A comparative analysis of lean start-up and design thinking and its integration

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Abstract

Purpose – This study aims to emphasize the integration of lean start-up and design thinking approaches and investigate how they may be used together.

Design/methodology/approach – The report uses a systematic literature review methodology to analyze and summarize previous research on combining lean start-up and design thinking. Inferences were discovered and analyzed after relevant publications were chosen based on predetermined inclusion criteria.

Findings – The research shows that combining lean start-up and design thinking significantly impacts entrepreneurship. Start-ups can efficiently uncover consumer needs, reduce risks and improve their product or service offerings by combining the client-centricity of design thinking with the iterative and data-driven concepts of lean start-up. This integration promotes an innovative culture, gives teams the freedom to try new things and learn from mistakes and raises the possibility of start-up success.

Research limitations/implications – The dependence on pre-existing literature, which might cover only some potential uses and circumstances, is a weakness of this research. It is advised that more empirical research be conducted to determine the precise circumstances in which the integrated strategy performs best. Future studies should also explore the difficulties and drawbacks of using these approaches to offer suggestions for overcoming them and maximizing their advantages.

Practical implications – The findings have significant ramifications for business owners and other professionals working in the start-up environment. The combination of lean start-up and design thinking emphasizes the relevance of early customer interaction and empathy-driven design. To foster creativity and hasten the expansion of start-ups, practitioners are urged to create a comprehensive strategy that integrates the advantages of both techniques. Through this integration, business owners may develop solutions that appeal to their target market, increasing adoption rates and market competitiveness.

Originality/value – This study is interesting in comparing lean start-up and design thinking, emphasizing the overlaps and benefits of their application to entrepreneurship. This study discusses successful start-up methods by offering suggestions for future research and practice. It also provides a basis for further developing and adopting the integrated approach.

Keywords Design thinking, Design strategy, Lean start-up, Empathic design, Integrated strategy

Paper type Literature review

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1. Introduction

Today's start-ups face a level of unpredictability never seen before, making conventional management approaches challenging to use (Rea, 1989). In the face of extreme uncertainty, the appeal of having a solid plan, strategy and market analysis – which once functioned as indicators of success – has diminished (Blank, 2011). With uncertainty in the world, entrepreneurs find it challenging to identify their target market and product, which makes old management strategies ineffective (Subrahmanya, 2015). Disillusioned with traditional management failures, a number of investors and entrepreneurs have embraced chaos as a solution, adopting the "Just Do It" school of entrepreneurship (Wood Bernbaum, 2007). It may seem contradictory to think that a start-up, with its innovative and disruptive nature, can or even needs to be managed (Miski, 2014). However, the objective is to direct that energy into successful transformations rather than dampen start-ups' enthusiasm and vibrancy.

1.1 Why do we see such glaring start-up failure wherever we turn?

Numerous reasons from science commercialization and management perspectives can be responsible for start-ups' failure (Shahidan *et al.*, 2023). The first issue is the allure of having a sound plan, strategy and market analysis. These things served as predictors of success in former times. Applying them to start-ups is incredibly tempting, but it only works if they operate in an environment of excessive uncertainty (Blank, 2011). Start-ups are still figuring out who their target market is and what their product should be. It becomes more challenging to anticipate the future as the world becomes less specific. The outdated management techniques are inadequate (Rea, 1989). Planning and forecasting accuracy are only possible when they are based on a long, stable operating history and a relatively unchanging environment. Start-ups often have a steady operating history and a stable environment. Start-ups need both (Subrahmanya, 2015).

The second issue is that some business owners and investors have given up and joined the "Just Do It" school of entrepreneurship after witnessing traditional management fail to address this issue. According to this school, chaos is the solution if management is the issue (Wood Bernbaum, 2007). Unfortunately, this, too, does not work.

The idea that something as inventive, disruptive and unpredictable as a start-up can be managed – or, more accurately, must be managed – might seem counterintuitive (Miski, 2014). Most individuals view procedure and management as dull, whereas start-ups are exciting and dynamic. However, what is truly thrilling is watching businesses succeed and transform the world. People's enthusiasm, drive and vision are invaluable assets that should not be thrown away on these new endeavors. We can and must improve. This is possible by the integration of lean start-up and design thinking. The field of entrepreneurial activities has grown recently, giving rise to interventions and approaches, including effectuation, design thinking, disciplined entrepreneurship, prescriptive methods and lean start-ups (Masoumi, 2023).

Lean start-up's entrepreneurial strategy focuses on iterative product development and consumer feedback. Eric Ries popularized it in his book "The Lean Startup." Building a minimum viable product (MVP) and testing it with actual consumers as soon as possible is the central tenet of the lean start-up methodology (Ries, 2011). Entrepreneurs may choose the best business concepts, marketing tactics and product developments by continuously experimenting and learning (Dennehy *et al.*, 2019). This iterative method improves the likelihood of producing a successful start-up by lowering waste and the risk of failure (Rasmussen and Tanev, 2016; De Cock *et al.*, 2020).

On the other hand, design thinking is a way of problem-solving that focuses on comprehending user wants and preferences. Entrepreneurs must use a human-centered approach to innovation to understand their customers' needs, describe the issue, develop original solutions and then develop and test them. Design thinking aims to create goods and services that satisfy the end user's needs, wants and aspirations (Razzouk and Shute, 2012).

Lean start-up and design thinking provide practical viewpoints and resources for business owners (Koen, 2015). Entrepreneurs may swiftly modify their goods and business plans in response to client feedback thanks to the framework provided by lean start-up (Link, 2016). Agility, market response and practical resource allocation are emphasized. The focus of design thinking, in contrast, is on comprehending and empathizing with users. Entrepreneurs can learn important information about the preferences and problems of their customers by using a user-centric approach. This enables them to provide more distinctive products and services that are more inventive and meaningful.

The capacity of these approaches to reduce risk, promote innovation and raise the possibility of creating successful start-ups makes them relevant to entrepreneurship (Zanjirchi *et al.*, 2019). Entrepreneurs may improve their decision-making process, create products that resonate with customers and increase their chances of long-term success by combining the iterative technique of lean start-up and the human-centered perspective of design thinking (Sidemo and Lundberg, 2021).

Lean start-up and design thinking concepts can be combined to create a potent method for entrepreneurship and innovation (Fixson and Rao, 2014). While design thinking provides a structured method for identifying unmet user needs and creating solutions centered on the user's needs (Fixson and Rao, 2014), lean start-up offers a framework for concept testing and hypothesis validation (Ries, 2011). By using these strategies, organizations can encourage creativity, promote collaboration and enhance their capacity to provide goods and services that meet customers' demands. In the end, learning about lean start-up and design thinking gives people the attitude and resources they need to successfully navigate today's challenging and competitive business climate and promote sustainable growth.

1.2 Objective of the literature review

The literature review aims to compare and contrast lean start-up and design thinking, two well-known approaches, in the context of entrepreneurship and innovation. The review's objective is to compare and contrast each strategy's core ideas, procedures and results while also looking for potential synergies. The review aims to offer insights into the benefits, drawbacks and application of lean start-up and design thinking in diverse organizational situations by examining existing research.

1.3 Research question

RQ1. What is the relative effectiveness of combining lean start-up and design thinking approaches?

RQ2. How do they compare regarding their impact on start-up success?

1.4 Summarization of the section

The structure of the paper is as follows: Sections 2 and 3 deal with the overview of lean start-up and design thinking approaches. After this, Sections 4, 5 and 6 deal with the comparative review, empirical evidence of the approaches and critique and discussion. Finally, the study

summarizes the main findings and insights from the review and provides recommendations for future research and practices in Sections 7 and 8.

2. Overview of lean start-up approach

> "Start-up success can be engineered by following the process, which means it can be learned and taught."
>
> *–Eric Ries*

The 2008 book "How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Business" by entrepreneur Eric Ries was the first to describe this concept (Ries, 2011). Faster delivery of a desired product to clients is made possible by the lean start-up's scientific approach to founding and operating start-ups. The lean start-up methodology teaches you "how to steer," "when to turn" and "when to persevere" to create a business as quickly as possible (Ries, 2011). It is a new product development strategy based on principles. Too many firms start out with a concept for a product they believe customers would want (Solaimani *et al.*, 2022). They then work on developing that product for months, perhaps even years, without ever displaying it to a potential consumer, even in the most basic form. They frequently did not speak to potential customers and find out whether or not the product was attractive when they failed to get widespread client uptake (Sadeghiani *et al.*, 2022). The start-up collapses when clients let their disinterest know that they do not care about the concept.

2.1 Goal

By eliminating costly practices in a company's early phases, this methodology seeks to increase the likelihood of long-term success for the enterprise (Lizarelli *et al.*, 2022). Early-stage firms can succeed by using the lean start-up process with little capital, in-depth business planning or a flawless product (Ferrari De Carvalho Teixeira *et al.*, 2022). The start-up that applies the lean start-up methodology must concentrate on getting consumer input on the initial product if it hopes to succeed (Silva *et al.*, 2020). This input will assist you in making modifications and revisions to the product, enabling it to evolve according to user preferences. The feedback one gets from clients should also prevent them from devoting resources to features and services that they do not want. Using the fewest resources possible is the goal of the lean start-up technique (Yang *et al.*, 2019). Entrepreneur Eric Ries first proposed this concept in a book he published in 2008. This book's central theme was how to use innovation to build profitable enterprises. He developed this process to reduce the risks of starting a business (Ries, 2011). As described in the book, these risks can be reduced by developing MVPs, continuously learning throughout development and engaging in constant experimentation (Ries, 2011). Eric Ries developed this concept using the expertise he gathered from failing two previous businesses and the simplified method of producing vehicles used in Japan in the years right after World War II. According to Ries, efficiency is the only way a business can succeed without squandering essential resources (Ries, 2011).

2.2 Principles

The five principles of lean start-ups are (Ries, 2011).

2.2.1 Entrepreneurs are everywhere. A start-up can exist without its employees working out of a garage. Anyone who works for a start-up – a human organization created to develop new goods and services in the face of great uncertainty – fits my definition of entrepreneurship. That implies there are entrepreneurs everywhere, and the lean start-up methodology can be applied to businesses of any size, including huge ones, operating in any sector or market. There are limitations to the conventional perception of entrepreneurs as

single people starting disruptive businesses out of their garages. Ries expands on this notion to encompass any individual working within any organization seeking to create new value while navigating uncertain circumstances. This idea refutes the idea that start-ups are only found in Silicon Valley or other comparable tech hotspots and recognizes the entrepreneurial spirit in a variety of contexts, such as big businesses, nonprofits and governmental institutions.

2.2.2 Entrepreneurship is management. A start-up requires a new type of management specifically tailored to its setting of tremendous unpredictability because it is an institution, not just a product. "Entrepreneur" should be treated as a job title in all contemporary businesses that depend on innovation for continued success. This idea suggests that start-ups approach the idea of management differently. Conventional management techniques are frequently inappropriate for start-ups' high levels of uncertainty. Unlike the more linear and steady processes seen in established firms, Ries contends that start-ups need a new type of management specific to their needs and is fast-paced, flexible and iterative. Research shows that start-ups benefit from flexible, experiment-based management approaches that enable quick pivots and learning, which lends credence to this viewpoint. Ries connects the start-up process more closely with methodical trial and learning rather than with random experimentation or guesswork by viewing entrepreneurship as a unique form of management.

2.2.3 Validated learning. Start-ups do not merely exist to employ people, generate revenue or assist consumers. They are there to get knowledge about developing a long-lasting company. This learning can be validated scientifically by conducting numerous experiments that let business owners test each component of their vision. Validated learning, a strict process for proving advancement in the uncharted territory of a new firm, is at the core of the Lean firm methodology. This entails start-ups formulating theories about various facets of the business world, putting these theories to the test through experiments and then taking lessons from the results. The scientific literature on experiment-driven innovation provides a full explanation of this strategy and emphasizes the significance of basing business decisions on empirical facts as opposed to conjecture or intuition. Validated learning highlights the need for start-ups to gauge their growth in terms of money and how well they comprehend and cater to their clientele.

2.2.4 Build-measure-learn. The core function of a start-up is to translate concepts into tangible goods, gauge consumer reaction and determine whether to pivot or go on. All effective beginning procedures ought to be designed to shorten that feedback loop. A key component of the lean start-up methodology is the build–measure–learn feedback loop, which encourages entrepreneurs to swiftly transform concepts into products, gauge user reaction and decide whether to change course or press on. This iterative cycle saves time and money by enabling quick product modifications based on real user feedback, rather than wasting time and resources on features or products that users do not find valuable. Based on theories of customer development and agile development, this strategy is effective in promoting innovation while avoiding risk. Start-ups can become more responsive and adaptable by implementing the build–measure–learn loop. These are important traits in the fast-paced and unpredictable start-up environment.

2.2.5 Innovation accounting. Entrepreneurs must concentrate on tedious tasks, such as prioritizing work, setting goals and assessing progress, to improve entrepreneurial outcomes and hold innovators accountable. This necessitates a brand-new accounting system created for start-ups and the individuals who hold them responsible. To successfully manage the lean start-up process, business owners want an organized approach to monitoring advancements, establishing benchmarks and assigning tasks. Unlike standard accounting techniques that center on financial measures, innovation accounting entails

developing a framework that enables start-ups to assess their success within the framework of their iterative learning and development cycles. This approach tackles the difficulty of evaluating advancement in settings where conventional return on investment indicators might not be applicable or representative of sustained success just yet. Research on innovation management strongly emphasizes the value of metrics that capture learning, consumer involvement and the iterative nature of development. Innovation accounting offers a methodical approach to assessing trials and making well-informed choices regarding the start-up's future course.

2.3 Lean start-ups versus traditional start-ups approach

The concepts used in the lean start-up process go against the norms traditionally upheld by the conventional start-up methodology. According to the conventional start-up methodology, businesses must develop a two- to five-year business plan outlining their objectives and strategies for success (Rasmussen and Tanev, 2016). When using the conventional strategy, you will use the plan you have prepared to collect money to enable you to achieve your business objectives. The conventional principles focus on silently creating things to the point that the product is unknown to everyone but the personnel working on it and the company's investors, another important distinction between the traditional strategy and the lean approach (Girgenti *et al.*, 2016). While this strategy works for businesses that have already experienced significant success, it may not be as beneficial for early-stage firms.

Entrepreneurs using lean methodology generally search for the ideal company model before testing their original concepts. After that, you iterate on the product and improve based on the customer input (Shepherd and Gruber, 2021). The traditional methodology and the lean methodology share a few characteristics. Although both of these strategies have a chance of success, their fundamental ideas are very dissimilar.

The main characteristics of lean start-ups and traditional start-up approaches are shown in Table 1.

2.4 Lean start-up model: build-measure-learn

Eric Ries' book, "The Lean Startup," describes the lean start-up technique. He emphasizes the lean start-up plan's three significant elements.

2.4.1 No. 1: build minimum viable product. Building a MVP is how Eric Ries advises beginning the product development process. MVP is an acronym for "a version of a new product that enables a team to gather the most verified learning about customers with the least amount of effort." It is the first iteration of a good or service with sufficient functionality to test it with the intended market (Lenarduzzi and Taibi, 2016). The fact that the business does not hold off till the good or service is complete, and ideal is a red flag. According to the lean start-up methodology, the only version that should be shared with clients is the first one. Of course, an MVP must meet specific criteria. It also cannot be released too soon to avoid discouraging the buyers. Therefore, an MVP should not contain too many functionalities before it is made available for testing (Duc and Abrahamsson, 2016). Only the essential ones that will speed up the user's learning curve should be included. It is important to remember that an MVP is not a product of lower quality. It ought to satisfy clients and meet their wants to get high-caliber feedback (Dennehy *et al.*, 2019). An MVP should only be distributed to a small, carefully chosen group of target customers rather than to a larger audience.

2.4.2 No. 2: measure. The business should concentrate on assessing the outcomes of testing an MVP while creating the final product version for the following elements of the

Table 1.
The main characteristics of lean start-up and traditional start-up approach

Sl. no.	Lean start-up	Traditional start-up
1	It enables you to create a product based on market demands	It starts with developing a thorough business strategy that is a strict framework for the following several years
2	Determines the interest of the buyer using verified learning	Includes projected financial data
3	Focuses on indicators like "lifetime customer value" and "product popularity"	It involves undercover development, so only investors and employees know what is being produced
4	It starts with a minimal viable product to gauge how buyers would respond to the offering	A business plan is used to request money from venture capitalist companies or angel investors
5	It is preferred to experiment rather than strictly follow a strategy	

Source: Table by authors

lean start-up process. Finding the appropriate measurement methods to get the quality and quantity of input is the key (Cook *et al.*, 2022). Many options include AB testing, focus groups and polls. The one best suited to the particular type of business, product and customer must be chosen. In-depth user interviews can be considered because the figures alone can be challenging to interpret. They serve as an illustration of qualitative data collection techniques because they seek to elicit the thoughts and emotions of the target audience. As a result, they are a great source of knowledge that can affect the qualities of the finished product (Raneri *et al.*, 2023).

2.4.3 No. 3: learn. Measuring without drawing any conclusions will be useless. Using consumer input is the third element of the lean start-up technique. Customers' feedback can be pretty helpful in terms of refining the product. Nonetheless, a new product can fail to achieve traction (Raneri *et al.*, 2023). The creators would then need to be ready to drop the original concept without expending an excessive amount of time and money resources. A new product has a real chance of satisfying customer wants and succeeding on the market if only the outcomes of MVP testing are handled wisely (Dennehy *et al.*, 2019).

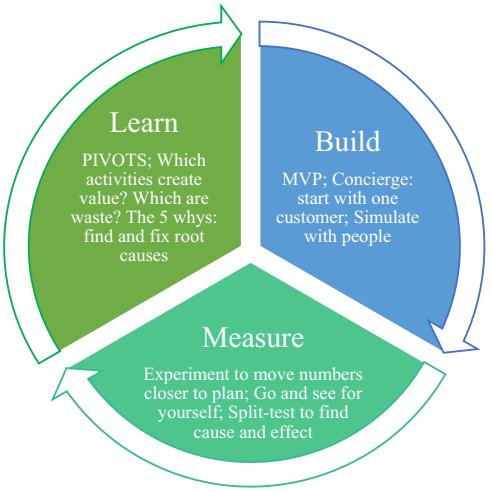
Figure 1 shows the lean start-up model.

Comparison with design thinking: The lean start-up methodology emphasizes quick experimentation and market responsiveness more than design thinking does. Although the user is at the center of both approaches, the lean start-up approach is more focused on the initial phases of product development and market validation.

3. Overview of design thinking approach

Traditional definitions of "design" have focused on a product's design and appearance, but in fields like style, design for interiors and building design, where products "consist of design," it is becoming more prevalent to connect design to the capacity to resolve difficult problems, also known as "wicked problems" (Buchanan, 1992). This idea of design is frequently mentioned in literature on design thinking. Due to the growing usage of design, there is a need for a system to classify the various kinds of design applications.

Design thinking has been debated in the design discourse for the past decade (Hassi and Laakso, 2011), but it was when it entered the management discourse that it attained broad acceptance outside of the design discourse. This is mainly attributable to Tim Brown's



Source: Figure courtesy of Ries (2011)

Figure 1.
Lean start-up model*

efforts (Brown, 2008), who was previously chief executive officer of IDEO. Earlier conversations about design thinking were based on academic design research primarily concerned with professional designers' skills and output (Buchanan, 1992). According to some, design thinking can help businesses get a competitive edge by improving their products and customer experiences or becoming more adaptable and agile (Acklin, 2013).

Brown (2008) describes design thinking as a human-centered approach to innovation that is inspired by designers' ways of being and thinking and that individuals without design backgrounds may use. This is one of the most well-known articles concerning design thinking. However, the term "design thinking" has many diverse meanings that can be applied to it. The difficulty in defining the concept due to the availability of numerous competing interpretations and points of view is one of the most significant problems with design thinking research. The traditional design research, more current managerial debates, what is done in the name of design in innovation or a combination of these are all sources of inspiration for interpretations of design thinking (Carlgren, 2013).

The study of Johansson-Sköldberg *et al.* (2013) is one of the most prominent studies on design thinking that aims to decipher the ambiguity and distinguish the various notions around design thinking. They provide definitions for the terms "design thinking" and "designerly thinking." Designerly thinking, which describes the work and reflections of professional designers, is a part of the design discourse. On the other hand, design thinking refers to design practices and competence that encompass uses outside of the design environment and are used by and for people without formal design training. By highlighting the differences between the usage of design thinking and the design carried out by professional designers, this description not only supports the definition offered by Brown (2008) but also aids in the development of a greater understanding of design thinking. This study fits the notion of design thinking as it is applied by start-ups in an entrepreneurial setting.

Four principles cluster design thinking:

(1) Humans as a starting point.

People are the source of new ideas and inspiration in design thinking. The focus is on the individual and his needs. After determining the needs, the next stage is to identify which goods and services are technically possible. The cost-effectiveness of each solution is then examined. Because there is a core focus on people and their needs, less extensive marketing is required, and new products and services fail less frequently. This concept acknowledges that the basis for developing significant and practical solutions is a real understanding of user behavior and preferences. The approach starts with a thorough investigation of each person's experiences and viewpoints. The design aims to reveal unmet wants and desires that users might not be completely aware of. This explores the psychological and emotional dimensions of human experiences, going beyond basic market research. After determining the needs of the user, the following stage is to assess the technological viability of possible solutions. Designers take into account the potential of the tools and technologies at their disposal. Because user needs and technical capabilities are integrated, the resulting solutions are guaranteed to be both desirable and implementable. One intriguing effect of dealing with people first is that it requires fewer intensive marketing initiatives. Solutions genuinely grounded in the user's needs are more likely to connect with the target market and not require forceful marketing efforts. This approach is consistent with the notion that great goods and services develop naturally when they genuinely meet the needs of users. Furthermore, the probability of a product or service failing is decreased when human-centric design is prioritized. Developing solutions that are more likely to be adopted and succeed in the market requires a fundamental understanding of people. As a result, fewer risks are connected to innovation, strengthening and enhancing the design process:

(2) Multidisciplinary teams.

Using multidisciplinary teams is the second tenet. Here, the emphasis is on the creative ability of interdisciplinary teams with four to six members rather than the creative prowess of an individual. Care is taken to guarantee that 50% males and 50% women are on each squad. In addition, it must be made sure that all specialties are well represented. A design thinker should believe in his capacity to use design thinking to create superior solutions. It is typical to feel optimistic and enthusiastic. To grasp the user's perception and sensations and to experience the world through his or her eyes, a design thinker needs to have a high level of empathy. In addition, it is important to examine the factors that contribute to a particular perception to spot user demands and wants that need to be met. A design thinker should be able to comprehensively analyze systems, processes and products to find obvious and subtle flaws. It is also important to choose the best solution from a pool of current solutions, create new solutions or modify existing solutions to obtain better results. A design thinker should like trying new things, learning from failures, taking risks and gaining experience. Because collaborative effort on solutions is necessary for complicated challenges, a design thinker should be cooperative. Here, collaboration with experts from different fields is equally important:

(3) Iterative process.

Because diverse teams are used, each member has a unique work process based on their education and experience. It is vital to establish a procedure that blends analytical thinking with intuition and is clear to all participants. Within the process, iterations can be used to enhance the solutions. It is distinguished by various divergent and convergent thinking in addition to the iterative nature of the process. A wide field of vision (divergent) is opened up during the first three phases to gather a lot of information and focus on a select few perspectives after the third phase. After testing prototypes included in a business model,

ideas for solutions are generated, and prototypes are developed (divergent) to concentrate on one. In addition, the application of design thinking yields increasingly tangible outcomes. As design thinking is an iterative process, solutions can be improved over time. It takes into account the changing insights from testing, user feedback and teamwork. The convergence and divergence of ideas distinguish this recurrent process. Divergent thinking helps to open up a large field of view in the early stages of the process. This entails investigating numerous viewpoints, compiling copious amounts of data and producing a wide range of plausible concepts. This broad approach fosters creativity and aids in gaining a thorough understanding of the problem space. Convergent thinking replaces the earlier divergent phases in the process. This entails narrowing down a few viewpoints and honing the concepts that are produced. The group can select the most promising solutions by prioritizing and reducing the number of options. The iterative nature of design thinking is fundamentally based on this continuous cycle of divergence and convergence. It permits ongoing learning, modification and advancement. One important component of this concept is the emphasis on prototyping. As concrete versions of concepts, prototypes help teams get insightful input from stakeholders and users. As the process progresses, prototypes are created, testing is done to get user feedback and ideas for solutions are made. This feedback loop helps to refine and improve results through subsequent iterations. As a result, the iterative approach turns into a flexible and dynamic way to tackle challenging issues and provide answers that meet the requirements and expectations of the user:

(4) Creative environment.

The mentioned process occurs in a creative setting, distinguished by a division and institution supporting ideas. Workshop spaces can be altered along with the workplace to encourage creative activity. Also pertinent are resources that can be used in the design thinking process. Businesses that use design thinking understand how important it is to foster an environment that values and facilitates innovation at work. Examples of this include open workplaces, gathering places and breakout areas that encourage impromptu conversations among team members. Furthermore, the physical environment's adaptability is emphasized. Spaces can be modified to meet the unique requirements of various design thinking stages. Prototyping materials, user research tools, testing technology and other resources pertinent to the design thinking process must be easily accessible. The decision-makers and stakeholders actively participating in the design process are part of the wider creative ecosystem beyond the immediate team.

The stages of the design thinking process are shown in Figure 2.

Comparison with design thinking: Design thinking emphasizes the full product development cycle, from problem discovery to solution refining, in contrast to the lean start-up approach's emphasis on quick testing and market validation. Although the user is at the center of both strategies, design thinking takes a more comprehensive approach to innovation.

4. Methodology

4.1 Research objective

Comparing the applicability of the lean start-up and design thinking methodologies in the context of entrepreneurship and its integration is the primary goal of this study. The study specifically seeks to ascertain whether combining both strategies results in any special benefits for start-up success.

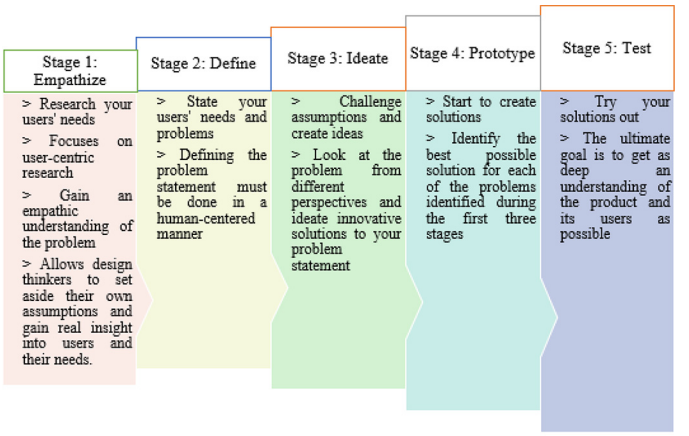


Figure 2.
Stages of design thinking process

Source: Figure by authors

4.2 Research design

This study uses a comparative review methodology to examine the material already available on lean start-ups and design thinking in the context of entrepreneurship. The study design enables a thorough examination of the studies of each strategy and facilitates a methodical comparison between them. An extensive search of scholarly resources and pertinent web platforms was done to compile the necessary information. Scopus and the Dimension database are two data sources. The following inclusion criteria were used to choose the articles:

- articles that were released between 2011 and 2022, making sure to include the most recent research;
- articles that were primarily concerned with the entrepreneurship applications of the lean start-up and design thinking methodology; and
- articles that are available in English.

To guarantee the applicability and thoroughness of the literature chosen for our comparison between design thinking and lean start-up, the inclusion criteria were carefully chosen. The years 2011–2022 were selected to encompass a noteworthy period that followed the release of Eric Ries's groundbreaking book, "The Lean Startup" (2011), which signaled a turning point in the spread of lean start-up concepts. We are able to include a significant amount of research and academic conversations that have surfaced since the beginning of the lean start-up movement because of this period. The use of pertinent terms during the search process included "lean start-up," "design thinking" and "entrepreneurship." Additional sources that may have been overlooked during the original search were looked up by looking through the reference lists of the chosen articles. The analysis entailed reading each paper attentively and identifying the relevant details, such as the theoretical underpinnings, techniques, findings and conclusions.

4.3 Sample

A total of 227 articles about lean start-up, design thinking and their application to entrepreneurship were found in the initial search. Following the application of the inclusion

criteria, 158 articles only addressed design thinking, 59 articles solely addressed lean start-up and 10 articles highlighted the confluence of both techniques. The total sample for this study, therefore, consists of 227 articles. For the present study, 10 articles are being considered for empirical evidence on integrating lean start-up and design thinking.

4.4 Limitation

It is critical to recognize some of this study's shortcomings. Although the selected period corresponds with the development and maturation of lean start-up principles, it is important to recognize that certain previous pertinent works may be absent. This restriction might affect how thorough the evaluation is, especially when it comes to the fundamental material written before 2011. The choice to obtain credible scholarly materials is demonstrated by the utilization of the Dimension database and Scopus. Nevertheless, it is imperative to recognize that the search may not have retrieved every pertinent publication. Despite their widespread recognition, Scopus and Dimension could ignore certain specialized papers or have certain discipline biases. Furthermore, there is a chance that the search will only turn up English-language literature. Since their inception, the fields of design thinking and lean start-ups have changed. It is possible that some earlier works do not accurately reflect these approaches' current condition. Furthermore, changes or improvements made after 2022 might not have been taken into consideration in this evaluation.

4.5 Mitigation strategies

To overcome these constraints, a comprehensive sensitivity analysis will be carried out to investigate the influence of the selected period and database on the overall results. Seminal works published before 2011 will be included whenever possible, and sources from other databases will be considered. By acknowledging these potential drawbacks, we hope to improve the transparency and trustworthiness of our methodology and provide readers with a more nuanced knowledge of the review's breadth and limitations, which will help them better evaluate the findings.

Figure 3 displays the research framework used in this paper's technique.

5. Integration of lean start-up and design thinking

5.1 Empirical evidence combining lean start-up and design thinking

Combining lean start-up approaches with design thinking has emerged as a potential strategy to promote long-term success in the dynamic world of innovation and entrepreneurship. Empirical evidence highlights the enormous influence that this fusion can have on the creation of goods, services and businesses. It can transcend conventional boundaries and open the door to innovative solutions that profoundly impact users.

Numerous studies have been done by combining lean start-up and design thinking. Table 2 shows the empirical evidence combining lean start-up and design thinking.

5.2 Implication of these findings for entrepreneurs and practitioner

The examined research has yielded substantial empirical findings that have significance for practitioners and entrepreneurs. These findings underscore the transformative impact of combining design thinking with lean start-up techniques.

Combining elements of lean start-up and design thinking, the conceptualize model is unique in that it provides practitioners and entrepreneurs with a framework for creating workable strategies for value generation. This methodology facilitates the creation of lean, user-centered business models that effectively answer real demands through iterative

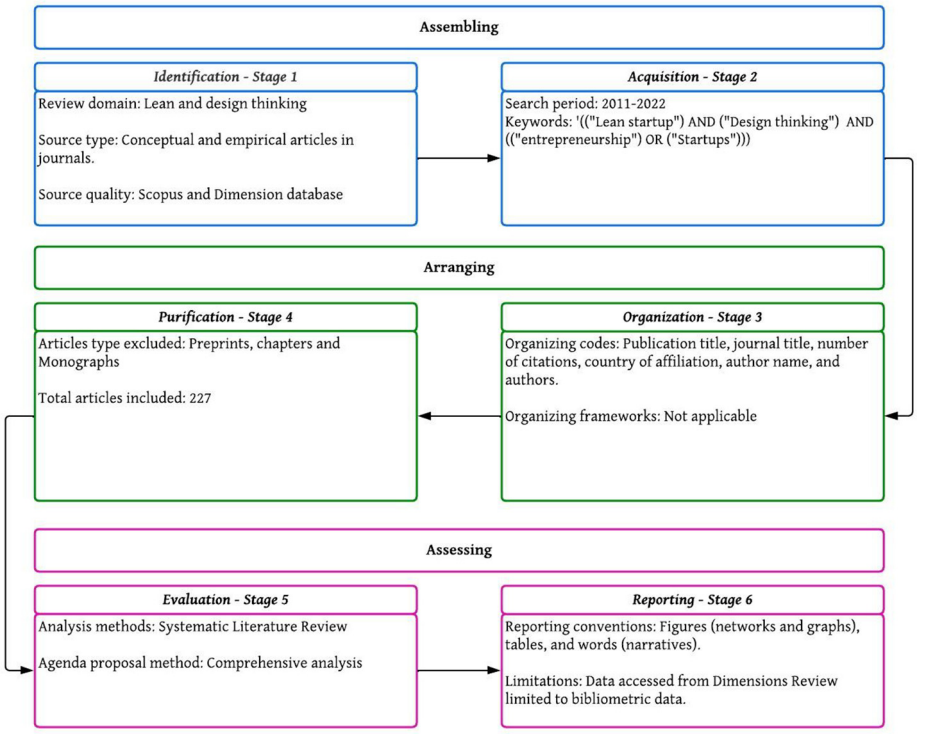


Figure 3.
Systematic literature review framework

Source: Figure courtesy of Paul *et al*. (2021)

procedures. By applying this paradigm, entrepreneurs may create their business models more effectively by thoroughly understanding their value proposition, target market, communication tactics and financial predictions.

Effectuation is a decision logic that is recognized in the field of entrepreneurship. It is a versatile skill that improves organizational ambidexterity and strategy creation. It is positioned as a beneficial resource that gives organizational innovation a competitive edge. The request for additional research emphasizes the importance of learning more about how effectuation may successfully manage innovation inside businesses.

In a different study, an innovation management model for start-ups that combines effectuation, design thinking and lean start-up provides a thorough framework. This comprehensive strategy streamlines ideation, product design, testing and business growth with the use of a stage-based framework and recursive learning loops. The study emphasizes how crucial it is to incorporate lean start-up and design thinking into entrepreneurship education to foster real-world competencies in project management, software development and digital services.

It emphasizes how complementary design thinking and lean start-up methodologies are, and leaders are encouraged to pursue both at the same time. This two-pronged strategy leverages the advantages of lean start-up, which excels in iterative experimentation and hypothesis validation, and design thinking, which excels in user empathy, ideation and

Table 2. Empirical evidence combining lean start-up and design thinking (Scopus and dimension database)

Sl. no.	Integration approach	Reference	Key integration points
1	Conceptualization of model	Allen (2022)	It combines lean start-up and design thinking into the conceptualized model, an iterative approach. Allows business owners to develop lean, user-centered, real-needs-focused business models
2	"Entrepreneurial view" event	Ferrari De Carvalho Teixeira *et al.* (2022)	Suggests holding an online course to encourage innovation and entrepreneurship in Brazilian colleges. Combines design thinking and lean start-up to promote innovative problem-solving and entrepreneurial thinking
3	Disruptive educational model	de Waal and Maritz (2022)	Uses lean start-up and design thinking to develop a novel approach to delivering educational programs in higher education Effectively embodies a conceptual solution that respects economical inventions and sustainability standards
4	Contemporary innovation management	Killen (2022)	Examines how innovation management is changing, with a focus on lean start-up techniques, agile project management and design thinking. Calls for more investigation into effectuation's potential to enhance contemporary innovation techniques
5	Combinatorial model	Ousghir and Daoud (2022)	Creates a combinatorial model that links effectuation, design thinking and lean start-up to enable successful innovation management in start-ups. Combines the three approaches to offer insights into business growth: ideation, product design, launch and testing
6	Recursive learning loops	Reis *et al.* (2019)	Examines the recursive learning loops that entrepreneurs use to build new businesses using design thinking, lean start-up and the business model canvas. Uses a framework with stages to assist in the formation of a corporation
7	Lean start-up in education	Altukhova and Vasilieva (2017)	Advocates for teaching "Internet entrepreneurship" with a focus on design thinking and the lean start-up technique to improve learning effectiveness. Offers examples and guidance grounded in human-centered design
8	InnoDev model	Dobrigkeit *et al.* (2020)	Explains the InnoDev model, a one-day training course for designers, project managers and software engineers that combines lean start-up, scrum and design thinking. Attendees of the workshop find the combination useful and beneficial for developing software

(*continued*)

Table 2.

Sl. no.	Integration approach	Reference	Key integration points
9	Simultaneous pursuit	Lichtenthaler (2020)	Argues that to increase the agility of innovation processes, design thinking and lean start-up should be pursued together. Highlights how these approaches work best together to produce better outcomes at both the front and rear ends of the innovation process
10	Contrasting effectuation	Mansoori and Lackeus (2020)	Highlights the key components of each entrepreneurial strategy and draws comparisons between effectuation and other approaches. Explains the potential benefits, limitations and theoretical advantages of various entrepreneurial approaches

Source: Table by authors

problem framing. When these tactics are integrated, the study projects results that are larger than the sum of their individual efforts.

The paper acknowledges effectuation's theoretical advantages but also points out some of its drawbacks, including its dependence on behavioral techniques and its limitations in later venture growth stages. Nevertheless, these disadvantages can be lessened by combining the advantages of alternative business approaches, offering a sophisticated viewpoint for enhancing entrepreneurial abilities.

To sum up, these findings promote creative thinking, support the synergy of techniques, expedite learning, provide actionable methodologies for incremental value development and emphasize the complementarity of different approaches. Practitioners and entrepreneurs can use these insights to guide their efforts, encourage innovation and improve organizational procedures in a variety of sectors.

6. Critique and discussion

6.1 Strength, weaknesses, opportunities, and threats (SWOT) analysis of combining lean start-up and design thinking

6.1.1 Strengths.

- Customer-centric approach: lean start-up and design thinking together guarantee a strong customer-focused strategy that is consistent with the fundamental idea of placing the user at the heart of innovation. This strength may be further capitalized on by forming cross-functional teams with entrepreneurs, customer experience specialists and design thinkers.
- Iterative and agile: both approaches' agile and iterative qualities enable businesses to react quickly to changes in the market. Promoting an environment that values adaptation and lifelong learning is essential to maximizing this strength. Teams should be encouraged to welcome change and see iterations as chances to get better.
- Innovation and creativity: innovation and creativity flourish in the environment created by combining lean start-up and design thinking. Establishing a culture that encourages innovation and views failure as a teaching tool is important for organizations. To strengthen this skill, acknowledge and commend innovative problem-solving techniques.
- Complementary methodology: a comprehensive approach to innovation is made possible by the complementing qualities of design thinking and lean start-up. Make sure teams using both approaches communicate with each other smoothly to take advantage of this. Cross-training sessions and collaborative workshops can improve frequent communication and understanding.

6.1.2 Weaknesses.

- Conflicting priorities: clear frameworks for collaboration and communication are necessary to balance competing agendas. Create a common project vision and plan that balances lean start-up's requirement for quick prototyping with design thinking's in-depth user comprehension. Team retrospectives held on a regular basis might address new issues.
- Complexity: organizations should use a phased implementation strategy to reduce the complexity brought about by merging approaches. Begin with small-scale initiatives, then progressively increase integration in light of your learnings. Spend

money on training courses to provide teams with the tools they need to carry out their tasks successfully.

- Resource intensive: resource constraints can be overcome by giving priority to the combined approach's essential phases. Do a thorough investigation to determine the crucial touchpoints where user feedback is most useful. To maximize resource use, consider lean approaches like digital tools for quick prototyping.

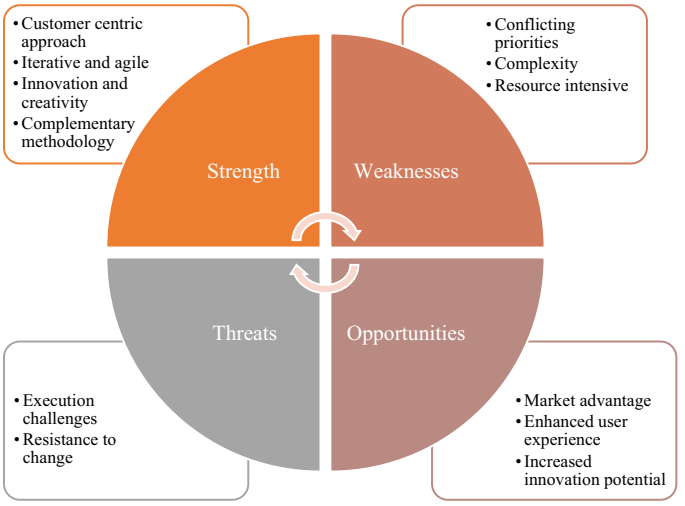
6.1.3 Opportunities.

- Market advantage: by using an integrated approach, organizations can obtain a competitive advantage. Invest in market research to gain insight into changing user expectations to take advantage of this chance. Customize goods and services according to knowledge gleaned from the combination of design thinking and lean start-up.
- Enhanced user experience: a thorough grasp of client needs is necessary to take advantage of the chance to improve user experience. Establish loops for ongoing user feedback to improve goods repeatedly. Reduce the time and expense involved with traditional approaches by gathering insights in real-time through digital platforms and analytics tools.
- Increased innovation potential: organizations should cultivate a culture that supports a variety of thought to fully grasp the greater potential for innovation. Promote cross-disciplinary cooperation and acknowledge noteworthy inventions that come up as a result of the lean start-up and design thinking teams working together.

6.1.4 Threats.

- Execution challenges: expert support is necessary when addressing execution issues. Think about hiring outside experts who are skilled in both design thinking and lean start-up. Their knowledge can help the company navigate the integration process and reduce the possibility of less-than-ideal outcomes.
- Resistance to change: expert support is necessary when addressing execution issues. Think about hiring outside experts who are skilled in both design thinking and lean start-up. Their knowledge can help the company navigate the integration process and reduce the possibility of less-than-ideal outcomes.

Overall, the combination of lean start-up and design thinking combines customer-centricity, agility and creativity; yet, it also offers difficulties due to complexity, competing priorities and resource needs. Careful preparation, good execution and a readiness to change and gain knowledge from the iterative process are necessary to successfully implement this combination strategy. To sum up, the integrated approach is presented in a thorough manner via the SWOT analysis. Strategic planning, training programs and professional advice are necessary to strengthen areas of weakness and take advantage of possibilities. Continuous learning and adaptability will be essential for managing obstacles and realizing the full potential of lean start-up and design thinking as firms set out on this integrated journey. Figure 4 shows the SWOT analysis of the combination of lean start-up and design thinking.



Source: Figure by authors

Figure 4.
SWOT analysis of the combination of lean start-up and design thinking

6.2 Potential synergies of integrating the lean start-up and design thinking approaches

Lean start-up and design thinking integration can produce potent synergies that increase the likelihood of start-up success. Both techniques strongly emphasize customer and iterative learning, making them extremely compatible and complementary. Eric Ries' lean start-up model strongly emphasizes the value of quick experimentation and verified learning. It encourages entrepreneurs to use the build-measure-learn feedback loop to test their hypotheses early on. Start-ups can swiftly recognize and respond to market demands by adopting a "fail fast, fail cheap" mentality, which lowers the risk of investing time and money in a good or service that does not appeal to customers. However, design thinking offers a disciplined method of problem-solving and creativity. Empathy, a thorough grasp of user needs and innovative problem-solving strategies are stressed. Start-ups are encouraged by design thinking to perform in-depth user research, pinpoint problems and come up with creative solutions. It encourages a human-centered strategy, making certain that goods and services are created with the consumer in mind.

By combining these two strategies, start-ups can gain from a comprehensive and iterative process that fosters innovation while lowering uncertainty. Start-ups may gain important insights from actual customers, test hypotheses and develop solutions that genuinely satisfy consumer needs thanks to the convergence of lean start-up experimentation and user-centric design thinking. Lean start-up and design thinking applied together can result in a more productive and efficient product development process. The lean start-up's iterative experimentation is informed by design thinking's emphasis on empathy and user research, ensuring that entrepreneurs are creating products that people genuinely want. In the lean start-up methodology, the knowledge gathered through design thinking aids in prioritizing and directing experimentation.

The incorporation of these approaches promotes cross-functional cooperation within start-up teams. Design thinking encourages interdisciplinary cooperation by bringing together people with various talents and viewpoints. The lean start-up methodology promotes close team collaboration and a culture of ongoing learning and development. Start-

ups can use their teams' collective intelligence and creativity to combine these collaborative characteristics, leading to more creative and significant solutions. In the end, combining design thinking and lean start-up gives start-ups a potent recipe for success. They can swiftly iterate, test hypotheses and develop products that help their target market solve their problems. Start-ups can improve their chances of establishing profitable, long-lasting companies in the highly competitive business environment by putting the customer at the center of the development process and adopting a philosophy of continuous improvement.

7. Implication

Before deciding between lean start-up and design thinking, entrepreneurs and organizations must evaluate their unique context, goals and obstacles. In circumstances when quick experimentation and market validation are essential, a lean start-up might be a better fit. Conversely, design thinking is the best method for producing creative ideas and thoroughly grasping user needs. It can be beneficial to combine the two methods since it enables a thorough approach to product creation. Note that while design thinking prioritizes a thorough understanding of user demands, lean start-up places more emphasis on speed and agility in product development. Achieving equilibrium between these components is essential. Combining the rapid and iterative experimentation of lean start-ups with the user-centric approach of design thinking guarantees that goods not only reach the market quickly but also strike a chord with people.

Lean start-up and design thinking flourish in a setting that encourages innovation and accepts failure as a necessary learning component. Business owners and executives are responsible for fostering an environment that values innovation, taking calculated risks, and ongoing development. To successfully integrate design thinking and lean start-up principles, a culture transformation is required. To integrate lean start-up with design thinking effectively, cross-functional teams must collaborate. Entrepreneurs and institutions ought to support interdisciplinary teams whose members contribute a range of viewpoints, experiences and skill sets. This diversity encourages innovative thinking and problem-solving from a holistic standpoint.

Incorporating design thinking's focus on empathy and user comprehension into the lean start-up methodology is beneficial. Putting money into user-centric design techniques like user research and prototyping guarantees that lean experiments are based on a thorough comprehension of the needs and preferences of the target audience. Blending the build–measure–learn cycle of lean start-up with iterative prototyping, a key component of design thinking, helps produce better, more user-friendly products. Early prototype creation, ongoing user input gathering and applying these learnings to subsequent revisions should be top priorities for entrepreneurs. Lean start-up introduces innovation accounting as a way to gauge a start-up's progress. Metrics must be modified to incorporate qualitative user happiness and experience measures to integrate design thinking. Leadership dedication is necessary to integrate design thinking with lean start-up successfully. Organizational leaders and entrepreneurs could fund training initiatives to introduce teams to the fundamentals of both approaches. This guarantees effective execution and a common understanding throughout the company.

8. Conclusion

This thorough literature analysis explores the integration of design thinking and lean start-up methodologies, revealing their respective contributions to the field of entrepreneurship. Entrepreneurs and practitioners in the start-up ecosystem can benefit greatly from the conclusions and recommendations derived from previous research. This conclusion is further divided into discrete sections that cover the following topics: limitations, theoretical contributions, practical applications and recommendations for additional research.

Although relevant research is synthesized in this review, it is important to recognize its limitations. The period of 2011–2022 was selected to provide a thorough but reasonable scope. Our methodology is more transparent when any biases related to depending just on Scopus and the Dimension database are acknowledged.

The integration of design thinking and lean start-up yields theoretical advances that present a comprehensive approach to entrepreneurship. This integration fosters an inventive culture that encourages experimentation and customer-centricity by encouraging a dynamic and iterative approach. Continuous empirical study can improve theoretical frameworks to address particular industry situations and issues.

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Future studies should focus on the following topics to further enhance the field.

Examine particular industrial contexts and situations where lean start-up and design thinking work best together. Professionals and entrepreneurs can adjust their tactics to market trends and industry dynamics with the help of this detailed understanding. Perform empirical studies on the challenges and impediments related to putting these strategies into practice. Provide doable advice on how to get past obstacles so business owners can successfully negotiate them and benefit from integration. Examine how the integrated strategy affects sustainability and start-up performance over the long run. Knowing the long-term effects can help optimize planning and resource allocation for long-term success.

In conclusion, a strong case can be made for start-up success when lean start-up and design thinking are combined. Equipped with customer-centricity, iterative experimentation and empathic design, practitioners and entrepreneurs can more skillfully negotiate the terrain of entrepreneurship. This comparative analysis advocates for the broad adoption and improvement of this integrated approach throughout the start-up ecosystem and provides a foundation for future study and practice.

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Further reading

Kaushik (2020), "5 Lean startup examples to inspire your own business", Starting Business, available at: www.startingbusiness.com/blog/lean-startup-examples (accessed 11 June 2023).

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