



Designomics

The role of financial literacy in Design Innovation

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Designomics: The Role of Financial Literacy in Design innovation

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Preface

In the pursuit of knowledge and innovation, I embarked on a journey to explore the intersection of design and financial literacy. This thesis represents the apex of my academic journey that would not have been possible without the guidance, support, and contributions of various individuals and academic resources.

First and foremost, I extend my deepest gratitude to my Graduation Committee, chaired by Prof. Sicco Santema and mentored by Dr. Nikolas Kyriakopoulos. Your wisdom and expert guidance have been invaluable throughout this process, serving as a driving force in the successful completion of this work.

I would also like to express my sincere appreciation to the interview participants. Your insights and experiences have been a cornerstone of this research, shedding light on an unexplored area at the intersection of design and finance.

To my dear wife, your unwavering encouragement has been my rock. Your belief in me propelled this journey, and your support made it possible.

To my parents, I owe a profound debt of gratitude. Your emphasis on education and unwavering support have been guiding lights on my path of learning.

To my friends, thank you for the camaraderie, discussions, and ongoing support. You've certainly enriched this academic journey.

Lastly, I'd like to acknowledge the Faculty of Industrial Design Engineering at TU Delft for providing the resources and platform for this research.

This work serves as an inspiration for future research in the domain of financial literacy in design innovation, with the ultimate goal of advancing design education and practice.

Sincerely,

Amir Anwar-Hameed

Executive Summary

Financial literacy is an essential component in design innovation projects, holding the potential to transform both the practice and education of design. The capacity to make effective financial decisions, encompassing knowledge, skills, and self-efficacy, is pivotal in the context of innovation (Warmath & Zimmerman, 2019). This capacity empowers designers to manage risks, budget projects, and effectively communicate with stakeholders, ensuring the evaluation of economic viability and sustainability (HBS Online, 2020).

This research underscores the importance of financial literacy within design innovation. By enhancing designers' financial competence, it shifts their focus from exploratory innovation towards strategic innovation. This transition involves combining elements of exploratory, design, and viable innovation, aligning innovation efforts with long-term project goals. This shift becomes possible by leveraging financial knowledge, resulting in choices that provide a competitive advantage, adaptability to changing market conditions, and entry into new markets (Lusardi & Messy, 2023).

While acknowledging the organisational influence on financial literacy, this research focuses its significance at a project level, particularly during the fuzzy front end of innovation. The study adopts the double diamond approach, a popular process among design practitioners (Brown, 2009; Martin, 2009; Liedtka, 2014), to evaluate financial literacy's impact on the innovation process.

The culmination of this research is the Design Innovation Viability (DIV) Dashboard, an innovative tool that guides designers and professionals through the intricacies of financial literacy in design innovation. It features a series of 16 learning modules, each focusing on specific components of financial literacy, and provides a structured learning assessment to gauge one's financial competence, by use of Bloom's Taxonomy.

The implications of this work are substantial, equipping designers with comprehensive financial literacy, enhancing design innovation competence, and enabling effective stakeholder communication. However, it is important to recognize the study's limitations. It is essential to further explore and expand the understanding of financial literacy in design innovation. Moreover, a more comprehensive framework for presenting a Value Case or Business Case in the final stages of design projects is needed (Duréndez et al., 2023).

In summary, this research pioneers the integration of financial literacy with design innovation, making financial competence a fundamental element. The findings resonate with the importance of financial literacy for both designers and professionals, reinforcing the significance of making informed financial decisions, assessing viability, and fostering strategic innovation. This work serves as an inspiration for future research in the domain of financial literacy in design innovation, ultimately advancing design education and practice.

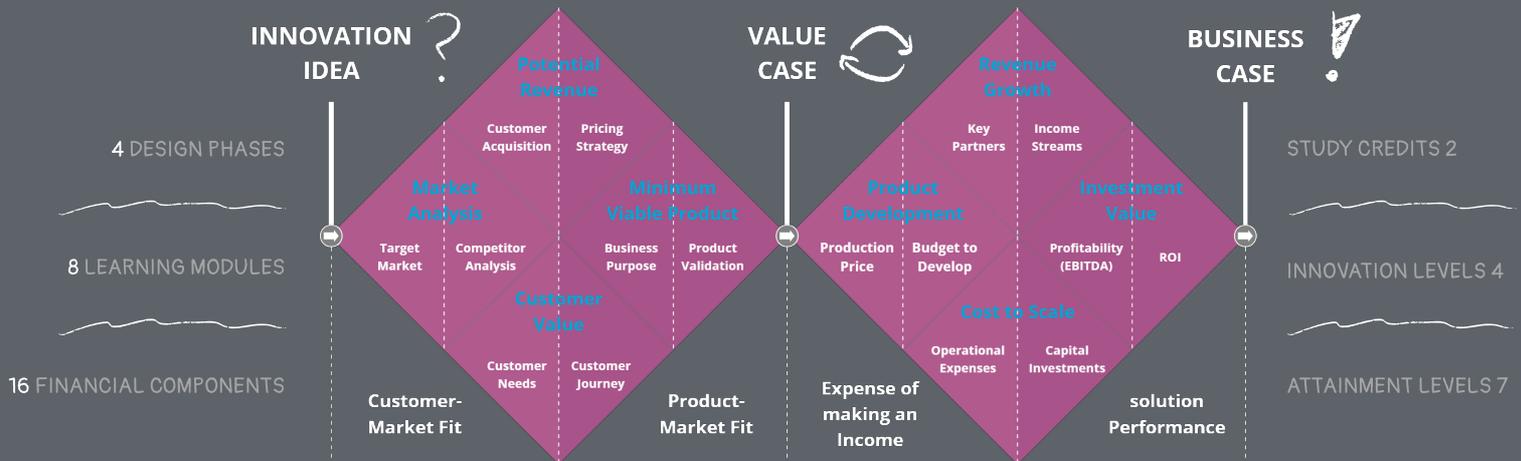
Designnomics

The role of Financial Literacy in Design Innovation

Financial literacy plays a critical role during design innovation, as it empowers designers to understand the viability of their creative process. This integration is essential in the dynamic field of design innovation, where financial literacy aligns holistic design objectives with key financial performance indicators, such as potential revenue, development costs, and return on investment. This fusion of two vast disciplines should not only provide designer with financial knowledge, but a comprehensive toolkit for applying financial components at various stages of the innovation process.

The goal of this research project is to enhance the integration of financial literacy into design innovation through interactive learning modules, utilizing the Design Innovation Viability (DIV) Dashboard. By exploring various components, it aims to improve financial acumen. The project focuses on creating a digital learning environment that equips design practitioners with the knowledge and skills needed for success in the evolving field of design innovation. The ultimate aim is to enhance designers who are both creative visionaries and astute financial thinkers, ensuring their success in the digital age of innovation.

DESIGN INNOVATION VIABILITY DIV DASHBOARD



LEARNING MODULE DESIGN

The sidebar can be navigated at any point during learning activities to explore different learning modules

Once satisfied their level of knowledge, users have the choice to move onto the next learning module

Alternatively, if users have completed both modules shown in the sidebar, it is possible to start the self-assessed case study shown at the bottom

The heads up display provides insights on user progress, time spent working on a module and level of participation

Module content follows the same structure across all learning phases

Real life examples can be explored to gain a deeper insight into the content (or if you're starting to get bored!)

“

**Nothing is easy about finance.
It will always be a pain-point in
any business.**



PIETER JONGERIUS - DIRECTOR OF FABRIQUE DESIGN

Table of contents

PREFACE	3
EXECUTIVE SUMMARY	4
1 INTRODUCTION	9
1.1 Assignment	10
1.2 Approach	12
2 BACKGROUND	14
2.1 Design Innovation	15
2.2 Financial Literacy	18
2.3 Key Takeaways	21
3 RESEARCH	22
3.1 Methodology	23
3.2 Data Collection	26
4 RESULTS	28
4.1 Data Analysis	29
4.2 Building Blocks	33



5 DESIGN STAGE	36
5.1 Viability Roadmap	37
5.2 Learning Modules	40
5.3 Digital Prototype	48
6 DISCUSSION	54
6.1 Viability Dashboard	55
6.2 Context of Innovation	57
6.3 Implications of Design	58
6.4 Limitations of Research	61
7 CONCLUSION	64
7.1 Project Conclusion	65
7.2 Personal Reflection	66
REFERENCES	67

APPENDIX

01

Introduction

This section lays the groundwork for the research project, starting with the initial assignment that sets the context, scope, and focus. It further explores the overall approach of the project, highlighting the research goals, methods, and tools utilized during different phases of the study, providing a clear roadmap to understand the progression of the research.

1.1 Assignment

- Context
- Scope & Focus
- Research Questions
- Personal Ambitions

1.2 Project Approach

- Approach & Method
- Planning

1.1 Assignment

CONTEXT

In the sphere of design innovation, financial literacy emerges as a transformative element with the potential to reshape both design practice and education. Financial literacy in design denotes the capacity to make effective financial decisions, drawing from knowledge, skills, and self-efficacy (Warmath & Zimmerman, 2019). It equips designers with the competency to navigate financial intricacies inherent in design innovation projects, expanding beyond just numerical computations to the robust utilisation of financial information in the creative process.

The importance of financial literacy in design manifests in its capacity to empower designers in precise and effective communication. Within the multifaceted domain of design innovation, designers interact with a diverse spectrum of stakeholders, including investors, executives, and accountants. This proficiency underpins collaborative success, ensuring the realisation of innovative solutions and informed decision-making. Financial literacy's influence extends beyond individual design projects, resonating in the macroeconomic arena (Leskinen & Raijas, 2006; Lusardi et al., 2010; Lusardi & Mitchell, 2011, 2014). It consistently emerges as a critical factor in shaping economic outcomes, reinforcing its significance in the realms of innovation and business.

However, despite the substantial benefits of financial literacy in design, various challenges must be addressed. These challenges encompass the acquisition and practical application of financial knowledge and skills by designers. The integration of financial concepts, such as budget structuring, cash flow analysis, and return on investment (ROI), derived from the business model, is crucial for ensuring the long-term viability of innovation (Koskelainen et al., 2023). Yet, this integration necessitates not only financial literacy but financial capability at various project stages.

The potential for synergy between financial literacy and design thinking is unmistakable. It holds the transformative power to redirect designers from exploratory innovation towards strategic innovation. This transition combines aspects of exploratory design and viable innovation, aligning design efforts with long-term project goals. Empowered by financial knowledge, designers make choices that confer a competitive edge, adaptability to shifting market conditions, and market entry. As the disciplines of design and finance continue to converge, the potential for innovation and business development unfolds into exciting new dimensions.

Therefore, how can financial literacy integration in design innovation processes optimally empower designers to make informed financial decisions, evaluate viability, and stimulate strategic innovation, consequently advancing design education and practice?

SCOPE & FOCUS

In this study, the primary focus lies in understanding the integration of financial literacy within design innovation. The scope encompasses exploring how designers can be empowered to make well-informed financial decisions, evaluate the viability of design solutions, and foster strategic innovation. This research delves into the challenges associated with financial literacy in design and seeks to identify the potential for enhancing designers' financial capability at different project stages. It also takes into account the broader context of design education and practice, acknowledging the macroeconomic influence of financial literacy. The overarching goal is to formulate a roadmap and learning module that equips designers with essential financial skills, enabling them to make better decisions during the 'fuzzy front end' of design innovation.

RESEARCH QUESTIONS

To explore the impact of financial literacy during the 'fuzzy front end' of design innovation, the following assumptions are considered:

Synergy of Financial Literacy and Design Thinking Framework: It is assumed that a synergy exists between financial literacy and the design thinking framework.

Impact of Financial Knowledge: An assumption is made that financial knowledge significantly influences the outcome of a design innovation project.

Role of Financial Literacy in Viability: It is assumed that financial literacy plays a pivotal role in ensuring the viability of innovative design projects.

These assumptions contribute to in a set of guiding research questions, shaping the research direction:

1. What is the nature of the relationship between design innovators and finance?
2. How does financial literacy affect decision-making in design innovation projects?
3. Which specific components of financial literacy hold the most relevance during the problem definition and solution proposal stages of the design thinking process?
4. What are the primary challenges encountered by practitioners when integrating financial literacy into the design thinking framework?

PERSONAL AMBITIONS

The driving force behind this research stems from a desire to bridge the perceived gap between the creative world of design and the territory of finance. The aim is to not only enhance personal understanding but to contribute to the empowerment of fellow designers and innovators. This research project seeks to facilitate a holistic grasp of financial intricacies within design projects and promote financial competency among creative professionals. This ambition aligns with the broader vision of advancing design education and practice, potentially transforming the way we approach innovation in the creative domain. This research represents a significant step toward realising these aspirations, paving the way for a future where financial and design expertise seamlessly coexist.

More information on the original project scope and motivation can be found in Appendix A.

1.2 Project Approach

APPROACH & METHOD

The research project commenced with a comprehensive literature survey, covering design innovation and financial literacy. This initial phase sought an understanding of the frameworks underpinning design innovation, particularly those recognised by design practitioners. Its primary aim was to unearth gaps within existing literature, setting the stage for the subsequent research cycle.

Building upon insights gained from the literature, the research transitioned into its core phase: the research cycle. Here, a select group of design practitioners in the field of design innovation participated in interviews. These interviews were tailored to uncover the intricacies of their innovation processes, focusing on the financial aspects of their decision-making and project challenges.

These interviews served multiple objectives. They shed light on the financial components and indicators instrumental in guiding and advancing design projects, thereby revealing practical aspects. Furthermore, the interviews delved into the nuanced interplay between the financial language and the realm of design. This phase required a qualitative analysis, employing a fusion of deductive and inductive reasoning, coupled with first and second-order constructs to interpret the collected interview data.

The final phase of the research project was dedicated to designing a roadmap and learning

module based on the results of the research cycle. These resources were tailored to align with the Strategic Product Design program at the Faculty of Industrial Design, TU Delft. The primary goal was to enhance the financial literacy of design students in the context of design innovation.

PLANNING

The qualitative study is guided by the double-diamond framework, as seen in Figure 1. The research unfolds in three phases. The first phase involves understanding the landscape, with an extensive literature review. Interview questions for design practitioners and academics are formulated, and interview data are categorised to identify associations and key performance indicators.

In the second phase, frameworks and educational connections are developed to create a learning module and roadmap, as well as the assessment of the synergy between design thinking and financial literacy.

The final phase is dedicated to project delivery preparation, ensuring precise and clear reporting in the project assignment. The format for presenting project execution is defined, and collaborative work with the graduation committee is conducted. The research project continually refines its problem definition as findings progress, with the ultimate aim of making a substantial contribution to the fields of financial literacy and design innovation.

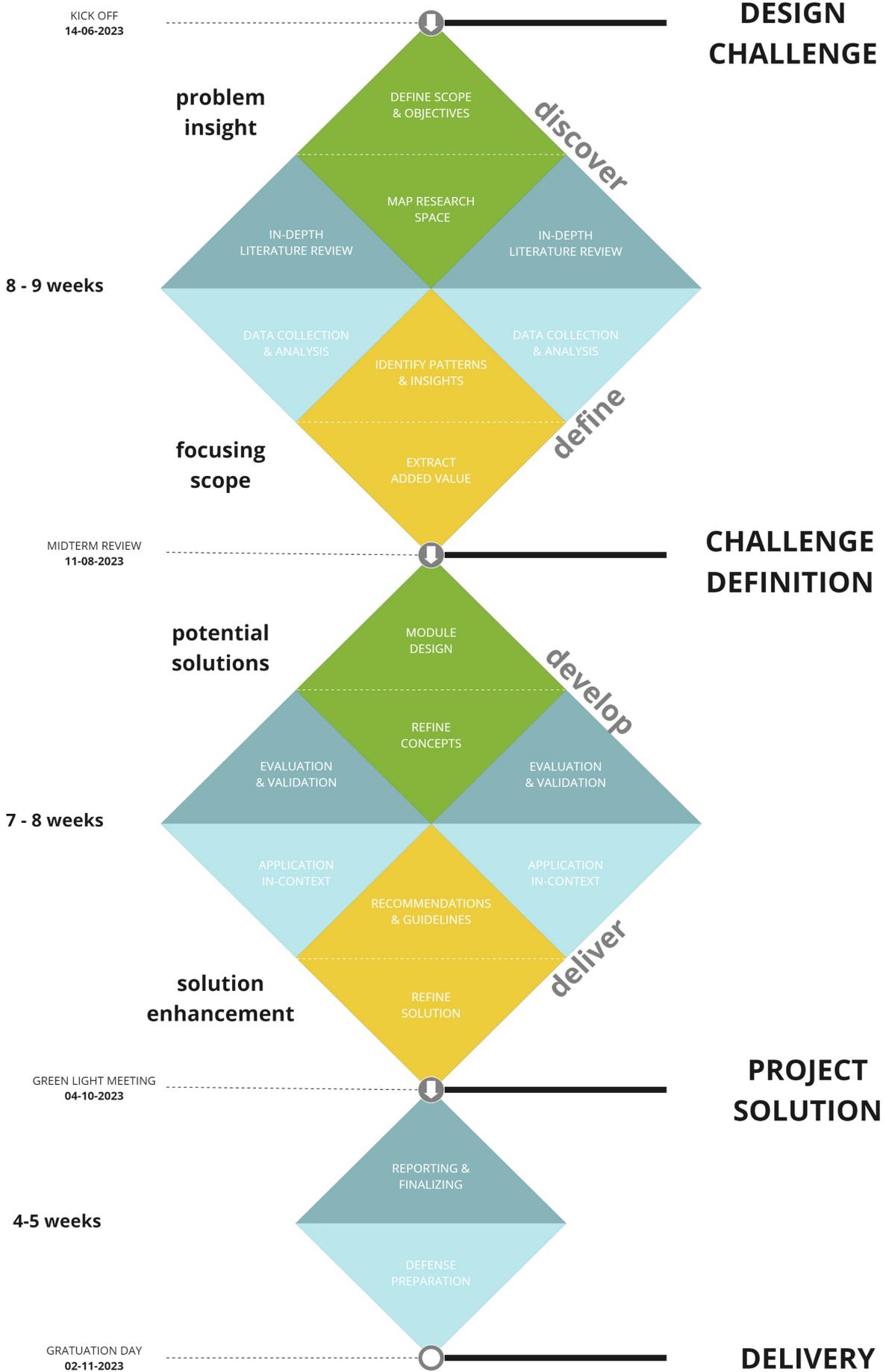


Figure 1: Project Plan and Timeframe

02

Background

This section delves into the theoretical background of design innovation and financial literacy. By exploring different innovation frameworks actively used by design practitioners, to grasping key financial components at play in order to achieve design viability. Literature will be extensively examined to define any research gaps on the topic of financial literacy in design innovation.

2.1 Design Innovation

- Design Thinking
- Organisational Context
- Framework for Innovation

2.2 Financial Literacy

- Understanding Literacy
- Literacy in Context
- Framework for Viability
- Implementation of Viability

2.1 Design Innovation

DESIGN THINKING

In the pursuit of innovation, which encompasses the creation, development, delivery, and scaling of *products, services, processes, and business models for customers* (McKinsey & Company, 2022), adhering to the pillars of Feasibility, Desirability, and Viability is essential, as seen in Figure 2. These pillars ensure that innovations are both usable and valuable to customers while maintaining a robust business case and technological feasibility.

The primary focus of this research is on the design approach to innovation, specifically the 'design thinking process' known as the double-diamond approach. This human-centred approach provides a structured path to innovation. At its core, the double-diamond

approach emphasizes user needs and desires while systematically exploring ideas and prototyping them. This approach, as depicted in Figure 3, follows the three pillars of innovation: desirability, feasibility, and viability.

The design thinking process consists of four distinct stages: Discover, Define, Develop, and Deliver, each interconnected with the other. These stages provide a clear framework for advancing innovation. Within this structured process, three gateways guide each stage. The first gateway initiates the process by defining the problem to be addressed. The second gateway, refines the problem through extensive research, contributing to a more profound understanding of its intricacies. Finally, the third gateway emerges after reaching the Deliver stage, where the best solution to address the defined problem is materialised.

The design thinking process, as embodied in the double-diamond approach, offers the flexibility necessary to accommodate a myriad of innovation challenges. Figure 3, constructed by Nessler (2023), provides a comprehensive illustration of the various research levels within the first diamond. The second diamond encourages the development of ideas through 'sprints,' exemplifying the adaptability and flexibility inherent in this approach.

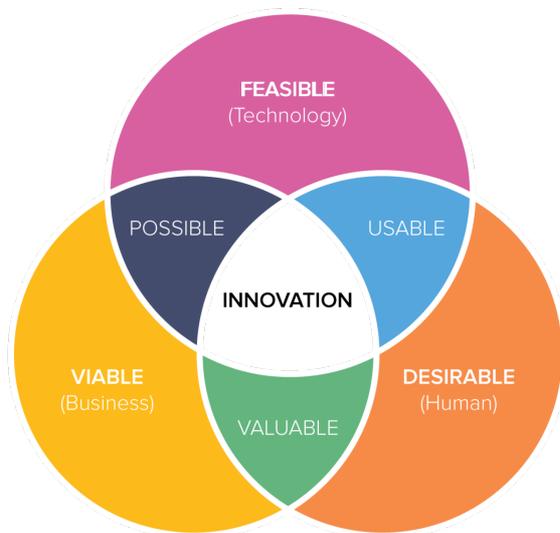


Figure 2: Pillars of Innovation

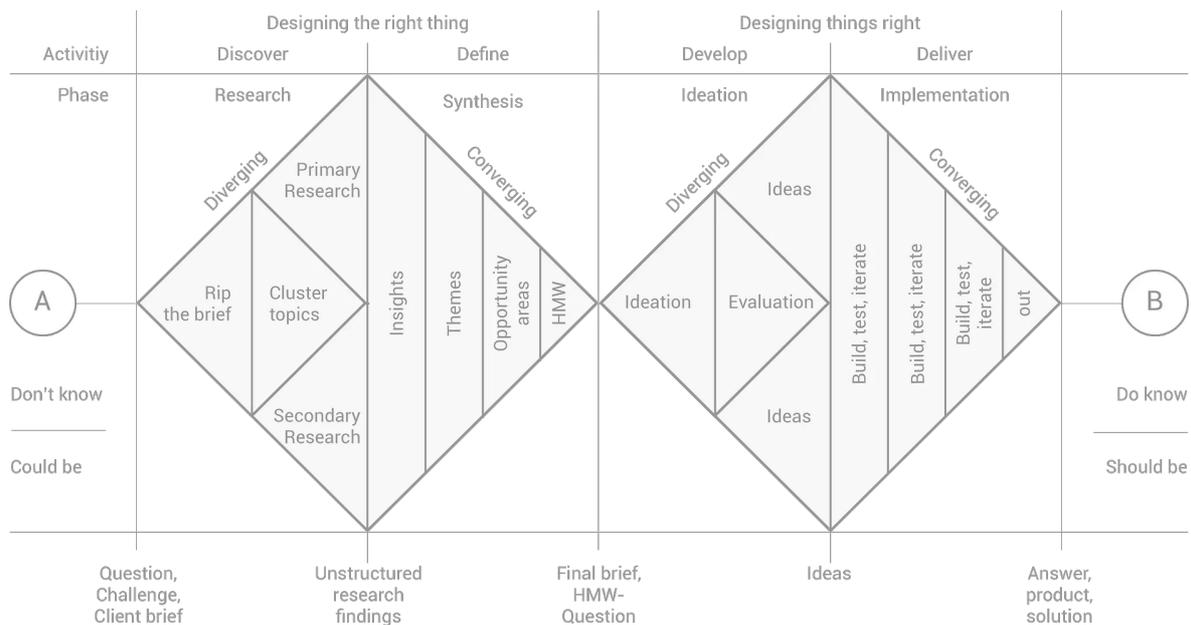


Figure 3: Double-Diamond Approach

ORGANISATIONAL CONTEXT

Design thinking has emerged as a powerful catalyst for successful collaboration within organisational ecosystems. Research underscores the importance of seamless collaboration among different departments to mitigate bottlenecks in creativity and communication issues (Sandberg and Aarikka-Stenroos, 2014; Story et al., 2014). Collaboration across departments effectively bridges the challenging "valley of death," a critical phase that often hinders innovation *between opportunity discovery and product development* (Klitsie et al., 2019). Organisations that adopt a design thinking approach are characterized by their agility and resilience, ensuring sustainable growth (Cassiman & Veugelers, 2006).

In the context of design-driven innovation, there is a pressing need to balance creative ideation with financial judgement (Jonker & Kosse, 2022). Designers therefore must harmonise

their holistic approach with financial practicality to ensure project stability. This research aims to unveil how design thinking can not only generate innovative ideas but also nurtures them into viable realities. By fostering an environment where innovation thrives, the synthesis of creative ideation and financial acumen becomes a driving force, ensuring the success of innovation projects.

FRAMEWORK FOR INNOVATION

Exploring various innovation frameworks provides valuable insights into the intricate relationship between creativity, strategy, and management. As the roles of innovation coaches and managers evolve, an understanding of project complexity and design thinking processes becomes paramount (Kanter, 2007). However, this evolution sometimes confines designers to specific design actions, potentially limiting their overall project impact (Brown, 2009; Liedtka, 2014).

The convergence of design engineering and finance opens new possibilities, fostering innovation and analysis (von Hippel, 2017). The rise of innovation coaching within organisations seeks individuals skilled in design thinking, agile practices, and lean start-up principles (Neubauer et al., 2020). Strategic Product Design calls for the harmonisation of design approaches with innovation strategies, combining creative problem-solving with business insight. This approach focuses on creating strategic value propositions (Ghemawat et al., 1998).

The desired outcome is to demonstrate to design practitioners that establishing a baseline of financial literacy enhances their overall capability to innovate. Hence, gaining a comprehensive understanding of their current financial knowledge, decision-making processes, and challenges will not only make this research more relevant but also provide opportunities for future exploration.

At the core of innovation lies the significance of customer segmentation, a cornerstone for creating viable products and services. The orchestration of factors such as salaries, customer acquisition costs, and market reach converges into thoughtful strategic considerations (Blank & Dorf, 2012).

Please refer to Appendix B for an overview of the summaries research direction.

One of the focal points of this research is a qualitative analysis of interviews conducted with practitioners and academics in the field of design innovation. The research analysis aims to uncover the synergies between design thinking and financial capability, as illustrated in Figure 4. This progression towards a higher level of financial literacy alongside design thinking shifts the focus from reactive to proactive innovation. The framework of Figure 4 will act as a source of reflection throughout the research project in order to validate the results and design solution.

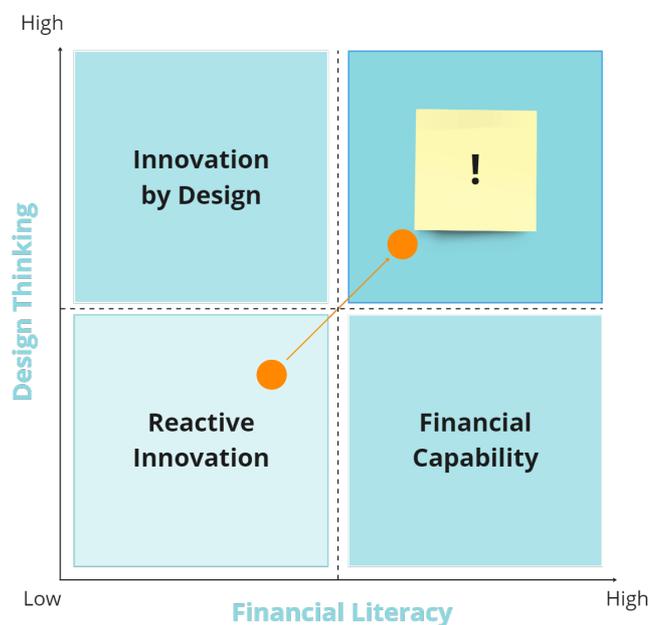


Figure 4: Design - Finance Synergy

2.2 Financial Literacy

UNDERSTANDING LITERACY

Financial literacy holds a substantial sway over the outcomes of design projects (Leskinen & Raijas, 2006; Lusardi et al., 2010). However, precisely quantifying this impact, potentially through the utilisation of key performance indicators (KPIs), continues to be a persistent challenge (Bergman & Knight, 2013).

Financial capability extends far beyond the grasp of financial concepts; it encompasses the practical application of financial knowledge and the adept identification of actionable opportunities (Engels et al., 2020). Insufficient financial literacy can lead to errors, influencing suboptimal decisions and rendering individuals susceptible to external pressures (Fernandes et al., 2014).

Comprehensive financial literacy delves deeper than cognitive knowledge alone; it integrates practical application skills and self-efficacy, resulting in a dynamic synergy (Klapper et al., 2015). The conventional understanding of "literacy as knowledge" has transformed to place a pronounced emphasis on self-efficacy, encapsulating an individual's belief in their capability to navigate tough financial decisions (Hira, 2010).

Taking into account these dimensions, a comprehensive perspective of financial literacy takes shape, underscoring the blending of financial skills, knowledge, motivation, and self-efficacy (OECD, 2021). This multifaceted

outlook opens up new prospects for financial literacy, positioning it as a transformative tool for designers across the spectrum of the innovation process.

LITERACY IN CONTEXT

Financially literate individuals within organisations tend to yield *better economic outcomes* (Leskinen & Raijas, 2006; Lusardi et al., 2010; Lusardi & Mitchell, 2011, 2014), underlining the critical need for the effective integration of financial literacy into innovation projects. Within the context of innovation projects, one framework of interest is the stage gate model. This model, while overlapping significantly with the double-diamond approach, places stronger emphasis on the business case than the overall innovation process. However, it presents a potential avenue for incorporating additional financial components into its stages.

For instance, in the course of developing an innovation project, considerations such as market size, potential revenue, and competition necessitate examination. This leads to the formulation of a business case, which remains dynamic and subject to continuous refinement as the project advances. With the conceptual maturation of the project, a budget is established, encompassing both fixed and variable expenses, along with development costs over a specified period. This budget provides clarity on the project's financial sustainability until its launch, offering insights into its return on investment (ROI).

The application of this process can vary across different innovation projects. However, while maintaining focus on design thinking, this will be the assumed order of context for further research until interviews are conducted.

FRAMEWORK FOR VIABILITY

As defined by McKinsey & Company (2022), financial literacy occupies a pivotal role within the innovation process, which encapsulates the development and scaling of novel *products, services, processes, and business models*. Central to this pursuit are the three fundamental pillars of innovation: Feasibility, Desirability, and Viability. These pillars, when integrated into the innovation process, facilitate the creation of solutions that are not only usable and valuable to customers but also financially viable, as portrayed in Figure 5 (Gedeon, 2021).

This interplay between financial literacy (also known as viability in this context) and

innovation, while apparent, remains an area of continuous exploration. Although the connections between financial literacy and these innovation pillars can be identified, they have not yet been independently administered to their full potential. This suggests an avenue for further development and integration in the realm of design innovation, which is a focal point of this study.

Moreover, a noticeable gap in current literature exists regarding specific financial components utilised throughout the design innovation process. While the importance of financial literacy is widely recognised, the practical application of this knowledge in the context of design innovation has been relatively understudied. Much of the existing literature has primarily focused on financial literacy in personal finance or broader entrepreneurial settings. The lack of information concerning the precise financial tools, metrics, and indicators crucial for design practitioners involved in the innovation process highlights a

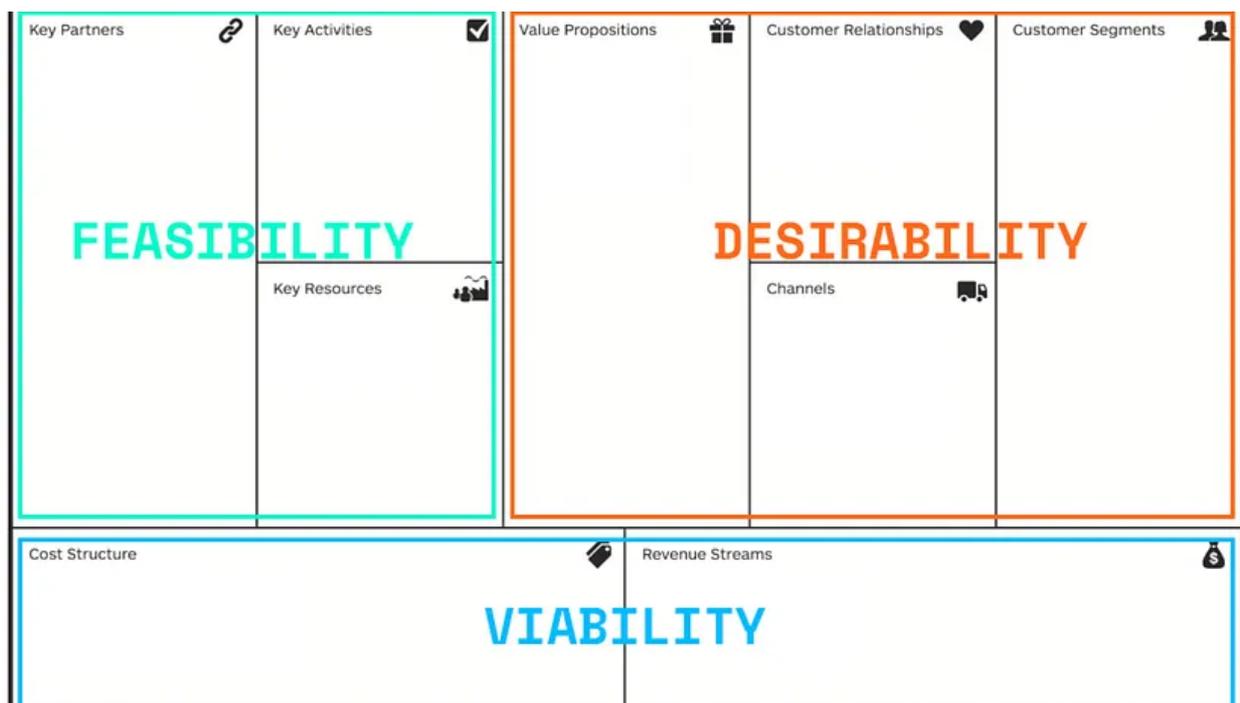


Figure 5: Business Model Canvas

significant void in our understanding of how financial literacy operates within this specialised field. This underscores the urgent need for further research to uncover and explain these particular financial components, offering insights into the intricacies of financial literacy as a crucial skill for design practitioners in innovation.

IMPLEMENTATION OF VIABILITY

The decision to adopt the double-diamond approach, centring on the convergence of the three pillars of innovation with a focus on viability, is grounded in the understanding that finance does not exist in isolation; it rather reflects the realities of a project, as emphasized by Bergman and Knight in "Financial Intelligence" (2013). This perspective underscores the significance of reasonable assumptions and estimates in enhancing project viability.

Incorporating the insights derived from the literature survey, this approach involves the

integration of specific financial components into the double-diamond process, as seen in Figure 6. These components encompass the formulation of a business case, adherence to generally accepted accounting principles (GAAP), budgeting, and the inclusion of key performance indicators (KPIs).

The implementation of these financial elements is primarily envisioned to occur through digital means, although the exact methodologies remain to be established and warrant further exploration. This alignment with digital tools and platforms is essential to equip practitioners with the skill set necessary for success in an increasingly digital-oriented world, a notion supported by various researchers (Elsinger et al., 2018; Engels et al., 2020; OECD, 2021).

By blending traditional financial literacy with elements of digital literacy, this approach aims to prepare design practitioners for the evolving landscape of innovation, where digital tools and financial insights are becoming increasingly intertwined.

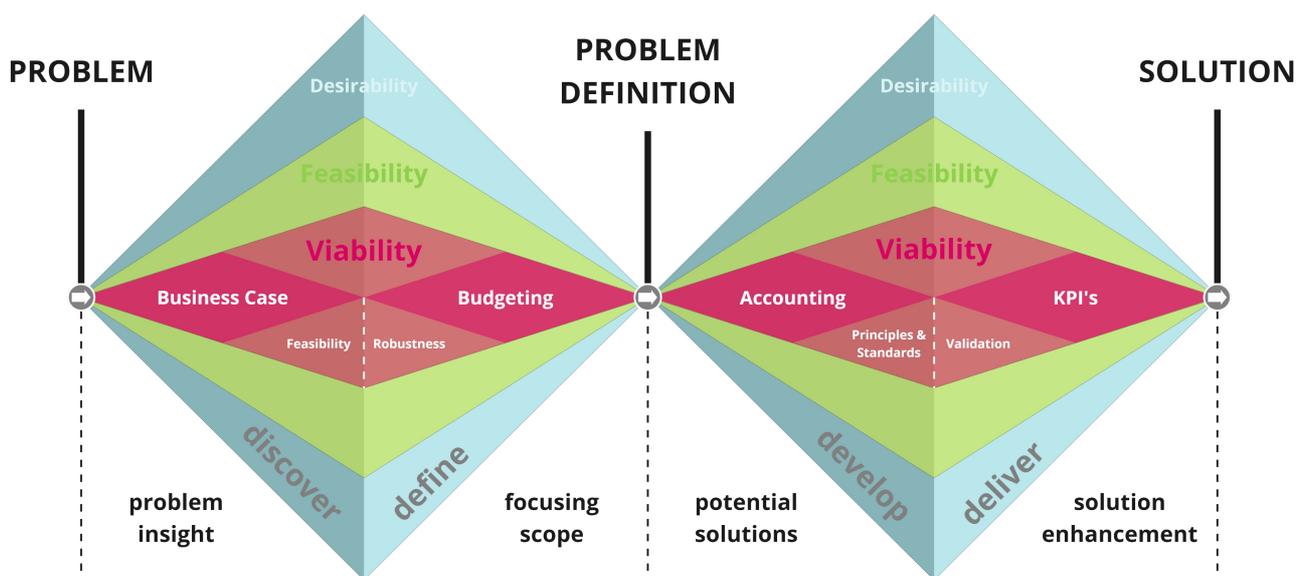


Figure 6: Double Diamond Approach through Viability

2.3 Key Takeaways!

This section presents the key takeaways which were discovered during the background literature study. The forthcoming points will be utilised for further justification of the research project's direction.

DESIGN INNOVATION

Pillars of Innovation

Design innovation emphasizes Feasibility, Desirability, and Viability, with a strong link between financial literacy and Viability.

Innovation Framework

The double-diamond approach offers flexibility for integrating new elements of design innovation effectively.

Design Integration

To boost financial viability, design innovation should incorporate key performance indicators such as market analysis, revenue potential, budgeting, and return on investment.

Design-Finance Synergy

Enhanced financial literacy and design thinking skills shift innovation practice from reactive to proactive.

FINANCIAL LITERACY

Practical Application

Beyond 'knowledge is literacy,' the ability to confidently apply this knowledge is a crucial skill.

Transformative Tool

Comprehensive financial literacy, encompassing financial skills, knowledge, motivation, and self-efficacy, serves as a transformative tool for designers.

Gap in Literature

Existing literature reveals a lack of insight into the specific financial components used during design innovation, underlining the need for more in-depth research.

Digital Innovation Tools

Providing design practitioners with digital means to enhance their financial literacy in design innovation is highly relevant.

N.B. A visual summary of the key findings through literature can be found in Appendix C

03

Research

All gathered literature and pending research questions will be substantiated through in-depth interviews with design practitioners. The aim of this section is to identify key driving components of financial literacy in the context of design innovation. Various themes of data will then be collected and examined for further analysis.

3.1 Methodology

- Research Overview
- Interview Process
- Reflection of Process

3.2 Data Collection

3.1 Methodology

After a comprehensive literature review on Financial Literacy and Design Innovation, it was possible to materialise specific question sets for design practitioners in the field of design innovation. First, an overview will be given, outlining desired target groups and approach to ensuring reliable quality across all interviews. This is then followed by the interview structure and questions, and the purpose behind them. Lastly, the method for collecting interview responses will be presented. Analysis and outputs will be discussed in later sections of this report.

RESEARCH OVERVIEW

As shown in the literature study, a gap in research exists specifically around the application of financial components within the design innovation process. Therefore, the purpose of this interview process is to uncover design practitioners understanding of financial components and how they are applied during innovative projects.

With varying experience across interviewees, it will make the answers more distinguishable and thus clearer where financial knowledge lacks. Therefore, multiple organisations, medium and large enterprises, were contacted for the purpose of this research. Ranging from the financial sector and strategic consultancy to engineering and design-driven software. In total 6 participants were interviewed, of which one is informal (no transcripts or consent of explicit publicity was made). Of the five formal

interviews, all gave consent to record transcripts, but three asked for their organisation name to remain anonymous.

The interviewed participants had the following roles in their respective sectors:

- Sustainability Specialist: Irish/European Consultancy Firm
- Partner & Strategist: Design Agency
- Anonymous: Intergovernmental Organisation
- Analytics Translator: Dutch Airline
- Aerospace Innovation and R&T Manager: Aerospace Manufacturer
- Strategy Consultant: Large Consultancy Firm

INTERVIEW PROCESS

The interview has been divided into two parts, the first is an introduction from both sides, researcher and participant, followed by a contextual overview of the research topic. It is important in this phase not to reveal too much of the collected data in order to prevent interview bias by the participant. Therefore, after a personal introduction by the researcher and their affinity with this topic, Figure's 2 and 3 from chapter 2 are shown. This is to ensure familiarity with topic basis; design innovation. That is then followed by an early (and simplified) version of Figure 6, labelled

'Approach'. More information on the evolution of Figure 6 will be presented in the Chapter 6. Lastly Figure 4 is shown to indicate the objective of this research; to find the synergy between financial literacy and design innovation.

The second stage of the interview allows for the participant to describe their background and experience broadly and then within scope of the research subject. After this point it is appropriate to begin asking specific questions to the participant. This is conducted in a semi-structured manner and allows for the researcher to explore further into the answers of the participant, therefore unscripted.

Project Involvement

The first question set is based on their project involvement, by encouraging the participant to describe their current or past involvement in a research project. The following questions are used:

1. Recent or ongoing innovation project you're involved with?
2. What was innovative about it?
3. What is/was your role in the project?
4. How is the project going/did it go?

Financial Decisions

Once the participant has sufficiently detailed their project, such that the researcher has enough context in order to draw connections, they will be asked about financial decision they had to make during the project. Therefore the following questions can be asked:

1. Do you consider any financial indicators when developing your project(s)?

2. How do you know that this needs to be addressed?
3. At which stage in the project do you consider them?
4. Do you think there are any adjustments that could have been made in hindsight to improve project performance?

Innovation Process Reflection

At this point, the participant will have accessed latent knowledge within the context of this research for them to observe Figure 6. This gives the participant the opportunity to either associate with its form or to differentiate between their experience and the figures applicability.

Financial Components

After this insight, the interview discussion no longer needs to evolve around their ongoing or previous project, but can be opened up to general discussion. Therefore, the next set of questions focus on financial components that they have experience using or are aware of:

1. Which financial aspects/components would you consider almost necessary to any project?
2. Why these components?
3. Do you think that most project members grasp these aspects? Or are some better accustomed than others?
4. What influence do you think this has on project performance?

Financial Challenges

By encouraging the participant to think more specifically about certain financial components, it increases the likelihood of them identifying certain strengths or weaknesses, either on a

personal or project level. Thus, this provides a suitable segue towards the final set of research questions which relate to any financial challenges they may face:

1. Which aspects of financial decision-making do you find the most challenging?
2. Why?
3. Which aspects of financial decision making do you find most easy?
4. What makes you feel capable?

Open Discussion

At this point, it is possible for the participant to start repeating answers, therefore it may be appropriate to reveal all the questions at once. This gives the participant time to consider their response and previous answers.

The formal interview at this point is now complete. But if there is spare time, the researcher may ask the participant for feedback on the interview process and whether they would like to be involved again at a later stage in the project:

1. Have you ever considered this much the impact of financial literacy on your project(s)?
2. Is there anything you feel like I missed when discussing this topic with you?
3. What suggestions do you have to improve financial literacy?
4. Would you like to be updated on the development of my graduation project?

REFLECTION OF PROCESS

The planned duration for interviews was 40 minutes, yet, on average, interviews lasted approximately 1 hour. This extended duration increased the workload for the researcher as it required deciphering both in-context and out-of-context responses from participants. The semi-structured nature of the interviews allowed the researcher to guide the conversation when needed, ensuring that interesting insights were not lost, even when questions were misinterpreted.

Given the qualitative nature of this research into the impact of financial literacy on design innovation, a limited number of participants were selected for the interview process. In a quantitative study, questionnaires could be distributed to a larger pool of design practitioners, but this approach would entail more work and time for analysis and might miss the rich detail attainable through qualitative interviews. However, a quantitative approach would be suitable for trend analysis, as a larger sample provides a more generalized conclusion.

Please note that the preliminary interview structure can be found in Appendix D, while full interview transcripts, which exceed 50 pages, are not included in the Appendix. For inquiries about the transcript content, please contact the author.

3.2 Data Collection

The data collection process was initiated during the interview phase and encompassed several steps. Interviews were documented through two channels: written notes and audio recordings. Subsequently, an AI tool, Aiko, was employed to transcribe the audio recordings into written transcripts immediately after each interview. This expedited process allowed for the comparison of written notes and transcripts to identify latent discoveries against the actual responses of the participants while the information was still fresh in memory.

Following transcription, each transcript underwent a comprehensive examination. Colour coding was used to identify key points within distinct phases of the interview process. This analysis culminated in the creation of six response sections, as illustrated in Figure 7:

1. Experience: Participants relevant experience in the subject matter.
2. Project Involvement: Utilizing a specific project as a case study at the start of the interview.
3. Financial Decisions: As discussed in the previous section.
4. Financial Components: As discussed in the previous section.
5. Financial Challenges: As discussed in the previous section.
6. Interesting Remarks: Noteworthy insights discovered during the analysis of individual interview transcripts.

To ensure that the highlighted key points aligned with the research questions established in Chapter 1, the following research questions are reiterated:

1. What is the nature of the relationship between design innovators and finance?
2. How does financial literacy affect decision-making in design innovation projects?
3. Which specific components of financial literacy hold the most relevance during the problem definition and solution proposal stages of the design thinking process?
4. What are the primary challenges encountered by practitioners when integrating financial literacy into the design thinking framework?

The criteria for identifying key points were initially broad to capture all relevant details and abstractions from primary responses. Following the initial analysis, the data were transferred to a Miro board, providing flexibility to make adjustments or rearrange information as necessary. This phase aimed to identify redundancies and refine interview responses.

Upon completing this data gathering phase, an assessment was conducted for each response to ensure its alignment with the project's scope. Responses were omitted from further analysis if they lacked relevance or failed to contribute value to the discussion. The primary reason for exclusion often pertained to conspicuous responses without the need for further interpretation. For example, one participant

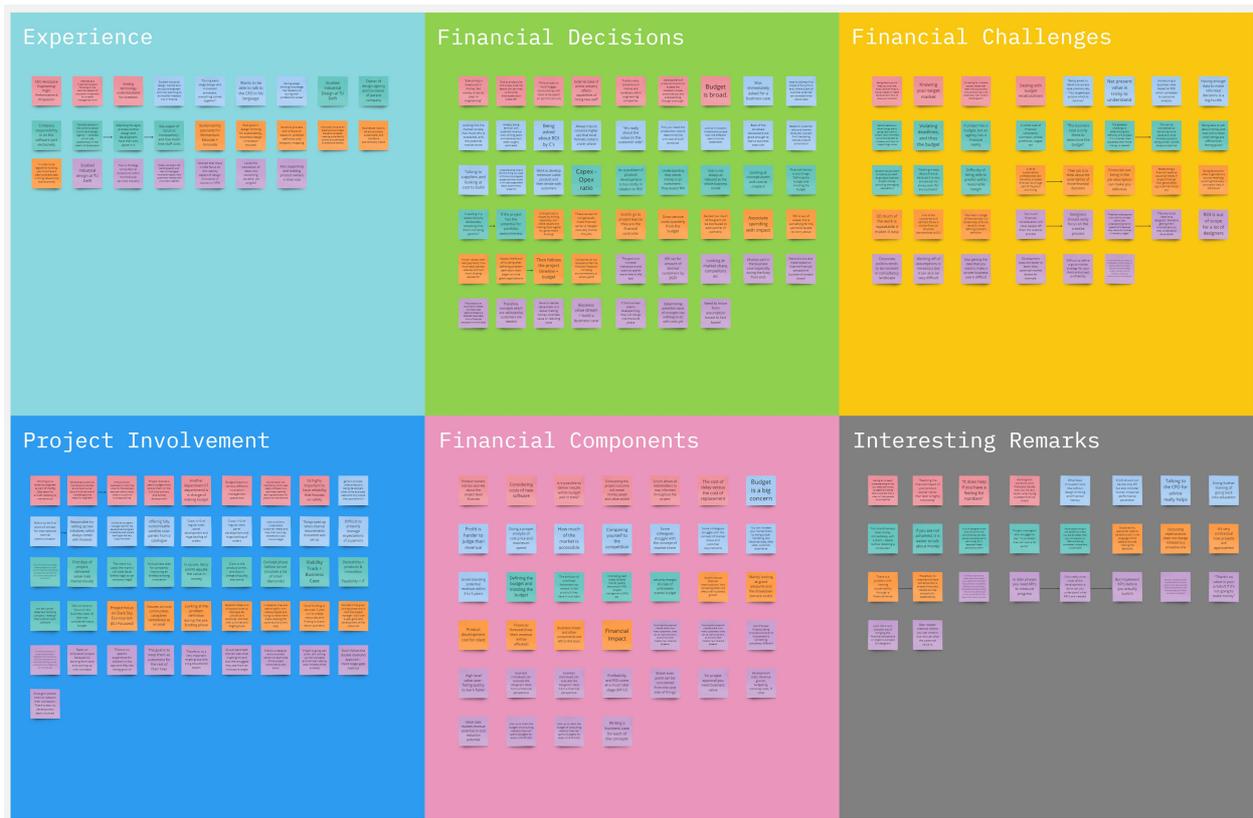


Figure 7: Collected Data from Interview Process

expressed: "The greatest challenge is determining the difficulty of a project - if it is harder than expected, then more money is needed." While this response hinted at the correlation between complexity and cost, it did not provide actionable insights; the design solution can strive for cost-effective simplicity.

See Figure 8 for an example of response assessment related to Financial Challenges. This marks the culmination of the data collection process, poised for the subsequent phases of analysis and interpretation. For an overview of the collected data, please refer to Appendix E.

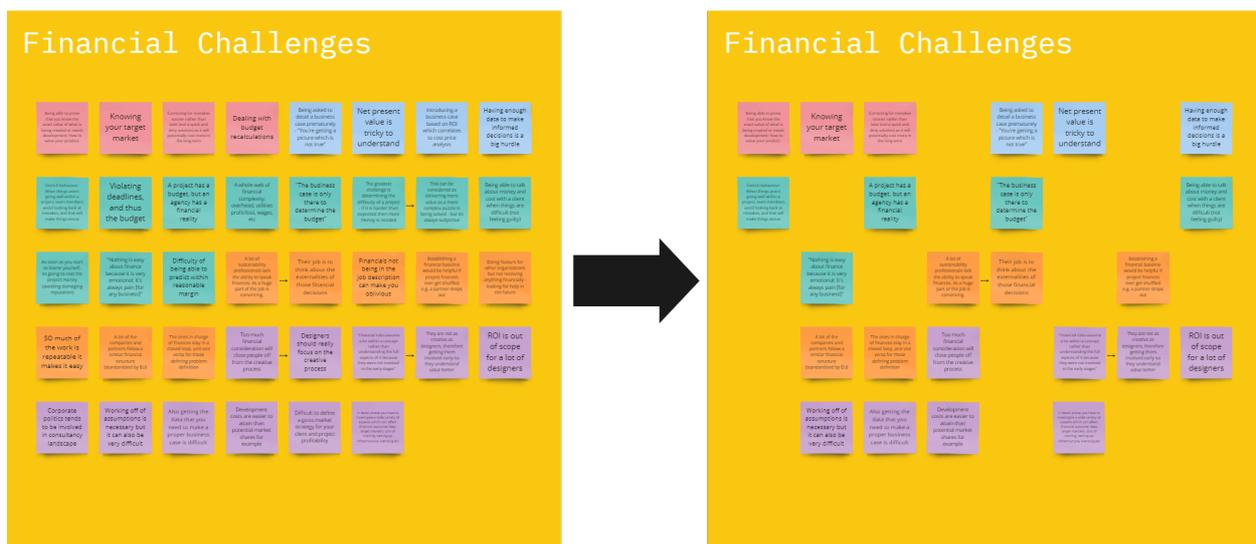


Figure 8: Deductive analysis of interview responses

04

Results

The collected data from the interview process is subjected to deductive and inductive analysis, whereby first order and second order constructs are derived. These constructs are then clustered to form the basis of a financial module design, and thus the realisation of a roadmap and learning module. Fundamental aspects of financial literacy in design innovation are described and presented in the form of building blocks.

4.1 Data Analysis

- Thematic Reconfiguration
- Clustering Themes

4.2 Building Blocks

- Building Blocks Analysis
- Design Direction

4.1 Data Analysis

The collected data has been meticulously organized into responses corresponding to the interview questions, although this initially offers only a preliminary level of insight and association with the topic of financial literacy. To extract meaningful insights and associations from this dataset, two distinct methods were employed: deductive analysis and inductive analysis.

Deductive Analysis

The first phase of data analysis involved a deductive approach. In this phase, interview responses were systematically coded into predetermined themes, aligning with the overarching research questions. This method facilitated the extraction of structured data and allowed for the establishment of a foundation for the subsequent inductive analysis.

Inductive Analysis

In the inductive analysis phase, the data was subjected to a more exploratory and open-ended approach. Information deemed 'out-of-scope' was judiciously removed, ensuring that the remaining data was germane to the research focus. This refined data was then organized into thematic content, and a hierarchical structure was established to represent the relationships and dependencies among the data within each theme.

Throughout this analytical process, the overarching design goal served as a constant

point of reflection. The goal underpinning this research is to develop a comprehensive roadmap and a learning module that equips designers with essential financial skills. This, in turn, empowers them to make informed decisions during the 'fuzzy front end' of design innovation.

THEMATIC RECONFIGURATION

In the deductive analysis phase, an exhaustive review of all response data was conducted, enabling the identification of new relationships and patterns within the data. This process resulted in the reconfiguration of data into refined thematic clusters. The first-order constructs that emerged during this phase were categorized into five primary themes:

1. Expectations/Opinions (Challenges or Concerns): This theme encapsulated participants' anticipations, concerns, or challenges related to financial decision-making in design innovation.
2. Objectives (Specific Aspects of Decision Making): Within this theme, specific goals and objectives related to decision-making in design innovation were explored.
3. Desires/Outcomes (Aspirations or Effects of Decisions): Participants' aspirations and the anticipated outcomes of financial decisions were highlighted within this theme.
4. Methods (Higher-Level Decisions and Processes): The methods and strategies employed by participants in their decision-making processes were a prominent feature.

5. Insights (Neutral Statements or Facts): This theme encompassed neutral or factual statements that did not fall into the categories of expectations, objectives, desires/outcomes, or methods.

Further refinement was carried out by defining second-order constructs for each sub-cluster, as detailed in subsequent sections. It's also important to note that the following sub-cluster descriptions are summaries of the datasets they represent, in the words of the participants. While reading through them, one may notice some repetition in themes and descriptions. This repetition serves as an opportunity for further refinement and reconfiguration of the clusters.

The overarching aim of this data analysis process is to unlock clear and distinct descriptions of the financial components at play within the design innovation process. This deeper understanding will significantly contribute to the development of a viability roadmap and the content needed to construct valuable learning modules. These modules are specifically designed to enhance the financial literacy skills of designers, equipping them with the presented knowledge and capabilities required to make informed decisions during the critical 'fuzzy front end' of design innovation.

1. EXPECTATIONS/OPINIONS

1.1 Challenges: There is a lack of financial clarity within the business domain. The fact that there is no distinction between different financial components or little focus on the viability of innovation. Therefore, it is difficult to detail a business case or understand what are the parameters of a budget - it's all fuzzy.

1.2 Difficulties: There is never enough data to make completely informed decisions, therefore a lot of assumptions must be made during the early stages of project viability. This means that it is difficult to detail the potential revenue (thus profitability) of an innovation. Which can be a cause for disapproval for superiors who ultimately decide on how much budget to grant an innovation project.

1.3 Behavioural: Designers tend to lack general financial knowledge, and discussing the consequence of this is not enough apparently to convince them otherwise. Designers tend to be sentimental about their work and find it difficult to value it financially. There is also a risk of being too financially 'woke', where you run the risk of killing the creative process. Or worse, not articulating mistakes which have been made during the design process.

2. OBJECTIVES

2.1 Market: It's important to understand your desired market, its size and how much of it you can have a share in. This is a means to deal with competition and finding your USP.

2.2 Budget: Understanding your project budget, the amount of overhead and security margins in order to prevent delays or depreciation.

2.3 Development: Developing your innovation comes with a bunch of costs: production, prototyping, software, transport etc. This is detailed for the purpose of the investor/client

2.4 Trade-off: You must make certain financial choices: the cost of delay versus the cost of replacement (applies during production). Max costs versus max spend. Development costs versus the return on

investment. Finally, capital expenses (investment costs) versus operational expenses of project.

2.5 Business Case: You must understand your business/concept goal; is it to make money, create valuable reputation or reduce costs.

2.6 Value: What challenge/problem is your innovation solving? This answers the desirability aspect.

2.7 Forecast: A big part of financial design is potential revenue. You need data to assess this, and having a break even point to run from. This improves the investment opportunity of the innovation lifespan.

3. DESIRES/OUTCOMES

3.1 Designer Skills: Designers need a non-complex approach to deal with financial complexities - there is no right or wrong way to approach. Some skills which are important are being familiar with ways to assess potential revenue and avoiding incremental development. Once the main design innovation objective is achieved, all other developments are secondary. The details should be so clear that it takes one minute to explain its value.

3.2 Timeline: The first stages of design innovation already deliver massive potential value. You are taking a problem with little to no understanding and creating meaning. This becomes easier when the requirements are understood and the customer needs can be mapped.

3.3 Communication: Talking to those with more experience, and having feedback moments vastly improves designer confidence

in project viability. This allows designers to better articulate the need for financial support.

3.4 Impact: You can measure the impact of your innovation by its financial success.

3.5 Value Case: Having a feeling for how value can be delivered to customers in reality. You increase the chances of long-term user commitment.

3.6 Project Skills: Having a foundation to the project finances is always a reliable fallback position. This requires a certain number of facts, but starting with back of the envelope calculations is sufficient. Forecasting the potential results will reveal the value being established (and potential money saved).

3.7 Performance: Not only profit but design impact should measure innovation success, while assessing user adoption.

3.8 Learning Curve: Better to make mistakes sooner rather than later in order to accelerate the learning process. Failure is a part of success.

4. METHODS

4.1 Value: Maximizing design value is crucial for successful innovation. Therefore, customer validation is needed to determine potential value.

4.2 KPI's: KPI's are necessary to measure progress or project success. But this can only come in a later stage once the business case is understood.

4.3 Process Phases: There are generally two phases to a design process: understanding the value (value case), and how that value will be delivered (business case).

4.4 Awareness: Being aware of the project scope and trying to remain within that scope. Then it is a case of understanding the

necessary time and resources to make progress.

4.5 Project Components: Understanding the necessary components of the value case and business case and indicating where they belong during viability assessment.

4.6 Budget: Once you are through both phases, you are able to identify a budget which is needed for project implementation. The details of this budget are not necessarily in the hands of the design innovator.

5. INSIGHTS

5.1 Business Value: Your business case contains the monetary value of your innovation. Therefore it must be unique and decisive, with description of potential income, as well as expenses.

5.2 Financials: Finances are a broad scope of resources which do not always fall consecutively into the innovation process. Having knowledge of organizational finances is helpful but it does not define the project viability case.

5.3 Roles: Multiple roles/stakeholders are involved during the innovation process. It is not always clear what each of them understands or influences, but it is the job of the innovator (designer) to articulate the project viability landscape. This ensures their control over the innovation process.

5.4 Investment: ROI is a difficult component to materialize without performance data. Suggesting investment potential instead of actual ROI is more sufficient.

CLUSTERING THEMES

With the clusters and sub-clusters now clearly defined, it became evident that certain similarities and recurring sub-cluster themes

existed across various clusters. Some sub-clusters shared identical names or had closely matching descriptions. This observation prompted further analysis, leading to a reorganization of the sub-clusters into new overarching themes.

Accrued Knowledge - Development (2.3), Trade-off (2.4), Performance (3.7), KPI's (4.2), Project Components (4.5)

Market Awareness - Market (2.1), Business Case (2.5), Value (2.6), Value Case (3.5), Value (4.1), Business Value (5.1)

Preceding Skills - Designer Skills (3.1), Impact (3.4), Project Skills (3.6), Learning Curve (3.8), Awareness (4.4)

Intrinsic Motivation - Behavioural (1.3), Communication (3.3), Roles (5.3)

Viability Process - Budget (2.2), Forecast (2.7), Timeline (3.2), Process Phases (4.3), Budget (4.6), Investment (5.4)

Designer Challenges - Challenges (1.1), Difficulties (1.2), Financials (5.2)

This recognition offered compelling reasons for further exploration and the clustering of data. Consequently, the sub-clusters have been reorganised once more into new themes that provide a clearer and more coherent representation of the dataset.

These newly formed themes will serve as the foundational elements for the core learning objectives. They are crucial for the development of a comprehensive design innovation viability roadmap and the creation of learning modules. These objectives will equip designers with essential financial literacy skills, empowering them to make informed decisions during the critical 'fuzzy front end' of design innovation. For a comprehensive overview of the analysed data, please refer to Appendix E.

4.2 Building Blocks

The culmination of this extensive analysis has led to the revelation of six foundational building blocks that significantly influence the design phase of innovation, as depicted in Table 1. These building blocks entail initiating a dialogue between designers and financial departments, effectively navigating diverse market choices, fostering a proactive mindset to propel the innovation process forward, establishing a robust financial foundation for the innovation process, comprehending the distinct phases of viability, and addressing the practical aspects of financial integration. To provide a structured framework, the sub-clusters representing these building blocks have been categorized into primary, secondary, and tertiary pillars, with primary encompassing the least abstract and tertiary involving the most abstract data forms.

The following theme clusters align with the respective building blocks:

- Establishing a Financial Foundation corresponds to Accrued Knowledge
- Navigating Market Choices corresponds to Market Awareness
- Mindset to Drive Innovation aligns with Preceding Skills
- Opening up Financial Dialogue matches with Intrinsic Motivation
- Understanding the Phases of Viability correlates with Viability Process
- Addressing Financial Integration Realities relates to Designer Challenges

BUILDING BLOCKS ANALYSIS

Each building block encapsulates a fundamental facet of financial literacy within the realm of design innovation. While the foundational pillars of innovation—Desirability, Feasibility, and Viability—were presented at the outset of this research project, Viability displayed the strongest affiliation with financial components. The building blocks defined in Table 1 could be regarded as the new pillars of innovation, albeit within the specific domain of financial literacy and design innovation.

While each building block harbours potential for future research and analysis, a clear distinction can be made between them. Certain blocks are positioned at a high-level, providing valuable contextual insight but operate at an organisational level. For instance, 'Addressing Financial Integration Realities' emphasizes that designers must be conscious of project challenges and process complexities, demanding a certain level of confidence to overcome internal or external obstacles like corporate expectations, organizational budgets, and personal insecurities. Awareness of these issues can mitigate potential delays or decision uncertainties during the design innovation process. However, since the objective of this research is to create a roadmap and learning module that equips designers with essential financial skills at the project level, this building block falls outside the current scope.

Building Blocks	Pillars of Viability
Navigating Market Choices	It is essential for designers to be aware of the market they wish to deliver value in. Therefore, market fit & accessibility is critical to design viability. Without a customer or user, the innovation cannot succeed.
Establishing a Financial Foundation	Throughout the innovation process, designers must grasp specific financial knowledge. The primary constructs are understanding your customer, the development costs, and how that relates to profitability and thus return on investment. In knowing this, one can establish viable performance indicators to determine project growth and performance.
Understanding the Phases of Viability	Project viability has different phases within the innovation process. The first phase is assumption-based and requires rigorous research of market fit, customer value and potential revenue. Whereas the second phase involves concept development (and the associated costs), a business model and potential return on investment.
Opening up Financial Dialogue	Designers should understand why project viability is imperative to their innovation process. Open communication with finance officers and departments across the organization in the early phases of project development enables a proactive approach to financial components. Synergy between designers and financiers will also ensure equilibrium in their project roles, while opening dialogue for both parties to learn from.
Mindset to Drive Innovation	Before an innovation process can begin, designers must already possess a holistic mindset. This will steady project growth, as they will continue to drive the project forward while quickly learning from their mistakes. This shifts the design process more efficiently from assumption-based to fact-based.
Addressing Financial Integration Realities	Designers should be aware of project challenges and process complexities. There is a certain level of confidence required by designers to overcome internal or external obstacles such as corporate expectations, organization budgets and their personal insecurities. Awareness of these issues will diminish potential delays or decision uncertainties when navigating the design innovation process.

Table 1: Building blocks of Financial Module Design

The same rationale can be applied to 'Mindset to Drive Innovation'. Designers must possess a holistic mindset before the innovation process can commence, enhancing project stability and shifting the design process from assumption-based to fact-based. Similarly, 'Opening up Financial Dialogue' underscores the importance of designers understanding the imperativeness of project viability to the innovation process. Open communication with finance departments during early project phases enables a proactive approach to financial components and ensures equilibrium in project roles.

It's crucial to emphasize that the above building blocks, while integral to the design innovation process, do not directly contribute to the development of financial literacy skills during the innovation process. Instead, they serve as prerequisites and conditions that should be in place before commencing the innovation process. These building blocks are more aligned with organisational aspects and are better suited to shaping the overall climate within which design innovation occurs.

Conversely, the remaining three building blocks, 'Navigating Market Choices', 'Establishing a Financial Foundation', and 'Understanding the Phases of Viability', align with tangible financial components that can be utilized within the innovation process. For instance, 'Navigating Market Choices' highlights the significance of market fit and accessibility to design viability, emphasizing the importance of factors like potential market share and competitor analysis. 'Establishing a Financial Foundation' stresses the necessity of determining concept profitability and return on investment once essential facts like production costs and potential revenue have been established.

'Understanding the Phases of Viability' underscores the need for a value case, involving customer value and the acquisition of a minimum viable product, before establishing a business case that can be presented to investors and stakeholders.

DESIGN DIRECTION

It is for this reason that the latter three building blocks are the chosen focus for the subsequent Design stage of this project. 'Mindset to Drive Innovation', 'Opening up Financial Dialogue', and 'Addressing Financial Integration Realities', while equally vital, operate at a higher level concerning project-level financial components and will be considered for future research. When dealing with financial literacy at an organizational level, encompassing aspects such as overhead, managing the expectations of superiors, and the relationship between organizational budgets and project budgets, these pillars of design innovation will undoubtedly become highly relevant.

Reiterating the primary objective of this research project, the goal is to design a roadmap and learning module explicitly tailored to equipping designers with the essential financial skills required for making informed decisions during the challenging 'fuzzy front end' of the design innovation process. As such, these building blocks serve as the foundational elements that underpin the subsequent development of specific financial literacy skills, ensuring that the design innovation process is supported by a solid financial framework. In essence, they establish the necessary conditions for the effective integration of financial literacy within design innovation at the project level.

05

Design Stage

This stage is a culmination of all previously gathered data to form the novel Design Innovation Viability roadmap. Thus, setting the scene for learning modules to be developed upon and implemented. A functioning prototype is then developed to test module content on design students. This results in the validation of a functioning financial module design.

5.1 Viability Roadmap

- Dashboard for Innovation
- Components of Focus

5.2 Learning Modules

- Theoretical Application
- System Architecture
- Financial Module Design
- Learning Module Content

5.3 Digital Prototype

- User Testing Insights

5.1 Viability Roadmap

To effectively incorporate the insights and data associated with the three chosen building blocks, "Navigating Market Choices," "Establishing a Financial Foundation," and "Understanding the Phases of Viability," into the design of the roadmap and associated learning modules, it's essential to follow a structured approach. This approach should seamlessly align these building blocks with the design phases of the double diamond approach to innovation, particularly within the context of financial components driving design viability.

Navigating Market Choices

This building block emphasises the significance of understanding and navigating the market landscape. It includes concepts like market size, accessibility, value on the customer side, competitive analysis, and potential market share. To best integrate this data into the design process, a logical approach was to place these insights in the Discovery Phase of the double diamond approach. During this phase, designers must explore the problem space, understand customer needs, and validate assumptions. The insights from "Navigating Market Choices" provide a solid foundation for understanding market dynamics, identifying potential customer segments, and ensuring the alignment of the design concept with market realities.

Establishing a Financial Foundation

This building block revolves around the necessity of establishing a financial foundation for innovation. It includes insights about determining the value of a product, assessing cost-related aspects, and defining business value streams. The data from this building block was integrated into the Definition Phase of the double diamond approach. Here, a well-defined problem, value proposition, and initial concept are established. These insights are vital for defining the financial aspects of the project, including potential cost structures, revenue streams, and business value.

Understanding the Phases of Viability

The "Understanding the Phases of Viability" building block focuses on the phases involved in achieving project viability. It includes aspects like value cases, business cases, development costs, and return on investment. The insights from this building block are most relevant to the Development Phase of the double diamond approach. During this phase, designers delve deeper into refining the concept, prototyping, and preparing for project execution. The data from this building block aided in making critical decisions related to budgeting, investment, and establishing financial milestones for the project.

DASHBOARD FOR INNOVATION

Upon a thorough reevaluation of the building block datasets, it became apparent how seasoned design practitioners envisioned the process of design innovation viability. Figure 9 introduces a dynamic dashboard tailored for designer innovators seeking to gauge the trajectory of their project's viability. This dashboard encompasses eight modules, thoughtfully distributed with four in each of the fundamental phases. These modules integrate 16 learning components, and while not all are exclusively financial in nature, possessing a comprehensive understanding of each facet signifies a high degree of financial literacy (Engels et al., 2020). The real measure of financial capability, however, lies in the proficiency to apply these components effectively throughout the innovation journey. It's worth mentioning that there is substantial existing literature on each component, including methods for their application. Therefore, a detailed breakdown of

each component isn't deemed necessary. Instead, the focus shifts towards assessing the familiarity of inexperienced design practitioners, such as design students, with these components. This evaluation unveils knowledge gaps that pave the way for more specified learning modules.

The bulk of this research centres around the viability of design innovation projects, necessitating a recalibrated emphasis on financial literacy. The research's ultimate scope encompasses crafting a roadmap and learning module that empowers designers with indispensable financial skills, enabling them to make well-informed decisions during the 'fuzzy front end' of design innovation. The DIV Dashboard effectively embodies this roadmap, outlined through a synthesis of existing literature and substantiated by the insights of experienced designer practitioners. It should be acknowledged, though, that this roadmap remains adaptable and subject to interpretation. Its trajectory may diverge

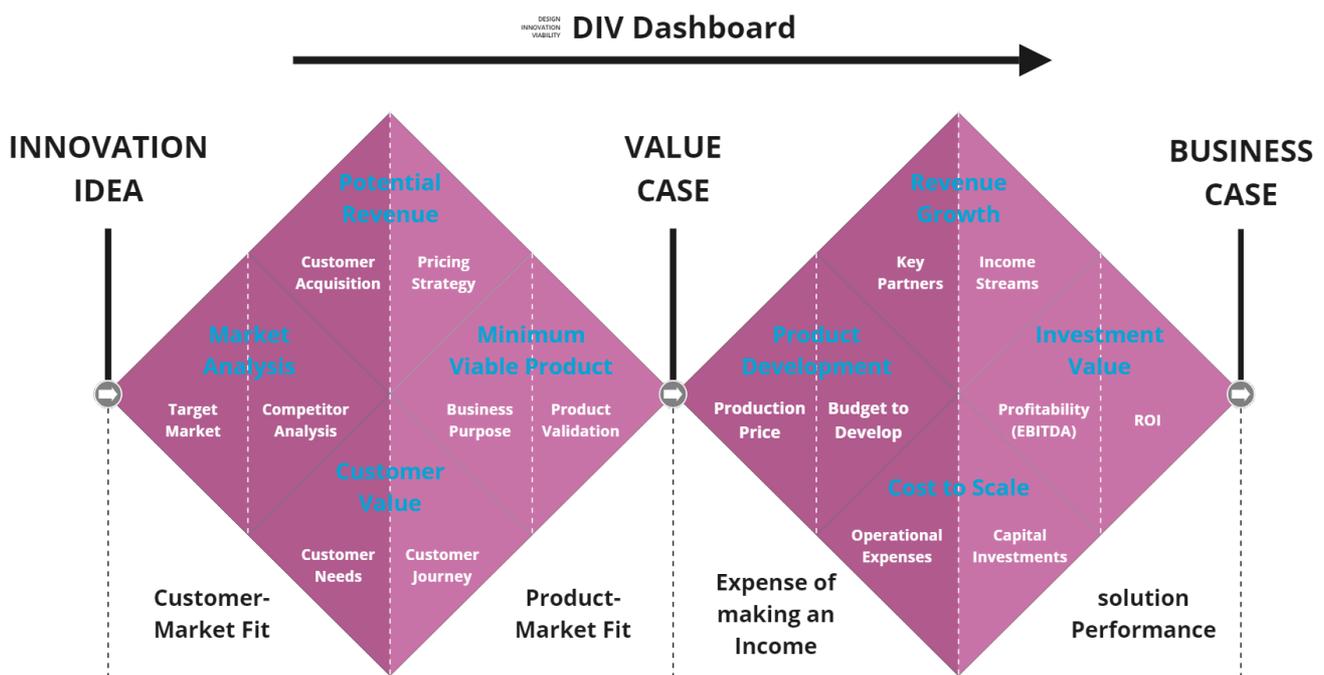


Figure 9: Design Innovation Viability (DIV) Dashboard

based on the unique goals of a specific innovation or its application within an existing business context. Consequently, certain phases of the dashboard could potentially become redundant. This will be discussed further in the 'Limitations of Research' section in Chapter 6.

In conclusion, it is imperative to identify the discovery phase as a strategic positioning, the define phase as strategic decision-making, and the development phase as the strategy in dynamic action. Drawing an insightful analogy between the first and second diamonds, the former pertains to understanding the fundamental nature of the project, akin to knowing 'what' business you are in. In contrast, the second diamond represents the strategic approach adopted in conducting that project, translating to 'how' you conduct your business. Together, they form a cohesive strategy for design innovation viability. The method of data integration used to form Figure 9 can be found in Appendix F.

COMPONENTS OF FOCUS

The development of the learning modules will place particular emphasis on the components illustrated in Figure 10 for further analysis. This emphasis is substantiated by insights from the interviews, which revealed that financial knowledge is frequently acquired through practical experience in innovation projects. Notably, the interviewees stressed that these components, particularly those featured in Figure 10, ought to be integrated into educational programs to enhance the financial literacy of designers. This aligns with the importance of practical, hands-on learning experiences in bolstering financial competencies among design students. The upcoming testing of the dashboard's Design Innovation Viability components with design students will assess their proficiency in these vital areas.

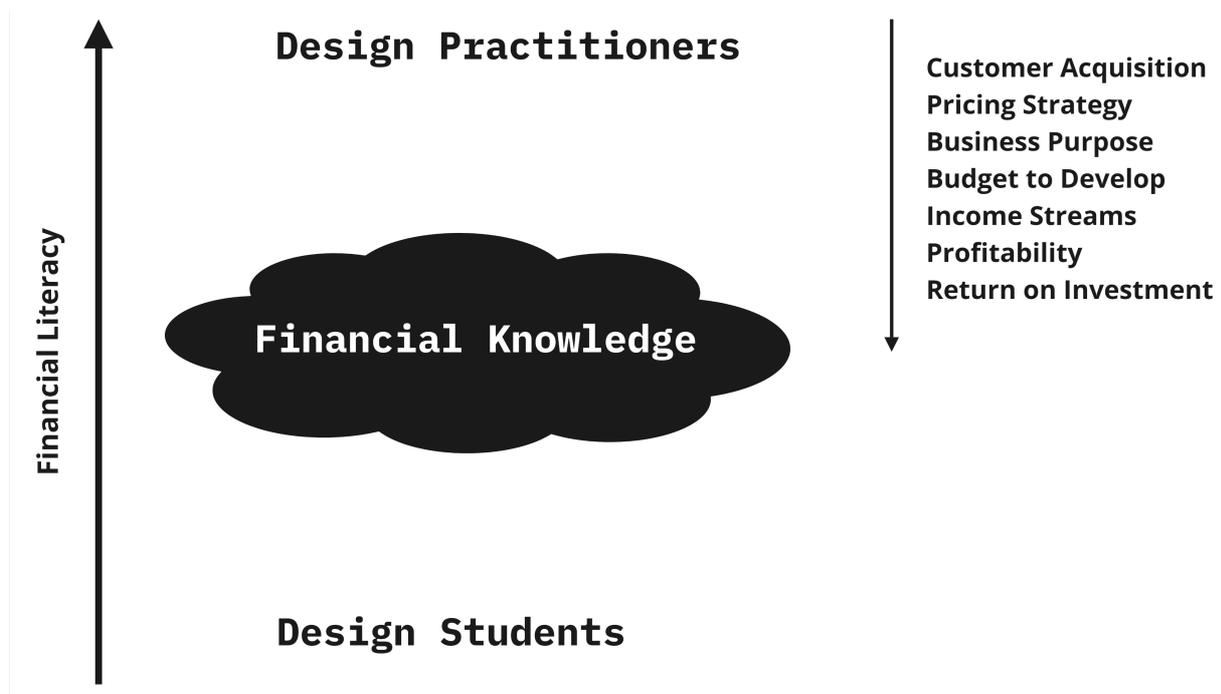


Figure 10: Financial components which lack acknowledgement in education

5.2 Learning Modules

In the development of the learning modules for the Design Innovation Viability (DIV) Dashboard, two fundamental educational frameworks, Bloom's Taxonomy and Constructive Alignment theory, were applied.

Bloom's Taxonomy

Bloom's Taxonomy, developed by Benjamin Bloom in 1956, classified educational objectives into six cognitive levels: Remember, Understand, Apply, Analyse, Evaluate, and Create. Each level built upon the preceding one in terms of complexity, as shown in Table 2. This taxonomy provided the foundation for aligning learning objectives, activities, and assessments. The guiding principle entailed that the cognitive level of the learning objective should dictate the corresponding level of learning activities and assessment methods. This alignment ensured the attainment of the intended learning outcomes. It's essential to use Bloom's Taxonomy thoughtfully, acknowledging that learning isn't always linear, yet it served as a valuable tool for instructional design.

Constructive Alignment Theory

The theory of Constructive Alignment, as explained by Biggs (2003), adopts a learner-centred approach that empowers students to assume an active role in their education. In this theory, learners decide what they will learn, rendering the teacher (or module) a facilitator. The theory highlights that clear learning

objectives should drive the design of learning activities and assessments, with an emphasis on students' understanding. Constructive Alignment promotes various forms of learning, such as group work, peer teaching, independent learning, and work-based learning. It recognizes that assessment plays a crucial role in learning and should be in harmony with learning objectives.

Bloom's Level	Action Verbs
Create	Design, develop, produce, build, construct, etc.
Evaluate	Argue, assess, compare, judge, recommend, etc.
Analyse	Choose, select, order, inspect, appraise, etc.
Apply	Apply, employ, show, use, plan, calculate, etc.
Understand	Cite, illustrate, discuss, explain, interpret, etc.
Remember	Find, identify, name, memorise, etc.

Table 2: Bloom's levels of Taxonomy

THEORETICAL APPLICATION

Guided by Bloom's Taxonomy for cognitive learning objectives and Constructive Alignment for instructional design, the DIV Dashboard's learning modules were meticulously crafted to ensure proper alignment of content, instructional methods, and assessments. Comprehensive assessment strategies were employed to gauge students' progress in achieving the desired learning outcomes. This approach went beyond evaluating designers' memorization skills; it also assessed their aptitude for self-assessment and the capacity to make decisions with potential repercussions.

With these educational frameworks shaping the learning modules, this approach took a central role in actively guiding students in their learning journey, fostering a deep understanding of the subject matter. It also facilitated the acquisition of essential financial knowledge and problem-solving skills vital for the viability of design innovation. Subsequent sections will provide a closer look at the specific structure and design of these learning modules.

SYSTEM ARCHITECTURE

The creation of robust learning modules drew inspiration from digital educational resources, particularly the University Teaching Qualification (UTQ) and the Times Education Supplement (TES). These references were instrumental in crafting a structured framework for the modules, ensuring their academic integrity and suitability for student assessment. Guided by the principles of Constructive Alignment theory, the process consisted of four consecutive steps:

1. Defining Clear Learning Objectives (LOs): Establishing unambiguous learning objectives to guide the educational process.
2. Selecting Appropriate Learning Activities Aligned with the LOs: Choosing suitable learning activities that align with the established learning objectives.
3. Assessing Students' Actual Learning Outcomes to Gauge Alignment: Employing assessment methods to measure students' achievements and assess alignment with the intended objectives.
4. Determining a Final Grade or Assessment: Utilizing assessment results to make informed determinations regarding students' final grades or assessments.

Learning Objectives

The learning objectives were established with the aid of Bloom's Taxonomy, a six-level framework of cognitive skills (Remember, Understand, Apply, Analyse, Evaluate, and Create). This taxonomy facilitated the integration of specific components into the learning module wireframe.

LO1 List and describe the 16 key components of financial viability during the design innovation process.

LO2 Analyse the customer-market fit and product-market fit of an innovation idea using the DIV Dashboard to identify a clear value case.

LO3 Create a comprehensive business case for a value case opportunity, incorporating aspects such as the product development budget, revenue growth tactics, cost of scaling operations, and investment value proposition.

LO4 Evaluate the financial viability of newly proposed design innovation projects.

These learning objectives collectively form a structured learning path that allows students to progressively build their financial literacy skills in the context of design innovation. By fostering an active learning process that integrates both theoretical knowledge and practical applications, these objectives contribute to the overarching goal of the research project

Learning Activities

In reference to the DIV Dashboard, Figure 11 showcases a wireframe featuring key elements: modules, components, learning activities, assessments, and resources. These elements align with Bloom's Taxonomy as follows:

- Modules: Targeted at 'Remember.'
- Components: Focused on 'Understand.'
- Learning Activities: Geared toward 'Apply.'
- Assessment: Aims for 'Analytical.'
- Resources: Works on 'Evaluation.'

Each of these elements represents a condensed version of a learning module, offering a concise connection to the broader topic of financial literacy. It is assumed that students possess a foundational level of knowledge, and these key elements help

identify areas where additional support might be needed. Detailed information on individual modules falls outside the current scope. Subsequent sections will provide a comprehensive overview of the complete learning module architecture, accompanied by two additional phases for a thorough course coverage.

A total of six learning phases were identified to create a comprehensive learning system. This system is designed to help students recognise the relevance of the content and bridge their existing design knowledge with financial literacy. The initial phase outlines the course's objectives, potential benefits, and introduces the DIV Dashboard.

The subsequent four phases are centred around the eight DIV Dashboard learning modules, and incorporates moments for reflection, assessments, and opportunities for further study or research. While a sixth phase has been proposed to facilitate the 'Create' stage in Bloom's Taxonomy, its precise structure and assessment method are under consideration. Each module concludes with summaries to assist learners in consolidating their knowledge or preparing for the project/exam assessment phase. Detailed wireframes for all modules can be found in Appendix G.

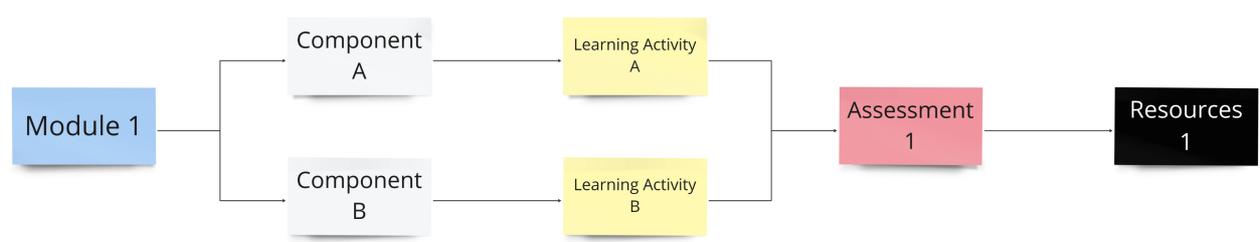


Figure 11: Module Framework Elements

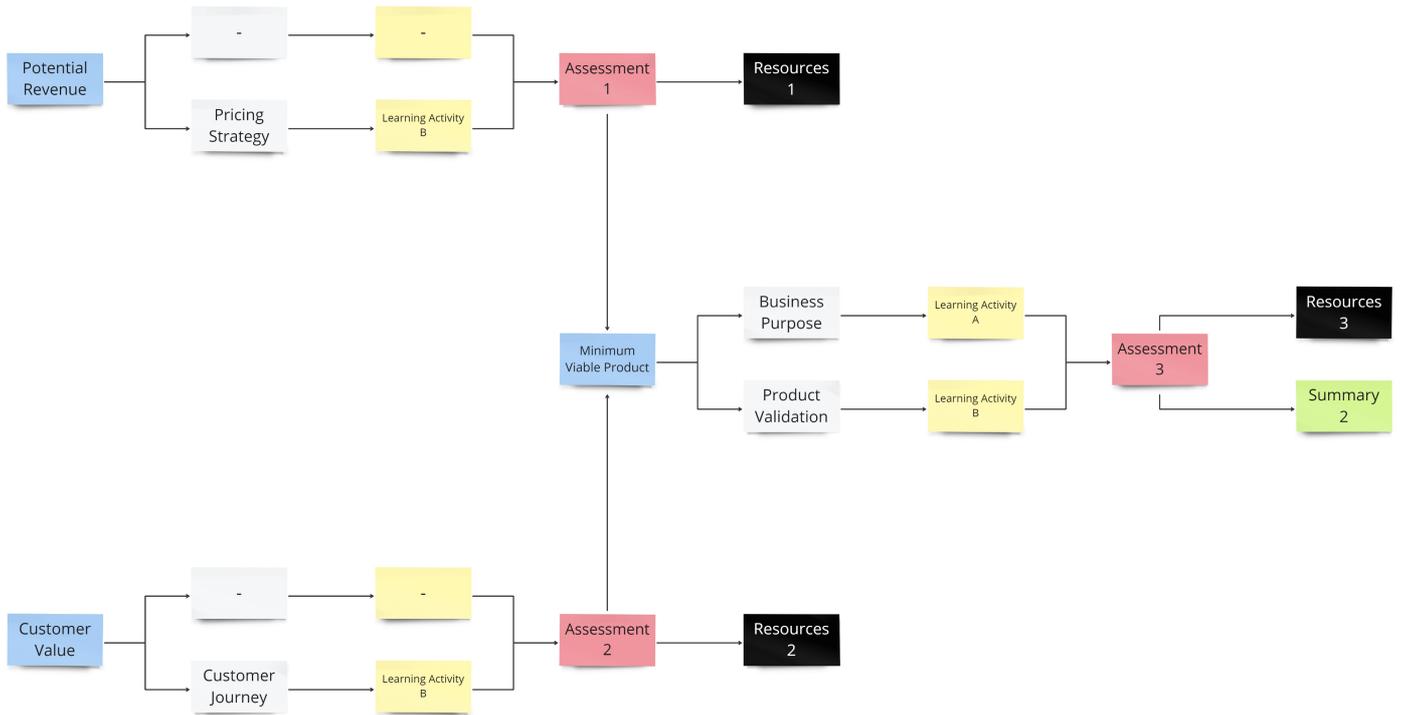


Figure 12: Phase 2: Product-Market Fit

It's important to note that these phases encompass cross-cutting learning components, as shown in Figure 12. It is shown that before moving onto the Minimum Viable Product module, learning components of Customer Value and Potential Revenue remain to be completed. This process aligns with the double-diamond approach to innovation, by focusing on the four phases: Customer-Market Fit, Product-Market Fit, Expense or Income, and Solution Performance.

FINANCIAL MODULE DESIGN

Each module follows a consistent wireframe structure, commencing with the module to be instructed, followed by the learning components. The component page begins with an introduction that provides a concise overview of the topic. This is followed by a

segment which theoretically defines the component, offering a clear description.

Key components are then enumerated to describe the practical implications of the component. A discussion ensues, delving into the component's significance to innovation. Lastly, to exemplify its real-world impact, a few real-world examples are provided for well known products, organisations or services.

Following the component content, a learning activity is conducted, employing various test methods:

- Multiple Choice Questions: A set of multiple-choice questions covering the definition, importance, and components of financial literacy.

- Fill in the Blanks: Sentences with missing words or phrases for students to complete.
- Matching Definitions: A list of terms and their corresponding definitions for students to match.
- Scenario-Based Questions: Hypothetical situations or scenarios for students to make decisions.
- True or False: A series of statements for students to determine the accuracy.

Feedback is provided immediately after completing the learning activity, including correct answers for multiple-choice questions and explanations for other question types. A score is then provided for learners to see how they are performing.

In the development of the learning modules, ChatGPT was utilised to guide the formulation of question sets for the learning activities and shaping the assessment criteria for grading. These suggestions were then used to tailor specific content for the question types, aligning them with the research project's educational objectives and Bloom's Taxonomy. It was crucial to strike a balance between AI assistance and human input to maximise the benefits of such collaborations. Overall, The use of AI to create a well-structured learning environment for design practitioners proved effective and made the prototyping stage much more efficient, as to be seen in Section 5.3.

After completing both learning components within a module, an assessment in the form of a short case study, incorporating all learning objectives from the module as a whole, is presented. Students write their responses, and afterward, a correct version is revealed for self-evaluation. Completion of every component, learning activity, and assignment page is mandatory to progress through the learning modules. This can be visually tracked via a progress overview tab, which should state the time spent, the phase of the course they are in, and the number of active participants. The latter serves as a form of incentive to not dwell on learning modules, but to aim to complete the comprehensive course and revisit modules of interest where necessary. In addition to this, resource pages and summaries are optional for module completion, allowing learners to explore topics further at their discretion.

In order to substantiate the layout of a learning module, Minimum Viable Product: Business Purpose (of Figure 12, and expanded upon in Figure 13) has been chosen for further illustration. The following section provides the content of each phase in a learning module.

LEARNING MODULE CONTENT

Please refer to the following pages for an overview of content for the learning component, learning activity and module assessment.

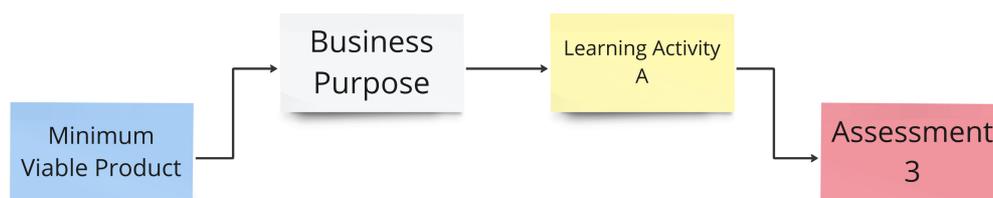


Figure 13: Business Purpose Component

LEARNING COMPONENT - BUSINESS PURPOSE

Introduction Business Purpose is a foundational concept in design innovation, serving as the guiding framework that defines the financial objectives and goals of an innovation project. It establishes the financial direction, objectives, and expected outcomes, providing a strategic foundation for the project.

Definition The Business Purpose is a comprehensive description that outlines the financial objectives and key performance indicators (KPIs) of an innovation project. It explicitly states the financial goals the project aims to achieve, such as revenue targets, profit margins, return on investment (ROI) goals, and other financial metrics that will be used to measure success.

Key Components

- **Financial Objectives and KPIs:** The Business Purpose should explicitly outline the financial objectives and KPIs that the innovation project aims to achieve. This includes specifying revenue targets, profit margins, return on investment (ROI) goals, and other financial metrics that will be used to measure success.
- **Cost-Benefit Analysis:** Financial literacy in innovation projects involves conducting a thorough cost-benefit analysis. The Business Purpose should address the expected costs of development, production, marketing, and distribution, as well as the projected benefits in terms of revenue generation and profitability. For instance, Tesla conducts detailed cost-benefit analyses for its electric vehicle (EV) innovations.
- **Market Alignment:** The Business Purpose should clarify how the innovation addresses market needs and demands, the competitive landscape, and the potential market share it can capture. This parameter ensures that the innovation aligns with financial goals by targeting markets where there is a clear opportunity for revenue growth.

Why it matters The Business Purpose is vital in design innovation as it provides a clear financial roadmap for the project. It ensures that the innovation project is financially viable, aligns with market opportunities, and defines success metrics.

Real-Life Impact

- **Alphabet (Google):** Alphabet regularly reports its financial metrics, including revenue from advertising, cloud services, and other segments. It also specifies long-term financial objectives, such as achieving profitability in its "Other Bets" ventures, which include innovative projects like Waymo (self-driving cars).
- **Tesla:** When designing new EV models, Tesla considers the costs associated with research, development, production, and battery manufacturing. They weigh these costs against potential benefits, such as increased market share, reduced emissions, and long-term cost savings for consumers due to lower fuel and maintenance expenses.
- **Volkswagen:** Before launching electric vehicle models like the ID.3 and ID.4, Volkswagen conducted thorough market research to understand global electric vehicle demand. Financial literacy played a critical role in assessing market viability by calculating production costs, supply chain logistics for battery sourcing, and potential financial impacts on revenue.

LEARNING ACTIVITY - BUSINESS PURPOSE

Introduction This activity aims to enhance your understanding of Business Purpose in the context of financial literacy during design innovation. It will help you grasp the importance, components, and real-world applications of Business Purpose.

Multiple Choice Questions

1. What is the primary purpose of Business Purpose in design innovation? a) To create a detailed project timeline b) To establish the financial objectives and goals of the project c) To design the product or service d) To conduct market research
2. Which of the following is NOT a component of Business Purpose? a) Financial Objectives and KPIs b) Cost-Benefit Analysis c) Marketing Strategy d) Market Alignment

Fill in the Blanks

- Business Purpose is a comprehensive description that outlines the _____ and _____ of an innovation project.
- Financial literacy in innovation projects involves conducting a thorough _____.

Matching Definitions Match the financial literacy terms with their corresponding definitions:

Return on Investment (ROI) and Market Alignment

1. ___ A measure of the profitability of an investment, calculated by dividing the net profit from the investment by the initial cost.
2. ___ Ensuring that the innovation addresses market needs and demands, the competitive landscape, and the potential market share it can capture.

Scenario-Based Questions

Scenario 1: You are leading an innovation project for a new electric vehicle (EV) model. You have set a financial goal of achieving a 20% ROI within the first two years of launch. How does this align with Business Purpose? a) It does not align with Business Purpose. b) It aligns perfectly with Business Purpose. c) It aligns with Market Alignment. d) It aligns with Cost-Benefit Analysis.

Scenario 2: Your team is conducting a cost-benefit analysis for a new software product. The expected development cost is \$500,000, and you anticipate generating \$1,000,000 in revenue in the first year. What aspect of Business Purpose does this analysis address? a) Financial Objectives and KPIs b) Market Alignment c) Cost-Benefit Analysis d) Return on Investment (ROI)

True or False

- True or False: The Business Purpose of an innovation project primarily focuses on product design.
- True or False: Financial literacy in innovation projects involves assessing market needs and demands.

MODULE ASSESSMENT - MINIMUM VIABLE PRODUCT

Introduction In this case study, you will explore the critical role of Business Purpose in design innovation projects from a designer's perspective. You will be presented with a scenario that requires you to analyse the financial aspects of an innovation project. Use your knowledge of Business Purpose and financial literacy to answer the questions.

Case Study: Battery Technology Decision

You are a key member of the innovation team at a leading electric vehicle (EV) manufacturing company. Your company has been at the forefront of the EV market, and you're constantly looking for ways to maintain a competitive edge. Recently, a new battery technology has emerged in the market, promising to revolutionize EV performance and reduce production costs.

The new battery technology is available for acquisition from a tech startup at a cost of \$5 million. This cost includes the purchase price, research and development expenses, and any associated costs. The start-up claims that this technology can significantly improve the performance of your company's EVs, potentially reducing production costs by \$2 million annually.

Market research suggests that with this new technology, your company could capture an additional 5% market share in the highly competitive EV market. This increase in market share is estimated to bring in an extra \$8 million in revenue annually.

You have been tasked with making a recommendation regarding the acquisition of this new battery technology. Your decision should align with the company's financial goals, as outlined in its Business Purpose, which includes achieving revenue targets, improving profit margins, and ensuring a strong market position.

Case Study Questions:

Question 1 (6 points): Explain the significance of the decision to acquire the new battery technology in the context of your EV project's financial goals, market competition, and overall success. How does this decision align with or conflict with the financial objectives and key performance indicators (KPIs) outlined in your Business Purpose? Consider aspects like revenue targets, profit margins, and return on investment (ROI) goals.

Question 2 (6 points): Conduct a preliminary cost-benefit analysis for acquiring the new battery technology. Include potential costs, such as the initial investment and any associated development costs. Additionally, outline potential benefits, such as increased market share and competitive advantages.

Question 3 (4 points): Based on your analysis in questions 1 and 2, make a well-informed recommendation. Should you invest in the new battery technology, or should you explore alternative solutions that better align with your financial objectives and Product Validation principles? Justify your recommendation based on financial and market considerations.

5.3 Digital Prototype

In this final phase of the design process, a significant milestone has been achieved with the creation of a prototype that transforms the learning module content, as detailed in the previous section, into a visually engaging and interactive environment. This prototype was crafted using Figma, a versatile prototyping tool that enabled the rapid development of visual content and seamless navigation between different content slides. The primary objective of this phase is to construct a model that can effectively test the learning module content in an appealing and practical manner, particularly with design students.

Visual Representation

The following pages illustrate the content structure within a typical learning module component. For ease of reference, answers are also included following the completion of each learning module, and can be found in Appendix H. An essential feature of this prototype is the inclusion of a self-evaluation section at the end of each exercise. This aspect encourages users to critically assess their work, identify strengths and areas for improvement, and engage more deeply with the learning materials.

Prototype Assessment

While the previous section establishes the foundational framework for a learning module, it's essential to understand that this format may not be optimal for user testing. As stipulated by constructive alignment theory and the

University Teaching Qualification (UTQ) principles, incorporating visual enhancements and presenting information in a digestible manner is crucial to keep designers engaged throughout the learning process. This information will also help to understand the allocation of European Credit Transfer and Accumulation System (ECTS) credits, where 1 ECTS credit equals 28 hours of student work.

Furthermore, as indicated in relevant literature, to enable design practitioners to thrive in the innovation process, *traditional financial literacy needs to be complemented by elements of digital literacy* (Elsinger et al., 2018; Engels et al., 2020; OECD, 2021). Therefore, an interactive prototype for 'Module: Minimum Viable Product' has been established.

Enhancements for User Engagement

Similar prototypes have been designed for the learning activities related to Product Validation. This interactive platform allows users to navigate seamlessly between different learning modules and revisit module contents to check information as needed. The approach to online learning activities aims to maintain high levels of interaction while offering progress overviews for users to monitor their learning journey. Additionally, it facilitates the flexibility for course coordinators to make content adjustments, modify test questions, or include examinations at the culmination of specific modules. Notably, it empowers them to track individual student progress where permissible.

The Dashboard shows the users progression in an attempt to gamify the learning experience, encouraging active engagement

The dashboard is titled "DIV DASHBOARD" and features a sidebar on the left with sections for "All Modules", "MVP 2", "Business Purpose", and "Product Validation". The main content area is titled "YOUR PROGRESS" and shows a progression through three stages: "INNOVATION IDEA", "VALUE CASE", and "BUSINESS CASE". Each stage is represented by a diamond-shaped diagram containing various sub-steps and metrics. Below the progress bar, there is a timer showing "29h 32m" and a progress indicator "07/16". A bar chart shows activity for the week (M T W T F S S). At the bottom, there are recommendations for other courses, including "Value Exchange Map" and "Cash Flow Planning".

Participation levels can also be monitored - This would be confidential between the user and the course coordinator

The heads up display provides insights on user progress, time spent working on a module and level of participation



Real life examples can be explored to gain a deeper insight into the content (or if you're starting to get bored!)

The sidebar can be navigated at any point during learning activities to revisit the component content before answering !

DIV DASHBOARD

All Modules →

MVP 2

Business Purpose

Module

Activity

Feedback

Product Validation

RECOMMENDED FOR YOU

UPCOMING ASSESSMENT 1

MINIMUM VIABLE PRODUCT

12 October 15:30

Business Purpose

Lessons 10

Hours 29h

Students 32

Learning Module 2 Learning Activity Feedback

Matching Definitions

Match the financial term on the left with its corresponding definition on the right.

Return on Investment (ROI) — A measure of the profitability of an investment, calculated by dividing the net profit from the investment by the initial cost.

Market Alignment — Ensuring that the innovation addresses market needs and demands, the competitive landscape, and the potential market share it can capture.

Scenario-Based Questions

1. You are leading an innovation project for a new electric vehicle (EV) model. You have set a financial goal of achieving a 20% ROI within the first two years of launch. How does this align with Business Purpose?

A It does not align with Business Purpose.

B It aligns perfectly with Business Purpose.

C It aligns with Market Alignment.

D It aligns with Cost-Benefit Analysis.

2. Your team is conducting a cost-benefit analysis for a new software product. The expected development cost is \$500,000, and you anticipate generating \$1,000,000 in revenue in the first year. What aspect of Business Purpose does this analysis address?

A Financial Objectives and KPIs

B Market Alignment

C Cost-Benefit Analysis

D Return on Investment (ROI)

Last Page Next Page

Most questions are interactive and can be easily selected when ready (hopefully not the wrong answer!)

Pages are easy to navigate through in case a question is proving difficult and the user would like to move on



Feedback is provided once answers are submitted, where the correct answers can then be seen

once satisfied with their level of knowledge, users have the choice to move onto the next learning module

Alternatively, if they have completed both modules, Business Purpose and Product Validation, it is possible to start the case-study assessment shown at the bottom

USER TESTING INSIGHTS

For the user tests, the plan was to approach design students who have completed the primary financial course in their curriculum. Without delving into the context of the research project, the prototype was presented to the participants on a laptop. Beginning with the Business Purpose learning component, participants were asked to go through the component content at their preferred pace. On average, this took about 10 minutes. Once they had reviewed the material, they proceeded to answer the questions from the learning activity. As the prototype wasn't fully developed, users were required to record their answers on paper, which could be assessed alongside the results in the feedback stage. After completing all the questions, they reviewed their answers to assess their performance.

In total, six participants were tested, with four being strategic product design master's students who had completed the New Product Economics course, and the other two coming from the Integrated Product Design master track without this background. When asked about their knowledge of the tested topic, most mentioned they hadn't explicitly encountered the term "Business Purpose" in the context of design innovation. Nevertheless, they found the content easy to grasp, a sentiment that was reflected in the questions asked. One noteworthy comment came from a participant who repeatedly suggested that the questions

were tricky, yet managed to answer them all correctly. When questioned about their scepticism, it was due to the fact that they had only reviewed the component content once. They typically preferred taking notes and revisiting content while studying. The participant's ability to answer all questions correctly after just one review implies that the questions might be too easy. However, no other participant achieved a perfect score, so the mentioned participant is considered an anomaly. Other suggestions, such as including an overview of progress in the heads-up display to motivate users in their progression, were made. Participants showed interest in the idea of implementing such a digital module in a financial design elective, for example. Participants from the Integrated Product Design master's track felt engaged with the learning module topics and expressed a lack of recognition for this content in their master's program but acknowledged the potential benefits.

Ultimately, the user testing validated the use of a digital learning module. Moreover, the chosen content, established through the Design Innovation Viability (DIV) Dashboard, seemed relevant and comprehensible for practical application by participants. The next steps would involve further advancing the learning modules and completing the component content for all modules, followed by broader user testing, including design practitioners in the field of Design Innovation.

THE PROTOTYPE CAN BE ACCESSED THROUGH [THIS LINK](#)

06

Discussion

An evaluation of the results and related findings will involve a reassessment of the initial assignment objectives, the literature review, the research methodology, and the developed solutions. It is equally important to acknowledge the limitations inherent in the research process, which will prompt suggestions for potential new research directions in the field of financial module design.

6.1 Viability Dashboard

6.2 Context of Innovation

6.3 Implications of Design

6.4 Limitations of Research

- Building Blocks
- DIV Dashboard
- Attainment Levels
- Literature Review

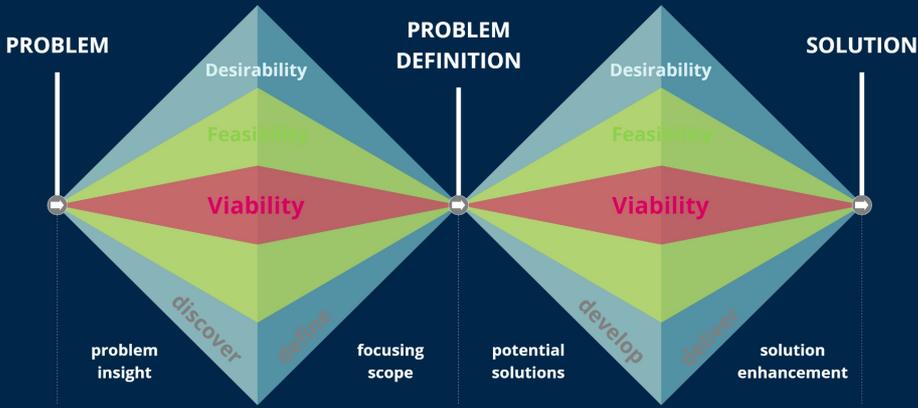
6.1 Viability Dashboard

The primary aim of this design research project, as articulated in Chapter 1, was to develop a roadmap and learning module to enhance designers' financial acumen, enabling them to make more informed decisions during the 'fuzzy front end' of design innovation. The utilization of the double-diamond framework for reference provided the initial perspective of viability within the design innovation process, as depicted in Figure 1. After conducting a literature survey and interviewing design practitioners, the framework was reevaluated in Chapter 5, culminating in the development of the DIV Dashboard. This framework serves as the foundational structure for the learning module components discussed in the preceding chapter.

The construction of this framework was pivotal for creating the learning modules, as it encapsulated the viability strategy derived from the interview analysis process. The evolution of this framework's development stages is presented on the next page. It is evident that certain key terminologies, such as the business case, budgeting, and return on investment (ROI), resurfaced in the final dashboard model but in distinct stages of the viability process. Originally, the business case was perceived as the initial outcome of divergent problem analysis. However, in the DIV Dashboard model, the business case is the penultimate result of the entire design innovation viability process.

This transition from an assumption-based approach to a research-based application of a business case in the innovation process underscores the potential margin of error that designers might encounter during the innovation process. In the early stages of the design framework, information is limited, making it challenging to validate a robust business case before proceeding to budget calculations. This could significantly impact the effectiveness of product development or commercialization since the business case remains heavily reliant on assumptions. In contrast, if the business case is established as the process's outcome, as depicted in the DIV Dashboard model, it empowers designers to gather relevant data and test initial assumptions, ultimately delivering a well-grounded business case to all stakeholders.

The research phase uncovered concerns expressed by design practitioners regarding the request to produce a business case without a full understanding of the imperative for a comprehensive innovation process. This process allows designers to transition from initial assumptions to more evidence-based objectives. By transforming the DIV Dashboard into an evaluative framework for the entire innovation process, benefiting both project members and superiors, the innovation process is inherently infused with strategic enhancements.



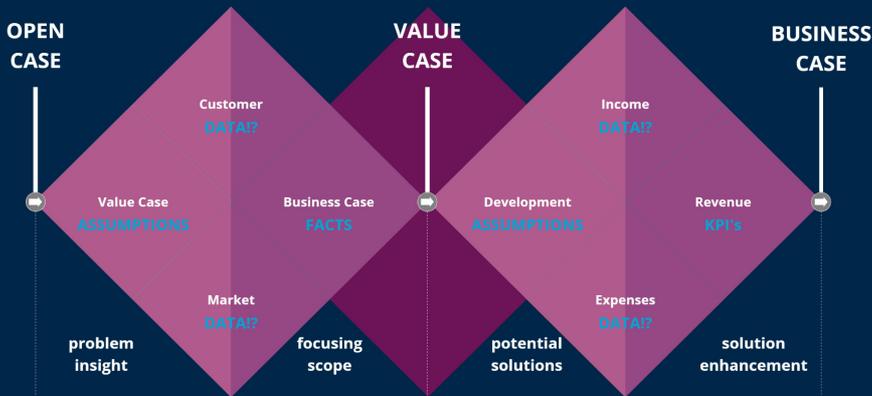
FIRST ITERATION

The primitive framework only associates the three core pillars of innovation: desirability, feasibility, and viability.



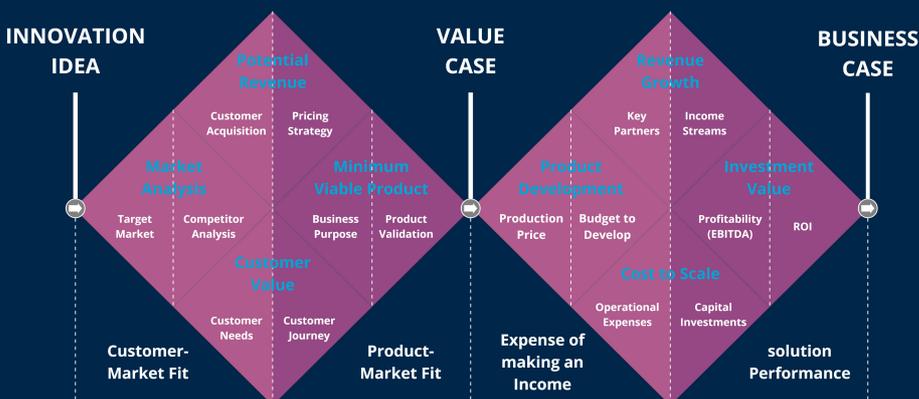
SECOND ITERATION

The second iteration tries to include details of high level financial components involved in the innovation process.



THIRD ITERATION

Post-research (interview) process, new components of innovation viability are established within the framework.



FINAL ITERATION

The final iteration now encompasses detailed components for assessment and evaluation within the innovation process.

6.2 Context of Innovation

The study has revealed a compelling synergy between design thinking and financial literacy. Initially represented as a quadrant in Chapter 1's Figure 4, financial literacy and design thinking were depicted along the X and Y axes, respectively. This model suggested that enhancing a designer's financial literacy would lead to a shift from reactive innovation to a more robust innovation skill set. Similarly, improving the design thinking skills of financial experts would enable them to embrace a multidisciplinary approach to innovation.

This understanding of the design-finance paradigm has given rise to a new quadrant model, encapsulating the clear synergy between design thinking and financial literacy. The research identifies four distinct quadrants:

1. Exploratory Innovation, positioned at the lowest level.

2. Design Innovation, characterized by high design thinking but low financial literacy.
3. Viable Innovation, marked by high financial literacy but low design thinking.
4. Strategic Innovation, integrating skills and knowledge from all previous categories.

These quadrants have been thoroughly assessed and contextualized within this project, emphasizing the need to shift from exploratory innovation to the strategic innovation quadrant. Differences between each level are depicted in Figure 12. Each quadrant possesses its unique strengths and can be valuable in various project contexts. However, prioritizing viability during the innovation process calls for a strategic approach. Thereby, further validating the need for financial module design within design education curriculums. In subsequent sections, we will discuss its application in Strategic Product Design.

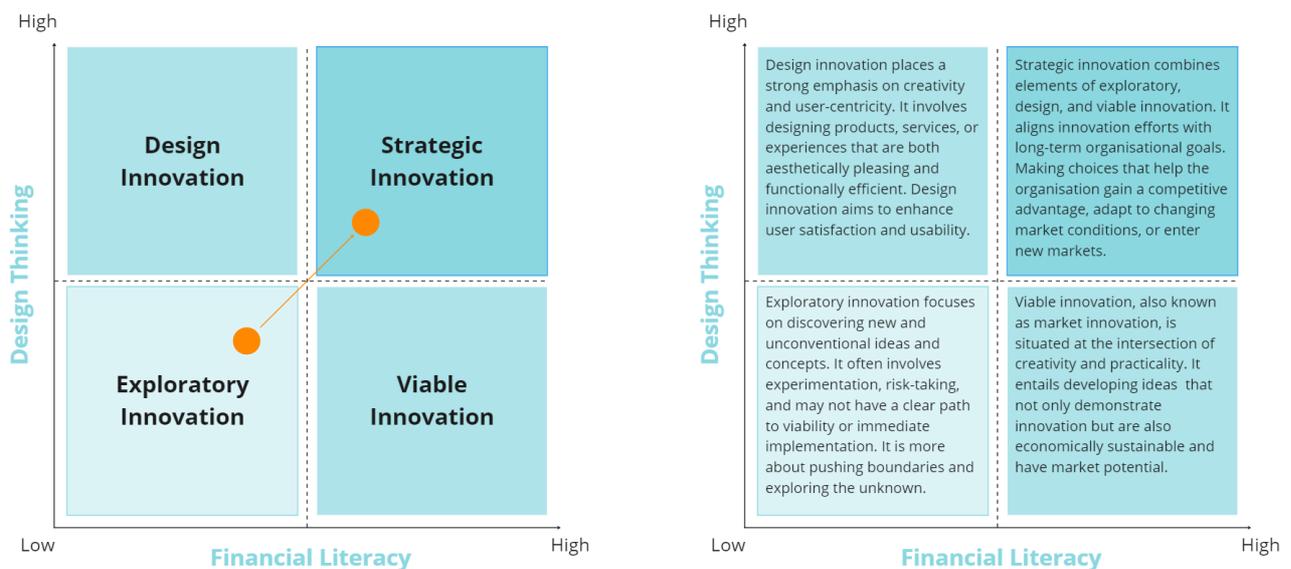


Figure 12: Synergizing Financial Literacy and Design Thinking in Innovation

6.3 Implications of Design

In the context of the Strategic Product Design curriculum, at the Faculty of Industrial Design Engineering at TU Delft, the development and implementation of the Learning Modules, based on the Design Innovation Viability (DIV) Dashboard, bear intrinsic relevance to the attainment levels outlined in the course curriculum. This section illustrates the direct alignment between the DIV Dashboard and Learning Modules, and the targeted attainment levels, substantiating their pedagogical value.

Attainment Level 1: Applying tools and techniques to collect information on customer behaviour, competitive behaviour, market trends and technological developments.

In the "Market Analysis" module, students delve into collecting valuable information about customer behavior by conducting a comprehensive analysis of the target market. They learn to decipher the intricacies of customer preferences and behaviors, acquiring essential insights into what influences consumer choices. Furthermore, the module emphasizes competitor analysis, teaching students to scrutinize competitive behavior in the market. By examining competitors' strategies and actions, students acquire a deeper understanding of market dynamics and the forces that shape them.

The "Customer Value" module delves into understanding customer behavior through two distinct components. First, "Customer Needs" focuses on gathering data on the specific

needs and desires of customers. This equips students with the tools and techniques to comprehend what motivates consumer behaviour. Second, "Customer Journey" provides insights into the steps customers take in their interactions with a product or service. By tracing the customer journey, students acquire a nuanced understanding of customer behaviour throughout their engagement, from initial contact to post-purchase experiences.

Attainment Level 2: Translating firm innovation strategies into conceptualized and visualized product /service (line) directions.

Before a Value Case and Business case can be delivered, designers must converge on the Minimum Viable Product and Investment Value, respectively. In the "Minimum Viable Product" modules, Business Purpose outlines the financial objectives and key performance indicators of innovation projects, aligning them with strategic goals. Meanwhile, Product Validation underscores the importance of financial efficiency and readiness for market entry, ensuring innovation is not only creative but financially viable.

The "Investment Value" modules, Profitability guides students in assessing the financial prospects of their projects, while Return on Investment equips them with the means to gauge the perceived return value on their innovation over a long-term period. This ultimately helps designers to better incentivise potential stakeholders to invest.

Attainment Level 3: Synthesizing data on the firm and its external international environment, including the firm-related strategic value of design, into realistic product/service concepts and their business cases.

As described in "Revenue Growth", the Key Partners module provides students with the essential skills to gather and integrate data from both internal and external sources, laying the groundwork for robust business cases. Concurrently, Competitor Analysis enhances their comprehension of the strategic importance of design within the external environment, fortifying their capability to formulate feasible product ideas and sound business cases.

The Business Purpose module synergizes this process, allowing students to translate innovation strategies into concrete product or service concepts while concurrently constructing a business case. Collectively, these modules empower students to transform intricate data into practical and strategically significant product or service propositions, thereby facilitating the development of effective business cases.

Attainment Level 4: Translating product/service line strategies, mission statements, brand identities and information on the firm and its external network of strategic partners into design and engineering guidelines.

Delivery of a Value Case is a culmination of all strategies, statements, and identities need to begin assessing the design/engineering side of the innovation project. Within the "Product Development" modules, students gain insights into translating strategic product/service line directions into actionable design and engineering guidelines. Production Price

emphasizes understanding the cost structure of product development, ensuring that the design aligns with the financial feasibility of the project. Meanwhile, Budget to Develop provides students with the financial acumen required to manage and allocate resources efficiently throughout the design and engineering phases.

On the other hand, the "Cost to Scale" modules are closely linked with operational expenses and capital investments. These modules are crucial to establish the connection between strategic business cases, mission statements, and brand identities, and the practical guidelines for design and engineering. Operational Expenses gauges students with the ongoing costs of scaling a product or service, ensuring that the long-term viability of the design aligns with strategic goals. Capital Investment delves into the financial aspects of funding the scaling process, ensuring that the project's financial reality is carefully managed.

Attainment Level 5: Independently setting up and conducting a complex multidisciplinary strategic design, design consulting or research project.

This attainment level is not directly contributed to any one or two specific modules, but as a whole through active participation. As previously stated, the goal of this research project was to equip designers with essential financial skills, enabling them to make better decisions during the 'fuzzy front end' of design innovation. By working through all learning modules, and understanding the reason behind the order of the DIV Dashboard, a design student is more susceptible to engaging in their own multidisciplinary projects. This has been validated through user testing with design students, who largely agree with the fact that they lack financial literacy in their curriculum.

Attainment Level 6: Presenting and reporting design concepts and (strategic and/or scientific) research findings in a professional manner.

Similar to attainment level 5, this level is not directly associated with a specific module. Instead, it arises from the culmination of knowledge and skills developed across all modules. For instance, upon completing a module such as the Minimum Viable Product Module, students engage in case studies for self-assessment. These questions are designed to align with the Evaluation phase of Bloom's Taxonomy (Section 5.2), providing students an opportunity to assess their knowledge and reporting capabilities. Their responses can then be compared with ideal answers for reflection. While the learning modules do not explicitly assess presentation skills, the ability to deliver a clear Value Case or Business Case is a critical competency often lacking among design innovation researchers, as indicated by interview results. This will be discussed further in the next chapter.

Attainment Level 7: Leading an innovation team and delivering strategic input to the team.

The attainment level 7, which pertains to leading an innovation team and providing strategic input, is closely linked to the modules and components within the Design Innovation Viability Dashboard. This dashboard serves as

a foundational source of project leadership, portraying the intricate aspects of viable innovation for in-depth deliberation. Aspiring design practitioners, in their pursuit of personal and professional development, should thoroughly understand these components. Notably, this comprehension extends beyond individual ambitions; it significantly benefits project teams. By grasping the intricacies of the DIV Dashboard, practitioners enable multidisciplinary discussions that span various sectors of an organization or parties involved in the innovation process. It fosters productive dialogue between stakeholders and designers, financial managers and production teams, leadership and researchers, and other relevant parties. This knowledge equips design practitioners with the tools to provide strategic input and assume leadership roles effectively within innovation teams, facilitating collaborative efforts for the project's success.

In conclusion, the Learning Modules meticulously align with the stipulated attainment levels of the Strategic Product Design curriculum. The comprehensive financial skills, the DIV Dashboard framework, and the accompanying financial decision-making competencies introduced through these modules distinctly enhance the pedagogical experience, equipping students with the vital skill set demanded by the multifaceted domain of design innovation. The next section will discuss its application in other design courses.

6.4 Limitations of Research

BUILDING BLOCKS

The limitations of this research arise from the selective focus on three out of the six identified building blocks: Navigating Market Choices, Establishing a Financial Foundation, and Understanding the Phases of Viability. The exclusion of the remaining three building blocks: Opening up Financial Dialogue, Mindset to Drive Innovation, and Addressing Financial Integration Realities, was due to the project's primary focus on the project level, rather than the broader organisational level. While this focus was justified within the study's scope, it presents limitations.

The three omitted building blocks, while relevant, were considered beyond the immediate scope of the project, which centred on providing specific guidance for design innovation projects. However, it is recommended to consider these excluded building blocks when examining design innovation strategies at an organisational level, as they could significantly impact broader innovation contexts.

Incorporating these excluded building blocks into the research would have enriched the results. For instance, "Opening up Financial Dialogue" emphasizes the importance of collaboration between designers and financial departments early in the project. Integrating this element could have provided practical insights into effective communication strategies and synergy between these

traditionally distinct domains. Such insights might have contributed to a more holistic understanding of the challenges faced during the design innovation process.

Similarly, "Mindset to Drive Innovation" emphasises the significance of a proactive and fact-based mindset. The inclusion of this aspect could have offered valuable strategies for fostering a culture of innovation within organisations and ways to enhance adaptability within design teams, thereby improving the study's comprehensiveness concerning the human factors and mindset required for successful design innovation.

"Addressing Financial Integration Realities" underscores the importance of being aware of potential challenges and complexities during the innovation process. Incorporating this component might have allowed for the identification of practical strategies for overcoming obstacles such as corporate expectations, budget constraints, and personal insecurities. These insights could have been instrumental in providing a more robust understanding of the real-world intricacies involved in implementing design innovation.

In summary, while the selected building blocks formed the basis for the Roadmap and Learning Module, the exclusion of the other three restricted the research's breadth. Their inclusion would have provided a more holistic view of design innovation and a deeper understanding of the challenges and strategies

necessary for successful implementation, particularly in organisational contexts.

DIV DASHBOARD

In developing the Design Innovation Viability (DIV) Dashboard and its associated learning modules, certain limitations were encountered that warrant discussion. These limitations are crucial for a comprehensive understanding of the model's scope and potential areas for future research.

One notable limitation concerns the order of the learning modules within the DIV Dashboard. The initial arrangement, such as placing "Customer Value" before "Market Analysis," was based on certain assumptions about the prior knowledge or context of the design project. However, it became evident that this sequence might not be universally applicable. In scenarios where the target market is not clearly defined, as often occurs during the 'fuzzy front end' of innovation, a different order of learning modules might be more suitable. This limitation highlights the need for adaptability in the application of the DIV Dashboard, and future research could explore context-specific sequences of learning modules to better serve diverse design projects.

Additionally, the learning modules' current scope primarily focuses on the content of value and business cases, providing in-depth knowledge on their components. However, a limitation arises regarding the absence of a structured framework on how to effectively present these cases. While designers gain valuable insights into the content, they may still lack explicit guidance on the presentation and communication aspects. Addressing this limitation could be a valuable area of future research to ensure that design practitioners not only develop robust cases but also know how to effectively convey their findings to

stakeholders, thereby bridging the gap between analysis and practical application.

In conclusion, the limitations in module sequence adaptability and the absence of a structured presentation framework in the DIV Dashboard's learning modules emphasize the need for ongoing research and refinement to enhance its effectiveness as a tool for design innovation viability.

ATTAINMENT LEVELS

Another aspect that emerged as a limitation in this research pertains to the use of Bloom's Taxonomy and Attainment Levels in designing the learning modules. While the modules were constructed following the guidelines of Bloom's Taxonomy to enrich learning activities, it is possible that alternative methods could enhance students' engagement with the topic of Financial Literacy in Design Innovation. For instance, the incorporation of peer evaluation within the online learning modules could offer an opportunity for participants to deepen their understanding by comparing their responses with those of their peers. This approach would foster collaborative learning and potentially result in a more holistic grasp of the subject matter. Furthermore, implementing group projects at the conclusion of a learning module to assess students' collective knowledge could simulate real-life design innovation projects, where multidisciplinary teamwork is essential for success.

Additionally, it's important to acknowledge that the attainment levels specified in this research are derived exclusively from the Strategic Product Design master program. There exist two other master programs within the Faculty of Industrial Design at TU Delft: Integrated Product Design and Design for Interaction.

Each of these programs likely has its own unique attainment levels, which could potentially be addressed through tailored learning modules in alignment with the specific learning objectives of these programs. Such an endeavor, however, would require further research and should be considered within the context of the strategic goals of the respective programs. This opens avenues for future exploration and refinement of the learning modules to cater to the diverse needs of students in different master programs.

LITERATURE REVIEW

The literature survey conducted in the early phases of this research project was instrumental in shaping the trajectory of the study. It involved two primary aspects: the examination of innovation frameworks and the exploration of financial literacy within the context of innovation. The inquiry into innovation frameworks revolved around identifying models that explicitly incorporated viability as a fundamental component. Notable models that embrace viability, often closely associated with financial competence, include the double diamond approach, business model canvas, stage gate approach, and SCRUM analysis. These frameworks offer space for the application of viability throughout their processes, as discussed in Chapter 2.

Among these models, the double diamond approach emerged as the focal point for this research. This choice was based on its widespread acceptance within the design thinking framework and its flexibility to accommodate novel findings and insights

related to financial literacy. Nevertheless, the strengths and potential benefits of the other models in the context of financial literacy remain an intriguing area for further exploration. Future research could delve into the unique attributes and advantages of these alternative frameworks, shedding light on their potential contributions to teaching financial components to design students.

Another noteworthy observation during the literature survey pertained to the domain of financial literacy. The existing body of literature predominantly addresses financial literacy in the context of personal finances for specific populations. However, the literature on financial literacy within design innovation cycles remains scarce. This scarcity of relevant research limited the depth and breadth of applied knowledge during the interview process and the subsequent research and design phases, particularly when recognising potential components for the DIV Dashboard and learning modules.

This research has endeavoured to bridge this research gap by engaging in interviews with design practitioners actively involved in design innovation. These interviews unveiled the financial components embedded within the DIV Dashboard, offering a practical and industry-specific perspective on financial literacy. To augment the research's applicability and validity, further exploration and analysis of literature concerning financial components in innovation projects are warranted. Such an extended review could provide more alignment between the identified components and the broader landscape of design innovation frameworks.

07

Conclusion

The project results and findings are concluded and summarised alongside the research process. Personal ambitions are reflected upon and the conclusion of this report is made. The insights gained set the stage for further research to be conducted.

7.1 Project Conclusion

7.2 Personal Reflection

7.1 Project Conclusion

This research underscores the relevance of financial literacy in design innovation projects. It subjects design education to the intricacies of financial components, equipping designers to navigate new innovation projects effectively and bolster their professional competence when engaging with diverse stakeholders.

This study unveils a platform for designers to cultivate their financial literacy - the Design Innovation Viability (DIV) Dashboard. The DIV Dashboard is a practical roadmap that bridges the knowledge gap in financial literacy within the context of design innovation. It offers a structured approach that empowers designers to navigate market choices, establish a firm financial foundation, comprehend the phases of viability, engage in financial dialogue, develop the right mindset, and address financial integration realities.

Moreover, the research introduces a novel framework for innovation, clarifying the quadrants of exploratory innovation, design innovation, viable innovation, and strategic innovation. This framework highlights the evolution of innovation strategies, emphasizing the shift towards strategic innovation. The quadrant approach presents a comprehensive perspective on the integration of financial literacy within design innovation, catering to the multifaceted needs of diverse design projects.

The implications of these designs are profound. The research project enhances the

understanding and practical application of financial literacy for design students, fostering a new generation of professionals equipped with comprehensive expertise. It empowers students to confidently embrace design innovation projects, enhancing their ability to make informed decisions and present their concepts and findings professionally.

Nonetheless, as with any research endeavor, limitations exist. These limitations encompass the focus on project-level scenarios within the Learning Modules and the absence of a comprehensive framework for presenting a Value Case or Business Case in the final stage. Moreover, the attainment levels considered in this study stem primarily from the Strategic Product Design master program, neglecting the unique contexts of other design programs such as Integrated Product Design and Design for Interaction. These limitations offer avenues for further exploration and research, aiming to refine and expand the understanding of financial literacy within the field of design innovation.

In summary, this research project represents a noteworthy step in integrating financial literacy with design innovation. It lays the foundation for a paradigm where financial competence is a fundamental element of the design field. This work contributes to the progression of design education and practice, offering prospective design professionals the essential skills for effective design innovation.

7.2 Personal Reflection

Earlier this year, I embarked on a journey to find a graduation project in the domain of design, organization, and strategy. My interest in the intersection of business and design thinking led me to explore areas such as policy and management. Simultaneously, I discovered a growing fascination with financial knowledge, spurred by my coursework in New Product Economics. The language of finance began to seem essential for my future career, particularly if I aspired to work at a managerial level. Drawing from my background as a business developer in a student dream team and a finance manager of a foundation associated with my rowing team, I was equipped with a strong foundation for tackling the challenge of financial literacy.

The realization that designers are not traditionally trained to communicate in numbers, except when absolutely necessary, sparked my project's direction. While we excel in expressing the intrinsic value of design to consumers and society, we often fall short in articulating its monetary value to potential stakeholders and investors. This project was an opportunity to expand my knowledge of financial literacy while leveraging my design skills. At times, I felt out of my depth and uncertain about the next steps. However, I learned that even a single idea can lead to numerous new concepts with careful exploration.

Certain discoveries during the project felt almost accidental, like the revelation of the DIV Dashboard. Reflecting on my analysis process, it became clear that certain interview responses hinted at the prescribed order of the roadmap. The same held true for the quadrant definitions and Learning Module prototype. These concepts were present from the project's outset but needed iterative development and feedback from my supervisory team. This process left only the visual design aspect, a task well within the purview of a designer.

I'm content with the project's outcome, particularly the value of the learning module concept. When I share it with fellow design students, they quickly recognize its potential as part of their curriculum. If I were to continue this project, my next steps would include validation with design practitioners to refine the learning modules' sequence and adaptability based on different contexts. I'd also work on the prototyping phase to develop a fully-fledged concept suitable for online learning platforms such as Udemy or the TU Delft MOOCs.

Looking ahead, I anticipate applying this newfound knowledge in my professional career. The blend of creativity and financial competence is both exciting and promising, and I hope to see my financial literacy expand further.

Financial Module Design - A Designer's guide to becoming Financially Literate

*Thank you for reading.
Sincerely, Amir*

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Appendix

A SEPARATE APPENDIX DOCUMENT CAN BE FOUND IN THE
TU DELFT REPOSITORY:

[HTTP://RESOLVER.TUDELFT.NL/
UUID:28DA510D-76A0-4963-8173-67E73A078C5D](http://resolver.tudelft.nl/UUID:28DA510D-76A0-4963-8173-67E73A078C5D)

