent Information*, 38, 33–41. <https://doi.org/10.1016/j.wpi.2014.05.001>
- [47] Keiningham, T., Aksoy, L., Bruce, H. L., Cadet, F., Clennell, N., Hodgkinson, I. R., & Kearney, T. (2020). Customer experience driven business model innovation. *Journal of Business Research*, 116, 431–440. <https://doi.org/10.1016/j.jbusres.2019.08.003>
- [48] Kessler, J., & Sperling, D. (2016). Tracking U.S. biofuel innovation through patents. *Energy Policy*, 98, 97–107. <https://doi.org/10.1016/j.enpol.2016.08.021>
- [49] Ketterman, S. (2019). Exploring the Reasons for Design Thinking Criticism. Toptal. <https://www.toptal.com/designers/product-design/design-thinking-criticism#:~:text=A common argument against design,and a few brainstorming sessions.>
- [50] Kleinknecht, A., van Montfort, K., & Brouwer, E. (2002). The Non-Trivial Choice between Innovation Indicators. *Economics of Innovation and New Technology*, 11(2), 109–121. <https://doi.org/10.1080/10438590210899>
- [51] Kleinsmann, M., Valkenburg, R., & Sluijs, J. (2017). Capturing the value of design thinking in different innovation practices. *International Journal of Design*, 11(2), 25–40.
- [52] Klenner, N. F., Gemser, G., & Karpen, I. O. (2022). Entrepreneurial ways of designing and designerly ways of entrepreneuring: Exploring the relationship between design thinking and effectuation theory. *Journal of Product Innovation Management*, 39(1), 66–94. <https://doi.org/10.1111/jpim.12587>
- [53] Koc, T. (2007). Organizational determinants of innovation capacity in software companies. *Computers and Industrial Engineering*, 53(3), 373–385. <https://doi.org/10.1016/j.cie.2007.05.003>
- [54] Kohli, R., & Melville, N. P. (2019). Digital innovation: A review and synthesis. *Information Systems Journal*, 29(1), 200–223. <https://doi.org/10.1111/isj.12193>
- [55] Krawchuk, F. (2018). DESIGN THINKING HOW TO THRIVE IN A VUCA WORLD. Exceptional Leadership by Design: How Design in Great Organizations Produces Great Leadership. <https://doi.org/10.1108/9781787439009>
- [56] Kumar, V., & Whitney, P. (2007). Daily life, not markets: Customer-centered design. *Journal of Business Strategy*, 28(4), 46–58. <https://doi.org/10.1108/02756660710760944>
- [57] Lambert, T. E. (2020). Monopoly capital and innovation: an exploratory assessment of R&D effectiveness. *International Review of Applied Economics*, 34(1), 36–49. <https://doi.org/10.1080/02692171.2019.1620703>
- [58] Lee, J. Y. (2011). INCREMENTAL INNOVATION AND RADICAL INNOVATION: THE IMPACTS OF HUMAN, STRUCTURAL, SOCIAL, AND RELATIONAL CAPITAL ELEMENTS.
- [59] Liedtka, J.; Salzman, R.; Azer, D. (2017). Design thinking for the greater good: Innovation in the social sector. In [www.coursera.org](http://www.coursera.org) (p. 352). [www.coursera.org](http://www.coursera.org). [https://www.coursera.org/learn/uva-darden-design-thinking-social-sector?ranMID=40328&ranEAID=KCWgjpGqTUg&ranSiteID=KCWgjpGqTUg-ICwbG6Lvaejfed3kXrw6A&siteID=KCWgjpGqTUg-ICwbG6Lvaejfed3kXrw6A&utm\\_content=10&utm\\_medium=partners&utm\\_source=linkshare&utm\\_cam](https://www.coursera.org/learn/uva-darden-design-thinking-social-sector?ranMID=40328&ranEAID=KCWgjpGqTUg&ranSiteID=KCWgjpGqTUg-ICwbG6Lvaejfed3kXrw6A&siteID=KCWgjpGqTUg-ICwbG6Lvaejfed3kXrw6A&utm_content=10&utm_medium=partners&utm_source=linkshare&utm_cam)
- [60] Liedtka, J., Sheikh, A., Gilmer, C., Kupetz, M., & Wilcox, L. (2020). The Use of Design Thinking in the U.S. Federal Government. *Public Performance and Management Review*, 43(1), 157–179. <https://doi.org/10.1080/15309576.2019.1657916>
- [61] Lin, Y., & Wu, X. (2023). Enhancing Knowledge-Based Professional Management of Auxiliary Police in Mega-cities: Challenges and Solutions. *Journal of the Knowledge Economy*. <https://doi.org/10.1007/s13132-023-01592-3>
- [62] LinkedIn. (2023). Communication: Online Courses, Training and Tutorials on LinkedIn Learning. LinkedIn Learning; LinkedIn. <https://www.linkedin.com/learning/topics/communication>
- [63] Lund Strøm, L. C., Willumsen, P. L., Oehmen, J., & Heck, J. (2018). Can design thinking mitigate critical strategy implementation risks? *Proceedings of International Design Conference, DESIGN*, 3, 1233–1244. <https://doi.org/10.21278/idc.2018.0450>

- [64] Magids, S., Zorfas, A., & Leemon, D. (2015). The New Science of Customer Emotions. In *Harvard Business Review* (Vol. 2015, Issue November).
- [65] Magistretti, S., Bellini, E., Cautela, C., Dell’Era, C., Gastaldi, L., & Lessanibahri, S. (2022). The perceived relevance of design thinking in achieving innovation goals: The individual microfoundations perspective. *Creativity and Innovation Management*. <https://doi.org/10.1111/caim.12519>
- [66] McCausland, T. (2020). Design Thinking Revisited. *Research Technology Management*, 63(4), 59–63. <https://doi.org/10.1080/08956308.2020.1762449>
- [67] Meinel, C., & Leifer, L. (2012). Design thinking research. In *Design Thinking Research: Measuring Performance in Context*. [https://doi.org/10.1007/978-3-642-31991-4\\_1](https://doi.org/10.1007/978-3-642-31991-4_1)
- [68] Mendoza-Silva, A. (2020). Innovation capability: a systematic literature review. In *European Journal of Innovation Management* (Vol. 24, Issue 3, pp. 707–734). Emerald Group Holdings Ltd. <https://doi.org/10.1108/EJIM-09-2019-0263>
- [69] Mendoza-Silva, A. (2021). Innovation capability: A sociometric approach. *Social Networks*, 64, 72–82. <https://doi.org/10.1016/j.socnet.2020.08.004>
- [70] Micheli, P., Wilner, S. J. S., Bhatti, S. H., Mura, M., & Beverland, M. B. (2019). Doing Design Thinking: Conceptual Review, Synthesis, and Research Agenda. *Journal of Product Innovation Management*, 36(2), 124–148. <https://doi.org/10.1111/jpim.12466>
- [71] MIT. (2023). MIT Sloan Design Thinking \_ Online Certificate Program. MIT; MIT. [https://executive-ed.mit.edu/mastering-design-thinking?irgwc=1&utm\\_campaign=AF\\_ImpactRadius&utm\\_content=\\_TEXT\\_LINK&utm\\_medium=Aff\\_397676\\_Digital+Defynd+-+S&utm\\_source=AF\\_ImpactRadius&utm\\_term=UQ8VJTVEfxyJTJUwUx0Mo382UknWTCUafV0kyc0](https://executive-ed.mit.edu/mastering-design-thinking?irgwc=1&utm_campaign=AF_ImpactRadius&utm_content=_TEXT_LINK&utm_medium=Aff_397676_Digital+Defynd+-+S&utm_source=AF_ImpactRadius&utm_term=UQ8VJTVEfxyJTJUwUx0Mo382UknWTCUafV0kyc0)
- [72] MIT Sloan Rebecca Linke. (2017). Design thinking, explained | MIT Sloan.
- [73] Müller, R. M., & Thoring, K. (2011). design thinking; evolutionary methods; creative education. 2, 137–147.
- [74] Mummah, S. A., Robinson, T. N., King, A. C., Gardner, C. D., & Sutton, S. (2016). IDEAS (integrate, design, assess, and share): A framework and toolkit of strategies for the development of more effective digital interventions to change health behavior. *Journal of Medical Internet Research*, 18(12). <https://doi.org/10.2196/jmir.5927>
- [75] Nakata, C., & Hwang, J. (2020a). Design thinking for innovation: Composition, consequence, and contingency. *Journal of Business Research*, 118(June), 117–128. <https://doi.org/10.1016/j.jbusres.2020.06.038>
- [76] Nakata, C., & Hwang, J. (2020b). Design thinking for innovation: Composition, consequence, and contingency. *Journal of Business Research*, 118, 117–128. <https://doi.org/10.1016/j.jbusres.2020.06.038>
- [77] Namdarian, S. (2019). 6 Companies That Have Successfully Applied Design Thinking. *CollectiveCampus.Com*. <https://www.collectivecampus.io/blog/6-companies-that-have-successfully-applied-design-thinking>
- [78] Newman, P., Ferrario, M. A., Simm, W., Forshaw, S., Friday, A., & Whittle, J. (2015). The Role of Design Thinking and Physical Prototyping in Social Software Engineering. *Proceedings - International Conference on Software Engineering*, 2, 487–496. <https://doi.org/10.1109/ICSE.2015.181>
- [79] Owen, C. L. (2006). Design Thinking : Driving Innovation. *BPM Strategies Magazine*, 1–5.
- [80] Owen, C. L. (2011). The core of “design thinking” and its application. *Design Studies*, 32(6), 521–532. <https://doi.org/10.1016/j.destud.2011.07.006>
- [81] Park, J. H., Lee, B., Moon, Y. H., Kim, G. S., & Kwon, L. N. (2018). Relation of R & D expense to turnover and number of listed companies in all industrial fields. *Springer Open*, 4(1). <https://doi.org/10.1186/s40852-018-0093-4>
- [82] Pascual-Fernández, P., Santos-Vijande, M. L., López-Sánchez, J. Á., & Molina, A. (2021). Key drivers of innovation capability in hotels: implications on performance. *International Journal of Hospitality Management*, 94. <https://doi.org/10.1016/j.ijhm.2020.102825>
- [83] Pham, C. T. A., Magistretti, S., & Dell’Era, C. (2022). The role of design thinking in Big Data innovations. *Innovation: Organization and Management*, 24(2), 290–314. <https://doi.org/10.1080/14479338.2021.1894942>
- [84] PIKOVER, J. (2023). The Value of Design Thinking in Business | Toptal. *Www.Toptal.Com*. <https://www.toptal.com/designers/product-design/design-thinking-business-value>

- [85] Price, R., Matthews, J., & Wrigley, C. (2018). Three Narrative Techniques for Engagement and Action in Design-Led Innovation. *She Ji*, 4(2), 186–201. <https://doi.org/10.1016/j.sheji.2018.04.001>
- [86] Prof William M.K. Trochim. (2023). TheNomological Network | Research Methods Knowledge Base. Conjointly. <https://conjointly.com/kb/nomological-network/>
- [87] Promsiri, T., Sukavejworakit, K., Keerativutisest, V., Virasa, T., & Kampanthong, K. (2022). Sustaining Thai Government Agency Innovation through Design Thinking Learning Effectiveness. *Sustainability*, 14(12), 7427. <https://doi.org/10.3390/su14127427>
- [88] Pusca, D., & Northwood, D. O. (2018). Design thinking and its application to problem solving. *Global Journal of Engineering Education*, 20(1), 48–53.
- [89] Quintane, E., Casselman, R. M., Reiche, B. S., & Nylund, P. A. (2011). Innovation as a knowledge-based outcome. In *Journal of Knowledge Management* (Vol. 15, Issue 6, pp. 928–947). <https://doi.org/10.1108/13673271111179299>
- [90] Raabe, J. P., Horlach, B., Drews, P., & Schirmer, I. (2020). Digital innovation units: Exploring types, linking mechanisms and evolution strategies in bimodal it setups. *Proceedings of the 15th International Conference on Business Information Systems 2020 “Developments, Opportunities and Challenges of Digitization”, WIRTSCHAFTSINFORMATIK 2020, March*. [https://doi.org/10.30844/wi\\_2020\\_h5](https://doi.org/10.30844/wi_2020_h5)
- [91] Raabe, J.-P., Drews, P., Horlach, B., & Schirmer, I. (2021). Towards an Intra- and Interorganizational Perspective: Objectives and Areas of Activity of Digital Innovation Units. *Proceedings of the 54th Hawaii International Conference on System Sciences*, January. <https://doi.org/10.24251/hicss.2021.714>
- [92] Rajapathirana, R. P. J., & Hui, Y. (2018). Relationship between innovation capability, innovation type, and firm performance. *Journal of Innovation and Knowledge*, 3(1), 44–55. <https://doi.org/10.1016/j.jik.2017.06.002>
- [93] Rauth, I., Carlgren, L., & Elmquist, M. (2014). Making It Happen: Legitimizing Design Thinking in Large Organizations. *Design Management Journal*, 9(1), 47–60. <https://doi.org/10.1111/dmj.12015>
- [94] Rijanto, A. (2018). Innovation Driven Enterprise, Sustainable Business and Firm Financial Performance. *The Asian Journal of Technology Management*, 11(1), 10–25. <https://doi.org/10.12695/ajtm.2018.11.1.2>
- [95] Roger Martin. (2010). Design Thinking Comes to the U.S. Army. *Design Observer*.
- [96] Romijn, H., & Albaladejo, M. (2002). Determinants of innovation capability in small electronics and software firms in southeast England. In *Research Policy* (Vol. 31).
- [97] Sam Heller. (2022). Innovations needed — but patents decline Auto industry’s number of awards dipped 7% last year. *Automotive News*. <https://web.s.ebscohost.com/ehost/detail/detail?vid=0&sid=cce044ed-1ad5-4ff7-b024-d964d1d94a81%40redis&bdata=JnNpdGU9ZWhvc3QtGjZlZQ%3d%3d#AN=154925788&db=bft>
- [98] Saunila, M. (2016). Performance measurement approach for innovation capability in SMEs. *International Journal of Productivity and Performance Management*, 65(2), 162–176. <https://doi.org/10.1108/IJPPM-08-2014-0123>
- [99] Saunila, M., & Ukko, J. (2012). A conceptual framework for the measurement of innovation capability and its effects. *Baltic Journal of Management*, 7(4), 355–375. <https://doi.org/10.1108/17465261211272139>
- [100] Schwab Katharine. (2018). Ideo breaks its silence on design thinking’s problems. *Fastcompany.Com*. <https://www.fastcompany.com/90257718/ideo-breaks-its-silence-on-design-thinkings-critics>
- [101] Seo, B. G., Park, D. H., & Choi, D. (2016). Innovative service concept generation based on integrated framework of design thinking and VRIO: The case of information supporting system for SMEs in Korea. *ACM International Conference Proceeding Series*, 17-19-Aug(August 2016). <https://doi.org/10.1145/2971603.2971626>
- [102] Siggelkow, N., & Tarwiesch, C. (2019). Is Your Business Built for 24/7 Customer Relationships? In *Harvard Business Review*.
- [103] Steve Banker. (2021). Oracle’s Point of View on Continuous Innovation - Logistics Viewpoints. *Logisticsviewpoints*. <https://logisticsviewpoints.com/2021/02/15/continuous-innovation/>
- [104] Streitfeld David. (2017). Behind Amazon’s success is an extreme tolerance for failure | *The Seattle Times*. *The Seattle Times*.
- [105] Teixeira, T. S. (2019). Disruption Starts with Unhappy Customers, Not Technology. In *Harvard Business Review* (pp. 1–8).

- [106] Thoring, K., & Müller, R. M. (2011). Understanding design thinking: A process model based on method engineering. *DS 69: Proceedings of E and PDE 2011, the 13th International Conference on Engineering and Product Design Education*, September, 493–498.
- [107] Tim Brown. (2008). Applying Design Thinking: 19–19. <https://doi.org/10.1145/3347709.3347775>
- [108] Traore, M. (2020). Assessing the Status of Autonomous Vehicles Innovation Using Patent Data [Rochester Institute of Technology]. <https://scholarworks.rit.edu/theses>
- [109] udemy. (2021). Design Thinking for Beginners\_ Develop Innovative Ideas \_ Udemy. Udemy. [https://www.udemy.com/course/design-thinking-for-beginners/?ranMID=39197&ranEAID=je6NUbpObpQ&ranSiteID=je6NUbpObpQ-ZMMWu5\\_DOXglreWekpyRBw&LSNPUBID=je6NUbpObpQ&utm\\_source=aff-campaign&utm\\_medium=udemyads](https://www.udemy.com/course/design-thinking-for-beginners/?ranMID=39197&ranEAID=je6NUbpObpQ&ranSiteID=je6NUbpObpQ-ZMMWu5_DOXglreWekpyRBw&LSNPUBID=je6NUbpObpQ&utm_source=aff-campaign&utm_medium=udemyads)
- [110] University Of Sydney. (2023). Master of Design (Design Innovation) (Strategic Design) - The University of Sydney. University Of Sydney. <https://www.sydney.edu.au/courses/courses/pc/master-of-design-design-innovation-strategic-design.html>
- [111] Usai, A., Scuotto, V., Murray, A., Fiano, F., &Dezi, L. (2018). Do entrepreneurial knowledge and innovative attitude overcome “imperfections” in the innovation process? Insights from SMEs in the UK and Italy. *Journal of Knowledge Management*, 22(8), 1637–1654. <https://doi.org/10.1108/JKM-01-2018-0035>
- [112] Volkova, T., &Jākobsone, I. (2016). Design thinking as a business tool to ensure continuous value generation. *Intellectual Economics*, 10(1), 63–69. <https://doi.org/10.1016/j.intele.2016.06.003>
- [113] wikipedia. (2019). Volatility, Uncertainty, Complexity, and Ambiguity (Vuca). Wikipedia.
- [114] Worktech Academy, & Johnson Beck. (2016). How creativity feeds into the innovation process - WORKTECH Academy. Haworth. <https://www.worktechacademy.com/creativity-feeds-innovation-process/>
- [115] Yao, M., & Li, L. (2022). Design Thinking Applied to Home Textiles Innovation: A Case Study in an Elderly Centre in Hong Kong. *Designs*, 6(3), 49. <https://doi.org/10.3390/designs6030049>