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**Exploring managerial heuristics in optimizing new
service development processes in a multinational
technology company**

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ABSTRACT

This rapidly evolving technology has led the industry to adopt emerging trends that have led to exponential efficiency and quality, as well as practices for implementing New Service Development (NSD). This study analyzes the impact of managerial heuristics, especially the “fast and frugal” perspective, in optimizing NSD in a multinational technology company. This research aims to evaluate the efficacy of the current NSD processes, pinpoint crucial decision-making junctures for applying heuristics, and construct a framework that optimizes operational efficiency and stimulates innovation.

This research highlights how heuristics facilitate the decision-making process by emphasizing key variables and ignoring extraneous information. Using qualitative methods, such as interviews with managers and NSD practice analysis, identifies heuristics as important tools for overcoming challenges in managing resources, involving stakeholders, and prioritising innovation. Using rules such as “give priority to features that deliver a 10 per cent or higher contribution to customer retention” allows managers to make timely and meaningful decisions without constant deliberation. The results culminate in an overarching theoretical framework that harbours managerial heuristics sheltered within iterative feedback loops, enabling responsiveness to change managerial and market demands. This framework emphasizes the dual nature of heuristics when it comes to NSD and how the trade-off exists between efficiency and innovation serving as a practical guide for decision-making in the NSD process. The study also touches on the value of embedding customer-oriented behaviours and using digital tools to be more responsive and in line with strategic goals.

The study offers useful contributions to the existing literature, yet it has important limitations, including being based on a single firm and facing recruitment issues that have implications for generalization. Further research needs to include cross-industry applications, adopt empirical validation of frameworks that have been introduced through heuristics, and assess how solutions align with and integrate with emerging technologies, including AI. Hence, this thesis form a theoretical and practical contribution by showcasing how fast-and-frugal heuristics can expedite NSD processes, thus offering a viable means for multinational technology firms to bolster competitiveness in fast-moving markets.

KEYWORDS: Managerial Heuristic; Fast-and-Frugal Decision-Making; New Service Development; Optimization Frameworks; Multinational Technology Firms; Innovation and Efficiency; Customer-Centric Practices; Iterative Feedback Loops

TABLE OF CONTENTS

1	INTRODUCTION	4
2	LITERATURE REVIEW	9
2.1	Theoretical foundations	9
2.1.1	Integration of heuristics in NSD	14
2.2	Empirical literature on New Service Development	16
2.2.1	NSD in the technology sector	17
2.2.2	Decision-making in the NSD process	18
2.3	Theoretical framework	22
3	METHODOLOGY	30
3.1	Philosophical assumptions	30
3.2	Research strategy	33
3.3	Case firms/participants/sample	34
3.4	Data collection	35
3.5	Data analysis	39
3.6	Ethical consideration, validation and reliability	40
4	FINDINGS	43
4.1	Detailed thematic analysis and application of heuristics in a multinational technology company NSD process	63
4.2	Extended theoretical framework	67
5	DISCUSSION	68
5.1	Theoretical contributions	68
5.2	Managerial implications	70
5.3	Limitations	74
	REFERENCES	79
	APPENDICES	85
	Appendix 1. Interview guide	85
	Appendix 2. AI disclaimer	86

Figures

Figure 1. Research gaps in the New Service Development (NSD) thesis	8
Figure 2. Theoretical framework: Integrating heuristics for NSD optimization and quality enhancement	29
Figure 3. Thematic map	44
Figure 4. Thematic map: Decision-making and heuristics in NSD	48
Figure 5. Thematic map: Customer-oriented focus	51
Figure 6. Thematic map: Efficiency and effectiveness in NSD	54
Figure 7. Thematic map: Quality assurance in service development	58
Figure 8. Thematic map: Difficulties applying managerial heuristics	62
Figure 9. NSD Processes with Heuristics apply in a multinational technology company	66
Figure 10. Comprehensive heuristics framework for NSD optimization and quality (NOQ)	67

Tables

Table 1. Participants' details	36
Table 2. Details of the interviews	37
Table 3. Summarized demographic characteristics of the participants and the interviews	38

Abbreviations

F&F	Fast and Frugal
NSD	New Service Development
PLM	Product Lifecycle Management
PPM	Product Portfolio Management
PPF	Product Portfolio Forum
R&D	Research and Development
MVP	Minimum Viable Product
NOQ	NSD Optimization and Quality

IH-NOQE

Integrating Heuristics NSD Optimization of QE

1 INTRODUCTION

The impact of innovation in highly advanced technology industries is becoming increasingly vital. Considerations for effective managerial decision-making in new service development (NSD) processes are particularly relevant for rapidly evolving sectors such as technology. Research that preceded this study has distinguished that integrating adaptive decision strategies, such as heuristics, can effectively optimize these processes by leveraging the trade-off between speed and accuracy during uncertain decision-making. Heuristics, for instance, enhance managerial efficiency by simplifying complex decisions without compromising quality (Artinger et al., 2015). However, this method, known as fast-and-frugal heuristics, provides a structured yet flexible framework to address the challenges linked with NSD, including resource allocation, idea creation, and alignment with the organization's goals and objectives (Luan et al., 2019). Additionally, NSD has become an increasingly important pillar for fostering industry innovation and competitiveness (Biemans et al., 2016). These findings illustrate the importance of investigating managerial heuristics from a strategic perspective in NSD, as decision-making in multinational technology companies is preceded by high stakes and multiple factors to consider.

Hence, this thesis draws on a wealth of existing literature to build upon its foundation. Martovoy and Mention's (2016) research demonstrates that sector-specific nuances, such as those in banking, highlight the necessity of tailoring NSD processes to industry contexts. In technology firms characterized by fast-paced innovation and adaptation, managerial heuristics can help address bottlenecks and improve service quality, according to studies by (Hydle et al., 2016). Moreover, the perspective of a study by Hafenbrädl et al. (2016) examines the real-world use of logical heuristics and shows how these tools can be used to maneuver through uncertainty without compromising strategic focus. In this regard, this study seeks to contribute to the ongoing discourse of improving NSD processes to get better results by incorporating these insights and illustrating future avenues in which heuristics could be applied. Although NSD processes and managerial heuristics have received extensive research attention, there remain

considerable gaps that need to be filled. Most of the literature focuses on specific sectors, such as banking (Martovoy & Mention, 2016) or construction (Love et al. 2023), while the application of heuristics in NSD processes in technology firms, a sector characterized by rapid innovation and complexity has been relatively underexplored.

Previously, Artinger et al. (2015) and Luan et al. (2019) addressed the potential of fast-and-frugal heuristics to boost decision-making efficiency. They call for more empirical research on the systematic application of these heuristics to organizational contexts, such as multinational technology companies. Therefore, this study responds to the call of Hafenbrädl et al. (2016), who urge that further exploration of heuristics in organizational decision-making is vital to understanding their practical implementations in improving innovation and efficiency.

Furthermore, Hydle et al. (2016) have proposed frameworks for NSD practices; however, further discussion is necessary to address challenges such as resource optimization and process streamlining with managerial heuristics. The opportunity to explore how these simple rules can bridge the gap between strategic objectives and operational execution arises from this need for more focus. Gremyr et al. (2014) also encourage research into critical points in NSD processes at which decision-making tools (e.g., heuristics) can have the most significant impact. This study aims to add to those discussions by illustrating the strategic application of heuristics to improve NSD processes in the technology sector. As a result, this addresses theoretical and practical gaps in recent research.

Additionally, this study seeks to contribute to this research opportunity by addressing the following research question: ***How can the 'fast and frugal' approach of managerial heuristics optimize and streamline the New Service Development (NSD) process in a multinational technology company?*** Thus, to provide relevant answers, it is vital to articulate, concrete research objectives to respond to this research question. These aims are to be achieved through the assessment of the existing NSD processes, identifying decision points that are critical in developing fast-and-frugal managerial heuristics, and

consequently developing an optimization framework that can improve both efficiency and quality in the NSD processes of a multinational technology enterprise. To answer the research question, the study adopts a qualitative research design and employs a case study methodology to gain an understanding of NSD practices and the use of managerial heuristics. The research is based on primary data (semi-structured interviews with managers engaging in NSD processes) and secondary data (such as company reports and important industry documents). This approach allows for a nuanced analysis of the functioning of heuristics in practice, enhancing the efficiency of decision-making and the quality of service.

This study addresses decision strategies and their evolution influenced by the dynamic environmental conditions in the technology sectors guided by the fast-and-frugal heuristics (Artinger et al., 2015). By focusing on multinational technology companies, the findings are relevant within the diverse organizational context of complex environments of rapid innovation and global competition (Hydle et al., 2016). In addition, drawing on past literature regarding decision-making (Luan et al., 2019) and the NSD process (Biemans et al., 2016), an analytical tool is proposed to focus on key checkpoints in NSD where heuristics could be applied to increase efficiency in decision-making. By integrating theoretical and practical perspectives, this study aims to contribute to the literature on managerial decision-making and NSD, offering strong recommendations of high relevance for organizations aiming at innovation excellence.

The study's main contributions. First and foremost, it contributes to the managerial heuristics literature on empirically investigating their role in multinational technology companies' NSD processes. Previous studies such as Artinger et al. (2015) have highlighted the theoretical potential of fast-and-frugal heuristics; this study provides practical insights into how these strategies can be integrated and implemented for effective decision-making as well as for enhancing NSD processes. Second, it responds to Luan et al.'s (2019) call that focuses on industry-level studies that include enhancing the software development productivity in the technology sector due to rapid innovation,

resource constraints, and the market pressure that faces technology companies, which creates unique challenges for NSD.

However, this study further develops constructs such as those described by Hydle et al. (2016) and (Gremyr et al., 2014). Consequently, this is done by recognizing key junctures in the NSD process where heuristics can be applied effectively to become actionable recommendations for tech-driven organizations. Third, this study extends to the broader field of innovation management by associating the implications of ecological rationality with NSD practices. Hafenbrädl et al. (2016) have called for studies that fall between the development of heuristics as theoretical models and the practical applications of heuristics in complex organizational settings. Nevertheless, this research is aligned and advances these lines of discussion by examining how heuristics facilitate NSD processes while ensuring or enhancing service quality. Moreover, it adds to methodological approaches by blending qualitative insights with a systematic analysis of NSD practices, thereby developing a reliable foundation for future research in similar contexts.

Finally, the thesis's structure is categorized into five chapters. The first chapter is the introduction, followed by the second chapter, where the relevant literature on NSD and managerial heuristics is reviewed, which serves as the theoretical foundation of the study. The third chapter describes the research methodology, which comprises philosophical assumptions and research strategy and beyond that, the case company is introduced; data collection and analysis are explained; validity and reliability are further discussed. The fourth chapter presents the findings. The data is then evaluated and analyzed within each case and illustrated and described. The last chapter five discusses the theoretical and managerial implications and suggestions for further future research. Figure 1 depicts the research gaps identified in the existing literature for this thesis.

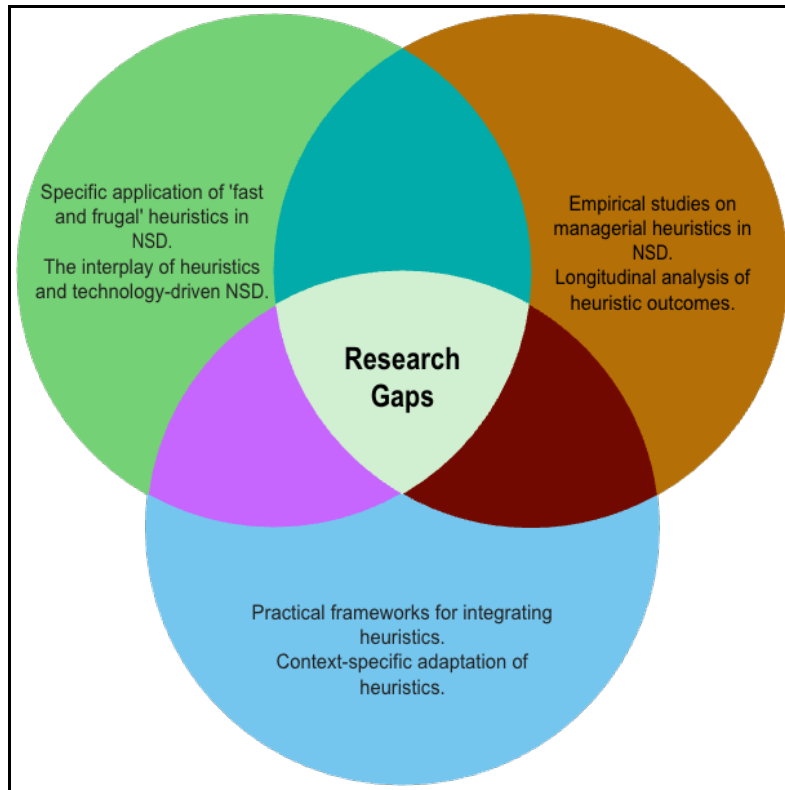


Figure 1. Research gaps in the New Service Development (NSD) thesis

2 LITERATURE REVIEW

2.1 Theoretical foundations

New Service Development (NSD) has come to the forefront as a significant research topic in service and innovation management, especially in those sectors that rely on differentiation and agility strategies to stay ahead of competitors. The understanding of how organizations manage and evolve their services about shifts in consumer needs and paradigm shifts in technology is the theoretical basis of NSD. Biemans et al. (2016) reviewed the history of NSD and how it has developed as an interdisciplinary field connecting marketing, operations, and innovation management. The authors claim that a structured method for NSD is critical to sustaining innovation and meeting organizational goals.

NSD has a strong theoretical element that continues to explore models through which organizations can appropriately manage and structure them. In the study by Hydle et al. (2016), concerning the importance of reliable but flexible frameworks relevant to business domains. These frameworks provide a roadmap for dealing with the issues that are associated with NSD and emphasize the importance of decision-making during action, especially for technology firms that are operating in dynamic environments. Beyond that Froehle and Roth (2007) present a resource-process perspective that views NSD as the synchronization of resource distribution and processes, emphasizing the interaction between organizational resources and the market environment. Different modes of innovation can greatly define NSD processes in terms of where to innovate. Gremyr et al. (2014), for instance, mention different types of modes of innovation, including incremental and radical, that characterize the service conceptualization, development, and implementation processes.

Moreover, these modes provide a foundation for understanding how organizations implement their NSD strategies and activities. Kindström and Kowalkowski (2014) also elaborate on this by adding a more complex view of service innovation where customer

knowledge and technological resources are highlighted in developing services. This is in sync with technology firms trying to integrate service innovation with product-oriented strategies. The roles of the stakeholders in NSD processes are also an important theoretical consideration. Melton and Hartline (2010) assert that NSD is a process integrally dependent upon the involvement of internal stakeholders, such as frontline employees, and external stakeholders, such as customers. However, this collaborative approach ensures the creation of new services in collaboration with customers and aligns with the organization's strategy. Martovoy and Mention (2016) build on this by analysing industry variation in NSD to show how industry characteristics affect the theoretical framework and the NSD process.

In short, NSD is underpinned by various theoretical foundations stemming from the domains of innovation management, resource allocation, and stakeholder collaboration. Such foundations provide a sound basis for the evaluation of the integration of managerial heuristics into NSD processes and the extension of NSD processes to achieve superior performance within complex and turbulent contexts. It seeks to combine diverse theories to enhance the understanding of NSD, focusing especially on multinational technology companies.

Decision-making theories and managerial heuristics

The technology sector is dynamic and uncertain; it requires a decision to be made in the New Service Development (NSD). Traditional theories of decision-making focus on systematic analysis and rational choice, yet those approaches might be secondary in the real world operating in an era of accelerating change and limited time and information. On such models, scholars have suggested that different strategies to choice can be conceived to emerge adapted to specific contexts (Luan et al., 2019). Ecological rationality argues that decision-making heuristics, simple principles, or cognitive shortcuts enable managers to make appropriate decisions by aligning themselves with environmental structures. Doing so minimizes cognitive load while keeping the process efficient (Artinger et al., 2015).

The theory of ecological rationality of fast-and-frugal heuristics builds upon especially useful principles of cognitive psychology which apply to management in controlling complex processes. These heuristics are methods of decision-making that involve the use of less comprehensive processes where only important details are considered and less important details are ignored to make decisions quickly and efficiently (Artinger et al., 2015). For example, the “recognition heuristic” allows decision-makers to eliminate unknown options in favour of the known ones, using recognition as a basis for decision-making. Bingham and Eisenhardt (2011) state that such heuristics are a result of practicing decision-making routines in similar situations and assist managers in developing simple rules which are suitable for an organization.

Numerous theoretical and empirical works have highlighted the usage of fast-and-frugal heuristics and their real-world implementations. As stated by Hafenbrädl et al. (2016), the authors explain how these heuristics help managers to make effective decisions in complex environments while identifying relevant information and avoiding overanalyzing the data. Similarly, Maitland and Sammartino (2015) agree that practice helps in the formation of heuristics, where managers working in conditions of high risk and uncertainty can develop heuristics that help in decision-making to be faster and more effective. Although these studies were conducted in general managerial contexts, the principles apply to NSD processes as well since the decision-making process must be prompt and effective.

Heuristics is most relevant to higher-risk and uncertain industries like technology and construction. The use of heuristics in construction projects is designed to decrease uncertainty, enhance resource allocation, and permit illuminated quick decisions (Love et al., 2023). Such conclusions also hold when new products are under development in technology firms, where product decisions also involve trade-offs amongst time, quality, and resources. Hodgkinson et al. (2023) take a historical glance at heuristics in management decision-making and identify heuristics as tools intended to address biases and increase decision-making efficiency over long-term decisions. Particularly in the

context of management, ecological rationality and fast-and-frugal heuristics offer a systemic lens to understand behavioral decision-making, accounting for the importance of the environment that surrounds it. Given time constraints and limited knowledge as typical features of NSD processes, these heuristics complement each other, perform well, and drive NSD decision-making to promise the best choices. This paper adds to the increasing literature on managerial heuristics, especially how they can contribute to the efficiency and effectiveness of NSD in technology firms by combining theoretical and empirical-based insights.

Innovation management and new service development (NSD)

Innovation management is instrumental in molding the processes and results of New Service Development (NSD). Biemans et al. (2016) define innovation management as the systematic approach used that coordinates an organization's innovation process, ensuring the creation of new services that are relevant to the market, feasible given the organization's resources, and consistent with the organization's strategy. It includes actions such as idea generation, resource allocation, and stakeholder involvement that are vital in enhancing service innovation. Biemans et al. (2016) assert that innovation management is the backbone of NSD as it provides the necessary framework that is required to manage the intricate process of designing and creating new services in dynamic environments.

Innovation is seen as an opportunity and challenge in the specific context of NSD, with innovation management vital, especially within technology companies. These organizations function in highly dynamic markets where the pace of innovation cycles is rapid, and the needs and expectations of customers shift (Kindström & Kowalkowski, 2014). Innovative processes would help you gain a competitive advantage. However, innovation management often has its challenges, such as managing resources and coordinating and practicing with other sections (Hydle et al., 2016). Gremyr et al. (2014) emphasized that technology companies must control these challenges by integrating

innovation modes that harmonize incremental enhancements with radical innovations, ensuring sustained industry and commercial relevance

The resource-process view provides insights into ways to improve the NSD process in the context of innovation management. According to them, a successful NSD requires matching organizational knowledge and technology with an improved developmental procedure (Froehle & Roth, 2007). This view considers the inward strengths as well as the external forces that shape our responses. Consistent with this, Gounaris et al. (2020) stress the importance of internal organizational conditions both in terms of leadership and culture in determining NSD performance and for providing the organizational climate necessary to foster innovation.

Another essential aspect of innovation management in NSD is collaboration among stakeholders. Melton and Hartline (2010) shared a memory that innovation is influenced by both internal (e.g., front-line staff members) and external (e.g., customers) stakeholders. They identify that collaborative efforts enhance the quality and saliency of new services by introducing diversity into the development process. Stakeholder engagement is crucial in this context as it could direct management strategy in tech companies while minimizing the exposure to service failures (Kindström & Kowalkowski, 2014).

Notwithstanding these opportunities, NSD in technology firms also encounters industry-specific challenges. Martovoy and Mention (2016) point out that sectors (e.g., technology and banking share common hurdles to innovation), such as regulatory constraints and the complexity of incorporating new services into existing frameworks. This involves a structured approach to innovation management that captures the need for strategic planning with agile execution. According to Edvardsson and Olsson (1996), the efficiency of NSD processes relies on the standards that can be established for the various components of development but also the flexibility with which each development project can be tailored to the specific demands of the project.

Alternatively, fast-and-frugal heuristics provide heuristically simple but effective tools to be applied under certain constraints of NSD processes, e.g., due to limited time availability or incompleteness of information. By compensating for each other, these heuristics facilitate effective decision-making and allow managers to choose viable solutions rapidly and effectively, even in less-than-ideal circumstances. Integrating theoretical and empirical perspectives, this study elaborates on how the utilization of these decision-making tools facilitated an effective and efficient usage of NSD practices by technology firms. The research closes the gap between theory and practice by providing actionable advice for managers that helps decision-makers manage outcomes better in complex environments.

2.1.1 Integration of heuristics in NSD

Integrating managerial heuristics in NSD processes is a novel approach to cope with the complexity and uncertainty underlying these environments. Managerial heuristics are guided by simple rules, reflecting ecological rationality, that offers decision-makers adaptive capabilities to enhance and optimize complex mechanisms (Artinger et al., 2015). These heuristics connect nicely with NSD because they allow managers to focus on the key factors, reduce cognitive load, and avoid making decisions based on exhaustive analyses, which would be difficult to process given the complexity of the tasks. This theoretical connection establishes heuristics as a practical mechanism for enhancing the efficiency of NSD processes in technology-driven industries.

Decision-making frameworks anchored on fast-and-frugal heuristics have gained traction, especially in efficiency in an intricate environment. These heuristics emphasize important cues and ignore irrelevant information, thereby allowing rapid and efficient choice-making (Luan et al., 2019). Hafenbrädl et al. (2016) showcase the practical daily usage of these heuristics and how they manage to ease complex processes while still making good decisions. Heuristics enables a flexible but cohesive framework to balance cost-time-quality trade-offs based on uncertainty in the environment, which is essential

for radical or even incremental innovation of services by technology-driven organizations within an optimal strategy.

Heuristics arise from experiential learning, making these techniques very suitable for dynamic environments like NSD. Through iterative encounters with a strategic process, managers develop managerial heuristics as platforms through which they learn to draw upon context-specific experiences to inform the novel actions that face the situations they find themselves in (Bingham & Eisenhardt, 2011). Through these heuristics, managers can devise "*simple rules*" to direct organization-creating processes, prioritizing resource allocation, manage stakeholder collaboration, or facilitate service delivery systems. Such flexibility is even more important to technology companies, where changes in the market often demand nimble and informed responses.

The application of heuristics in uncertain and complex environments is also relevant for NSD. The construction industry has relied on heuristics to accommodate uncertainty and decision-making (Love et al., 2023). Even though their paper is targeted at a different domain, it could give good insights into technology initiatives, which are parts of NSD processes. Maitland and Sammartino (2015) likewise stress the function of heuristics in mitigating uncertainty, especially in politically and economically unstable environments. Their study highlights the importance of leveraging managerial experience to formulate heuristics that resolve the unique challenges of NSD, such as coordinating new services within existing infrastructure and managing cross-functional collaboration.

Moreover, integrating heuristics into NSD processes also enhances their strategic significance. Marle and Robin (2024) examine the formulation of heuristics that encompass strategic key components such as partner value and long-term organizational objectives. This integration implies that decision-making structures are efficient and match with overarching strategic objectives. Hodgkinson et al. (2023) explore the evolution of heuristics in executive contexts and emphasize their facilitative aspect of speeding up decision-making within the constraints of time and resources.

Managerial heuristics in the NSD processes specify a practical and flexible way of managing the complexity and uncertainty of the environment of technology firms. This research also builds a theoretical basis integrating decision-making frameworks with NSD optimization that argues for using heuristics to improve efficiency and effectiveness in service development. This dual strategy of theory and practice renders heuristics a fundamental element of New Service Development that propels innovation and the attainment of strategic goals.

2.2 Empirical literature on new service development

The new service development (NSD) process is much more dynamic and multidimensional, which is a vital part of supporting innovation and sustaining competitive advantage among industries. The extent of prior research on NSD in empirical studies has researched the NSD frameworks, NSD performance outcomes, and the impact of stakeholder collaboration. They presented a resource-process framework arguing for the resources and processes involved to be aligned to optimize the outcome of service development activities (Froehle & Roth, 2007). However, this framework is especially useful for understanding how organizations can condense NSD while keeping operational challenges in mind.

Multiple research studies have indicated that NSD performance is positively influenced by stakeholder collaboration. According to Melton and Hartline (2010), customers' perspectives and frontline employees play significant roles in the execution of innovations. Hence an introduction of such a new service is relevant. Incorporating different viewpoints help organizations improve their product quality and fit within the market. Hydle et al., (2016) suggest a useful framework for NSD practices that incorporates stakeholder input, providing a more pragmatic approach to navigating development bottlenecks.

The modes of innovation are also critical in NSD. According to Gremyr et al., (2014), incremental and radical innovation tend to complement each other as strategies for

attaining service excellence. In exercising these modes, firms can match their service offerings with changing market demands by striking a balance between short-term enhancements and long-term innovation ambitions. According to Hillebrand et al., (2011), the focus on market and customer enhances NSD performance significantly. There is empirical evidence that relates systematic processes with superior NSD performance. Standardized solutions make it possible to add more efficiency and lower the development risk, particularly for small and medium-sized enterprises. As Blommerde-Winters (2022) reviews critically, though these findings are not specific to the technology industry, they provide helpful insight for organizations attempting to improve their NSD processes through structured methodologies.

2.2.1 NSD in the technology sector

The challenges faced by NSD in the tech space are largely peculiar to this landscape due to rapid cycles of innovation, resource constraints, and the demand for agility. Kindström and Kowalkowski (2014) emphasizes the need to integrate service innovation into product-oriented business models as a key to success. Their study highlights the value of aligning service development activities with overarching strategic goals, thereby allowing technology companies to respond to market dynamics.

Industry-specific issues and constraints, such as scarcity of resources and the demand for constant innovation, lead to different but dynamic approaches in NSD. Huikkola and Kohtamäki (2020) examine the agile development methodologies employed by manufacturing companies, providing vital insight into the application of analogous strategies in technology companies. These methods reinforce flexibility and incremental enhancement to insulate organizations from the unpredictable characteristics of service innovation. In a technology-driven company, the first stages of NSD, termed "fuzzy front end," are usually very critical. Boukis and Kaminakis (2014) propose a conceptual

framework of how this phase should be managed and the important use of managerial heuristics to guide decision-making and reduce ambiguity. Also, Huikkola, Kohtamäki, and colleagues (2022) describe the application of simple heuristics in smart solution development, revealing how these tools can streamline intricate processes.

International contexts pose more obstacles to new service development in the technology sector. Kaartemo and Peltola (2009) examine a case study of a Finnish technopark company based in Russia and how cultural and legal disparities affect service expansion. The results highlight the importance of strategies and adaptation to find solutions for the global issues at hand. Kindström and Kowalkowski (2009) investigate a process approach for the advancement of manufacturing service offers, emphasizing the interactivity between innovation, resource utilization, and market demands. However, this perspective is mostly vital for understanding how technology companies can surmount industry-specific obstacles and attain sustained growth.

2.2.2 Decision-making in the NSD process

Decision-making is vital to New Service Development due to the inherent ambiguity and complexity of the process. Empirical research shows that managerial heuristics can enhance decision-making efficiency for managers by acting as simplification tools to achieve optimal outcomes. Such evidence is provided by Hafenbrädl et al., (2016), who show compelling evidence on how fast-and-frugal heuristics can reduce the cognitive load of decision-making within NSD. Through heuristics, which may prioritize key features of information and ignore irrelevant ones, this enables efficient and effective decisions to be made in dynamic environments.

Experience plays a significant role in developing and applying heuristics. According to Bingham and Eisenhardt (2011), "*simple rules*" often occur from having had to make complex decisions repeatedly. These rules empower managers with the information required to focus on specific decision points in NSD processes, including resource

allocation, stakeholder prioritization, and time management. The interaction between heuristics and experience is also illustrated by Maitland and Sammartino (2015), highlighting how managers improve their decision-making strategies to deal with uncertainty and reduce risks.

Fast-and-frugal heuristics also allow the collaborative facets of NSD. In a study by Marle and Robin (2024), they explored how strategic partnerships could be integrated into a heuristic decision-making framework, demonstrating how these tools can optimize decision-making in collaborative NSD settings. Therefore, this is particularly important for technology-driven NSD, where innovations and scalability are often driven by external partnerships.

In uncertain and complicated contexts, heuristics provide adaptive strategies for effective decision-making. Luan et al., (2019) elucidate that ecological rationality underlies these heuristics, facilitating decision-makers in aligning their tactics with environmental frameworks. This adaptability is essential for NSD, as swift alterations in market dynamics and technical progress necessitate prompt and informed decision-making. Studies highlight the crucial importance of heuristics at certain decision-making points in NSD processes. Love et al., (2023) mention how heuristics are used in the construction industry to reduce uncertainty and optimize resource allocation, offering insights for New Service Development (NSD) practitioners. They also strengthen the understanding of heuristics as powerful tools that can help navigate the challenges around NSD.

Heuristics also combine intuitive and intellectual decision-making. Artinger et al., (2015) argue that heuristics can be viewed as adaptive tools, promoting the process of moving from systematic processing to fast decision-making. This equilibrium is essential in NSD, where temporal and informational limitations frequently require prompt yet precise decisions.

Heuristics serve a structural function in NSD by simplifying the decision-making framework while ensuring alignment with organizational objectives. Heuristics act as cognitive shortcuts that enable managers to prioritize relevant variables and avoid information overload, according to Kruse et al., (2023). Consequently, these methodologies are powerful tools to use to optimize NSD processes with the inherent uncertainty in decision-making that the nature of NSD means can stall progress.

The concept of managerial heuristics adopted in NSD processes represents a certain preparation towards refining the efficiency and effectiveness of decision-making. Heuristics allow managers to navigate the complexities of new service development by addressing critical decision points to align decisions with strategic goals. Empirical studies emphasize that heuristics are flexible and useful instruments, confirming their importance as critical precursors to improving NSD processes.

2.2.3 Fast-and-frugal heuristics in practice

Specifically, due to their time-consuming and complex nature, NSD processes have started to leverage fast and frugal heuristics to reduce complexity. These are simple to implement, very generic heuristic techniques that help decisions by highlighting the salient characteristics and diminishing extraneous information.

Empirical evidence and case studies demonstrate how these mental shortcuts improve the speed and accuracy of decision-making when faced with complex and uncertain environments (Hafenbrädl et al., 2016). The tools and techniques of social network dynamics also provide insight into the unique problems that NSD faces, given their implementation in the real world. One of the central benefits of such fast-and-frugal heuristics lies in their ability to match decision-making strategies to environmental structures, which, as we have shown, facilitates resource allocation and substantially improves efficiency. Luan et al., (2019) describe ecological rationality as the basis for the

use of these heuristics that allow managers to deal with uncertainty without needing to gather comprehensive information. In NSD, this fluidity is hugely beneficial, with the high rates of innovation cadence and the time constraints inherent in taking things to market necessitating rapid yet effective decision-making.

Besides, case studies on different types of industries construction included emphasising the power of fast and frugal heuristics in complex decision-making contexts. Love et al., (2023) provide an example of heuristics in construction projects, showing how managers can use simplified decision rules to cope with uncertainty and resource constraints. These outcomes give NSD valuable information, particularly for tech businesses that face similar strain to innovate and evolve rapidly without compromising effectiveness. Fast-and-frugal heuristics also hold tremendous promise when it comes to collaboration. To maximise productive collaborative efforts in the development of services, Marle and Robin (2024) present the mechanisms through which these heuristic techniques can be integrated into decision-making frameworks to encompass strategic partnership considerations.

Nonetheless, this is extremely pertinent to NSD processes initiated in digital businesses, wherein these necessarily require partnerships as they need to innovate and scale. Both studies show empirical evidence for heuristics gained through experiential learning that enhances efficiency in decision-making in dynamic environments. Bingham and Eisenhardt (2011) describe the evolution of "simple rules" from hindsight, allowing managers to respond quickly and efficiently within continually changing contexts. Related research by Krabuanrat and Phelps (1998) investigates the balance between heuristic and logical decision-making and emphasizes how heuristics offer useful outcomes by being more effective in strategic decision-making. The importance of heuristics in NSD processes is especially noticeable in technologically advanced settings. Huikkola et al. (2022) explore how heuristics are applied to create novel concepts, enhancing decision-making and encouraging creative outcomes. Their results align with

more general issues about how to use heuristics tactically considering the turbulent nature and complexity of NSD.

Generally, fast and frugal heuristics offer a practical and effective means of improving NSD procedures. By embracing simplicity and adaptability, these heuristics avoid complex designs that become challenging to explain and coordinate collaboratively while offering swift solutions in situations with limited resources and time. These heuristics have continued to improve the effectiveness and efficiency of the decision-making process. As such, they have become an integral component of NSD that the literature has empirically reported on.

2.3 Theoretical framework

The theoretical framework developed in this thesis research overlaid decision-making theories as well as fast-and-frugal heuristics within the NSD practices. The research guidance provides a defined framework for optimizing and enhancing NSD processes in a multinational technology firm. But this framework cultivates iterative feedback loops, annotates how NSD outcomes can feed back into earlier phases of decision-making and practice embedding, and provides organizations with the ability to pursue an agile and responsive approach in complex, diverse, and uncertain environments. The framework employs the concept of ecological rationality to view heuristics as adaptable methods of decision-making that monitor the organization's objectives while reducing complexity (Luan et al., 2019). So, the other part of this structured approach is to answer the research question: ***How does the implementation of the 'fast and frugal' approach of managerial heuristics in technology companies affect the optimization and streamlining of their NSD processes?*** The components of the framework are listed as follows:

Decision-making foundations: This component is the theoretical foundation of the framework, which uses ecological rationality to align decision-making strategies with the

environment's structures (Luan et al., 2019). Hafenbrädl et al. (2016) direct heuristics to central heuristics, which lower cognitive demands and allow individuals to arrive at decisions quickly in uncertain situations. Thus, this flexibility is essential for the NSD since the need for immediate decisions while maintaining accuracy is driven by the fast-paced evolution of markets and technologies. One example of this would be the role of the manager, who could focus on the features requested by the most important customers and rapidly respond to the market needs versus spending time analyzing (Bingham & Eisenhardt, 2011). Regular refinement of such foundations based on the results of NSD is guaranteed by insight-driven refinement feedback loops. Likewise, iterative development cycles in response to customer feedback ensure that executives respond to customer needs while initiatives are progressing (Huikkola et al., 2022). The heuristics simplify decisions and help firms preserve agility in competitive settings.

Managerial adaptation and heuristics: The component of management adaptation and heuristics focuses on the creation and improvement of these strategies through experience and evolution. Hafenbrädl et al., (2016) refer to these rules as "fast and frugal," tuning them to select only relevant variables and ignore others, thereby offering adaptive strategies that enable excellent performance in uncertain and dynamic environments. Heuristics are particularly effective in strategic decision-making, which is crucial for NSD, including resource allocation, stakeholder collaboration, and prioritizing innovation. Heuristics such as "focus on the most vocal customer feedback first" help managers spend their limited resources effectively by reducing the exhaustive model building (Bingham & Eisenhardt, 2011). Coherent and actionable principles, such as prioritizing features with a customer retention impact of at least 10 per cent, facilitate collaboration with stakeholders and co-produce strategic goals during cross-functional project reviews (Calle-Escobar et al., 2016). For innovations centered on UX, heuristics (e.g., adding the less expensive of two equally impactful features) help teams make timely and cost-efficient decisions (Huikkola et al., 2022).

Since management adoption is iterative, heuristics persist over time. Learning mechanisms (e.g., refining heuristics) play a crucial role in continuously improving decision strategies by incorporating insights from the outcomes of NSD (Artinger et al., 2015, p. 302). Such feedback loops help organizations adapt to evolving market and internal environments, enhancing agility and responsiveness (Luan et al., 2019). However, the use of heuristics in NSD, such as agile development, illustrates this flexibility better. The heuristic “launch a minimum viable product (MVP) in three months of concept approval” is an example of a directive that ensures timely market entry and quick response to the customers’ needs (Huikkola et al., 2022). As well heuristics promote internal cooperation and team alignment toward shared objectives, reducing the complexity of decision-making during cross-functional interactions (Bingham & Eisenhardt, 2011).

Hence, this element, which focuses on how feedback loops consistently adjust decision rules over time, fits well into the larger theoretical scheme. It assists organizations in navigating complex NSD environments by balancing simplicity with adaptability. (Hafenbrädl et al., 2016). Since heuristic exploration can be viewed as an iterative process, it guarantees that heuristics evolve in response to escalating challenges, enabling firms to remain competitive in rapidly evolving markets (Huikkola & Kohtamäki, 2021). In this way, management adaptive heuristics transform into a higher-level decision-making tool that ensures NSD practices are efficient, collaborative, and sensitive to both internal and external demands, thereby contributing to optimization and quality improvement/enhancement in NSD processes.

Integration with NSD practices: One strategy is to integrate NSD practices and heuristics into agile and iterative development cycles, as well as operational activities that drive strategic initiatives. In the context of NSD, heuristics are significant during service design and delivery tasks, resource allocation decisions, customer interaction, and stakeholder engagement. In this way, heuristic-driven approaches allow organizations to prioritize high-impact tasks, which is important for resource efficiency and responsiveness to

dynamic market conditions (Huikkola & Kohtamäki, 2021). In tech companies where these challenges are common, such agility provides the capability to overcome hurdles such as scarcity of resources, inter-departmental coordination, and changing market dynamics.

On the other hand, empirical studies show that heuristics can play a role in decision-making frameworks in NSD. Calle-Escobar et al., (2016) highlight these processes, considering that one of the main areas of management that facilitates the interaction of multi-disciplinary teams is in the field of service design, where design issues often involve several stakeholders, and these can help simplify decision-making processes. Similarly, Huikkola et al., (2022) indicate how the heuristics are a guardian of the agility and responsiveness of NSD operations to meet market needs, aligning decision-making processes with the organizational objectives. A good illustration of this can be found in agile software development, where heuristics related to customer feedback assessment and prioritization may significantly contribute to service prototype adjustments and thus limit unnecessary slowdowns in the development process. This makes you innovative yet efficient enough to flourish in quick reaction time.

Heuristics allow organizations to optimize for efficiency, creativity, and speed. For instance, they strengthen agile development iterations by providing direction to produce minimum viable products (MVPs) under strict timelines, therefore facilitating rapid adjustments before products reach the market (Huikkola et al., 2022). These iterative processes allow NSD activities to be both resource-efficient and able to adapt dynamically to external pressures. At the centre of this integration is the “*Updating Practices*” feedback loop. The loop iteratively updates NSD practices by drawing upon lessons learned from optimization results. These iterative adjustments ensure heuristics remain timely and useful, enabling organizations to maintain alignment with strategic goals and evolving market dynamics. Such elements of NSD cannot merely be left into

static routines but embedded within the NSD practices of the firms to induce cooperation between the cross-functional teams to lead to adaptability and, ultimately, operational excellence under innovation-berserk.

Fast and frugal heuristics: This component demonstrates how heuristics are tools that support dealing with complexity. Heuristics, such as being able to deliver a minimum viable product in three months, facilitate speedy adaptations to emerging market needs and constant innovation (Huikkola et al., 2022). These heuristics help the agents in the team in the decision-making process by giving basic guidelines for quick decision-making to maintain an optimum level of both so they can act quickly without straining from a decision-making point of view (Bingham & Eisenhardt, 2011). These heuristics not only make NSD practices efficient and effective concerning outcome but also align with the rules of ecological rationality.

NSD optimizing, streamlining, and quality enhancement: The theoretical framework aims to achieve the most effective, fastest, and highest-quality New Service Development (NSD) process. The synergistic incorporation of principles of decision-making, business management, and evolutionary cycles enables their deployment and enhancement. Interestingly, heuristics provide appropriate tools to aid in balancing conflicting objectives to innovate while also being efficient, helping firms to timely adjust at the silo level while remaining dynamic and agile in a changing environment (Hafenbrädl et al., 2016). Besides, organizations can benefit from heuristics to optimize their operations and lower risks, especially in situations of complexity and uncertainty. One example of a heuristic you might create is: *“When in doubt, in regulatory environments, default to the strictest compliance standard.”* This reduces the risk of services being rushed into new global markets by ensuring compliance with all applicable standards while still maintaining speed in decision-making (Maitland &

Sammartino, 2015). A strategy enables organizations to quickly align their processes with outside needs while minimizing lag time and increasing operational congruity.

The iterative feedback loops created by the framework are essential in ensuring that NSD optimization and streamlining evolve as the marketplace changes. This structure allows the insights gained from optimization outcomes to bubble back up through decision-making under uncertainty as well as managerial heuristics to ensure constant legal experimentation and adaptability (Huikkola et al., 2022; Luan et al., 2019). Hence, this approach also keeps the heuristics up-to-date and user-friendly, fitting organizational objectives and product developments (Haafenbrädl et al., 2016). Incorporating these factors, the framework delivers a set of high-quality, efficient, cohesive strategies for achieving NSD outcomes (Calle-Escibar et al., 2016). However, this interdependence highlights the practical importance of heuristics in solving the operational problems affecting service delivery sectors within the innovation economy (Bingham & Eisenhardt, 2011). By curating these complex dynamics, the iterative nature of the framework enables firms to retain their competitive edge in this landscape that is defined by the dual challenges of innovation and efficiency (Huikkola & Kohtamäki).

The two major feedback loops achieve the adaptability of the theoretical framework. ***“Insight-driven refinement”***: In this first loop, when organizational objectives and market realities evolve, the lessons learned from the NSD results feedback adjust and transform the foundations of managerial heuristics designed to support decision-making. The second loop, ***“Updating practices,”*** informs iterative changes to the NSD processes that flow from step 1 and aims to ensure operational practices are flexible, responsive, and aligned with strategic priorities and goals based on real-time feedback. These mechanisms function as a dynamic system, continuously feeding back NSD outcomes to earlier components of the framework through their feedback loops. This

provides us with a higher adaptability and responsiveness to fluid situations (Huikkola et al., 2022; Luan et al., 2019).

Hence, this theoretical development integrates theoretical insights and empirical evidence to establish a connection between decision-making theories and NSD practices. The newest framework of heuristics is an attempt to break down the process into a systematic structure based on simplicity, adaptability, and experiential learning. Such traits provide agility to quickly make decisions and innovate, enabling organizations to react proactively to changing market conditions under a strategic alignment (Huikkola et al., 2021; Calle-Escobar et al., 2016). For example, fast-and-frugal heuristics eliminate complexity in decision processes by concentrating on the most important variables, resulting in efficient but relevant determinations even under pressure and in tech-embedded contexts (Hafenbrädl et al., 2016).

The iterative refinement of heuristics through feedback loops highlights the practical relevance of the framework. This heuristic-based approach assists in sustaining complexity management for organizations to reach operational efficiency while optimizing NSD activities. Although such a framework embeds into theory the application of the theoretical insights, it makes this theory very directly applicable to multinational technology firms whose operations take place in rapidly changing markets (Luan et al., 2019). For such an uncertain and dynamic environment, this structured methodology can align both innovation and efficiency for firms to maintain competitiveness and responsiveness. As a result, this thesis summarizes the literature discussed in the upcoming theoretical framework (Fig. 2).

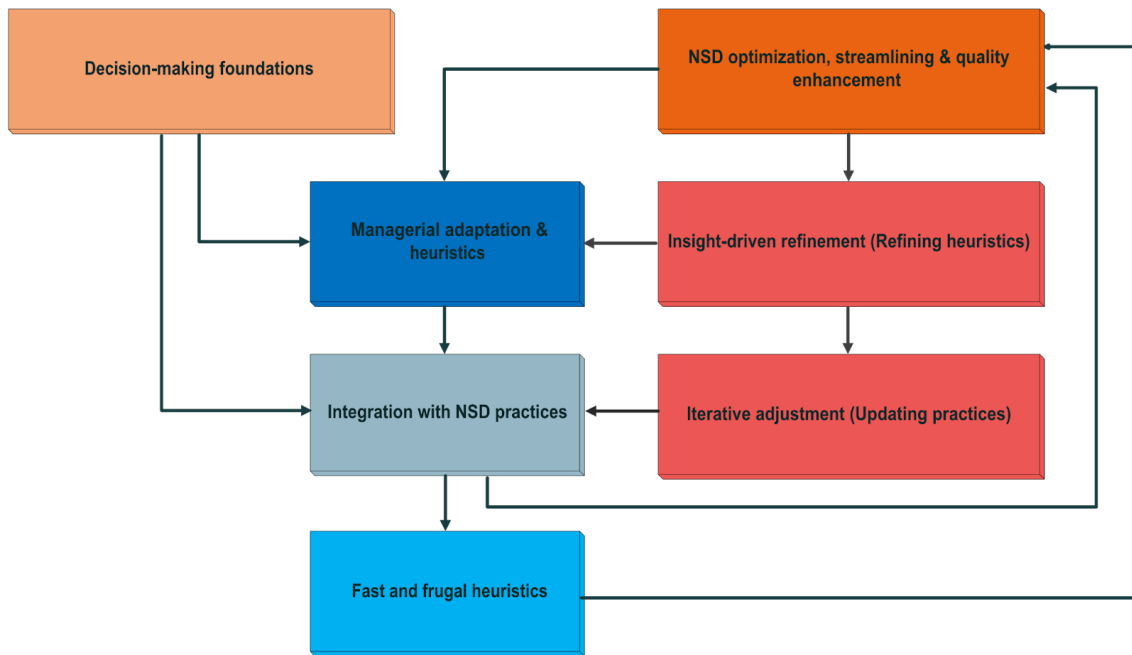


Figure 2. Theoretical framework: Integrating heuristics for NSD optimization and quality enhancement (IH-NOQE)

3 METHODOLOGY

Following on from insights gained from the previous chapter (a literature survey to provide context and refine research questions), this chapter deals with the methodology. It explains the philosophical assumptions that drove the study, the chosen research strategy, and the methods adopted in investigating managerial heuristics during the new service development process in a multinational technology company. The chapter elaborates on the case selection, data collection methods, and analytical techniques. “Each of these methods is described to demonstrate transparency and clearly illustrate how they contribute to a thorough and scientifically valid study.” The chapter also talks about the validity and reliability of the research, which assures that the findings shown in the upcoming chapters are robust and reliable.

3.1 Philosophical assumptions

Different research studies often have varying results, which is a function of the beliefs and preconceptions of the researcher, which will affect not only the approach taken to the problem but also the research method employed (Chua, 1986). The type of research project depends on the methodology applied during the implementation. To conduct an in-depth study of an occurrence, a researcher should adopt a research framework that influences the interpretation of knowledge and directs the research process, from data collection to result discovery (Saunders et al., 2012). Ontology refers to the assumptions of the researcher regarding the nature of reality or truth, which are largely connected to the choice of the subject, the methodology that is used, and the interpretation of knowledge (Burrell & Morgan, 1979; Bryman, 2016).

The evolution of knowledge in a certain domain is closely connected to other belief systems and assumptions (Saunders, Lewis & Thornhill 2019) Whether knowingly or not; researchers must make assumptions during their research endeavors. It is important to think through and identify these assumptions to design a research plan. This step is

important in ensuring the quality and rigor of the research structure (Burrell and Morgan, 2016; Saunders et al., 2019).

These assumptions include ontological (the realities encountered within the research process influence the researcher's approach to conducting research) and epistemological (what constitutes acceptable knowledge, individuals and social entities learning how to know) aspects (Saunders et al., 2016). The very nature of the paradigms in play deeply influences what research methods are chosen and how the findings are interpreted (Crotty, 1998 and Saunders et al., 2019). A consistent approach to research philosophy that reinforces these assumptions throughout the research and aligns them with all elements is critical (Saunders et al., 2016; Saunders et al., 2019). This is supported by Burrell and Morgan (1979), who stated that the study's basic principles are directed by the researcher's perception, both about ontology and epistemology. This study adopts an interpretivist perspective on research as it seeks to understand how managers experience and enact their roles in the NSD process. The interpretivist philosophy is based on socially constructed realities and the fact that both the researcher and the participants involved bring their perspectives to the topic in question. As Saunders et al., (2019) note, this approach branches out into a nuanced understanding of the various readings of complex social phenomena, NSD managerial heuristics in this instance, within a global multinational technology company.

The interpretivist approach aligns with a subjectivist perspective on both ontology and epistemology, referring to the belief that reality is shaped by individual experiences and perceptions and ideology about values, how knowledge develops and the way individuals' study and thereafter share this knowledge (Collis and Hussey, 2014). The connection between the researcher and how knowledge is obtained is influenced by the researcher's viewpoint (Killam, 2013). This study explores how managers influence the NSD process in technology firms, guided by a philosophical foundation rooted in a realist ontological stance. This implies that NSD processes, strategies, and managerial decisions are considered objective realities that have an existence outside of individual perceptions. While there are already some industry-set and market-oriented measures

for these processes, such as structural divisions (Burrell & Morgan 1979), personal interpretations and views by managers are still crucial. The study acknowledges these two factors: external market forces, which can skew managerial behavior to some extent, and the individual's perspective, which can add value through insight and creativity but does not dominate the process. The combination of realist and nominalist perspectives helps build a deeper understanding of the way managers deal with challenges, synthesize customer input, and prioritize financial targets in NSD (Grey et al., 2014).

Through an ontological lens, the study explores how managerial decisions correlate with external realities as well as internal beliefs. Such perspective informs the way the research is undertaken, especially the rigorous data gathering and analysis, through ontology's lens of knowledge creation, as noted by Creswell (2005). According to Burrell and Morgan (2017), truth is produced in the process of interactions between both elements, which provide a holistic perspective of managerial heuristics and influence on NSD. Epistemology, however, underscores the importance of what we can learn from understanding those experiences (Chowdhury, 2014; Saunders et al., 2019). We use this perspective to locate the process of making sense of the NSD process by managers themselves and how those sense-making processes shape their organizations.

This study adopts an abductive approach to theory development, integrating deductive and inductive reasoning in a recursive process. It combines the two and enables researchers to capture the essence of a phenomenon, develop themes, and improve theories through iterative analysis (Saunders et al., 2019). The template in this approach is based on existing literature, but it develops emergently, and therefore, this approach is well-suited to a study like this. The abductive approach is, therefore, appropriate for this study, as it allows for the connection between theoretical ideas and observed phenomena in the real world. Although previous research can help establish a baseline

of understanding about managers' involvement in NSD, interviews will surface specific practices, challenges, and nuances associated with this setting.

3.2 Research strategy

According to Creswell (2018), exploring the research approach is a significant way of driving up the volatility of social research. At the heart of achieving the aims of this study is that we consider a relevant method for both collecting and analyzing data. There are two fundamental classifications of research methodologies: qualitative approaches and quantitative approaches (Leppink, 2016). This study employed a qualitative study aiming for an early understanding of the subject of study. The qualitative research approach is based on systematic methodologies, and subjective data are included in the conclusion and recommendations. It is about understanding the why and how of things rather than just the what, where, and when. Understanding "why" and "how" is the core of qualitative research (Rahman, 2017).

The research design demonstrates how the research was conducted. There are three study research designs: explanatory, descriptive, and exploratory (Saunders et al., 2019). A research design is an outline, plan, or strategy that describes the procedures that are followed to investigate the research problem (Rezigalla, 2020). The exploratory research design is employed for this study, considering the nature of the study. The focus on smaller sample units rather than larger units, which can hinder in-depth investigation and discussion, has made exploratory studies especially compatible with this research approach (Leppink, 2016). This qualitative approach was appropriate, as, with this type of approach, data are collected and analyzed to facilitate in-depth means of probing the research problem (Cooper et al., 2007). Secondary data collection provides flexibility in analyzing data (Mugenda & Mugenda, 2003)

As argued by Saunders et al., (2012), having a clear understanding of the philosophical assumptions behind the research enables the researcher to have a strong base for efficiently planning the whole process of collection of data as well as analysis. This type of research uses options like interviews or content analysis. Hence, qualitative research allows a single phenomenon to unfold effectively, exploring the surface-level meanings found in these accounts from different organizations (Grey et al., 2014). Qualitative analysis was chosen as an appropriate tool for this research because of the time restrictions placed on the research.

3.3 Case firms/participants/sample

The case company of this study is a global technology firm with operations in marine and energy. The sample size included nine (9) key participants representing the company's stakeholders — vice presidents, directors, managers, and specialists who worked on developing and creating new services in multinational technology.

The participants in the study have different levels of experience, which span from 19 to 40 years, providing diverse perspectives from individuals in the field. The information was gathered via interviews, with two sessions held in person and the remaining seven conducted online. On average, the interviews lasted 29 minutes and 36 seconds, facilitating conversations tailored to each participant's specific domain of knowledge. To ensure privacy protection and confidentiality, participants are anonymized and given coded identities (P1 – P9) of their names. Their valuable input is anticipated to aid in comprehending the responsibilities of managers in enhancing NSD procedures in technology firms.

Glaser and Strauss (1967) describe the stage of data collection and analysis known as theoretical saturation as the stage when new data no longer produce new categories or insights, and the researcher is confident that the current data is enough to create a comprehensive and detailed understanding of the topic under study. Therefore, a

conscious effort was made to ensure that there were sufficient participants to present a wide range of opinions on the research questions. A multinational technology company served as the main case company for the research.

3.4 Data collection

The qualitative method of data collection and analysis was the adopted strategy for this research due to its appropriateness based on the nature of the research question, the philosophical assumptions, and following the research strategy. Furthermore, since the qualitative approach is interactive and naturalistic and thus well-suited (Saunders et al., 2019), the data-gathering process comprises collecting vital data to help the researcher attain the research goals by highlighting essential meaning from the data. In the scope of qualitative research, data can be categorised into primary and secondary. The two main methods of collecting data are through primary sources and secondary sources (Saunders et al., 2009; Yin, 2009). Primary data is defined as first-hand information obtained via interviews and observation. On the other hand, secondary data covers existing information such as notes, journals, video recordings, and comparable sources (Eriksson & Kovalainen, 2016).

Primary data were created through semi-structured interviews. The secondary case categories are examined by employing semi-structured interviews to elicit empirical data. According to Saunders et al., (2019), semi-structured interviews are especially good for explanatory research. The flexibility of Semi-structured interviews allows in-depth explanations to extract meaning and understanding (Saunders et al., 2019). Moreover, the study also features secondary data, which comes from company blogs, presentation slides, and published reports. A less explored domain, such as NSD, necessarily calls for an approach. Phair and Warren (2021) state that you need to research to make sense of this and construct theories. Data will be mainly collected through semi-structured interviews and a broad literature review. Borg and Gall (2003)

defined an interview as a research instrument which involves gathering the data through direct verbal interaction among individuals. Its greatest strength is its ability to adapt to whatever the circumstances.

To learn about how to bring services to the tech field, partners were interviewed at a multinational technology company, specifically for their thoughts and reflections while building service solutions. This included reading articles as well as reviewing business reports and case studies around launching services in the tech industry. These interviews served to solicit feedback from professionals representing the roles & levels present in organisations that are engaged in the process of NSD. This section provides the demographics of the participants, including their gender, profession, years of experience, data collection methods, and duration of the interview. The interviews were with senior managers, directors, vice presidents, and one president, all from a multinational technology company. Roles ranging from project planning, R&D, business development, and sustainable practices provide different perspectives relevant to NSD processes.

The table illustrates details of the conducted interviews for the research, including the mode of interviews, dates, and duration of each interview session. Largely, interviews were done virtually, for anywhere from about 19 to 45 minutes. Two were face-to-face, both on 17 September 2024, with the length of each being 44 minutes and 15 minutes, respectively. Online interviews accounted for a significant portion of the sample, according to the statistics, confirming that interview procedures can be tailored to the demands of interview subjects. All meetings were conducted in the English language, video recorded, and transcribed. The following table presents the details of the participants, and the additional interviews held within the scope of this study.

Table 1. Participants' details

Participants	Designation
P1	Senior Manager Project Planning and Control
P2	Director (R&D Engineering)

P3	Research & Technology
P4	General Manager, Project Management EEQ
P5	General Manager Research Coordination Funding
P6	Director, Sustainable Fuels & Decarbonization
P7	V.P Voyage Services
P8	President, Portfolio Business & Executive VP
P9	V.P Business Development Director

Table 2. Details of the interviews

Mode of interview(s)	Interview(s) date	Duration
Online	04.09.2024	45mins 11secs
Online	12.09.2024	21mins 36secs
Online	13.09.2024	30mins 36secs
Online	16.09.2024	26mins 59secs
Face-to-Face	17.09.2024	34mins 4secs
Face-to-Face	17.09.2024	44mins 12secs
Online	02.10.2024	15mins 1secs
Online	08.10.2024	28mins 50secs
Online	11.10.2024	19mins 54secs

A description from the table below shows that Participant (P1) is a male individual holding the position of senior manager in project planning and control. He has accumulated 19 years of experience in his field. The data collection method used was an interview, with a duration of approximately 45 minutes and 11 seconds. This depth of experience and seniority provides valuable understanding from a skilled professional in the project planning and control department. P2, a male and director of the R&D Engineering unit. He has held that position for over 35 years. The data was gathered from a 21-minute and 36-second interview.

P3: A male, Director of Research and Technology, with 32 years of experience in his field, was interviewed to gather data. The interview lasted approximately 30 minutes and 36 seconds. This participant's demographic profile reflects extensive experience and a senior role, which may provide in-depth insights into research and development perspectives. Besides, P4 is a male, a general manager of project management EEQ. He has a substantial level of experience, with 25 years in his role. The data was collected using the interview method with a time length of 26 minutes and 59 seconds. The high

levels of experience and seniority showcase a thorough understanding of the subject matter, helping to enrich the study.

P5: Male, general manager of research coordination and funding, has 24 years of industry experience in the field. The data was collected through the interview method, which lasted for 34 minutes and 4 seconds. The 6th participant (P6) is a male director of Sustainable Fuels & Decarbonization, and with 30 years of experience in his field, he possesses significant expertise and knowledge in sustainable fuels and decarbonisation. The data was collected through a face-to-face interview that lasted for 44 minutes and 12 seconds. This combination of experience and seniority indicates that the participant offers more insights into sustainable practices and decarbonisation protocols.

In this case, P7 is a man and holds the title of vice president of voyage services. He has 23 years of experience in his field; the participant brings a wealth of knowledge and expertise. As a data collection method, two interviews lasted 15 minutes and 1 second. These features give the characterization of a senior expert with an overview of significant management operations. P8 is female with the positions of president, portfolio and business, and executive VP. P9 (vice president of business development/male): He has held this position for 40 years. Data were collected from a 19-minute, 54-second interview.

Table 3. Summarized demographic characteristics of the participants and the interviews

Participants	Gender(s)	Designation	No. Years	Date	Duration
P1	Male	Sr. Manager, Project Planning and Control	19	04.09.2024	45mins 11secs
P2	Male	Director (R&D Engineering)	35	12.09.2024	21mins 36secs
P3	Male	Director, Research & Technology	32	11.10.2024	30mins 36secs
P4	Male	General Manager, Project Management EEQ	25	08.10.2024	26mins 59secs
P5	Male	General Manager Research Coordination Funding	24	02.10.2024	34mins 4secs

P6	Male	Director, Sustainable Fuels & Decarbonization	30	17.09.2024	44mins 12secs
P7	Male	V.P Voyage Services	23	17.09.2024	15mins 1secs
P8	Female	President, Portfolio Business & Executive VP	22	16.09.2024	28mins 50secs
P9	Male	V.P Business Development	40	13.09.2024	19mins 54secs

3.5 Data analysis

Glesne (2016) asserts that data analysis is when researchers set out to both organise and make sense of their data, transforming their data into what essence it should look like from its initial state so that it tells the story that readers can read in the form their hypothesis provides. Qualitative data collection typically relies on interpretation. This means that various explanations need to be given with the data because extensive qualitative evidence was gathered. Cohen et al. (2011) stated that data analysis in qualitative research is distinguished by the "*merging of analysis and interpretation and often by the merging of data collection with data analysis.*" (p.537).

In this research, thematic analysis is used as the primary tool for evaluating managerial heuristics in the NSD process in a global technology company. This entails coding and interpreting qualitative data arising from interviews to elicit recurring themes and patterns of relevance to managerial practices and decision-making in NSD.

The author of this thesis initially open-coded raw interview data, following Thorne's (2000) iterative process, to extract in vivo codes and descriptive summaries of participant utterances. Subsequently, the author employed axial coding to sort and link these open codes, which facilitated the emergence of core themes that reflected the managerial heuristics, strategic priorities, and organizational influences in NSD. Transforming data into a coherent narrative requires restructuring it to communicate a sense of participant thought and lived experiences (Glesne, 2016). Hence, this

mechanism enabled us to explore the intricacies of the managers' work within the NSD context, where the cycle of collection and analysis necessitates the separation of understanding from its interpretation (Cohen et al., 2011).

The thesis's author coded inductively and used managerial heuristics in NSD initiatives in technology companies. This meant that codes could develop from the data without predetermined categories, which is especially useful when investigating poorly understood features of management practices in NSD. By this methodology, the study aimed to fulfil the following objectives: to evaluate the effectiveness and efficiency of existing NSD processes, identify key decision points and situations at which important managerial heuristics could streamline decision-making, optimize the NSD process for improved efficiency and quality, and integrate specific heuristics into NSD practices.

3.6 Ethical consideration, validation and reliability

Several principles were integrated into the interview design, which was voluntary participation, the right to privacy, and anonymity and confidentiality of information. Regarding voluntary participation, the participants were invited to participate willingly in the data collection process. In the guide, participants were discouraged from providing detailed personal information such as names, contact numbers, and addresses to alleviate anonymity concerns. The participants were assured that their identities would not be made public nor used for any purpose outside this study. Furthermore, the research ensured that information was kept confidential, assuring the participants that any information they filled in would be kept secret and would not be used against them.

“The qualitative paradigm assumes that reality is socially constructed and that it is what participants perceive it to be. This lens suggests the importance of checking how accurately participants’ realities have been represented in the final account” (Creswell & Miller, 2000, p. 125).

Validity and reliability act as credibility frameworks used to assess the quality of research. Validity is related to whether the research measures what it is intended to measure (Saunders et al. 2019); this enables accurate data collection and analysis. Reliability concerns consistency: it is about how repeatable research is. In short, reliability measures whether the same method, if used by another researcher, yields similar outcomes.

The terms authenticity, goodness, verisimilitude, adequacy, trustworthiness, plausibility, validation, and credibility have been used by qualitative researchers in place of the term validity (Creswell and Miller, 2010). Schwandt (1997) mentions that characterization is the extent to which an account accurately represents participants' realities of social phenomena and is credible to the people studied. Morse et al. (2002), breaking this down further, state that validity relies on an ongoing iterative process that enables the researcher to move between design and implementation, ensuring consistency among question formulation, literature, recruitment, data collection strategies, and analysis.

Thompson (2016) argues that participant observation is largely dependent on the individual characteristics and skills of the researcher. Therefore, repeatability is difficult, if not impossible, to achieve. According to Saunders et al. (2016), semi-structured interviews tend to be difficult to maintain repeatability because the data is collected over time and can change. However, both participant observation and semi-structured interviews are still considered to validate (Saunders et al., 2016; Thompson, 2016). Nonetheless, the use of recorded interviews and transcripts produced using semi-structured interviews as data in this study, as well as the detailed description of the research aspects employed, supports study reliability since the study provides a basis on which interpretation is provided. To assess the trustworthiness of the study, data interpretation was shared with participants for validation. Moreover, forming a data

structure is fundamental to verifying the correctness of this qualitative research (Nag et al., 2007).

4 FINDINGS

This section presents the findings of the data analysis, whose goal is to explore and enhance an in-depth view of the managerial heuristics, specifically the *'fast and frugal' approach*, in optimizing and streamlining the New Service Development (NSD) processes within a multinational technology company. In addition, the study seeks to find crucial decision points within these pathways where specific fast and frugal heuristics can be employed to reduce decision-making time while improving their outcomes. Further findings collectively provide a gradual enhancement of NSD practices, ensuring that they are both effective and adaptive to evolving industry needs.

Semi-structured interview thematic analysis: The analysis of all the transcripts from the semi-structured interview revealed the following themes, illustrated in Figure 3 as randomly listed below: decision-making and heuristics in NSD (theme 1), Customer-oriented focus (theme 2), Effectiveness and efficiency in NSD processes (theme 3), Quality assurance in service development (theme 4), and Difficulties applying managerial heuristics (theme 5).

Emerged Themes

After careful analysis of all the transcripts, the following themes emerged:

- **Theme 1:** Decision-making and heuristics in NSD
- **Theme 2:** Customer-oriented focus
- **Theme 3:** Efficiency and Effectiveness in NSD processes
- **Theme 4:** Quality assurance in service development
- **Theme 5:** Difficulties applying managerial heuristics

The subsequent thematic map (Figure 3) illustrates themes and subtitled themes, which are derived following an extensive review of every transcript:

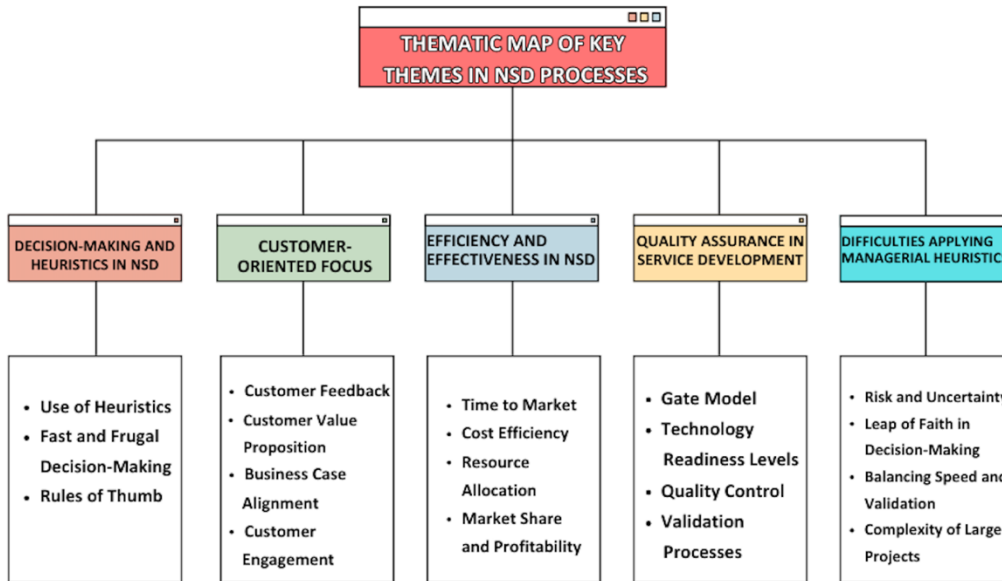


Figure 3. Thematic map

Theme 1: Decision-making and heuristics in NSD

Managers can utilize decision-making strategies to streamline the NSD process effectively and efficiently. Fast and economical decision rules that emphasize efficiency over information are particularly beneficial in paced and intricate fields such as technology, where making timely decisions is essential for maintaining competitiveness. Through exploring these guidelines and strategies, the aim is to find methods to streamline decision-making in NSD by simplifying complexities while staying focused. Executing and following this framework into the NSD procedure can empower managers to make decisions that boost the pace and flexibility of service development without sacrificing excellence.

(P3) commented: *“In the context of service development, I recognise that certain assumptions are always necessary because it’s impossible to have a complete picture or accurately predict which customers will adopt a solution. A few years ago, when One Company’s regulation was introduced, requiring vessels to comply with new emissions standards by the end of 2023, we had to make assumptions to move forward. One of the immediate solutions we considered was limiting the power of the engines to meet the regulatory requirements. Based on a rule of thumb, we could roughly estimate what*

kinds of vessels and operating profiles would probably adopt this solution. Given these assumptions, we decided the potential market was large enough to warrant building out the solution, and we moved quickly. If we had spent years doing in-depth studies/research or consulting with thousands of customers before making our decision, we would have missed an important window of opportunity. When things like this happen, speed and making informed assumptions are the two things you need to be competitive and answer the needs of the market.” (P3)

There is a demonstration of a growing interest in how managers make decisions (Cui et al., 2019; Dahmani et al., 2020). During periods of strategic change, managers need to approach decision-making cautiously, especially in environments characterised by risk and complexity. Managers, however, tend to shift to automatic mode, resulting in a fast, effective, and often reflexive approach to decision-making that is heuristic-based (Huikkola & Kohtamäki, 2021). P4 provided an elaborate scenario: *“When I invest in an R&D project or work on developing a new concept, I begin by establishing a solid business case. In one of my previous roles, we faced the same problem multiple times, which is why this approach had become imperative. Our customers used bow tester devices that help maneuver ships sideways during berthing, but when they malfunctioned, they couldn’t afford a ten-week wait for a replacement. Recognising this as a potential service gap, we proposed a rental service for swing sets, where customers could receive a replacement within a week, albeit at a premium price. To assess the practicality of this concept, we had to create a business case. This included calculating the funds needed to maintain an inventory of swing sets for rental and predicting the interest from potential customers who might utilise this offering. The business case played a role in determining whether to move with this investment.” (P4).*

Innovation is of paramount importance for managers to gain a competitive advantage. In the difficult market environment of today, constant enhancement of customer satisfaction and the quality of services should be put first, as well as stimulating innovations in the design of the service, which will determine the edge over competitors

(Andreassen et al., 2016). P1 affirmed by stating, *"I think the bottom line is that whatever we create should be of high quality." We must be careful in the process, and if at any point we feel like the quality is compromised, we must step back and re-evaluate our approach, adapt, possibly redesign from scratch, or go back to an earlier successful method if there is nothing wrong with reproducing it. In principle, I agree with the need to explore new ways of improving; however, "quality must never be sacrificed on the altar of such improvements" (P1). To onboard new services successfully, the business strategy must align with the service strategy (Ryu & Lee, 2015). These alignments have several benefits, including that they enable managers to strategically ascertain target markets, endorse synergy between organisational innovation endeavors, and allow similar methods to be employed from previous NSD efforts (Van der Panne et al. 2003).* Participants mentioned some advantages of activities or roles that could eventually lead to efficiency.

Moreover, P3 stated, *"In our company, we follow a single, standardized process for service offering development. This process is structured around a gate model, with clearly defined steps at each stage. While the steps themselves remain consistent, the approval process can vary depending on the value of the project. Essentially, the higher the value of the development, the further up the organisation the approval must go. However, we don't have multiple processes to choose from; there is only one unified process that applies to all service developments. The variation in the approval path is simply related to the escalation levels based on the project's value" (P3). "As a multinational technology company, we started a continuous improvement initiative last year, building on a long-standing commitment to optimizing our processes. This is not our first attempt of its kind in the past years; we have rolled out initiatives such as Operational Excellence driven by the focus on reducing waste. From our perspective, controlling waste entails more than reducing it; this means streamlining efficiency and finding ways to work more efficiently. This dedication to growth is vital to our approach. I regularly stress to our team that in an evolving industry, if we fail to adjust and grow,*

we run the risk of waning out of competition. This mentality forces us to always strive for enhancement" (P4).

Moreover, experiences reported by participants around the application of heuristics by managers at a multinational technology company during the NSD process were heterogeneous. Oftentimes, these heuristics or guidelines helped them execute efficient, faster decisions in the face of uncertainty, they said. *"In a recent project, we modified the engines of LNG carriers from dual fuel running on both gas and diesel to operate purely on gas. This shift to pure gas technology not only improves fuel efficiency but also reduces emissions, which is particularly important in today's regulatory environment, where emissions can lead to financial penalties. This project leveraged higher-level management earlier on to approve the concept and feasibility, including costs, timelines, and market potential. Going forward, we had regular steering committees where management reviewed our progress to validate, we were on track. Before the full market release, we needed to prove that the offering could achieve these goals. This structured process, with gate checkpoints, really shows how a multinational technology company ensures alignment with our strategic objectives and sets up a successful introduction to the market" (P2).*

A participant experience: *"In my last experience, we even had a workshop that was set up to kick off new service developments, and we brought people from different functions there. These workshops are like service design workshops that help us have a structured process and explore various aspects of the service we're designing. During these sessions, each person brings their insights and "rules of thumb" to the table, which shapes our approach. We typically don't rely heavily on external analytics at that stage; instead, we draw on our collective knowledge and experience. In mere days, we can have a good outline and direction for what a new solution might be. A nicely configured workshop with the right agenda and a good facilitator can achieve what could take months otherwise. This approach not only speeds up progress but also gives everyone a sense of ownership over the project, which goes a long way when it comes time to bring the idea to life." (P7)*

A participant emphasised that these heuristics add value since they reduce complexity, enhance efficiency, and enable timely action, all vital in the NSD setting. *"In a company of our size, I see a straightforward governance structure as essential for ensuring transparency in our decision-making. The key here is for everyone to be fully aligned and clearly understand the reasoning behind the decisions we make. Our tasks are carried out more efficiently when the whole team is on the same page. Having a clear governance structure together with transparency is not just important but instrumental to our success"* (P5).

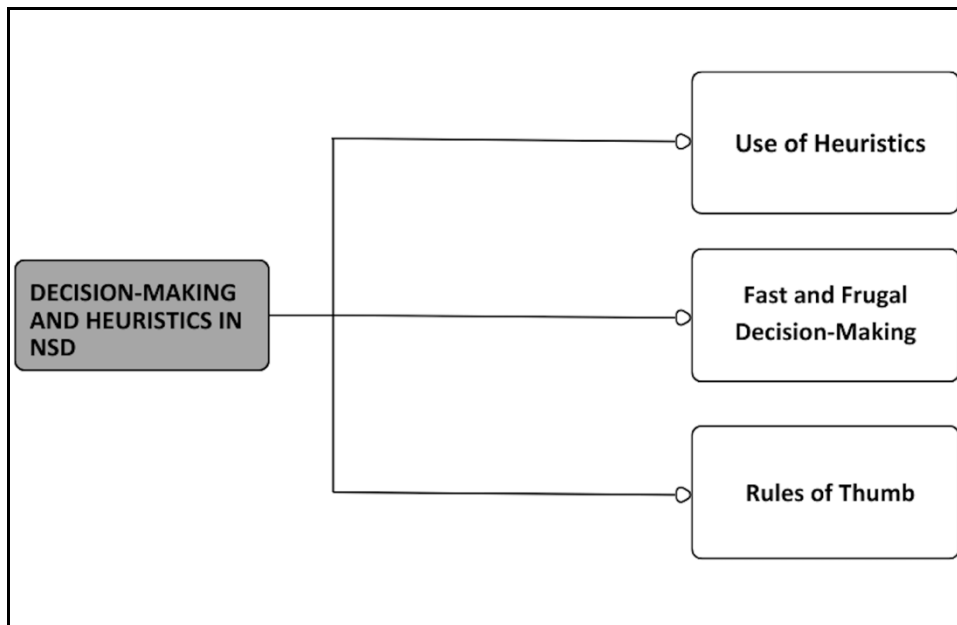


Figure 4. Thematic map: Decision-making and heuristics in NSD

Theme 2: Customer-oriented focus

One of the key themes that arose in the study was the increase in customer centricity in a multinational technology company's NSD process. In the past, the company had put more emphasis on technology innovation as a primary engine behind new service development. Customer needs were often an afterthought, even if the technology was certainly ahead of its time. This sometimes resulted in the company's output not matching customers' expectations.

Yet, in the last few years, we have nonetheless noted some very positive developments in the company's approach to NSD, moving even further toward a focus on a methodology that involves understanding your customer needs and then using that understanding as a basis for the design solution. Moving forward, the company is putting an increased emphasis on aligning innovations with the expectations and challenges experienced by the same end-users adapting to technology. These changes are not orthodox and mark a substantial change within the methods. According to P9, this is mainly because of a changed focus on building a good business case and value proposition for clients. In the current NSD process, a demanding appraisal of both the technical and operational feasibility of new products and their capability to provide empirical value for customers has been taken into consideration. A detailed understanding of user needs and assessment of how the suggested solution would drive measurable business returns. With an emphasis on customer-driven value, a multinational technology company can build a more sustainable and market-driven approach to innovation.

However, this movement toward customer-centricity has resulted in more informed and deliberate decision-making within the organization. This newer version typically includes customer validation as a must-have step in any NSD process, according to P9. The early-stage feedback is crucial to improve and validate the service and allow the company to assess market viability ahead of time and costs associated with large-scale service development. So, these are data-driven changes based on customer understanding and feedback, minimizing the risk of having invested in products that have no customer interest. In line with this customer-first approach, Participants 6 and 7 also noted that customer feedback is a key element in defining the direction of new services and products. These feedback loops, they suggested, had sprung up as a central linchpin in the multinational technology company development cycle, with both parties ensuring things aligned even from the human-tech cycle perspective. *"I think there have been huge advances, especially in understanding customer opinions and the views of*

other stakeholders, to make impactful improvements. This approach is crucial. Our focus is on listening to our customers closely and collaborating with them to find solutions that best meet their needs.” (P7).

Moreover, adopting rapid prototyping and engaging the customers earlier in the NSD process has been increasingly practiced. As noted by P7, through rapid prototyping and solicitation of customer feedback in the early stages of development, multinational technology can iteratively improve its solution to better satisfy customer needs before launching the product. *“If our developed services are not being utilized, it indicates we may be on the wrong track. Our Approach To reduce this risk, we have been trying to work closer with customers early in the process. Speaking to them directly provides huge insights into what creates value. That means we know what they want, and we make sure that their needs fit with what we create and not put them in a corner and test ideas that do not resonate in the market” (P6).*

In this respect, an NSD process of a multinational technology company is a significant shift in the way a company approaches innovation, with the customers always at the center point. By building on insights from customers at the front end of the product life cycle, the company assures that all new services and products are both technologically and contextually advanced and relevant to their customers. These two factors, focusing on the customers, lead to better satisfaction and output for the company, thus making these initiatives the road to the wider business goals of long-term success in the market with relatively high volumes.

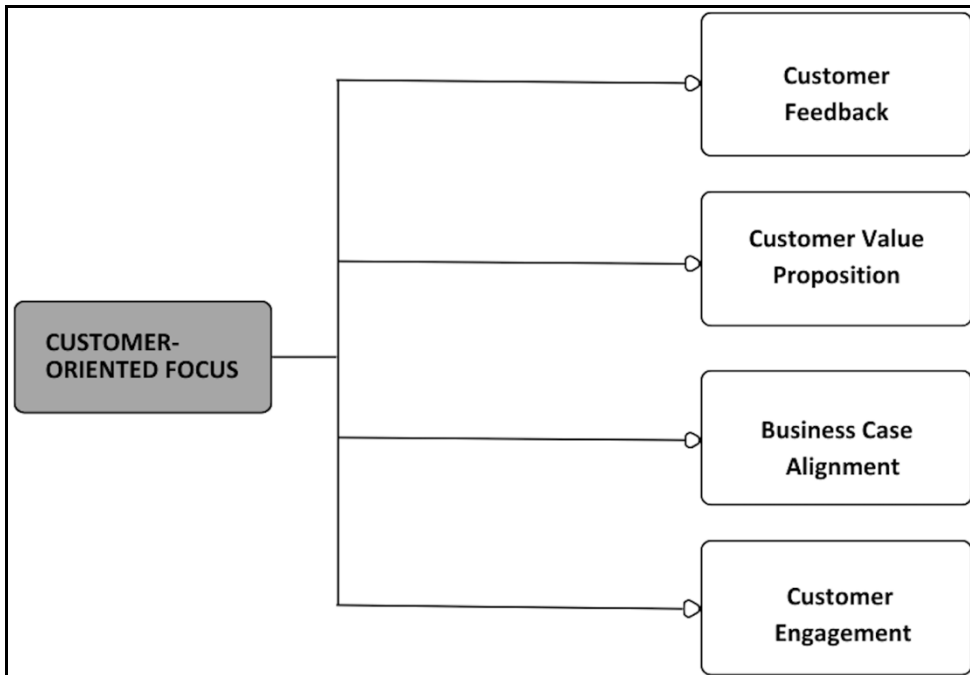


Figure 5. Thematic map: Customer-oriented focus

Theme 3: Efficiency and effectiveness in NSD processes

Enhancing NSD practices is pivotal to delivering effective and efficient engineering of services in terms of quality and resources, something that is expected within the competitive tech sector. For technology organisations, optimising NSD operations to accelerate speed and quality is critical, especially given the scope involved. Prioritising efficiency in this goal means cutting down on inefficiencies like redundancies and delays in the NSD process, empowering companies to use their resources. *“We have established internal guidelines for developing each of these steps. These guidelines ensure that we approach the development of services in a structured and efficient way. Additionally, for services that require development, we assess the associated costs and the impact on the organisation. Depending on the scale of the development, especially if it involves multimillion-dollar investment, we seek approval at various levels within the organisation, and in some cases, this even requires approval from top management”* (P2).

Tech companies often take NSDs at high-stakes, complex issues in time-pressing situations. Understanding these moments well can be incredibly powerful, as they allow managers to apply heuristics that avoid unnecessary deliberation, minimize resource investments, and accelerate the time-to-market of new services. Staying ahead in the ever-evolving technology sector today requires swift decision-making. Unlike previous studies that focused solely on cognitive elements, this new research on heuristics includes different factors as well. "We employ various project management and development tools to ensure visibility throughout the entire development process.". We also have a unique system of technical 'serenity' levels and a gate model, which we rely on to continuously review, assess, and refine our work to ensure quality and alignment at every stage" (P5). For instance, Hodgkinson and Healey (2011) introduced a framework for emotionally informed heuristics, suggesting that these may significantly influence dynamic capabilities at the micro level.

The current tech landscape, which is changing at a rapid pace, necessitates businesses to act more swiftly than ever. Indeed, participant 7 opined, *"Decarbonization is very high on everybody's priority list now, likewise customer satisfaction. In the end, it will be important to understand the needs of our customers and offer solutions that meet those needs. We must make sure that we are reaching not only environmental targets but also value-added that resonates with our customers."* (P7)

Adopting a structured approach can assist organisations in effectively integrating customer needs into the New Service Development (NSD) process (Biemans et al., 2016). *"When there is discussion on new services, yes, it does include services or new products, but it is not as easy as just following a set of protocols. While R&D has its processes and frameworks that we follow, the root of our innovation starts with customer needs or through the drive to integrate new technologies into our services. There isn't a rigid blueprint for innovation; after all, creativity can't be confined by fixed rules. It sparks from inspiration. The real challenge is how you capture that inspiration, channel it, and decide which ideas are worth pursuing. There is still a selection process because not all*

innovative ideas can be pursued. Essentially, the goal is to map out your ideas based on how easy they are to implement and their potential yield” (P4).

Simultaneously emphasizing quality ensures that services that are launched meet or exceed industry and customer standards. This is to enable managers to enhance NSD processes to increase efficiency and prepare their company for innovation, success, and prosperity in the market. Making an analogy with new products, research on New Service Development (NSD) has treated services as a type of service offering, like goods, but focused mainly on their development and management (Barrett et al., 2015). Participant 4 added on service offerings: *“In addition to the earlier comment, there is a selection process in place, as not every idea can be developed. We generally base this selection on financial feasibility. How much potential revenue can the idea generate compared to the investment needed? For example, it may be prioritised when an idea can be executed in two months with high returns. But if it’s a three-year project with the same high returns, it requires a different level of consideration. Ultimately, we aim to assess and focus on ideas based on how easy they are to implement and their potential yield.” (P4).* NSD plays a prominent role in improving a firm's financial (Aas & Pedersen, 2011; Dotzel et al., 2013; Melton & Hartline, 2010) and non-financial performance (Blazevic & Lievens, 2004; Thakur & Hale, 2013), making such phenomena evident and relatable.

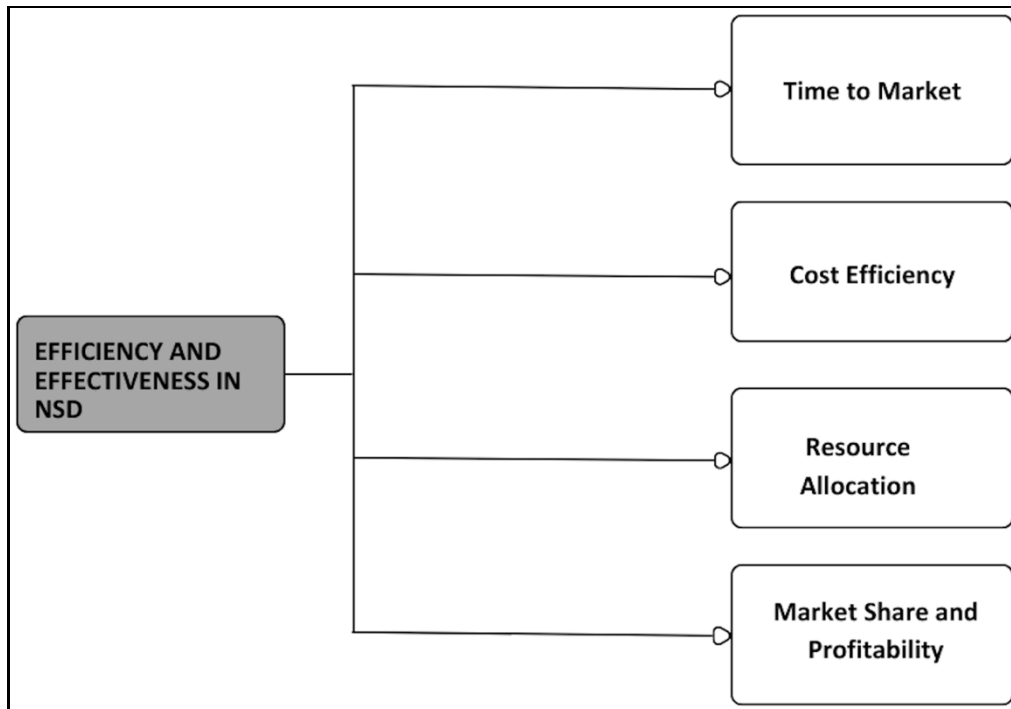


Figure 6. Thematic map: Efficiency and effectiveness in NSD

Theme 4: Quality assurance in service development

Adaptability through forms of individual, social, and evolutionary learning enabled managers to act confidently and flexibly in complex, emergent situations. *P8 noted* “There are certain things you keep checking along the way, but it’s difficult to articulate them. It’s one of those things that you only know by doing, over and over. You don’t need to review the criteria every time; it becomes second nature. Of course, the process requires structure, and you approach it from multiple perspectives. This helps in reaching an outcome and shaping the concept, especially since various participants and decision-makers are involved” (*P8*).

The concept of “value” in NSD research was traditionally perceived as something that firms were creating and delivering to customers by themselves. However, more recent views on value regard it as co-created through an interplay of firms and customers. From this new information, we understand that value is about more than just a product or service; however, the experiences customers have and how they engage with the service in their own contexts. As a result, this highlights that, in defining the value of a service,

customer engagement and the specific circumstances of its use are key. (Gummesson & Mele, 2010; Grönroos & Voima, 2013). P1 commented: *"I think the biggest improvement has been the level of overall awareness of everyone in the industry has progressed. People now have a clearer understanding of the entire value chain, recognising where they fit within it and identifying the other stakeholders involved. Not everyone is necessarily applying all these lean principles in their daily work, and that's okay, I say, if they are aware of them. The key learning is that we're all in it together, so everybody must know how the shared process works, what the endpoint is, and where they fit into that chain. By seeing how we contribute, we can better support our colleagues in doing their job well, too."* (P1).

Recent research has challenged the earlier view that heuristics are merely a product of cognitive limitations and inherently lead to suboptimal decisions (Kahneman, 2011). The original idea was that heuristics, mental shortcuts people use to make decisions, are not simply a result of limited cognitive ability and do not automatically produce bad decisions. Initially, heuristics were just a consequence of the limitations of human cognitive resources and usually included errors or bias. Yet, recent studies, such as Kahneman (2011), argue heuristics can guide us well and can lead us to good decision sometimes.

"There are several layers where discussions and decisions unfold. It all begins at the foundational level with Product Lifecycle Management or PLM. This is where various stakeholders, such as sales teams, product managers, and R&D, bring their ideas and insights to the table. The next phase is what we call Product Portfolio Management (PPM) after ideas are collected. This is where we look systematically at the full portfolio, appraising those campaigns that make up the most strategic path forward for the product or engine in question. So, for instance, we get to choose which engine should be first in line for development and which should be second, and so on. This way, our development is aligned with our business and the market needs." (P4)

One way to move forward is by recognising foundation elements that form rules of thumb and guidelines. This method might streamline the rules of thumb into a compact collection of elements akin how basic particles combine to form chemical elements in the periodic table. Three primary building blocks have been suggested (Gigerenzer et al., 1999) search rules, which define the direction of exploration within the search space; 2) stopping rules, which indicate when to end the search; and 3) decision rules, which determine how the final decision is made. *“Well, we have an eight-stage development process, where at the first phase, when starting the development of the service process, we have an approval, which is asked from higher up in the organisation. Then the development team goes on and makes, for example, GATE 1, 2, and 3 further forward and at a certain stage before releasing, which also needs to be approved by the same higher-level organisation before starting to roll it out and take it into use; so, Gate stage model” (P2).*

The set of heuristics and foundational components available to an individual or species for forming heuristics, along with the core cognitive abilities these components utilise, is referred to as the adaptive toolbox (Gigerenzer et al., 1999). These core abilities include recognition memory, frequency tracking, object tracking, and imitation skills, which differ systematically across species and individuals. Heuristics can be efficient and streamlined precisely because these fundamental cognitive capacities are already established, as stated, *“When we validate new features, we of course know what we are aiming at and we know what the targets are, and these are predefined by these guidelines as well” (P9).*

How is the selection of heuristics determined for a specific problem? While some authors suggest that the challenge of selecting a suitable approach is unique to heuristics (Newell, 2005; Glockner et al., 2010), this issue also extends to statistical models of cognition. As P4 stated: *“I think it starts with building a business case that includes a couple of key pieces. But it’s not just about adhering to a strict code. You have an idea, but how do you build a concept? This must be underlined by a business case; otherwise, it becomes difficult to know whether you should pursue the idea or kill it” (P4).* Some

research did note a change in decision-making by managers and organisations. Instead of following rigid, recognized, official procedures (which may require extensive data collection, detail analysis, and pre-defined protocol), they often use heuristics, which are simpler and more flexible ways. Heuristics, or *"rules of thumb,"* are shortcuts or general strategies that help humans make quick judgements even with very limited information available; heuristics are typically applied in situations of uncertainty or time pressure and usually involve making decisions based only on the most relevant but limited data available (Bingham & Eisenhardt, 2011).

"I think the process we are working through is well established, so rather than question if that process is efficient, I think we focus on whether we are getting the right outcome. We do everything we can also to minimize new projects unless we feel we have a solid business case before we go in. "Over the last few years, we've increasingly looked at the business case around a value proposition, framing it from the customer's perspective, as opposed to just looking at it as a technology development program" (P3). Unlike the dominant view of heuristics and biases, the fast and frugal heuristics approach deals with decision-making under uncertainty in vague contexts. Heuristics appear to be particularly successful under these circumstances, research suggests. *"We have our sort of governing, or, I should say, principles, ways of working, and our processes. So, whatever we are kind of developing should go with that" (P1).*

Furthermore, this adaptability of heuristics may stem from learning processes occurring at individual, social, and evolutionary levels (e.g., Boyd & Richerson, 2005; Gigerenzer, Hoffrage, & Goldstein, 2008). Formal heuristics models provide more precision than classifications; however, accuracy alone does not encompass the entirety of heuristic science. To broaden our understanding, it's crucial to have a structure that effectively integrates rules of thumb. Numerous models exist, and even if one assumes that the mind relies on a single statistical tool like Bayes regression or neural networks, the selection challenge then shifts to determining how parameter values are chosen to

address each new problem (Marewski, 2010). On the issue of each new problem, P5 attested: *“Yes, we utilise a portfolio process. There are straightforward covenants in place, and new developments or ideas are presented for decision-making through this governance structure” (P5)*. One of the problems of entrepreneurial ecosystems revolves around the coordination of resources and innovation projects amongst stakeholders to harness the potential of these opportunities (Endres et al., 2021). *“We must guarantee that the solutions we provide to customers are working.” It’s not acceptable to follow up a week later to check if a product is still working. We apply a three-step method for developing new features, services, or products to do this” (P6)*.

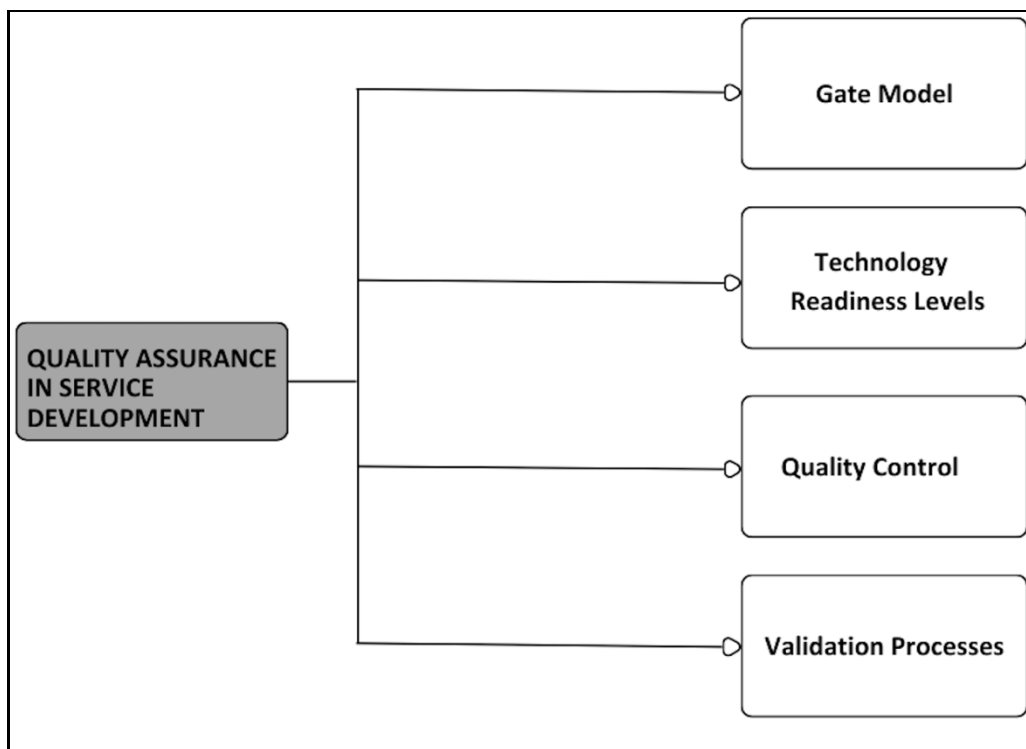


Figure 7. Thematic map: Quality assurance in service development

Theme 5: Difficulties applying managerial heuristics

Under the presence of limited time/information, managerial heuristics offer a helpful (and often influential) shortcut to reduce complexity and speed up decision-making, as they are bound to do, but they also present challenges themselves. These types of

challenges include uncertainty and risk, the appropriateness of heuristics in the context of large complexity, the risks of overuse and misuse, the balancing act between speed and validation, poor assessment of market demand, as well as a necessity for customer centricity. Such a consistent framework poses one main challenge: heuristics are speculative by nature, with inherent uncertainty and risk. P9 described the use of heuristics as a “leap of faith,” explaining that decisions made on assumptions and prior experiences are not guaranteed to be successful. This view is reflective of the overarching themes revealed by other participants, who collectively emphasized that heuristic-based decision-making carries a level of uncertainty and risk. Similar apprehension regarding the reliability of heuristics in dynamic contexts was expressed by P6: For example, he raised the concern about the difficult predictability of a new variable affecting an expected outcome.

Nevertheless, it is especially problematic in high-stakes contexts, where the lack of comprehensive information can create a great deal of uncertainty. Heuristics are fast and frugal, which is very helpful when it comes to situations with time pressure or lack of data. However, relying on simpler and faster decision-making processes constantly can put managers at risk by missing out on important subtleties or challenges of a problem. Optimistic factoring, for example, might cause potential losses to become unreachable in fast-moving and competitive marketplaces. The other problem is whether heuristics make sense for big and complex projects. Heuristics may be useful for speeding up decision-making.

However, P8 highlighted that they may not be appropriate for bigger, more impactful projects, which require a lot of investment. Such projects typically call for thorough analysis, thorough risk analysis, and thorough planning, which heuristics may not, by definition, lend themselves to. Over-reliance on heuristics in such cases can also lead to avoidable blunders, such as misallocation of resources or misalignment with strategic

objectives. In this case, it shows how important it is to use both heuristics and more formal decision-making tools, like stage-gate models or decision trees, to help with steps such as risk assessment, resource allocation, and strategic alignment for big projects.

The overuse and misuse of heuristics is another challenge. P8 highlighted the drawbacks of relying on heuristics too heavily: not all heuristics are foolproof. Such a heuristic may lead to overgeneralization or misapplication when a manager does not consider the specific context or limitations of a heuristic. The more details one leaves out, the simpler a decision becomes, which, throughout time, leads to meaningless or irrelevant approaches and thus diminishes the decision quality. As an example, attempting to apply a short-term, tactics-based heuristic to a long-term strategic challenge is likely to lead to some serious misalignment.

The need to balance speed with validation became a major concern when attempting to use heuristics. To accelerate decision-making is the major advantage of heuristics, but this speed comes at the cost of rigorous validation. Referring to the covertly collected data, P8 highlighted that *“heuristics must be implemented quickly due to tight design deadlines in the enterprise domain, but there also has to be an element of validation to avoid expensive errors or wasted resources.”* Finding this balance is demanding for managers, who must assess when and how to deploy heuristics in the right domain. P8 elaborated on this in their reference to applying additional checks or background feedback loops to avoid costly mistakes. This perspective is in keeping with insights shared amongst other participants advocating for real-time validation techniques, for instance, phased testing and peer reviews, to further shore up the robustness of decisions without impacting timeliness.

Therefore, the decision-making process still needs to be timely and rigid, with the least possible errors. This leads to miscalculation of market demand and external risks, which are also a big part of heuristics. Making decisions quickly based on past experiences or old information can lead to false conclusions about what customers or competitors are doing or how the market is evolving. In areas like precision engineering and high-end consumer goods, where the tolerance for defectiveness is low, not having a unified team can prove highly detrimental. As P6 pointed out, early-stage customer feedback and validation processes can help to decrease these risks. It would root the decision in reality: outcomes in the real world versus what has worked in the past (which may be out of date) or intuition (based on a gut feeling.)

One of the most important findings of the research was that there is a trend toward focusing more on customer-centricity in the NSD process. In the past, there was an inclination to focus more on the technology than on the customers, as noted by P7: *"A lot of their previous projects were all about how to write the next best piece of technology software, but not as much about what the end users want."* While this approach did lead to some creative possibilities, it also led to several ideas that were not market-ready, highlighting the need to anchor customer understanding early in product and service development. But this tactic has changed. P9 stated that the organization now spends a little more time building a solid business case and a solid value proposition so that each innovation aligns with customer expectations and business returns. The early-stage customer validation that precludes a regulatory dive and has now become integral to most organizations gives managers an opportunity to test their ideas before committing the same significant resources. P6 and P7 said that feedback loops from customers and rapid prototyping are key to maintaining a strong alignment of new services with the needs of the market.

Managerial heuristics can be effective tools assisting firms to cope with the uncertainty of the NSD process and reduce the time it requires for the implementation process, yet management must still have reasonable use of them. To deal with the limitations of managers, to account for context, and to provide some safeguards, managers may need to keep several things in mind. By integrating insights from customers, seeking comprehensive validation, and combining heuristics with formal structures such as phased testing and decision trees, managers can tackle the trade-off between speed and rigour. These strategies mitigate disadvantages, improve decision-making reliability, and facilitate a better alignment of innovations with their customer and market requirements. It leads to strong and improved decision-making in difficult times and innovation that is both customer-driven and strategic.

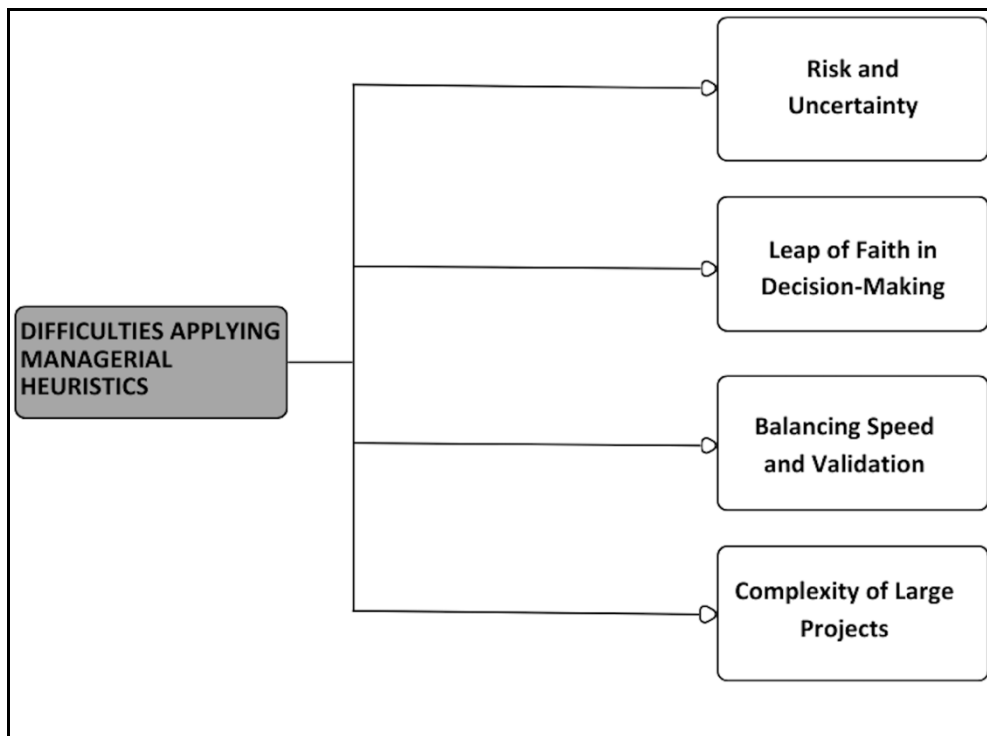


Figure 8. Thematic map: Difficulties applying managerial heuristics

4.1 Detailed thematic analysis and application of heuristics in a multinational technology company NSD process

Based on the thematic analysis of the NSD process of a multinational technology company, the study finds evidence of the company's increasing focus on the customer and the need for fast and frugal heuristics to enable reorientation. The innovation strategy at multinational tech company has been technology-driven in nature historically, often at the cost of not addressing customer needs sooner in the process. This misalignment sometimes led to products and services that did not entirely meet customer expectations. But over time, as the company continued to develop, the NSD process evolved under a paradigm shift toward customer-centricity. This change highlights the growing need to incorporate customer feedback and insights into every stage of the service development cycle. Heuristics are fast and frugal, and implementing these heuristics has aided multinational technology company in decision-making, allowing for swift responses to new claims of the market while adhering to the business mission.

A major feature of this transition concerns the use of heuristics for different steps of the NSD process. One of them, for example, is the *"Search Rules,"* which are used at the onset of idea-finding and problem-solving. To give a real-world example, one task of the customers seemed to be to order bow testers and devices that were used in ship manoeuvring to the customers; however, they were not satisfied with the long deliveries, which led to a rental service of swing sets with the customer. As customers dealt with wait times for replacements of up to ten weeks, the development team implemented a heuristic rule for the search: *"find a way to give customers a solution faster in the future."*

Consequently, this led to the rental service idea, which was for a swing set delivered in a week for a premium price. However, with the help of heuristics, the team was able to

narrow down on a feasible and customer-centric solution in a keen manner and proved the efficacy of fast and frugal heuristics in solving complex problems. In the same way, *"stopping rules"* came into play to decide when we had searched enough for alternatives, and we could go ahead with the rental service idea. After assessing investment costs and market demand, the team used the heuristic: *"Proceed with development if business case feasible."* Hence, this ensured the team did not deliberate for long on a course of action, a hallmark of fast and frugal decision-making.

The business case is, perhaps, the most important component in Decision Rules and was a vital input for the decision to move forward with the service development. After evaluating the costs and customer interests, the development team ensured that the new idea matched the business goals and market profitability. This aligns with the decision rules applied by the executives, who used heuristics: *"If market volumes and pricing milestones align with customer expectations and investment cost remains in acceptable ranges, we will go ahead."* The team did so by continually refining and adjusting the business case based on early-stage customer validation. This iterative approach helped to validate heuristics while also ensuring that the development was both possible to implement and of interest to the market.

Additionally, a crucial aspect was the incorporation of feedback loops and collaborative innovation to optimize the development process. Engaging customers at an early stage assured that the service concept was adhering to the needs of the customers, which is typical of the *"search rule heuristic."* Those pitfalls were lessened by the steady flow of customer feedback, which meant the company changed course as necessary and reduced the chances of being out of sync with the market. Fast and frugal heuristics facilitate quick yet efficient decision-making that meets customer needs—a process that is made clear in this example. A multinational tech company can benefit from a structured governance model such as the eight-stage gate model. **Stipulated Approval Criteria at each gate:** The managers use the "stopping rules" at each gate to assess the viability of development and whether to continue with the project. It is a process that is

at once structured but flexible, unlike fast and frugal heuristics suited for making fast and frugal decisions for managers in a world of incomplete information. It allows for decision points at which leaders determine if the project continues to serve organisational goals and customer needs.

To clarify the incorporation of the heuristics within the NSD process, a flowchart is provided outlining how the researcher proposes search rules, stopping rules, and decision rules to operate at the individual stages. This subdivision of the NSD decision-making process provides a clear understanding of the pathways and heuristics involved in decision-making, which helps speed up the NSD process. By implementing these heuristics, the company can keep the actual service development process both efficient and aligned with market needs, which we expect to help a multinational technology company become a truly customer-oriented innovator. **Figure 9** below outlines and illustrates the NSD process of a multinational technology company using a heuristic approach. Hence, it illustrates decision-making processes, including the search rule (the exploration of opportunities to develop), the stopping rule (when to stop), the decision rule (how to choose), and their implications for guiding managers in every stage of NSD.

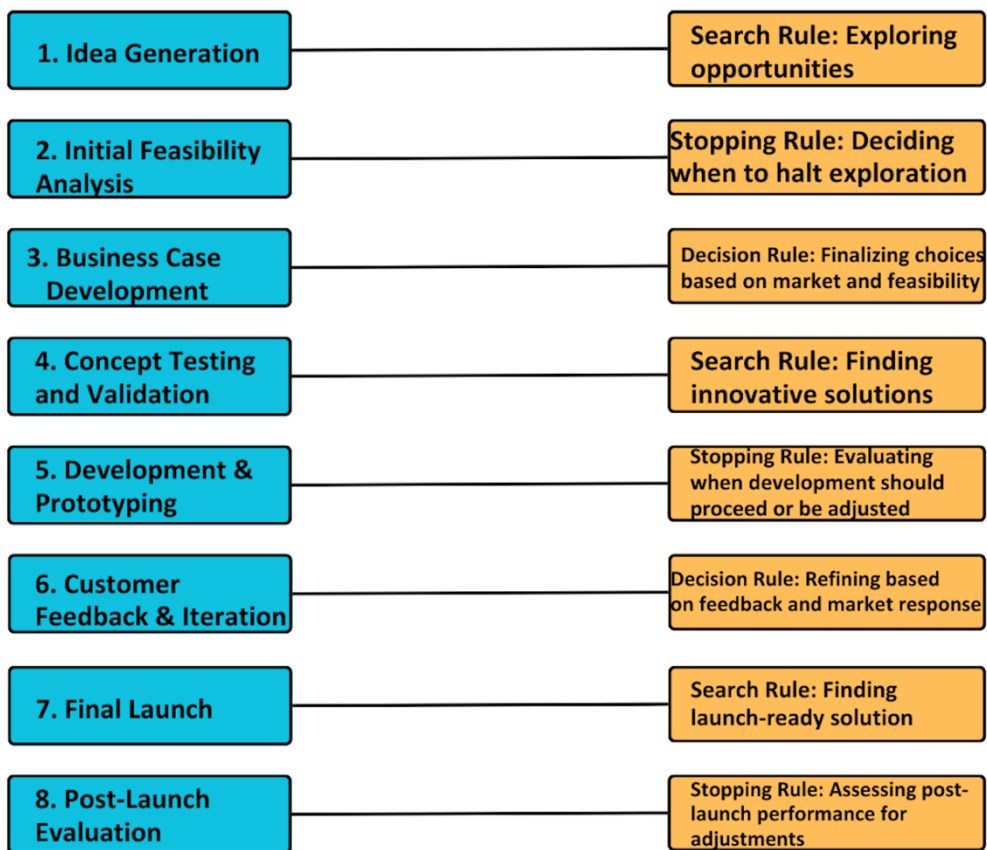


Figure 9. NSD Processes with Heuristics apply in a multinational technology company

4.2 Extended theoretical framework

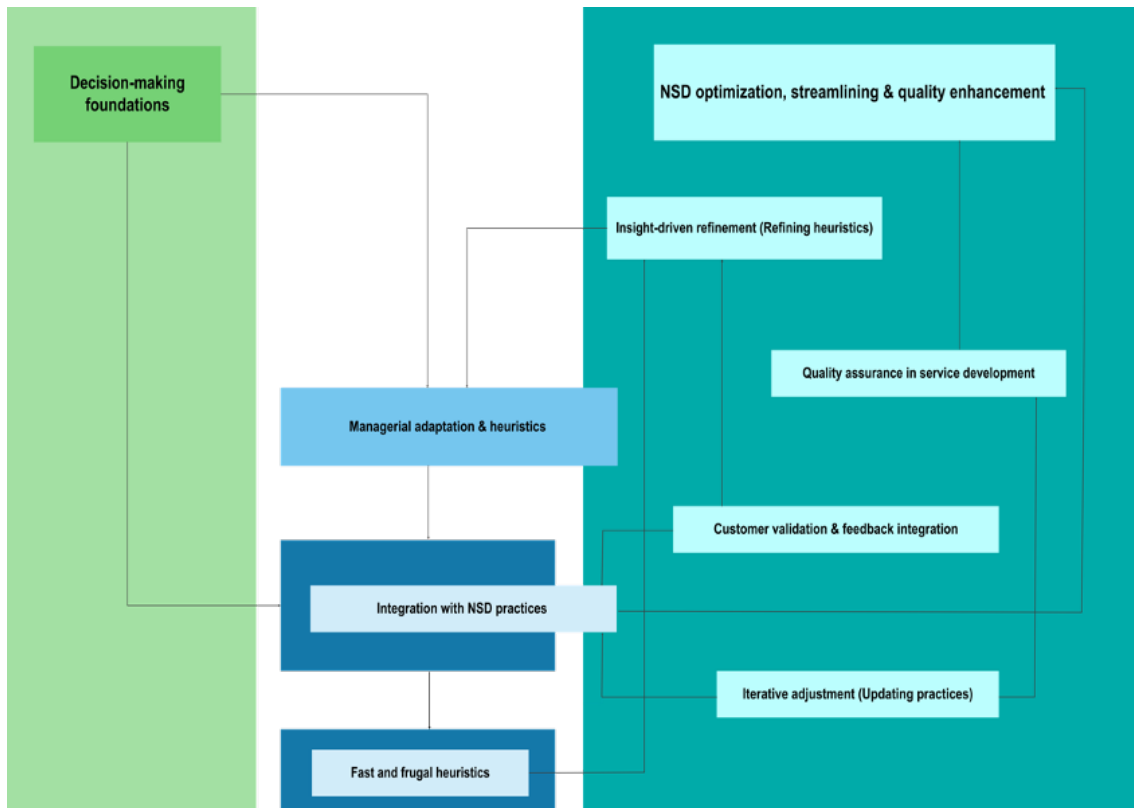


Figure 10. Comprehensive heuristics framework for NSD optimization and quality (NOQ)

5 DISCUSSION

5.1 Theoretical contributions

The theoretical framework, referred to as integrating heuristics for NSD optimization and quality enhancement (IH-NOQE), not only propels the current body of knowledge on managerial heuristics in New Service Development (NSD) in multi-national technology firms but also has the potential significance of becoming a guide and model for practitioners in multinational technology firms, as evidenced by a significant increase in the number of managerial heuristics created or leveraged and general methods developed to optimize overall NSD quality. While decision-making has long been studied as a framework, we provide a dynamic model that incorporates decision-making foundations, managerial adaptation, heuristics, and iterative feedback loops as theoretical and practical advances in the field.

Dynamic feedback loops for continuous improvement: Based on **insight-driven refinement** and **iterative adjustment** feedback loops, the framework offers a new lens through which to understand how NSD processes can dynamically respond to changes in the market and customers' needs. These loops extend the applicability of ecological rationality by connecting decision-making foundations with operational processes, thereby resulting in higher organizational agility (Luan et al., 2019). As a result, this framework is different from classical static heuristics models (Hafenbrädl et al., 2016), as it incorporates mechanisms for iterative refinements that ensure decision-making consistent with strategic and operational objectives.

Enhanced understanding of heuristics in NSD: The framework enhances our theoretical insight into fast-and-frugal heuristics in NSD by contextualizing their usage in crucial NSD practices like resource allocation, stakeholder cooperation, and innovation

prioritization. A feature-oriented go-to-market strategy using heuristics, such as the "focus on features that increase customer retention by 10 per cent or more," guides cross-functional teams to simplify their decision-making while maintaining strategic alignment (Huikkola et al., 2022). Thus, this finding extends Bingham and Eisenhardt's (2011) perspective on heuristics as dynamic, experiential tools, demonstrating that they serve a broader purpose than simply efficiency; they also align with customers' needs and firms' organizational goals.

Reconciling efficiency and innovation: A key insight of the framework is how to balance the competing tensions of efficiency versus innovation, which is an issue all too common for tech-enabled industries. Combining these heuristics, like the requirement to "get a minimum viable product within three months of getting the concept approved," demonstrates the coexistence of agility and quality improvements in NSD (Huikkola & Kohtamäki, 2021). This viewpoint enhances previous research by illustrating how heuristics can create operational equilibrium and help sustain competitiveness.

Customer-centric and adaptive decision-making: The framework highlights customer-centricity through elements of "**customer validation** and **feedback integration**," further indicating how customer inputs become pivotal in designing NSD outcomes within their nascent phase. This strategy is aligned with the findings of Calle-Escobar et al. (2016). When used to the effect of stepping up cross-organizational collaboration and innovation, as Järvenpää et al. Moreover, by examining decision-making under uncertainty, the framework builds on the scholarship by Maitland and Sammartino (2015) to illustrate how customer feedback induces adaptive behaviors.

Novelty and practical implications: The IH-NOQE framework provides a guideline for a structured yet flexible NSD process, connecting the gap between heuristic theory and

the practical context. The framework critiques early modern dichotomies in decision-making between the formal structures of decision models versus intuitive strategies—by showing how heuristics play out in iterative, feedback-guided processes. This paves the way for further exploration into how heuristics drive efficiency and innovation in dynamic NSD contexts.

In summary, the framework provides a consistent, empirical-based model that contributes to the literature on managerial heuristics, NSD, and decision-making under uncertainty. Consequently, it highlights the need for flexibility, iterative improvement, and customer orientation in maximizing NSD processes, thus tackling critical issues in tech-oriented socio-technical environmental frameworks.

5.2 Managerial implications

This section provides practical recommendations for practitioners based on the insights and theoretical framework of this study. These findings are intended to help managers optimize the New Service Development (NSD) process in a multinational technology company. Fast-and-frugal heuristics provide a middle ground between innovation and operational efficiency, allowing managers to respond nimbly to changing market dynamics.

Streamlining decision-making in dynamic environments. One of the key findings arising from this research is the role of managerial heuristics in facilitating rapid and efficient decision-making during NSD processes. In such tense and time-pressured situations, managers would need to make decisions based on a limited amount of time and resources, which might render some traditional methods unsuitable. Fast-and-frugal heuristics help managers simplify decision-making by concentrating only on relevant variables and discarding unnecessary information (Hafenbrädl et al., 2016). For

example, a heuristic (e.g., default to the strictest compliance standard for initial rollout) might reduce regulatory risks and speed up decision timelines (Maitland & Sammartino, 2015). To execute this approach effectively:

Managers are guided by heuristics such as “prioritize high-impact opportunities,” which helps manage allocation to remain cognitively grounded and ensure alignment with organizational objectives in environments that are regularly fast-paced (Artinger et al., 2015). Deploying these simple but clear rules can help multinational technology corporations circumvent the limitations of resource-scarce situations and help in a timely response to market demand to trim down delays in NSD cycles. This new finding extends the work of Artinger et al., (2015), illustrating the dynamic nature of heuristics in live decision-making. It is also per the idea of ecological rationality, as Luan et al., (2019) postulated, which attempts to reconcile simplicity and flexibility in uncertain domains.

Hence, to apply this approach effectively, organisations should upskill managers to identify the critical decision points to apply heuristics. (2) Create a library of verified heuristics specific to NSD environments (3) Build feedback loops to continuously develop heuristics so they are always in alignment with changing organizational and market dynamics. Therefore, this research highlights that managerial heuristics are vital resources for accelerating decisions in dynamic settings. Developing and applying them well might lead organizations to be more efficient and responsive and perform better aligned with their NSD strategy. These practices reduce decision-making bottlenecks and enable managers to make well-informed decisions in ambiguity, thereby improving the speed and responsiveness of NSD processes.

Enhancing efficiency and innovation. Finding the right balance between efficiency and innovation has always been a question in NSD, and this study reiterates the key role heuristics play in establishing such a balance. Heuristics provide managers with

straightforward yet adaptable guidelines to aid in resource allocation, stakeholder collaboration, and simplifying the process of setting innovation priorities (Artinger et al., 2015). Rules such as “prioritize features that improve customer retention by over 10%” allow managers to allocate resources to high-impact initiatives without extensive analysis (Huikkola et al., 2022). Likewise, heuristics like “launch a minimum viable product (MVP) within three months” enable entering the market on time while ensuring quality, successfully balancing the dual pressures of speed and thoroughness during innovation (Huikkola & Kohtamäki, 2021). These results expand on the work of Bingham and Eisenhardt (2011), highlighting heuristics as tools in the service of strategy to achieve organizational goals. Managers can leverage iterative feedback and heuristic-based learning integrated processes in creating beliefs about experimentation that guide how their practitioners conduct NSD, as this can facilitate continuous improvement with respect to NSD efforts to ensure they align with customer needs and strategic directions. Agile methodologies complement this process by allowing MVPs to be built, tested, and adjusted in iterations to saddle back on dynamic requirements because of evolving customer needs.

As a result, these recommendations highlight the pragmatic usefulness and provide actionable insight relevant to the optimization of NSD processes in multinational technology organizations. Organizations can sustainably strike the right balance between efficiency and innovation in such rapidly changing, fast-paced industries by embedding these practices into their NSD frameworks to ensure an agile approach to operational efficiency and a competitive advantage process.

Building customer-centric NSD practices. A major outcome of this research highlights the importance of customer-centricity in the NSD process. Managers must prioritise customer feedback in the early development cycle of creating new services to align with the needs of the market, minimising the chances of product misalignment and ensuring

innovations remain relevant, purposeful, and impactful (Calle-Escobar et al., 2016). This necessitates rapid prototyping, iteratively validating each step with customers so that the organizations can adapt quickly to changing market demands. In NSD, the incorporation of customer feedback allows for the streamlining of decision-making through heuristics such as "hospitality companies should focus on features that increase customer retention by 10 percent or more" (Hafenbrädl et al., 2016). These heuristics serve as a bridge between customer insights and strategic priorities, fostering more effective and cohesive alignment among cross-functional teams involved in NSD and ensuring that the results of NSD align with customer expectations.

To create customer-centric NSD practices, organizations need to ***Structure Mechanisms for Early Engagement***: Conduct design workshops, focus groups, and feedback loops to involve customer insights from the onset of NSD ***(2) Provide heuristics-driven decision rules***: Teach managers how to use heuristics like, "Should I weight customer insight around strategic objectives?" to assess and use input. ***(3) Utilize digitization***: Use sophisticated analytics and online platforms to continuously gather, process and act on real-time client data, facilitating adaptive and strategic choices (Huikkola & Kohtamäki, 2021). ***(4) Notice that validating and prototyping iterations are crucial***: Evolve innovative products through rapid prototyping cycles based upon customer feedback, minimizing the chance of misalignment with the market. By embedding these practices, customer-centricity will remain rooted as a core component of NSD. Data analytics helps organizations institutionalize feedback loops that help them identify hindrances in their decision-making strategies while implementing heuristic-based decision-making methods that further assist them in their research. Therefore, these approaches allow companies to keep their competitive edge since NSD results adapt to developing markets and customer needs as well as strategic priorities.

To sum up, the major managerial implications generated from this research point towards the strategic significance of incorporating heuristics into NSD practices. By streamlining decision-making, balancing efficiency and innovation, and portraying customer-centricity, managers can optimize NSD processes to drive success in organizations amidst competitive and dynamic markets. These lessons provide concrete guidance for the empowerment of heuristic-based practices that are in line with the realities of contemporary technology companies.

5.3 Limitations

This research contributes to four main ways to the understanding of the interplay between the heuristics of fast and frugal decisions and the coordination of New Service Development (NSD) in a multinational high-tech company. For a more nuanced view of the findings and their implications, though, some limitations must be acknowledged.

Contextual limitations: A key limitation includes the research's contextual emphasis on one multinational technology firm. Although this specificity enabled an in-depth investigation of managerial heuristics on an NSD practice in its true environment, it limited the extent to which the findings can be generalized to the wider technology industry. The organization-specific culture, components, and market conditions at the study firm may not be the same as those of other companies or industries. Hence, this limitation resonates with the concerns raised by Luan et al. (2019), who demonstrated that heuristics are also context-dependent, suggesting that they may need extensive tweaking if applied in different ecological or organizational contexts.

Methodological constraints: The study employed heavily heuristic-driven frameworks, which, while useful, also have their challenges. Heuristics facilitate decision-making by highlighting important variables and ignoring irrelevant information (Hafenbrädl et al.,

2016). However, this simplification can create bias in complicated decision-making situations. Hilbig (2010) reviews the empirical foundation of heuristics and suggests that while heuristics are useful tools, their reliability should always be empirically validated before they are used consistently. Further, the recent work by Artinger et al. (2015) illustrates how heuristics that are fast-and-frugal need not always fit smoothly in dynamically varying or unpredictable environments.

Participant recruitment challenges: Achieving access to participants proved to be particularly problematic through the data collection stage. Qualitative insights were limited as many potential participants had busy schedules. This restriction likely limited the range of perspectives included in the analysis, preventing potentially enriching findings. Additionally, although this study examined heuristics stemming from managerial work and organization, bringing in additional stakeholders beyond those included in the study, such as cross-functional teams or customer input, to account for their collaborative impact of heuristics in NSD may have limited a more holistic explanation.

Generalizability across cultural and political contexts: Maitland and Sammartino (2015) argue that the application of heuristics becomes particularly troublesome in politically or culturally hybrid contexts. This study only explored a multinational company and did not delve into much on how different cultures or politics may affect the usefulness of heuristics in NSD. However, this caveat calls for more research to investigate potential heuristics in different geographic or socio-political contexts.

Implications for future research: These limitations emphasize the need for further exploration of heuristic-driven decision-making. Future research should evaluate the analysis among multiple businesses in different sectors and, in this way, recreate

analysis, which can generalize results. As such, greater consideration of stakeholder perspectives and the utility of heuristics for NSD can be provided through data collected across a broader spectrum of environments and cultural and political contexts.

In summary, although the insights gained from this study about managerial heuristics in the context of optimizing NSD processes are valuable, the above-mentioned limitations need to be considered for the interpretation of the findings and their wider implications. Recognizing these limitations allows the study to provide a basis for future work which can focus on these areas to better integrate heuristics within live and dynamic organisations.

5.4 Recommendations for future research

This study provides great insights into using fast and frugal heuristics to design an optimal NSD process for multinational technology firms. However, there is space for further research based on the findings and limitations. The recommendations target gaps in existing knowledge and broaden the applicability of heuristics in NSD.

Exploring heuristics across industries: Future research must explore the extendability and relevance of managerial heuristics across different industrial contexts. Although this study is based on a multinational technology firm, applying the same lens to the other industries (i.e., banking, manufacturing, and healthcare) can shed light on the industry-specific dynamics around the effectiveness of heuristics. For example, according to Martovoy and Mention (2016), the NSD direction reflects strong, unique patterns in the banking industry, indicating that consideration of sector-specific nature is required to employ heuristic approaches to NSD. Comparative studies across different types of industries can also provide a cross-sector perspective, benefiting the study of how heuristics operate in different organizational and market contexts.

Digitalization and AI integration in NSD processes: With the rise of digital tools and AI in decision-making, there is an open opportunity for research to investigate how to achieve integration with heuristic-driven frameworks. Keding and Meissner (2021) also explore how AI-augmented processes can help compensate for such heuristics and enable greater NSD agility and efficiency. Future research could explore the interaction between heuristics and digital tools, potentially considering the extent to which real-time analytics and machine learning could enhance the application of heuristics in fast-evolving environments. Additionally, Huikkola et al., (2022) describe the implications of automation for the development of smart solutions and propose a future investigation into the role of automation on heuristic-driven NSD processes.

Validating the empirical basis for heuristics: Hilbig (2010) also questions the empirical basis of fast-and-frugal heuristics and the variety of experimentation involved. Future work might fill this gap by using longitudinal studies or larger experimental designs to assess the reliability and generalizability of heuristics across organizational contexts. Doing so will enhance the theoretical underpinnings of heuristics and give more confidence to their practical application.

Considering cultural and trans-border dynamic: Since numerous technology firms function worldwide, future research should consider how cultural, and government differences affect the applicability of heuristics. Luan et al., (2019) stress the contextuality of heuristics, which might call for adaptation in cross-border NSD processes. This could involve ethnic and cultural lenses impacting heuristic decision-making and to what extent global organizations can harmonize or localize their systems' heuristics.

Evaluating feedback loops in NSD: Finally, further research could explore the feedback loops driving heuristic-based decision-making. Hafenbrädl et al. (2016) discuss how heuristics are refined because of feedback, but its role in NSD has also been underexplored. Future studies may evaluate the role of ongoing feedback loops in determining how heuristics evolve about cycles of innovation and customer-centricity practices.

In short, the recommendations point to opportunities to extend the investigation of managerial heuristics beyond the limits of the existing studies. Specifically, this may involve studying domain-specific use cases, the use of digital utilities, empirical validation, socio-cultural context, and feedback loops that may lead to more nuanced theories about how heuristics can improve and accelerate NSD processes in fluid organizational contexts.

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APPENDICES

Appendix 1. Interview guide

I am Derek Obese, currently enrolled in the master's degree program (Economics and Business Administration) at the University of Vaasa. Thank you for participating in this interview. My objective is to delve into the decision-making approaches and roles of managers in the New Service Development Process within technology companies. Your answers will surely be kept private and confidential. Please take your time to think over your inputs and provide thoughtful replies to each question. Your ideas are immensely cherished. Thank you for your cooperation.

Section A: Demographics

Gender:

Designation:

Years of experience:

Section B: Semi-structured interview Demarcation of concepts:

1. How do managers assess new service development process effectiveness in a multinational technology firm?
2. How do you identify the excellence of the service development process? Which signs and/or measures do you use?
3. How do managers at a multinational technology company decide the effectiveness of their service development process?
4. How do you determine the effectiveness of your methods? Identify indicators for efficiency.
5. What are some ways that managers in a tech company use to ensure that enhancing efficiency doesn't compromise the quality of their services?

6. Can you share some instances of the technologies that managers in a multinational technology firm utilise to enhance productivity while maintaining or enhancing it, per your understanding?
7. Can you give specifics about the actions rolled out by you or another manager to enhance the efficiency of the processes involved in creating novel services?
8. What type of results or improvements have these schemes attained?
9. How do managers at a tech company determine which protocols to adhere to when developing services?
10. How do managers in a technology firm use a practical model, to guide their decision-making processes when creating novel services?
11. Can you express situations when you or a manager in an international technology organisation applied these principles to streamline decision-making efficiency and effectiveness during the development of services?
12. Could you provide an example that encapsulates the fundamental ideas and values of a technology business and its leaders around decision-making for New Service Development (NSD)?
13. Is there any aspect of decision-making in New Service Development (NSD) that you believe merits discussion for this research project?

Appendix 2. AI disclaimer

In accordance with the instructions issued by the University of Vaasa, this master's thesis was written with the aid of artificial intelligence (AI) tools. The author of the paper used the following AI tools: The author used QuillBot and Grammarly to check the grammar,

spell-checking, and typo correction to form clarity and more coherent restructures. ChatGPT in free and paid versions for producing ideas, creating new forms, and connecting ideas together for the thesis. So these two software packages helped fine-tune the content of the thesis.

Therefore, the tools were employed in this thesis study to assist the writing process; however, they did not supplant the author's original thoughts, analysis, or argument. The author of the thesis has reviewed, revised, and integrated the suggestions proposed by AI so as to formulate content with uniqueness, accuracy, and specificity. The thesis author bears full responsibility for ensuring that this submitted work is accurate and complete, in accordance with the ethical guidelines by the University of Vaasa. The author is solely responsible for any errors and omissions.