A FRAMEWORK FOR CORPORATE INNOVATION MANAGEMENT AND MANAGERIAL INNOVATION IN MEDICAL DEVICES INDUSTRY

Lappeenranta–Lahti University of Technology LUT

Master's Programme in Industrial Engineering and Management, Master’s thesis

2023

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Examiners: Associate Professor Kalle Elfvengren

Professor Ville Ojanen

ABSTRACT

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Keywords: Innovation Management, Managerial Innovation, Corporate innovation management, digitalization.

This thesis explores on developing framework for implementing strategic corporate innovation management and managerial innovation within the Finnish medical devices industry. Identifying the key factors that affect effective innovation management and the barriers preventing its implementation inside an organization. An in-depth analysis of corporate innovation management, managerial innovation and innovation in the medical industry focussing on Finnish market has been carried out through the literature review, theoretical framework and empirical analysis. To do so, semi structured interviews with three managers from a medical devices firm and also a survey has been conducted with the employees for which we got 32 responses giving us enough sample to work on formulating a framework.

The framework aims to foster an innovation culture, empower innovation leaders, implement innovation processes and tools, promote external collaboration, track progress using key performance indicators (KPIs), and protect intellectual property. It also addresses challenges and opportunities unique to the industry. Additionally, it emphasizes how managers are accountable for fostering a supportive atmosphere, offering a clear strategic direction and vision, allocating resources, encouraging cross-functional collaboration, and supporting risk-taking and learning. The results add to our understanding of innovation management in the Finnish medical device industry and offer useful information for future research projects, legislators, and practitioners. Additionally, this research lays a strong platform for future studies that will look deeper into particular facets of innovation management, like the long-term effects of the suggested framework, industry comparisons, and the incorporation of cutting-edge technology.

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Thank you.

Harish Ramesh

ABBREVIATIONS

OECD	Organization for Economic Cooperation and Development
R&D	Research and Development
OD	Organizational Development
MI	Managerial Innovation
KPIs	Key Performance Indicators
DC	Dynamic Capabilities
RBV	Resource-Based View
IVDD	In Vitro Diagnostic Medical Device Directive
IVDR	In Vitro Diagnostic Medical Device Regulation
GMP	Good Manufacturing Practice
IEEE	Institute of Electrical and Electronics Engineers
EMA	European Medicines Agency
FIMEA	Finnish Medicines Agency
ISO	International Organization for Standardization
IP	Intellectual Property
OI	Open Innovation
SMEs	Small and Medium-sized Enterprises
IoT	Internet of Things
AI	Artificial Intelligence
IT	Information Technology
FDA	Food and Drug Administration
WHO	World Health Organization
GE	General Electric
S&P	Standard and Poor's 500

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1 Introduction

The demand for creative solutions to handle challenging healthcare issues is growing in the highly dynamic and quickly developing medical devices market. In order to remain competitive and provide value to patients and other stakeholders, organizations in this field must now place a greater emphasis on innovation management (Hartmann et al., 2019). There are various levels of innovation, including managerial, organizational, and technological innovation. The ability of businesses to effectively manage innovation at both the strategic and operational levels has become increasingly crucial. Innovation is a key driver of growth and competitiveness in the global economy. While organizational innovation focuses on implementing new organizational structures, procedures, and practices, technological innovation involves the creation and introduction of new goods or processes. On the other side, managerial innovation focuses on the creation and use of novel management procedures and practices that help businesses enhance performance and accomplish their strategic goals (Birkinshaw & Gibson, 2004). Technical and managerial expertise are needed for effective innovation management, as well as the creation of an innovative culture. Successful innovation management, according to Tidd and Bessant (2014), entails fostering an atmosphere that promotes experimentation, teamwork, and continual learning. It also needs creating systems and procedures that allow for the testing, improvement, and expansion of novel concepts as well as promoting an innovative culture.

Managerial innovation has the potential to be a potent tool for fostering organizational change and raising productivity. According to Birkinshaw and Gibson (2004), businesses can increase efficiency, promote an innovative culture, and better overall company outcomes by developing new management practices and processes. This is especially true for the medical device sector, where businesses are under increasing pressure to offer ground-breaking solutions to challenging healthcare issues. The Finnish medical device industry provides a singular opportunity to research innovation management strategies in a focused geographical and sectoral setting. Finland has a long history of innovation and is renowned for its advanced research infrastructure and world-class healthcare system. One of Finland's important industries is the manufacturing of medical equipment, with a focus on R&D and a rising need for creative solutions (Business Finland, 2021). A growing number of demands are being placed on the Finland medical device industry to satisfy the needs of an aging population while simultaneously containing costs and upholding excellent standards of patient care. To stay competitive and fulfil the changing needs of their clients, medical companies working in this sector must be able to innovate fast and successfully. Medical businesses must create a comprehensive framework that combines corporate strategy, innovation management techniques, and managerial innovation in order to do this. But little study has been done on how Finnish medical enterprises may successfully use such a framework to enhance their innovation outcomes. Despite the significance of managing innovation, many businesses find it difficult to do so and launch new goods and services. This is frequently brought on by a number of issues, such as a lack of funds, resources, and defined innovation plans and procedures (Dodgson et al., 2008). Additionally, there are stringent quality requirements and regulations in the medical device industry, which can make it challenging for businesses to launch new goods and services.

By creating a framework for applying managerial innovation and strategic corporate innovation management in the Finland medical industry, this thesis seeks to close this gap in the literature. The framework will give medical companies a useful manual for enhancing their capacity for innovation and accomplishing their strategic objectives. A review of prior studies on innovation management in the healthcare industry will be included in the study, along with a survey of Finnish medical enterprises to learn more about their present innovation methods and issues. The results of this study will be utilized to create a framework for implementing managerial innovation and strategic corporate innovation management in the Finland medical sector. The framework will give medical companies a useful manual for enhancing their capacity for innovation and accomplishing their strategic objectives. Additionally, the results of using this framework will be reviewed, and suggestions for medical organizations wishing to enhance their innovation outcomes will be given. Therefore, it is crucial for businesses looking to remain competitive and provide value to patients and other stakeholders to build effective innovation management techniques in the medical devices market. Companies may progress technology, build long-lasting competitive advantages, and promote social and economic growth by fostering an innovation culture and putting good innovation management methods into practice. In conclusion, managerial innovation and strategic corporate innovation management implementation in the Finnish medical devices sector are significant research topics. This subject provides a chance to examine the potential and difficulties connected with innovation management in a particular regional and sectoral context and to come up with useful advice for businesses looking to strengthen their innovation capabilities. This research can advance the subject of innovation management by examining how innovation management functions in the medical device business. It can also shed light on how innovation influences competitiveness and economic growth.

1.1 Background

The act of inventing and introducing something new and beneficial to the world is known as innovation. It is "a new idea, device, or method that is useful and is new to the unit of adoption," according to Chesbrough (2010). Market demand, technological improvements, and modifications to social or cultural norms are just a few of the variables that might influence innovation (Tidd & Bessant, 2014). It might range from minor adjustments to current goods or procedures to significant adjustments that completely alter entire industries (Christensen, 2013). Innovation is widely acknowledged as a fundamental driver of sustainable development and has a critical role in fostering economic growth and competitiveness (OECD, 2015). In order to effectively manage innovation, methods and structures must be developed that allow for the testing, improvement, and scaling up of new ideas as well as an atmosphere that supports experimentation, cooperation, and continuous learning (Dodgson, Gann, & Salter, 2008). A combination of technical, social, and economic knowledge and abilities are necessary for innovation to emerge at the individual, organizational, or societal level (Murray & Caulier-Grice, 2010).

The process of planning, coordinating, and managing resources and activities linked to innovation within a company is known as innovation management. In addition to recognizing and managing the risks and uncertainties related to innovation, it entails establishing and putting into practice strategies, policies, and processes that encourage innovation (Dodgson, Gann, & Salter, 2008). Creating an atmosphere that supports experimentation, cooperation, and ongoing learning is necessary for effective innovation management, which calls for a combination of managerial and technical skills. It also calls for creating systems and procedures that allow for the testing, improvement, and expansion of novel concepts as well as cultivating an innovative culture (Tidd & Bessant, 2014). Organizations can build long-lasting competitive advantages and stimulate economic growth by managing innovation well (OECD, 2015).

Innovation is not merely the introduction or use of fresh concepts or procedures. Finding innovative ways to accomplish tasks can be summed up as the idea or meaning of innovation. According to this perspective, innovation is all about finding new ways to achieve the same or better results. This often means that innovation signifies advancement. In many instances, using the new procedures resulted in shorter turnaround times or lower costs. Innovation management is the process of taking innovative ideas from conception to implementation. This system is the cornerstone of a business' ability to innovate, and when employed correctly, it could result in anything from a product that breaks records to an innovative way to satisfy customer demands. There are several processes involved in innovation management, such as idea generating, sharing the idea, assessing its viability, prototyping the idea as a proof of concept, reviewing it, and lastly bringing it as a production-ready solution before launching it. Over the past year, the healthcare sector has experienced substantial change, pushing businesses to re-evaluate their operational strategies in light of novel business models, unexpected collaborations, and accelerated timelines. Many of these alterations are most likely permanent. According to comprehensive study by Tidd & Bessant (2014), the workplace of the future and digital acceleration are the two key sectors where the COVID-19 pandemic has caused significant changes that are expected to last. Additional investigation will be done to comprehend the impact it had quantitatively on our goal.

The statement "customer focus is the origin of innovation" may be oversimplified to illustrate the overall concept of organizational innovation in this firm (Wong and Chin, 2007). The constantly changing world of today pushes successful firms to adapt, excel, and expand more swiftly than in the past. Government regulatory changes, market needs, and technological improvements all put pressure on competitive advantages. Today, understanding and developing flexible and adaptable settings should be prioritized over sustainable advantages (vretveit et al., 2012). The focus has shifted from having ample financial resources to being flexible and embracing new services and technologies quickly. Because of the waning former confidence in the stability and worth of brands, there is no place for safety zones anymore. Even the most well-established sectors and businesses can be destroyed by new technologies or business model improvements (Vretveit et al., 2012). Innovation management is a field that focuses on overseeing innovation processes. Both organizational and product innovation can be encouraged using it. Managers and engineers can work together utilizing a set of tools for innovation management if they have a common knowledge of goals and processes. Technology divisions, marketing and sales, logistics, manufacturing, etc.) or from within the organization (clients, vendors, competitors, consultants, media, globalization, etc.), the objective of innovation management is to enable the organization to capitalize on an opportunity (Xue and Zhang, 2018).

The framework combines standard methods for strategy formulation with innovative, non-conventional methods for business innovation (Elia et al., 2022). It combines viewpoints from a variety of complementary fields, including unconventional methods of innovation found in the business creativity movement, conventional strategy consulting, the perspective of industrial design firms on the creation of new products, qualitative consumer/customer research, futures research found in think tanks, conventional scenario planning, and organizational development (OD) practices that examine how organizations function (Lo). The framework is made up of a collection of procedures that encourage creative teams to think outside the box, explore a wide range of options, identify significant opportunities, select the most promising course of action, create a shared vision for growth, define doable action plans that "bridge from the future back to the present," and set up the business in accordance with success criteria. (Cohen, 2021). This will also cover how recent technological advancements have affected medical innovation. For instance, the introduction of 5G facilitated the execution of a remote surgery in China. Therefore, innovation in the medical industry is not just limited to one particular discipline; rather, it is a result of collective invention across a variety of industries (Karanja and Malone, 2022). Since they are the ones in positions of decision-making, managers' roles will also be crucial. Based on the findings of this study, it can be demonstrated that a framework for efficient innovation management could be developed, and that managerial innovation will have a significant impact on it.

1.2 Objectives, research questions, and limitations

This thesis aims to understand and develop a comprehensive framework for integrating corporate strategy, innovation management practices, and managerial innovation in the Finland Medical devices industry. The purpose is also to determine the main factors influencing effective innovation management in the Finnish medical devices industry and offer suggestions for enhancing innovation results. Also, identifying the barriers which halt the implementation of innovation management in firms plus this thesis work will contribute firms with a practical guide for improving their innovation capabilities and implementing innovation management. Additionally, it will contribute to the body of knowledge on the management of innovation in the healthcare industry and offer helpful advice to medical companies looking to enhance the results of their innovation efforts. Develop your knowledge and comprehension of the Finland medical industry's potential for implementing innovation management. Based on an extensive literature review, it seems there is a lack of studies focusing on managing innovations and managerial innovations in any industry and in particular very less in the medical devices industry which is evolving on a day-to-day basis. There may also be a dearth of studies on the precise methods and ideal procedures for using innovation management in this situation. Filling in this research vacuum could assist organizations in the Finnish medical industry gain insightful information and add to the body of knowledge on innovation management in healthcare. In doing so, the thesis will find responses to the following research questions:

1. ***What are the existing methods and challenges in the Finnish medical device industry's innovation management?***

The thesis can benefit in a number of ways from the answer to this question. In the first place, it can offer a thorough grasp of the current innovation landscape in the Finnish medical device business, including the many kinds of innovations being pursued and the techniques and tools being used to manage them. Second, it can pinpoint the particular challengess and hindrances that businesses encounter while managing innovation, such as resource limitations, regulatory obstacles, and a lack of qualified staff. Thirdly, it can be useful to pinpoint the top methods for managing innovation in the Finnish medical device sector, which can serve as models for other businesses.

2. ***What are the duties and obligations of managers in Finland's medical device firms when it comes to fostering and executing innovation?***

This will help in clearing different aspect of the managers role. First of all, it can offer a thorough comprehension of managers' roles in innovation management within the Finnish medical device business, including their particular duties and obligations with regard to promoting and carrying out innovation and additionally, it can shed light on the organizational frameworks, procedures, and cultures required by Finnish medical device companies for effective innovation management.

3. ***How can Finnish manufacturers of medical devices use digital technologies to improve their capacity for innovation?***

This can help in understanding how digital technologies can be used to manage innovation in the Finland medical device industry. Also, provide some methods or tools which could fasten the process plus it can provide some insights on any particular challenges and hinderances that firms experiences when applying digital technologies for innovation management such as the requirement for new knowledge and abilities, regulatory compliances and privacy issues.

However, the research has few limitations. First, the findings of the research will be applicable for the medical devices industry and may not for other industries. Second, the gathered information on the existing practises and methods from firms can be restricted to a certain level of confidentiality and hence it cannot be used to full extent. Finally, the time constraint and the sample size may not reflect the entire medical devices industry as it requires in depth research and analysis of data collected. However, based on the survey and interviewers opinions this thesis work will add more valuable information for any future research carried out on this particular area.

1.3 Methodology

To gain in-depth comprehension and to be able to interpret innovation management and the role of managers in innovation management, this study’s research methodology is based on a mixed data collection methodology. While interviews capture qualitative data through open-ended questions and discussions, surveys often involve the collection of quantitative data through organized questionnaires. This study is conducted by comparing different existing methods of innovation management and identifying the things that worked for firms, and which can be utilized in developing a framework that could be used as a benchmark for other companies to follow. It also offers better possibilities for analytical generalization of the results.

The main data collection strategy is semi-structured theme interviews. The interviews were held as in-person sessions since I am part of the firm. Additionally, part of the answers were obtained via email. Three different managers were interviewed in total to capture the innovation management process in its original form. Also, a survey has been conducted to gather inputs from people apart from managers so that the information could be used to compare and visualize the gaps between them and the managers.

This study is divided into two main parts. The first is the literature review, where the methodology and results from some studies related to the research topic were briefly introduced to give a clear idea of the state of the art that will be taken as a reference for the completion of this work. Different databases are utilized to gather different literature for the study (eg: IEEE, Science Direct, Emerald, Web of Science). The second part consists of the practical aspect of the research, where a survey and interviews with a group of participants from two different firms were developed to obtain the information needed to give answers to the proposed research questions. The data gathered was categorized and analysed to find helpful patterns for this purpose. By enabling the gathering and analysis of both quantitative and qualitative data, a mixed data-collecting methodology can offer a more thorough understanding of the research issue. In addition to validating results, this can paint a fuller picture of the research problem. When selecting the best data collection methodology, it is crucial to carefully analyse the research question and study objectives in addition to making sure the procedures are valid and reliable.

1.4 Structure of the thesis

As indicated below, the thesis is divided into six main sections. The backdrop, the goal of the thesis, the research questions, and an outline of the technique used in this are briefly explained in Chapter 1's opening paragraphs. The second chapter then provides a thorough review of the recent literature to present all the essential elements of innovation management, particularly in the corporate structure and the role of managers in innovation management for the medical devices business. Chapter 3 gives a theoretical framework, formulated, two framework one is dynamic capabilities and resource-based view (RBV) framework. The dynamic capabilities framework offers a thorough and adaptable approach to innovation management that is ideal for the opportunities and problems the Finnish medical device industry is facing. Understanding the internal drivers of innovation management in the Finnish medical device industry is made easier with the help of the RBV framework. Managers can create strategies and tactics that utilize their strengths and fix their shortcomings to promote innovation and long-term success by taking a close look at the company's internal resources and capabilities. The empirical analysis is presented in Chapter 4, and it uses survey results and manager interviews from a medical device company to produce the research's findings. As a result, the theoretical framework and this chapter are used to address the research issues in chapter 5. The chapter summarizes the significance of this thesis and provides an analysis of the study results. The conclusion and potential directions for future research are offered in chapter 6 after an overview of the study has been gained. The structure of the thesis is described in figure 1.

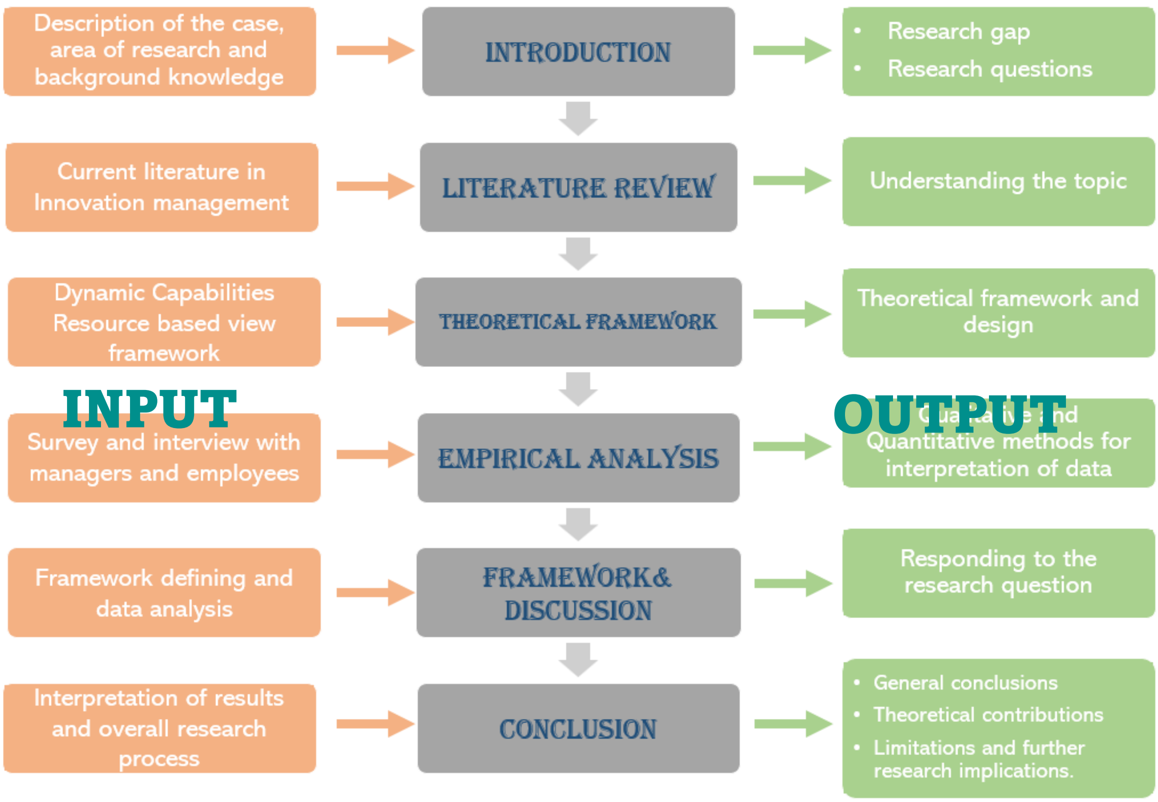

Figure 1: Structure of the thesis

2 Literature review

Recent years have seen a significant amount of research into organizational performance and innovation management. Organizations look to innovation as a major factor in growth and success as they work to preserve their competitive advantage. Like in many other nations, Finland's medical sector faces a number of issues that call for creative solutions. These difficulties include shifting patient expectations, rising healthcare expenses, and demographic changes. In response, medical organizations are looking into how to adopt managerial innovation and strategic corporate innovation management to strengthen their capacity for innovation. With a focus on Finland, this literature review aims to present an overview of the status of research on managerial innovation and strategic corporate innovation management in the context of the medical business.

2.1 Innovation management

According to Dodgson et al. (2017), innovation management is the systematic management of the actions, resources, and processes that result in the creation and application of novel concepts, ideas, products, services, or processes that add value for clients and the company. It encompasses managing ongoing innovation projects as well as the discovery, creation, and marketing of new ideas. According to the literature, innovation management is crucial to an organization's success and is linked to improved levels of performance and competitiveness (Damanpour, 2014; Laursen & Salter, 2006). In the era of digital transformation, businesses must innovate more frequently and quickly. Innovation drives business growth and keeps companies one step ahead of their rivals. In response to the changing demands of the market, innovation management creates new business models as well as innovative products, services, and technologies. Customer satisfaction and employee engagement both rise as a result of effective innovation management. When considering broader picture, innovations can be incremental for example Apple iPhone, it can be a breakthrough innovation like Zipcar and also disruptive innovation like Amazon. Based on the firm’s field and the technology in hand it can vary for each organization. In this case, however, we are more interested in how technology influences innovation and on how it might be utilized to stimulate innovation and innovative behavior both inside and between businesses. Technology is commonly referred to as an invention's output (Erdener and Dunn, 1995; Madsen et al., 2005). Another element important to the conception, development, and application of inventions is the innovation method. Being a large topic, corporate strategy frequently has a vague definition. According to Damanpour and Evan (1984), Read (2000), Martins and Terblanche (2003), and Martins and Terblanche (2004), "strategy" in this study refers to components of the corporate and innovation strategies of the company and how they affect the management of innovation. The diffusion of the strategic vision across the entire organization is also referred to. Organizational structure and culture also plays a pivotal role in the innovation management. Employees refers to the organization's non-management staff members and the part they play in influencing innovation management. This element considers the many personality traits connected to employees (e.g., Ahmed, 1998; Bharadwaj and Menon, 2000) as well as the drive for innovation among employees (e.g., Mostafa, 2005). Resources refers to all of the organization's resources—human, financial, and physical—but they are discussed in relation to the number of slack resources and the management of resources (e.g., Knight, 1987; Wan et al., 2005) to have an impact on the ability of an organization to manage innovation. knowledge administration. In this study, knowledge management refers to the organization and application of knowledge for the management of innovation. This encompasses all knowledge-related topics, both inside and outside the organization. The importance of organizational learning in knowledge management will also be considered by this component (Salavou, 2004; Ng, 2004). The phrases management style and leadership are used to describe the people who are in charge of operating the organization, and they are equally important. This issue deals with several aspects of how management influences the management of innovation. For instance, it takes into account the management style used by a firm (e.g., Pearson et al., 1989; Hyland and Beckett, 2005) and the ways in which management could inspire employees to be more creative (e.g., Roffe, 1999; Rivas and Gobeli, 2005). Though there are some risk factors associated with innovation management (Dodgson et al., 2017), which are as follows in the table 1:

Table 1: Risk factors associated with innovation management.

RISK FACTORS	DESCRIPTION
Failure to satisfy customer needs	Failure to recognize and satisfy the needs and preferences of the customer, which could result in a failed product or service.
Competitive imitation	Competitors copying successful technologies fast could reduce market share and competitive advantage.
Absence of internal support	Innovation efforts are hampered by a lack of support and resistance to change from important decision-makers and stakeholders inside the company.
Financial strain	Insufficient funding for research and development, which restricts the company's capacity to invest in innovation and puts its competitiveness at danger.
Regulatory obstacles	Regulatory restrictions that are too strict and compliance challenges that make it difficult to produce and market innovative goods or services.
Technological obsolescence	Due to the rapidly changing nature of technology, constant investment in current and future-proof technologies is necessary.
Market failure	Failure of an innovative product or service to satisfy consumer demand or establish market traction, perhaps resulting in commercial failure.

After careful consideration of all the risk factors, the innovation process will be important for managing innovation and the crunch part of it will be between the ideation and the implementation stage of the product. Without an innovation strategy, attempts to boost innovation can easily devolve into a collection of widely praised best practices, including, but not limited to, dividing R&D into autonomous decentralized teams, encouraging internal entrepreneurial ventures, creating corporate venture-capital arms, pursuing external alliances, embracing open innovation and crowdsourcing, working with customers, and implementing rapid prototyping. All of the techniques are effective by themselves. The problem is that a company's capacity for innovation depends on its innovation system, which is a cohesive set of interconnected processes and frameworks that determines how a company searches for novel problems and their solutions, puts ideas into business plans and product designs, and chooses which projects to fund. Different best practices involve trade-offs. A variety of supportive changes to the organization's overall innovation framework are frequently required in addition to the implementation of a specific practice. Without an innovation strategy, a corporation will not be able to select all the elements of the innovation system and make trade-off decisions. It is more important than ever to follow the right procedures, processes, and well-thought-out strategies while managing innovations. This is where innovation management, which combines managing innovative processes with cutting-edge chain management techniques and provides methods and tools that let managers and staff members collaborate on shared objectives, may come in very handy (Matzler et al. 2015). There is no one standard structure ideal for all types of innovations, as claimed, for example, by Foss and Saebi (2018) in the broad context, hence many writers argue that the structure of an inventive organization should change depending on the innovation techniques chosen. While the structure supports the innovation process, the strategies direct innovation activities (Ehrenberger et al. 2015). The ideal innovation strategy is always dependent on the specific circumstances of the relevant firm. However, effective innovation management typically involves all four of its components according to Christensen (1997) as in figure 2, which are coordinated and characterized by economic theory.

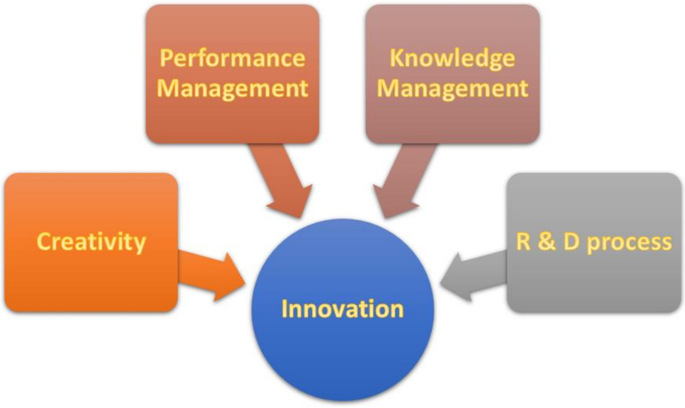

Figure 2: Components of Innovation

Therefore, it is crucial to underline the value of managers in commercial organizations who are knowledgeable about the innovation processes. With the introduction of new lines of action and clever innovation, the organization has established a space for innovation and delivered returns from previous years' efforts.

Generally, there are several strategies for fostering innovation, depending on the setting, sector, and corporate structure. The significance of coordinating structural, strategic, and innovation systems cannot be overstated. Results from the biological and pharmaceutical industries show that management has a good overall capacity for innovation, notwithstanding varied opinions about the enterprise-level innovation philosophies. Nearly half of the businesses included in the study said they would give innovation philosophy more attention. According to several industry surveys, most businesses create and remodel their management systems in accordance with various market strategies (Franca et al. 2017). Companies in this area are encouraged to create new ideas as part of the culture and innovation environment, and corporate focus is employed as an excellent management tool for focusing and structuring. Businesses must consider the tactics that motivate the creation and use of innovation in order to create or sustain a competitive edge through innovation management. The management is responsible for the strategies, frameworks, and organizational structures used in the field of innovation. The proposal examines how innovation management is structured and how innovation processes frequently appear as coherent alternatives to understanding innovation, given the need to comprehend the crucial elements of enterprise innovation management in order to gain a sustainable competitive advantage. All automobile businesses appear to be open to establishing helpful norms for innovation and implementing various innovation methods depending on various market strategies. Additionally, all businesses pay great attention to the cultural and environmental innovations they view as being crucial to their growth. Technological advancements are crucial to the process of managing innovation. The strategy may vary per industry.

Companies in the biological and pharmaceutical sectors evaluate the significance of management innovation within the five elements under "total management innovation." It's interesting to note that organizations share the same ideas on institutional innovation, organizational and structural innovation, as well as cultural and environmental innovation. Employees in the sector can easily acclimate to the new organizational structure under the aegis of organizational and structural innovation. Most chosen businesses believe their capacity for innovation to be above average for the sector. These traits should always be supported by the innovation metrics, and your initiatives should be in line with a more innovative corporate culture. The proportion of new ideas and initiatives that come from employees as opposed to management, or the amount of time all organizational levels spend on development as opposed to operation, could be some of the main supporting input indicators in this category.

Employee involvement in innovation activities and employee assessments of the organization's innovation potential are two examples of output measures that support an innovative corporate culture. In order to improve team performance, managers can broaden their primary responsibilities by managing innovation. Innovation in management can advance organizational objectives in this way. the creation of an innovation roadmap, for example, and the planning of innovation activities. The following steps make up the entire innovation process that turns an idea into a successful invention: concept development, business planning, problem-solving, solution prototype, implementation, and marketing.

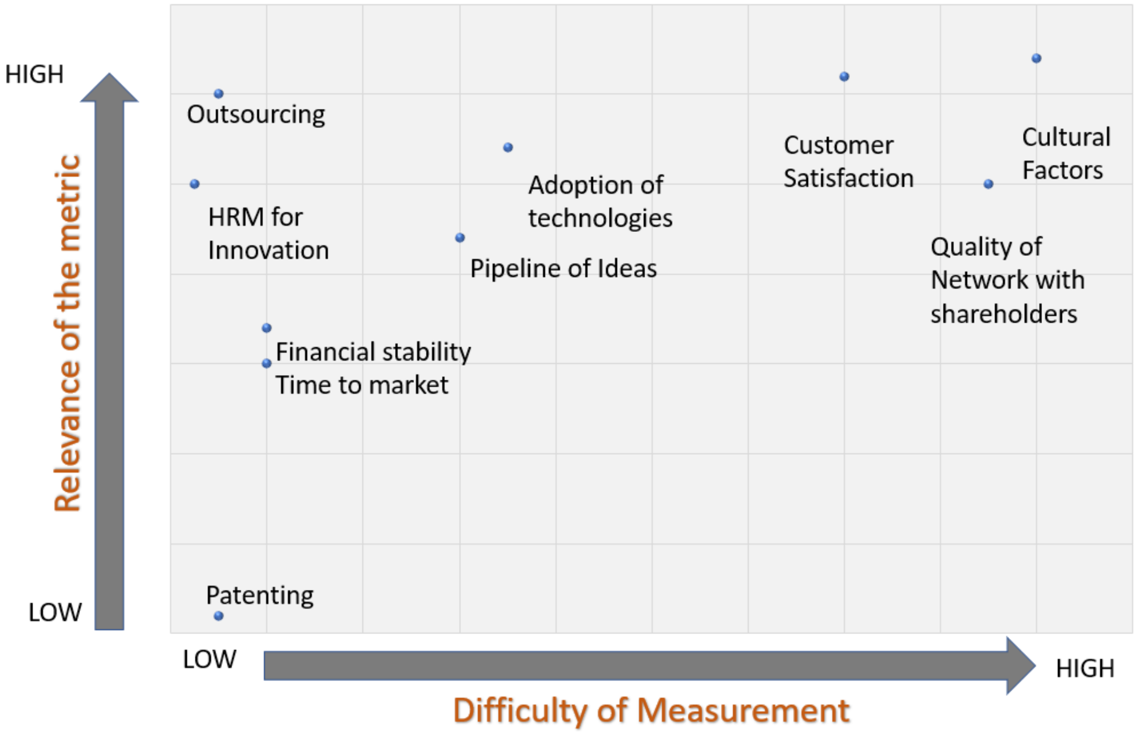

Figure 3: Different metrics to measure innovation vs its complexity (Yli-Renko et al, 2002)

There are different metrics which an organization can use it to measure the success of the innovation efforts some of them are depicted in figure 3 and explained below,

Growth in the revenue: Perhaps the simplest criterion for assessing the success of innovation activities is revenue growth. Businesses can monitor revenue growth over time to ascertain whether their innovation efforts are resulting in an expansion of the whole firm. A company's innovation efforts may be paying off, for instance, if it had static or declining revenue but then had a substantial boost after launching a new product or service (Fagerberg et al., 2006). It's crucial to remember that, in addition to innovation, a variety of other factors can have an impact on revenue growth, thus it should be utilized in conjunction with other indicators.

New product development: Counting the quantity of new goods or services created over a specific time period can be a helpful indicator of how well an invention is progressing. This can involve the introduction of new product lines, the addition of additional features to current items, or the launch of brand-new products. Organizations may assess whether their innovation activities are producing a consistent stream of new offers that can foster growth and draw in new clients by keeping track of the number of new items generated (Flynn & Amann, 2016).

Customer satisfaction: In the end, whether or not customers are eager to purchase and use the new products or services being developed will determine whether innovation efforts are successful. Checking if innovation efforts are fulfilling customer requirements and expectations can be done by measuring customer satisfaction. Surveys, focus groups, and other types of feedback systems can be used to accomplish this (Fagerberg et al., 2006). High levels of customer satisfaction may indicate that innovation initiatives are succeeding and that consumers are responding favourably to new goods or services.

Time-to-market: The length of time it takes to introduce a new good or service to the market can be used to gauge the success of an innovation. To assess how effective and efficient their innovation process is, businesses might monitor the time it takes from ideation to product launch. A faster time-to-market may indicate that innovation initiatives are being carried out promptly and efficiently, which can help to sustain a competitive advantage in quickly evolving industries.

Patent applications: Filing for patents can help businesses obtain a competitive edge and safeguard their discoveries. Monitoring the number of patent applications can be a helpful tool to gauge the level of R&D spending and the potential for future innovation. It's crucial to remember that not all innovations should or can be patented, and that the mere number of patent applications may not be a reliable indicator of an innovation's success.

Employee engagement is important for fostering innovation since motivated staff members are frequently more likely to make innovative contributions and take calculated risks. Finding out whether an organization has a strong innovation culture and whether its employees are dedicated to participating in the innovation process can be done by measuring employee engagement levels (Flynn & Amann, 2016). Surveys and other methods of getting feedback can be used for this.

Market share: In the end, the success of innovation initiatives will depend on whether they result in a sustained rise in market share. To ascertain whether their innovation initiatives are giving them a competitive advantage in their business, organizations might monitor their market share. For instance, if a business introduces a new product and notices a rise in market share, this may be a sign that the innovation effort was successful. Market share should, however, be used in conjunction with other measures as it can be influenced by a variety of other factors outside innovation.

The ethics of the innovation will also have a say in the innovation management, at first look, innovation seems to be morally neutral, and its moral value seems to be completely dependent on its application. A tight relationship, such as that required to apprehend terrorists, can be facilitated through social media, WhatsApp communications, and other such tools. Both the dissemination of information and its search are facilitated by the internet. While it is true that the user bears responsibility, innovation frequently has significant effects on both individuals and entire communities (Gassmann & Enkel, 2004). It is evident that innovation encompasses not only technological and economic advancements but also ethical and social ones. Jobs, the fight against crime, privacy invasion, discovering a cure for inherited disorders, and the production of synthetic genomes can all be affected by innovation. Education, interpersonal communication, participatory democracy, and fresh, novel economic models are all tied to innovation (Goldman & Fennell, 2013).

Innovation that is responsible is vital. However, it's not always simple. The complicated and disruptive times we live in call for serious thought, particularly in light of the potential benefits and drawbacks. Although predicting these effects is not always simple, it is vital to try. In any case, it would be beneficial to track each innovation and evaluate its results. From this point forward, innovation must be humanized through creativity.

2.2 Strategic corporate innovation management

The creation and application of strategies that allow firms to generate and seize value from innovation is referred to as strategic corporate innovation management (Liu et al., 2018). It entails incorporating innovation into the company's overall strategy, culture, and operational procedures. A disciplined and cyclical strategy is used by many firms to make innovation management a regular element of business. Corporate innovation is the process by which an organization experiments with contemporary practices, technology, strategies, and possibilities to increase the competitiveness of its current business model in the market. Corporate innovation is really about inspiring individuals working in corporate settings to think creatively. In order to accomplish this, firms may establish a special innovation team and place them in outlying locations where they may collaborate closely with startups According to the literature (Kang & Kang, 2017; Laursen & Salter, 2006), strategic corporate innovation management is crucial for firms to attain long-term performance and competitive advantage. Corning, a top producer of specialty components used in electronic displays, telecommunications systems, environmental products, and life sciences instruments, is an excellent illustration of how a close relationship between business strategy and innovation can drive long-term innovation leadership. (Disclaimer: The person giving this context has experience working as a consultant for Corning. It should be emphasized, however, that the data in this article is based on the 2008 HBS case study "Corning: 156 Years of Innovation" by H. Kent Bowen and Courtney Purrington. The information and conclusions drawn from this study provide a thorough picture of Corning's long history of invention.) Through ground-breaking technologies, Corning has continually changed its business over the course of its more than 160-year history and expanded into new markets. When compared to contemporary best practices, Corning's strategy appears outdated. One of the rare businesses with a centralized R&D facility (Sullivan Park, in rural upstate New York) is the corporation. It makes significant investments in basic research, a process that many businesses abandoned long ago. In addition, it makes large investments in manufacturing infrastructure and equipment and keeps a sizable manufacturing presence in the United States, defying the widespread trend of production offshoring and outsourcing. However, Corning's strategy for innovation makes perfect sense when evaluated from a strategic perspective. The company's primary focus in terms of business strategy is selling "keystone components" that significantly improve the performance of clients' complex system goods. In order to implement this strategy and identify new applications for its technology, Corning must be at the cutting edge of glass and materials science (Garcia & Calantone, 2002). That calls for significant expenditures in ongoing research. Corning ensures that experts from the various disciplinary backgrounds underpinning its core technologies can collaborate by centralizing

R&D. Sullivan Park has developed into a hub of accumulated knowledge in the use of materials science to solve industrial issues. Heavy expenditures in manufacturing and technology are necessary because novel materials frequently call for complementing process advances. Additionally, by maintaining a home manufacturing base, the business may scale up production and facilitate the transition of new technologies from R&D to manufacture. Everyone may not agree with Corning's approach. Research long-term investments are risky: Corning's optical fiber industry was completely destroyed by the telecommunications bust in the late 1990s. The success of Corning, however, highlights the need of having a well-defined innovation strategy that is directly tied to the overall business strategy and fundamental value proposition of a company. Most efforts to increase a company's capacity for innovation are doomed to failure without such a strategy (Hult, Hurley & Knight, 2004).

Established businesses are prone to get set in their ways and willing to rest on their laurels rather than advancing. They put their attention on developing fresh revisions of current items rather than trying to stay on the cutting edge. The issue with this strategy is that it exposes businesses to upheaval. Modern thinking and lean startups have the power to quickly upend an entire sector. A S&P 500 Index company's average longevity in 1960 was close to 60 years. The average age of businesses listed on the stock exchange is just 20 years old, which is young in the quickly evolving digital sector.

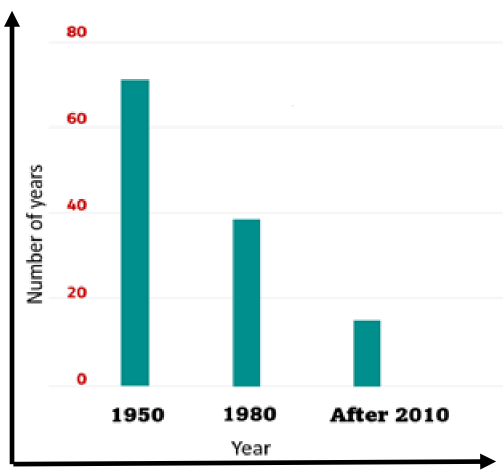

Figure 4: S&P 500 index on average longevity of companies (Davis, 2011)

A startling 52% of Fortune 500 businesses have either gone out of business, been purchased, or gone bankrupt since 2000. As seen when Uber and AirBnB irreversibly changed the taxi and hotel industries, respectively, even the largest organizations aren't immune to the threat of digital disruption. Corporations must establish a culture that embraces new technologies and aggressively look for ways to improve their business model if they want to stay competitive (Jantunen et al., 2005). Enterprises may stay adaptable in the face of escalating competition by adopting this proactive approach to business innovation. Even before any company has a chance to establish itself in the market, businesses may spot new prospects. R&D and the purchase of startups and other businesses are both effective forms of corporate innovation. They are not the only approaches a company may use, though. Corporations can access a wide range of ideas that enable them to extend their market lifetime and find more success in staying ahead of the competition by integrating a variety of approaches into their corporate innovation strategy. Corporate innovation usually falls under two categories, its either open or closed system innovation management. Closed innovation is the process of developing new concepts and planning for the future using only internal resources (Damanpour, 2014). Creating teams solely focused on innovation, gathering fresh concepts from current employees, establishing dedicated innovation teams, and initiating internal corporate accelerator programs are examples of common closed corporate innovation approaches. Some of the approach an organization carry out in closed system to carry out innovation management they are shown below in the diagram,

Figure 5: Methods of Closed innovation management.

A real-life case study for Closed model can be the identified in SAP.iO Venture Studio. Enterprise solutions for customer relations and corporate processes are the main focus of SAP, a software firm. The corporation introduced SAP.iO in 2017, which it describes as its "strategic business unit to incubate startup innovation and drive new business models for the company." (SAP, 2017) The program's Venture Studio initiative also enables incubation for internal businesses created by SAP employees who have discovered a business challenge and a viable solution. The initiative offers help for external startups. To get started and eventually join a SAP business unit so they can scale inside the broader firm, these employee-led initiatives receive money in addition to design, development, and sales support. For instance, the SAP project Paid Promptly simplifies receivable operations and is currently offered to customers through the SAP Store.

Open innovation is the practice of obtaining novel goods, concepts, and frequently new brands from sources outside of the corporate hierarchy. Companies pursue open innovation through acquisitions and investments, the creation of innovation outposts, collaboration with outside accelerators, or staging of events like hackathons and pitches. In case of open innovation below are some of the approaches which use to implement.

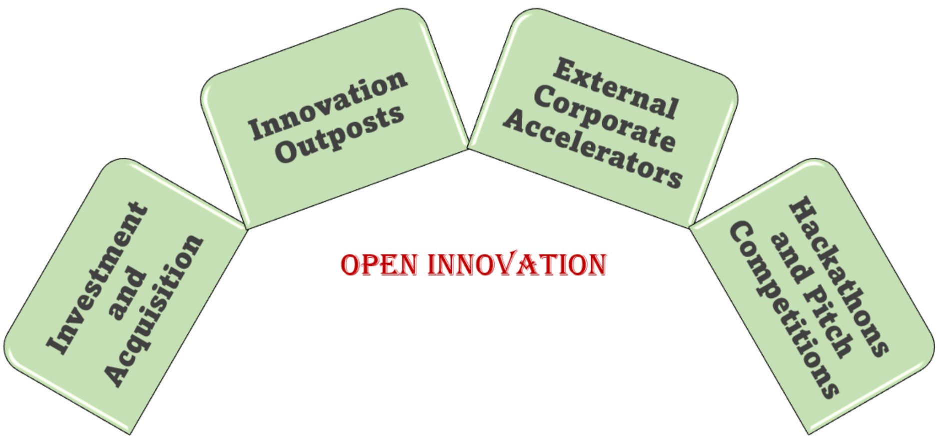

Figure 6: Methods of Open innovation management.

Case study for Open model can be taken from the success story of Walt Disney, The Walt Disney Company can offer numerous examples of how a corporate innovation strategy with a strong emphasis on open innovation may be crucial to market success, with its historical success in acquisitions being one of the most notable. When the business paid $7.4 billion for Pixar in 2004, it made one of its initial significant acquisitions. Then, in 2009, the company bought Marvel Entertainment, a superhero franchise, for $4 billion. Finalizing the process in 2012, Disney paid $4.05 billion to acquire Lucasfilm and the Star Wars brand. The three acquisitions produced undeniable results. Prior to the purchase of Pixar in 2003, the market value of The Walt Disney Company was $46.97 billion. As of November 2022, that value had risen to $164.20 billion (Kapor, 2019).

However, there are few challenges concerning the corporate innovation management,

Thinking short term: Companies with venture capital backing and those that are publicly traded face significant pressure to meet quarterly results. Although a strategic goal may be in place, the executive team is mostly concerned with ensuring growth for the upcoming quarter. This short-term perspective limits innovation because it lacks the time horizon and flexibility needed for innovation. For instance, a company's ideas and solutions will frequently have a short-term perspective. Less emphasis is placed on significant inventions that have the potential to completely transform a sector but require longer to implement. This contributes to the fact that smaller businesses frequently innovate better than larger ones. When the next quarterly result is the top priority, less funding will go toward creative ventures that are less tested and more dangerous (Kao, 2002). Executives at publicly traded corporations are also acting to protect themselves from shareholder backlash if they take too many risks that don't pay off. All things considered; the forces that direct the actions of larger businesses tend to favour the short term over the long term.

Lack of Vision: A company's vision identifies a goal or state of being that it is attempting to achieve. When combined with purpose, it provides employees with a sense of the wider picture and aids in contextualizing the significance of their work. This vision is a crucial tool for assisting in decision-making, especially when it comes to innovation. Numerous innovations are possible. But what counts is developing solutions that matter to your clients. Innovation attempts fail because they aren't in line with market need. The lack of a compelling vision is one of the reasons why innovation fails. Your team and you can see the forest for the trees with the aid of vision. A clear vision serves as an enlightening eye, shedding light on all the issues, challenges, and possibilities in your industry—exactly the elements that will inspire your invention (Löfgren, 2004). Your team's innovation and concentration will be wasted if you don't have a clear understanding of the big picture and the direction you need to go in.

Corporate constraints: Each department will need managers who can identify and support innovative activities because innovation can come from anywhere inside the corporation. The current issue is that managers only serve one purpose in relation to operational performance. Instead, then creating a new status quo, their focus is on maintaining and improving the current one. In particular for seasoned managers, managing and fostering innovation requires a fundamentally different style of thinking that won't come naturally. The issue of managers acting as the gatekeepers to senior workers is another. This is a problem since lower-level personnel are unable to put ideas into action without higher level permission (Martínez-Ros & Orfila-Sintes, 2009). This may result in communication barriers between the leadership team and ideas that can address immediate issues.

Quantifying results: Innovation is a chaotic process that looks more like a zig zag than a line. There is no set path to innovation, despite the fact that there are tools like design thinking that streamline the process. This makes it challenging to predict and evaluate the outcomes of innovation, but these tasks are necessary for every organizational endeavour. The difficulty for leaders is to put a number on the outcomes and development of innovation. This is important in order to assess its efficacy, but if done carelessly, it could have unintended consequences. A focus on outcomes that is too intense can lead to concepts that are safer but less effective, which prevents actual innovation.

Managing Incentives: It can be challenging to control how rewards and incentives for innovation are distributed. Offering the proper remuneration structure is essential, even in organized agreements like corporate accelerators or internal startups, to guarantee that founders are motivated to give the project their all-in order to succeed. It may be more challenging when innovation comes from within. If your business is the sole owner of the intellectual property your employees produce, they might not be inspired to develop (Chesbrough, 2003). Your staff won't share the rewards but will instead share the risks without an employee remuneration plan that encourages intrapreneurs, which will finally stop activity.

Expectation Management: There may be a gap between reality and project assumptions since innovative progress is hard to measure. Teams frequently go through numerous iterations and learning opportunities before they find the best answer. Furthermore, because you are working in the dark, it can be challenging to tell when a breakthrough is imminent. The team members themselves, management, and other employees who may perceive that the startup projects aren't "real work" may all become frustrated as a result of this. Projects may lose their momentum as a result or start to be micromanaged by the bigger company. It's difficult to strike a balance between corporate pragmatism and the flexibility and perseverance that innovation demands so that initiatives can succeed while also being allowed to flounder when required (Kucukusta & Demirkan, 2015).

Apart from these reasons, Lack of engagement, lack of learning and improving the skills, lack of client focus, not having the right people to work on the project and structure of the firm also contributes to some of the challenges in corporate innovation management.

2.3 Managerial innovation and its metrics

According to Liu et al. (2018), managerial innovation is the introduction of novel management techniques, processes, and structures that enhance organizational performance. It entails the creation and application of fresh management strategies, including brand-new organizational frameworks, performance management programs, and leadership techniques. According to the literature, managerial innovation is essential for businesses to better perform and adapt to changing contexts (Birkinshaw et al., 2008; Laursen & Foss, 2003). According to a recent study by Su et al. (2018), MI is a smart way to support a corporation's development and boost its managerial strength skills by utilizing novel ways to exploit crucial resources. While some academics view MI as a process (Shultz 2016), others see it as a cycle of organizational change that begins with ideation and continues until the successful completion of the final stage of implementation (Roy 2016). Agogué et al. (2017) assert that MI has proven to be an effective instrument for inspiring managers and leaders to develop the principles of relativity, contingency, and agility in developing and putting into practice managerial policies and strategies. While contingency is the extent of the relationship variables found between the size of the organization and the environmental uncertainty, which are frequently influencing to the degree of innovation and control within organizations, relativity in the context of MI can be described as emerging from the impact of new technologies, as well as the manner of practice within the organisational management (Kisperska-Moro 1992); and agility is the ability of an organization to adapt to the environmental contingencies imposed, with an organization's potential for innovation having a beneficial impact on the organizational and management agility (Ravichandran 2018). On the other side, Sheehan et al. (2014) assert that MI boosts employees' self-actualization and self-esteem through emphasizing organizational citizenship. Additionally, Garca-Cruz et al. (2018) contend that managers must construct an integrated workplace by developing a proper system of staff collaboration and communication. Managers who desire ongoing improvement or dynamic change in management through technology 4 and the readily available resources can accomplish this while simultaneously improving performance, communication, speed, accuracy, and productivity while lowering costs, effort, and redundancy. From top management to operational level, it has been noted that a component of MI literature suggests that managers must demonstrate their commitment to their employees' self-development and enhanced learning in order to better understand the various perspectives present in an organization's systems (Sheehan et al. 2014; Agogué et al. 2017; Garca-Cruz et al. 2018). There are various real-life examples showing how managerial innovation has turned out be a fundamental reason for the success of the product. The only way to alter how managers do their duties in a large organization is to reimagine the procedures that direct their work. The mechanisms that translate management ideas into common practices include strategic planning, capital budgeting, project management, recruiting and promotion, employee evaluation, executive development, internal communications, and knowledge management. They set up the procedures and customs that direct managers' work. Management innovation emphasizes a company's management processes, as opposed to operational innovation, which concentrates on a company's business operations (such as procurement, logistics, customer service, and so forth).

In the early 1900s, General Electric enhanced Thomas Edison's most well-known invention, the industrial research laboratory. GE provided organizational discipline to the chaotic field of scientific discovery. GE obtained more patents than any other American company throughout the ensuing 50 years. That amazing achievement accounts for a significant percentage of GE's current competitive strength. Another illustration of this is the fact that DuPont made a substantial contribution to the advancement of capital-budgeting techniques when it began employing return on investment estimates in 1903. A few years later, the company also developed a standardized process for assessing the efficiency of all of its numerous product lines. These advancements, among other things, assisted DuPont in becoming one of the nation's industrial giants. Another illustration is that Procter & Gamble first formalized its brand management strategy in the early 1930s, which is when the company began to dominate the packaged goods market. Over the years, P&G has steadily built on its early success in obtaining value from intangible assets. P&G's product portfolio includes 16 brands with annual sales of $1 billion or more. These examples show how a management innovation can give an inventive company a significant competitive advantage and lead to a fundamental shift in how the sector is run. Technology and product innovation, however, often only provide minimal improvements. A management innovation will result in long-term advantages when it meets one or more of the following three requirements: The innovation is systemic, entails numerous processes and procedures, and is a component of an ongoing program of invention where advancements are made through time. The innovation is founded on a revolutionary premise that questions managerial orthodoxy (Alghamdi, 2020). Businesses can benefit from a number of future trends and chances for managerial innovation to stay competitive and achieve long-term success by looking ahead.

Innovation driven by technology: The growing importance of technology in company management is one of the main themes in managerial innovation. Technology is changing how businesses run, from artificial intelligence and machine learning to big data analytics and the Internet of Things (IoT). To automate repetitive operations and improve decision-making, for instance, corporations are utilizing AI and machine learning algorithms (Alghamdi, 2020). Businesses are using big data analytics to learn more about consumer behaviour and market trends. Businesses can now gather and analyse data from a variety of sources to improve the effectiveness of their operations.

Agile leadership: The transition to agile management is another trend in managerial innovation. With an emphasis on flexibility and adaptability, this strategy enables organizations to react swiftly to shifting market circumstances and client demands. Traditional hierarchies must be dismantled in order for teams to work cooperatively and autonomously under agile management (Dyer, Gregersen & Christensen, 2011). This method is especially well adapted to dynamic, fast-paced workplaces where creativity and innovation are crucial.

Employee's involvement: In recent years, employee engagement has emerged as a critical factor in business success, and this trend is likely to persist in the years to come. Employees that are engaged are more creative, innovative, and likely to stick with their company. New methods of employee engagement are being developed by creative managers, including gamification, social recognition, and flexible work schedules (Enkel, Gassmann & Chesbrough, 2009). Businesses may increase productivity, lower turnover, and foster creativity by fostering a healthy work atmosphere and giving employees the freedom to take responsibility for their work.

Inclusion and diversity: The focus on inclusion and diversity is another trend in managerial innovation. Companies are starting to realize the advantages of a diverse staff, such as more creativity, better decision-making, and greater customer relationships. Innovative hiring practices, flexible work schedules, and employee resource groups are just a few of the new techniques that creative managers are using to draw in and keep diverse talent (Edquist, 2010). Businesses may tap into a wider range of viewpoints and ideas, fostering greater creativity and success by fostering an inclusive culture that embraces diversity.

Sustainability in business: The importance of sustainable business practices is rising in today's society. Businesses that promote sustainability are more likely to draw and keep customers as consumers become more aware of their environmental and social impact. Innovative business leaders are constantly looking for innovative methods to lessen their environmental impact, including through the use of waste reduction initiatives, sustainable supplier chains, and energy-efficient technologies (Dyer, Gregersen & Christensen, 2011). Additionally, they are placing a high priority on social responsibility, exemplified by ethical sourcing, respect for workers' rights, and involvement in the community.

Since managerial innovation is frequently elusive and difficult to measure, doing so can be tough. This article will examine the metrics that should be used by businesses to gauge the performance impact of management innovation, as well as how it may be monitored and evaluated.

Managerial innovation metrics

Assessing the degree to which managers are implementing innovative techniques and procedures to promote performance and success is a key component of measuring managerial innovation. Figure 7 presents some techniques to gauge managerial innovation.

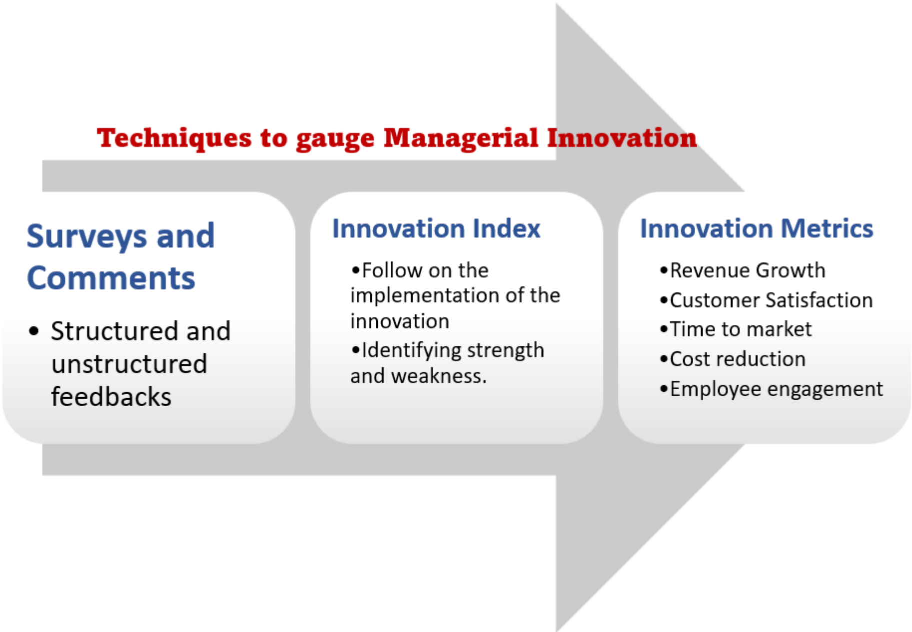

Figure 7: Techniques to gauge managerial innovation.

Conducting surveys and obtaining input from stakeholders and employees is one of the simplest ways to gauge management innovation. Structured surveys or unstructured feedback systems like suggestion boxes or online forums can be used for this. Surveys can be created to collect data on a variety of topics, including the uptake of new technologies, the application of new procedures, or the degree of employee involvement. The comments obtained can be utilized to pinpoint areas of strength and weakness and implement corrections as needed. The innovation index is a method for measuring how much an organization is implementing innovative procedures and practices. The innovation index often consists of a series of questions that evaluate many facets of innovation, including organizational innovation, process innovation, and product innovation. By comparing an organization's innovation performance to that of its rivals or peers in the industry, one can use the innovation index. This might offer insightful information on how well the company is doing and where it needs to concentrate its efforts to advance. Innovation metrics are objective evaluations of the effectiveness of innovation. These indicators can be used to monitor how innovation projects are doing over time and determine how they are impacting performance (Govindarajan & Trimble, 2010). Innovation measures include, for instance: number of new products/Percentage of revenue increase / patents filed etc can be measured. In addition to that, some of the other metrics which could be used to evaluate managers are employee satisfaction, revenue growth, customer satisfaction, time to market and cost reduction. It is necessary to integrate managerial innovation to organization’s overall innovation strategy, there are different steps which firms has to carry out in order to do that integration.

Create an innovative culture: To incorporate managerial innovation into an organization's overall innovation strategy, it is essential to create a culture of innovation. Employees who are empowered to challenge the status quo and are encouraged to think creatively work in an environment that values innovation. It is a culture were trying new things and taking risks are valued, and where failure is viewed as an opportunity to grow. Leadership must set a positive example if it wants to foster an innovative culture. Managers and executives should encourage a transparent and cooperative work atmosphere where staff members feel free to offer suggestions and criticism (Alghamdi, 2020). They should be prepared to experiment with novel concepts and take measured risks, demonstrating that innovation is a key priority. Making an environment that encourages experimentation and risk-taking is another essential component of an innovative culture. This entails encouraging staff members to try out novel concepts and methods, even if they don't initially pan out. Organizations should establish risk-free environments where staff members can try out novel concepts without worrying about failing. Innovation should also be praised and rewarded. Employees who develop original ideas and effective projects should be honoured by their employers. This can be accomplished through incentive schemes, awards schemes, or other strategies for promoting innovative projects that succeed (Dyer, Gregersen & Christensen, 2011).

Organizations should make sure that innovation is a continuous process rather than a one-time occurrence. They should promote iteration and continual improvement as part of their regular business practices. This entails giving staff members continual training and tools, as well as developing procedures for routinely assessing and optimizing innovation activities. Organizations can lay the groundwork for long-term success and ongoing progress by fostering an innovative culture. Employee engagement is higher, managers can collaborate better, and a firm can react more swiftly to shifting market conditions.

Set Goals and Objectives: Integrating managerial innovation into an organization's broader innovation strategy requires setting clear goals and objectives. These objectives must be measurable and doable, and they ought to be in line with the mission and strategic goals of the firm. Organizations can concentrate their efforts on innovation and monitor their progress by creating clear goals and objectives. Organizations should first define the precise areas where they aim to innovate before setting effective goals and objectives. This could involve boosting customer experience, producing new products or services, cutting expenses, or improving operational efficiency. Organizations should create a plan for attaining their innovation goals after these areas have been identified. The roadmap should outline the precise steps the business will take to accomplish its objectives, along with completion dates for each step. Indicators for gauging each initiative's performance should be included, such as revenue growth, customer happiness, or employee involvement. Organizations should have a method for prioritizing their innovation activities in addition to identifying goals and objectives (Alghamdi, 2020). This can entail assessing every endeavour in terms of its potential impact, viability, and resource needs. High-priority efforts should receive greater money and attention, whereas lower-priority ones may be postponed or abandoned. In order for everyone to know what they are working towards and how their individual efforts contribute to the success of the firm, it is crucial for organizations to clearly communicate their innovation goals and objectives to all of their employees. Regular updates, team gatherings, or other forms of internal communication can accomplish this.

Create an Innovation Team: A key element in incorporating managerial innovation into an organization's overall innovation strategy is resource allocation. Resources for supporting innovation projects may include cash outlays, labour, time, and other assets. The likelihood of success can be increased by effectively allocating resources to support and resource innovative endeavours. Organizations should take each innovation initiative's potential impact and viability into account when allocating resources. Resource allocation should prioritize high-impact activities that are deemed practical, while those with lower potential impact or feasibility may get fewer resources or be put on hold completely. When allocating resources, organizations should also take the risk involved with each innovation effort into account. In order to offset potential bad results, high-risk efforts could need more resources, whereas low-risk ones might need less. Organizations should have a comprehensive grasp of their entire innovation budget and the resources available to support innovation efforts in order to spend resources efficiently (Laursen & Salter, 2014). This may entail creating a separate budget for innovation initiatives or designating a percentage of the organization's total budget for such projects. A mechanism for managing and overseeing resource allocation should be in place as well. This can entail creating a cross-functional innovation team to supervise projects and guarantee that resources are being deployed properly.

Foster Collaboration and Knowledge Sharing: Integrating managerial innovation into an organization's broader innovation strategy requires building a culture of innovation. Employees who are encouraged to come up with fresh ideas, take chances, and welcome change are said to work in an innovative environment. This kind of culture can promote innovation, raise employee engagement, and encourage creativity. Organizations should emphasize the value of innovation to all employees before attempting to create an innovative culture. This can entail defining an explicit vision and mission for innovation and outlining how it fits with the organization's overarching goal and long-term goals. Leaders should also exhibit traits that promote innovation, such as taking chances and being adaptable. Organizations should create procedures and frameworks that encourage innovation. This can entail setting up cross-functional teams or innovation hubs where staff members from several departments can work together on fresh concepts (Martínez-Ros & Orfila-Sintes, 2009). Additionally, it might entail creating an innovation pipeline where concepts are methodically assessed and developed. Additionally, businesses should give staff members the tools and assistance they require to innovate. This can entail giving staff members the chance for training and growth, awarding rewards for innovation, and giving them the time and freedom to try out new concepts. Finally, businesses ought to acknowledge and celebrate successful innovations. This may serve to emphasize the value of innovation and generate enthusiasm for fresh concepts. Celebrating accomplishments can help create momentum and inspire staff to keep coming up with fresh ideas.

Embrace Technology: The first step in incorporating management innovation into a company's broader innovation strategy is to embrace technology. Organizations that don't keep up with technological improvements run the risk of falling behind as the business landscape is continually changing and expanding due to technology. Organizations should first evaluate their current technical capabilities and pinpoint opportunities for development before embracing technology. This could entail performing a technology audit to assess current systems and procedures or asking staff members or consumers for suggestions on how technology can be improved. Organizations should create a plan for investing in and adopting new technology solutions after identifying areas that need improvement. This could entail making investments in fresh software or hardware, creating original technological solutions, or working with tech companies or startups (Laursen & Salter, 2014). Additionally, businesses should foster a culture that embraces technology and promotes trying out novel devices and approaches. This could entail developing cross-functional teams or innovation laboratories to test out new tools and technologies, as well as offering employees training and development chances to master new technological skills.

Measure and Evaluate Performance: A crucial step in incorporating management innovation into an organization's overall innovation strategy is measuring and monitoring progress. By using data-driven decisions, it enables firms to assess the performance of innovation efforts, pinpoint areas for development, and decide how best to allocate resources and formulate a strategy. Organizations should first define clear metrics and key performance indicators (KPIs) for innovation in order to assess and track progress. Metrics like the quantity of newly produced goods or services, the share of new goods' sales revenue, or the quantity of newly filed patents may be among them. These indicators must be quantifiable, specific, and in line with the organization's broader innovation strategy and objective. Organizations should build a method for gathering and analysing data once metrics have been established. This could entail developing dashboards or reports that monitor progress in relation to KPIs or using tools like surveys or feedback loops to collect opinions from staff members and clients. Additionally, organizations want to set up a procedure for routinely examining and analysing data. This can entail assembling a cross-functional innovation team to assess progress and pinpoint potential improvement areas. Based on data insights, the team might also suggest changes to resource allocation or strategy.

In conclusion, firms that are open to change and adopt new methods of managing their people, processes, and resources will find that the future of managerial innovation is exciting and full of opportunity. There are various trends and possibilities that firms may take advantage of to achieve sustainable success, from employee engagement and agile management to technology-driven innovation and sustainable business practices. Innovative leaders are utilizing cutting-edge tools like blockchain and artificial intelligence to engage staff members and encourage lifelong learning. Businesses can stay ahead of the competition and find long-term success in today's quickly evolving business environment by embracing these trends and possibilities. For performance, productivity, and growth, managerial innovation must be incorporated into an organization's entire innovation strategy. Creating an innovation team, promoting cooperation and information sharing, embracing technology, and cultivating an innovative culture are all ways that organizations might do this. They can also measure and evaluate success. Organizations may unleash the full potential of their managers and achieve long-term success by adopting a strategic approach to management innovation.

2.4 Innovation in the medical industry in Finland

The past ten years have seen a dramatic upheaval in Finland's medical sector as a result of technology breakthroughs, shifting healthcare needs, and escalating international rivalry. Companies have made significant investments in R&D to produce new goods and services that cater to unmet demands, which has played a crucial part in this shift. This review of the literature aims to give an overview of current research on innovation in the Finnish medical sector while highlighting significant trends and advancements. A thriving medical sector, including both established players and startups, can be found in Finland. The sector is distinguished by a heavy emphasis on research and development, with businesses making significant investments in innovation to keep one step ahead of the competition. According to a report by the Finnish Healthtech Association, Finland's medical technology sector has about 300 companies, 10,000 employees, and annual revenue of about two billion euros. Finland's medical sector faces a number of problems that call for creative solutions. These difficulties include shifting patient expectations, rising healthcare expenses, and demographic changes. In response, medical institutions in Finland are looking into measures to improve their capacity for innovation. According to the literature, innovation is a key component of medical organizations' success and is linked to greater levels of performance and competitiveness (Eskola et al., 2018; Laursen & Salter, 2006). Before exploring on the innovations carried out in the medical industry let try to get the broader picture here, All citizens of Finland have access to the country's publicly supported healthcare system. The healthcare system and economy of Finland both benefit greatly from the medical sector. Medical device producers, pharmaceutical corporations, health IT service providers, biotechnology companies, and providers of healthcare services make up this diversified industry. The market is fiercely competitive, and some Finnish businesses are pioneers in their specialized industries. The publicly funded universal healthcare system in Finland is one of its strong points. No matter their social standing or income level, all Finns have access to healthcare thanks to the system. The government and regional municipalities jointly run the system, which is financed by taxes. The World Health Organization (WHO) frequently ranks Finland's healthcare system as one of the best in the world. There are different segments of medical sector in Finland, they are as shown the figure 8 below, and our focus for the thesis is on medical devices segment.

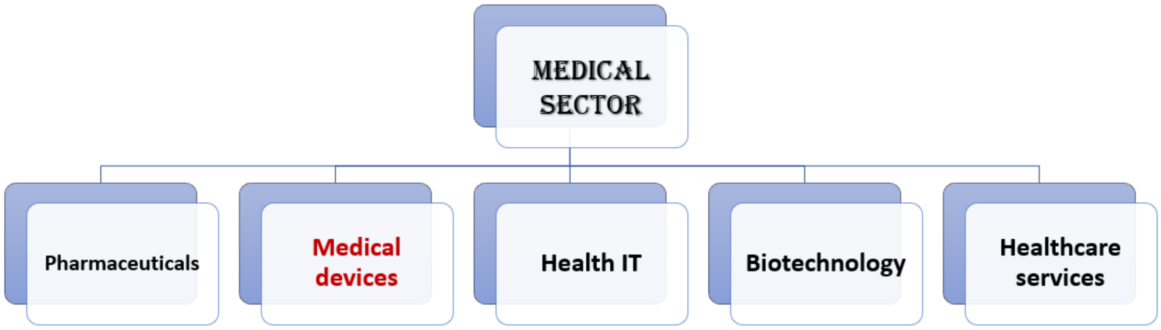

Figure 8: Different segments under medical sector

One of the most significant sectors of the Finnish medical industry is the medical device sector. Major medical device producers like GE Healthcare, Planmeca, and Elekta are based in the nation. These businesses manufacture a variety of medical devices, including imaging systems, surgical tools, and diagnostic tools. Innovative products and technologies are being developed by a number of firms in the Finnish medical device sector.

Another significant area of the Finnish healthcare sector is the pharmaceutical sector. Pharmaceutical firms in Finland, such Orion Corporation and Faron Pharmaceuticals, concentrate on creating and manufacturing medicines for a variety of illnesses. These businesses have great capacities for research and development, and they have created a number of ground-breaking medicines that have received EU and other market approvals.

Finland has a highly inventive and developed health IT sector, with multiple businesses creating cutting-edge technologies including electronic health records and data analytics tools. Leading firms in the field of health IT include TietoEVRY and Reaktor Healthcare, both of which are based in Finland. Their products help healthcare providers give better care and achieve better patient outcomes (Damanpour, 2014).

The Finnish medical industry's biotechnology sector is expanding, with businesses like Valo Therapeutics and Biohit creating and marketing novel medicines for a variety of ailments. These businesses are concentrated on creating cutting-edge solutions that might enhance patient outcomes and lower healthcare expenses.

Finland also has a developing healthcare services industry in addition to its medical device, pharmaceutical, health IT, and biotechnology sectors. Mehiläinen, Terveystalo, and Pihlajalinna are just a few private healthcare organizations that provide a variety of services, including primary care, specialty care, and home care. These service providers prioritize providing patients with high-quality care and expanding access to healthcare services.

However, the point of focus for this thesis is medical devices industry, size of the Finnish Medical Device Industry

Over 15,000 people are employed in Finland's medical device business, which also contributes significantly to the nation's economy by bringing in over €2.5 billion a year in revenue. The success of the sector is largely attributable to a strong emphasis on research and development (R&D), with Finnish medical device businesses making significant investments in invention and the creation of new products (Eskola et al., 2018; Laursen & Salter, 2006).

2.4.1 Key trends in Finland's medical device industry

The main trends influencing Finland's medical device sector are discussed in this section. Finnish businesses are leading the way in the development of ground-breaking medical equipment because they place a significant emphasis on innovation and investment in R&D. A substantial amount of digitalization is also taking place in the sector, utilizing connected devices and data analytics to improve patient outcomes. Innovation is fueled by partnerships between corporations, academic institutions, and healthcare organizations, while sustainability is given more importance through resource usage and eco-friendly methods. These patterns fuel the sector's expansion and enhance medical technology.

Innovation: The Finnish medical device sector has a reputation for putting a strong emphasis on innovation, with businesses actively spending in R&D to create new goods and technology. This emphasis on innovation has promoted industry expansion and led to the creation of a number of ground-breaking goods.

Digitalization: The growing digitalization of medical equipment is another significant development in the Finnish medical device market. In order to enhance patient outcomes and save healthcare costs, this includes the use of linked devices, remote monitoring systems, and data analytics tools (Kucukusta & Demirkan, 2015).

Collaboration: Between business, academia, and healthcare providers, there is a long history of cooperation in the Finnish medical device sector. This partnership has encouraged innovation and the creation of new products while also ensuring that these products are in line with the requirements of patients and healthcare professionals.

Sustainability: With companies creating products that are intended to have a decreased environmental impact, there is an increasing focus on sustainability in the Finnish medical device industry. Utilizing renewable resources, cutting waste, and creating items that are simple to recycle or reuse are all part of this (Kucukusta & Demirkan, 2015).

2.4.2 Finland's regulatory framework for medical devices

The Finnish Medicines Agency (Fimea) oversees the regulation of medical devices in Finland. Medical devices sold in Finland must be high-quality, safe, and functional, according to Fimea. The organization is also in charge of monitoring and enforcing regulatory compliance as well as the registration and approval processes for medical devices. Based on the level of risk they pose to patients; medical devices are divided into four risk categories. The medical devices are classified based on the risk level to 4 types they are Class I, Class IIa, Class IIb, Class III. The regulatory criteria for Class III devices are the strictest, whereas Class I devices, which present the lowest danger to patients, are under the least regulatory scrutiny. Manufacturers of Class I devices must certify their own compliance with regulatory standards and attach a CE mark to the product. The Medical Devices Directive's fundamental requirements are met by a device if it bears the CE mark. The approval procedure is more stringent for devices classified as Class IIa, IIb, and III. A technical dossier describing the device's design, functionality, and intended usage must be included in the conformity assessment application that manufacturers must submit to Fimea. Results of any clinical trials or other research on the device must also be included in the application. Fimea examines the application and could ask the manufacturer for clarifications or further details. Fimea issues a certificate of conformity after the application is finished to show that the gadget complies with legal standards and can be sold in Finland. Post-Market Monitoring, Fimea keeps an eye on the efficiency and safety of medical devices once they have been authorized and placed on the market. This entails keeping track of unfavourable incidents and doing inspections of manufacturing facilities. Fimea may also ask manufacturers to revise the labelling or usage instructions for a device or request further clinical data. The Good Manufacturing Practice (GMP) requirements must be followed in the production and distribution of all medical devices sold in Finland, according to Fimea. To guarantee that their products are continuously produced to a high degree of quality, manufacturers must adhere to GMP requirements. Despite being extensive, Finland's medical device regulation framework nevertheless has certain issues. The growing complexity of medical devices, which can make it challenging to evaluate their usefulness and safety, is one of the major issues. Complying with regulatory regulations may be difficult for producers due to this intricacy (Kapor, 2019). The speed of technical advancement in the medical device sector is another difficulty. Since new technologies are continually being developed, it can be challenging for regulatory bodies to stay on top of changes and guarantee that new goods are reliable and safe. Concerns concerning the security of some medical devices, particularly those that are implanted in the body, have also arisen in recent years. As a result, regulators have tightened the reins on these devices, requesting more clinical information and performing more frequent facility inspections at manufacturers. Additionally, increasing competition, change in the customer need and impact of Covid-19 makes this segment of medical industry tightly competitive and firms are facing issues.

2.4.3 Case studies of innovations

Innovation has been a fundamental driver of growth in the medical industry in Finland. According to research, the sector has a strong culture of innovation, with businesses emphasizing the creation of novel goods and services to meet unmet needs. A survey by the Finnish Funding Agency for Innovation (former Tekes, now Business Finland) indicated that medical technology companies in Finland invest around 7% of their turnover in research and development, which is much higher than the average for all industries (Kim & Park, 2012). One area of innovation that has garnered substantial attention in Finland is the use of digital technologies in healthcare. Companies are developing new technologies and services that leverage artificial intelligence, big data analytics, and the Internet of Things to improve patient outcomes and reduce costs. For example, a Finnish software company called Tieto, for instance, has created a cloud-based platform that enables healthcare providers to securely share patient data while also promoting interaction and collaboration between healthcare specialists. Another area of innovation that has gained traction in Finland is the creation of wearable medical devices. These devices, which are often worn on the body and may monitor vital signs, are becoming increasingly popular as people strive to take greater control of their health. These wearable devices track sleep, activity, and other health metrics, and Finnish businesses like Oura Health and Polar have been at the forefront of this trend. A number of firms employing innovation to challenge established healthcare methods are also based in Finland. For instance, a Finnish startup called Klinik Healthcare Solutions has created an online platform that enables patients to schedule appointments with healthcare professionals and access medical advice remotely (Laursen & Salter, 2014). We will go into more detail about the essential processes of innovation management in the Finnish medical device industry in this article.

Figure 9: Process of innovation management in medical sector

Identifying unmet needs: Finding market demands that are not being served is the first stage in innovation management. To do this, market research must be conducted in order to comprehend the requirements of patients, healthcare professionals, and other stakeholders. Various methods, including as surveys, focus groups, and interviews, can be used in market research. Companies can create goods and services that satisfy unmet needs by identifying them, benefiting both patients and healthcare professionals. Understanding the demands of patients and healthcare professionals is particularly important in the Finnish medical device business. Finland is renowned for its top-notch healthcare system, which is supported in large part by the medical equipment sector. Companies must collaborate closely with healthcare professionals and patients to comprehend their problems and unmet requirements. Focus groups, questionnaires, and the examination of patient data to spot patterns and trends may all be part of this process.

Haltian is one instance of a Finnish business that has successfully discovered unmet requirements. The business created the Snowfox, a wearable gadget that aids in the management of asthma in kids. When the child's breathing becomes difficult, the device tracks it and notifies the parent via their smartphone. Haltian was able to develop a useful product that has the potential to enhance the lives of millions of children and their families by addressing the unmet demand of parents who worry about their child's asthma.

Conducting research and development: Companies must create new goods and services to address unmet requirements when they have been discovered. This calls for doing research and development, which is often an expensive and time-consuming process. Concept development, prototyping, and testing are just a few of the several tasks that research, and development might include. Additionally, businesses must make sure that their goods and services adhere to safety standards and legal requirements. In the field of medical devices, Finland places a lot of focus on research and development. Numerous notable research institutions, like the University of Helsinki and the VTT Technical Research Centre, are located in the nation. For the creation of novel medical devices, these institutions carry out cutting-edge research in disciplines like biotechnology, nanotechnology, and materials science.

Planmeca is one instance of a Finnish business that has carried out R&D successfully. A digital dental imaging system that the business created employs 3D imaging technology to produce high-quality images of a patient's teeth and gums. The device also comes with a number of diagnostic tools that aid dentists in spotting potential issues before they become serious. Planmeca was able to build a useful product that has the potential to enhance the lives of millions of dental patients by making an investment in research and development.

Making sure regulations are followed: Medical devices must adhere to strict regulatory standards, which can differ by country and device kind. In order to manage innovation effectively, one must make sure that services and products adhere to legal requirements while also reducing costs and time to market. To ensure that goods and services satisfy the standards set by regulatory organizations like the FDA and the European Medicines Agency, regulatory compliance requires close collaboration with regulatory specialists. The Finnish Medicines Agency (Fimea) and the National Supervisory Authority for Welfare and Health (Valvira) are in charge of regulating medical devices in Finland (Laursen & Salter, 2014). Businesses must make sure that their goods adhere to all applicable laws and standards, which can change based on the kind of gadget and the purpose for which it is being used. This entails carrying out thorough testing and validation to make sure the equipment is reliable and safe, as well as keeping thorough records to back up regulatory filings.

Although it can be a difficult and time-consuming procedure, ensuring regulatory compliance is crucial for businesses engaged in the medical devices sector. Businesses that successfully negotiate the regulatory environment can launch their products more quickly and confidently while lowering their risk of facing fines or other consequences.

Launching and commercializing the product: Launching and commercializing a product comes after it has been developed and all legal procedures have been satisfied. This include creating a marketing strategy, selecting the right target market, and creating a sales strategy. Additionally, businesses must make sure that the prices of their goods are competitive and that means of distribution have been set up to reach consumers. In the Finnish medical device business, commercialisation is prioritized highly (Chesbrough, Vanhaverbeke & West, 2006). The nation has a well-established ecosystem of investors, including venture capital firms, who help startups and creative businesses flourish. Additionally, there are numerous incubators and accelerators that give businesses the tools and support they need to launch their goods on the market.

Optomed is one instance of a Finnish business that has successfully introduced and sold its goods. The business created a handheld fundus camera that enables medical professionals to take clear pictures of the retina. The camera is substantially less expensive than conventional fundus cameras and is portable and simple to operate. As a result of Optomed's successful product launch and commercialization, the camera is presently in use in more than 60 nations worldwide.

Constant innovation and improvement: Innovation management is a continual cycle of invention and improvement rather than a one-time process. In order to meet changing client wants, businesses must consistently monitor the market, uncover new unmet needs, and improve their current products and services. This calls for continuous study and development as well as continual cooperation between various organization stakeholders. The manufacturing of medical equipment in Finland has a strong culture of invention and ongoing development. Companies are encouraged to use new technologies and materials to develop innovative products and services, partner with other businesses and universities, and invest in research and development.

Suunto is one instance of a Finnish business that has embraced innovation and constant development. The business created a number of wearable gadgets, including as fitness trackers and sports watches, that let users keep tabs on their performance and physical activity. Based on consumer feedback and new technology advancements, Suunto continuously updates and improves its products (Laursen & Salter, 2014).

While innovation has been a key driver of growth in the medical industry in Finland, the sector faces a number of challenges. One of the biggest challenges is the need to attract and retain top talent. Companies must work harder to create a supportive and appealing work environment that can attract and retain the best talent as the demand for skilled professionals in the medical industry rises. Another problem facing the company is the need to manage complex regulatory systems. Medical devices and other healthcare products are subject to stringent regulations, which can be difficult for startups and smaller companies to navigate. To make sure that their goods and services adhere to the relevant standards, businesses must invest in regulatory compliance. Despite these challenges, the Finnish healthcare industry has significant growth opportunities. The country has a strong R&D tradition and has fostered a culture of innovation and entrepreneurship. With continued investment in innovation and a supportive political environment, the Finnish healthcare industry is well-positioned to continue its growth trajectory. For businesses engaged in the Finnish medical device sector, innovation management is an essential activity. Collaboration between numerous stakeholders, including R&D teams, marketing and sales teams, and regulatory specialists, is essential to effective innovation management. Identification of unmet requirements, research and development, regulatory compliance, product introduction and commercialization, as well as ongoing innovation and improvement, are important steps in innovation management. Businesses that effectively manage the innovation process have the ability to develop useful goods and services that could enhance the lives of millions of people worldwide.

Overall, the Finnish medical sector is a vibrant, forward-thinking sector dedicated to enhancing patient outcomes. The industry has been able to keep its position as a leader in the global medical sector thanks to its strong emphasis on research and development, innovation, and partnership with healthcare providers. The Finnish medical industry is well-positioned to maintain its expansion and influence in the years to come with ongoing investment in these sectors.

3 Theoretical framework

This chapter introduces the theory behind the research objective and build a basis for the empirical analysis. According to Creswell (2014), A theoretical framework serves as the basis for a study and aids in directing the design of the study's research and data analysis. It is a methodical strategy to arrange concepts and ideas that explain the events being studied. The framework makes it easier to spot important factors, connections, and gaps in previous studies. The goal of the study is to pinpoint the important components of these frameworks that are pertinent to the sector, evaluate how well they might enhance innovation management, and pinpoint any obstacles or constraints to adoption. Hence, the research questions are designed to gather information, analyse the current innovation management trends and compare with the methods implemented in medical devices firm also utilize some of the existing case studies available which will be done in the empirical analysis. However, before that it is important to gain an understanding of the theory and the overview of the framework was depicted in figure 10 below.

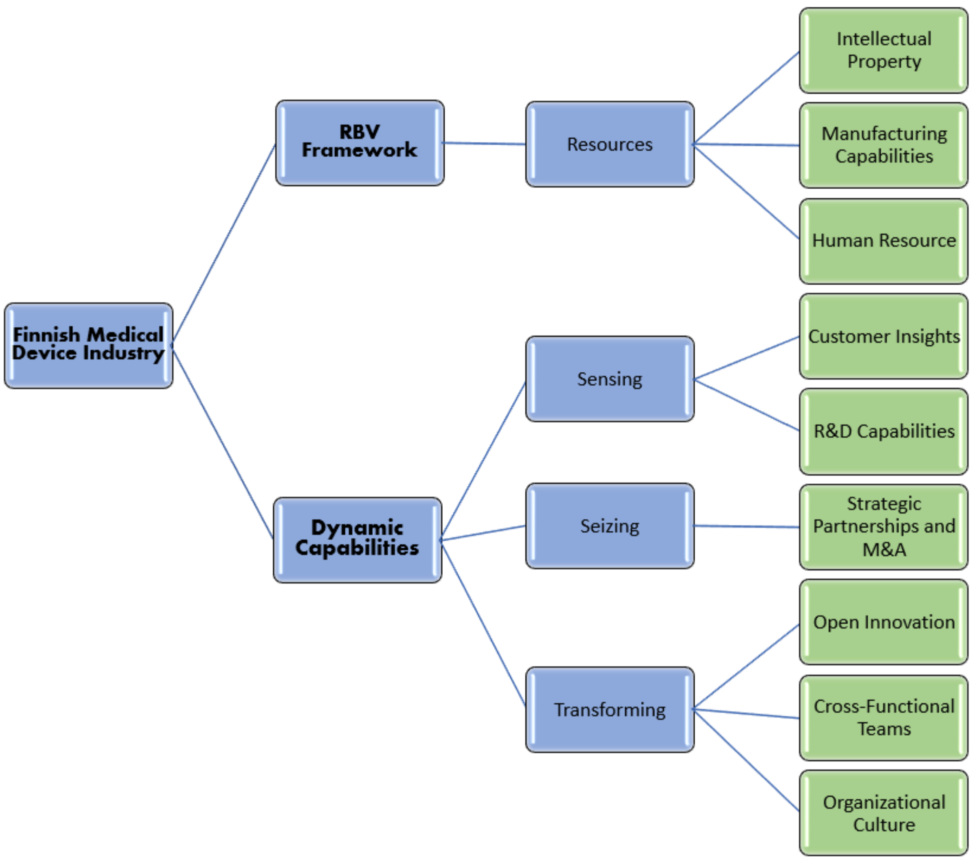

Figure 10: Theoretical framework

Chapter 3.1 introduces the theory of Resource based view framework which can be utilized for this research purpose. It offers a helpful lens for examining the distinctive assets and skills of businesses in the Finnish medical device sector. In order to achieve a sustained competitive advantage, RBV highlights the significance of firm-specific resources such technological expertise, brand reputation, and human capital. RBV can assist in locating and utilizing these resources to promote innovation and enhance overall performance in the medical device sector, where innovation is essential for success. RBV can assist in identifying possible areas for innovation and competitive advantage by examining a firm's resources and capabilities in light of market opportunities and competitive threats.

Chapter 3.2 introduces a new framework which could go hand in hand with RBV which is Dynamic capability (DC) framework. It offers a framework for comprehending how businesses might create and use resources and skills to attain long-term competitive advantage through innovation. The ability of a business to adjust to shifting market conditions, innovate and learn in response to fresh problems, and continuously improve its operations and processes is important, according to DC. It can assist businesses in building the capacities to recognize and seize new possibilities while also responding to changing customer wants and competitive threats in the medical device sector, where innovation and new product development are essential for success. For instance, a business might develop DC by making R&D investments, forming strategic alliances, or improving internal procedures to speed up innovation and product development.

3.1 Resource based view

According to Barney (1991), the resource-based view (RBV) paradigm highlights the importance of a company's internal resources and competencies in establishing and maintaining competitive advantage. The major sources of a company's competitive advantage and long-term success, in accordance with the RBV, are its special and valued resources and capabilities, such as knowledge, skills, patents, and relationships. The strong technological capabilities, highly skilled workforce, and encouraging innovation ecosystem of the Finnish medical device industry are well known. With the help of these resources, Finnish medical device companies can create and market cutting-edge medical products that cater to unmet clinical needs (Korkman, 2018). The industry also receives financial assistance from the Finnish government and regulatory direction, which strengthens its competitive edge (Hakkarainen et al., 2019). This paradigm has been widely used to analyse how businesses might manage their innovation and development activities in a variety of industries, including the medical device industry. In order to survive in the fiercely competitive and quickly changing Finnish medical device market, businesses must constantly innovate and create new goods and services. Regulatory regulations, high R&D expenses, and fierce rivalry are a few of the issues that make innovation management in the medical device sector difficult. The RBV framework might offer a helpful viewpoint for comprehending how Finnish medical device businesses can make the most of their internal resources and competencies to manage innovation and development initiatives in this setting.

The internal resources and capacities of Finnish medical device businesses can be analysed using the RBV framework to pinpoint their strengths and weaknesses in terms of their innovation management procedures. In order to find areas for improvement, the RBV framework, for instance, can be used to examine the company's R&D skills, manufacturing processes, intellectual property, and collaborations. Managers can concentrate on enhancing the company's unique and valuable resources by identifying these areas in order to increase its competitive edge. Finnish medical device businesses, for instance, may encourage innovation and create fresh goods and services by utilizing their great R&D capabilities. According to Caniato et al. (2015), the medical device sector invests heavily in R&D, and the RBV framework highlights the value of creating distinctive and valuable knowledge assets through R&D. In order to use outside knowledge and skills in the development of new goods and services, Finnish medical device businesses may also concentrate on forming solid alliances with academic and research institutes. Open innovation is one method Finnish medical device companies can make the most of their resources and ability to innovate. Finnish medical device companies can obtain fresh knowledge and skills that might aid them in developing new goods and services by working with external partners such as universities, research institutes, and other medical device companies (Hakkarainen et al., 2019). Additionally, to make sure that their inventions match clinical demands and regulatory standards, Finnish medical device companies can benefit from their solid partnerships with key stakeholders (Korkman, 2018).

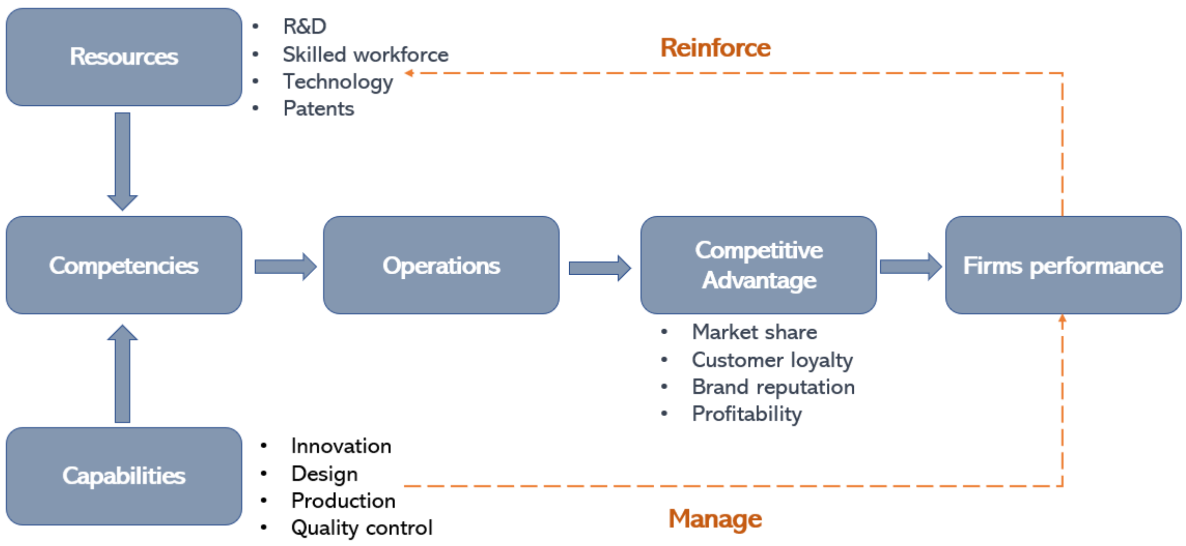

Figure 11: Resource based view framework

Figure 11 gives a clear idea on the RBV framework. Defining the tasks and responsibilities of managers in encouraging and implementing innovation. Utilizing the company's internal resources and competencies to promote innovation is something managers at Finnish medical device businesses may do by using the RBV framework. For instance, managers can use the R&D resources and intellectual property of the business to create brand-new goods and services. By building an atmosphere that values innovation and takes calculated risks, they can also create a culture of innovation. Finally, they can create strategic alliances with outside parties to draw on their knowledge and experience when creating new goods and services. The RBV framework also underlines how crucial it is to allocate funds wisely in order to encourage innovation and development initiatives. For instance, managers can allot funds for R&D to create fresh goods and services. In order to guarantee regulatory compliance and lower the possibility of product failure, they can also commit resources to product testing and certification.

Using digital technologies to increase the potential for innovation. The RBV framework can be used to investigate how Finnish medical device businesses can make the most use of their internal resources and capacities to successfully use digital technologies for innovation. For instance, businesses can improve their digital capabilities by utilizing their current production and supply chain capabilities. In order to increase their potential for innovation and effectiveness, they might also invest in R&D to create new digital technologies. The

RBV framework also highlights how crucial it is to create distinctive and priceless knowledge assets through digital innovation. For instance, businesses can use digital technology to gather and analyse data to understand the requirements and preferences of their customers. Additionally, they can use digital technologies to create fresh goods and services that meet unmet consumer demands.

When using the RBV framework to create strategies for innovation management, there are some constraints that must be recognized. The fact that the RBV framework does not completely consider how external forces like market demand and technological disruption shape the industry landscape is one of its primary weaknesses. The paradigm presupposes a static industry environment, which may not hold true in fact, as noted by Teece et al. (1997). Therefore, when creating their innovation plans, businesses must also consider these external influences. The RBV framework's potential inability to accurately capture the impact of intangible assets like brand equity and organizational culture in generating competitive advantage is another drawback. Wernerfelt (1984) asserts that the RBV paradigm might undervalue intangible assets, which are sometimes challenging to assess and quantify. For instance, companies can set themselves apart from rivals in the Finnish medical device market by establishing a solid brand reputation and encouraging an innovative culture (Barringer and Ireland, 2010). These intangible assets could be challenging to copy and might give persistent competitive advantage. Finally, the RBV framework does not offer a clear guide for how businesses should manage and improve their resources over time. Helfat and Peteraf (2003) claim that while the framework highlights the significance of sustainable competitive advantage, it does not offer recommendations on how businesses can adjust to changes in the industry environment or continually refresh their resources and capabilities to remain competitive.

For Strategic corporate innovation management ramifications, companies need to have a thorough awareness of their specific assets and capabilities in order to manage innovation in the Finnish medical device sector. Finnish medical device companies can create new products and services that satisfy clinical needs and regulatory requirements while also achieving sustainable competitive advantage by leveraging these resources and capabilities through open innovation and strong stakeholder relationships (Teece et al., 1997). In conclusion, the RBV framework offers an insightful lens through which to view how Finnish medical device businesses might efficiently manage their research and development initiatives. Managers can discover areas where they have special and valuable assets that can be used to drive innovation by examining their internal resources and competencies. They can also create plans to create these.

3.2 Dynamic capabilities

In their influential study "Dynamic Capabilities and Strategic Management", published in 1997, Teece, Pisano, and Shuen established the idea of dynamic capabilities (DC). In order to handle quickly changing surroundings and establish sustained competitive advantage, a firm must be able to integrate, build, and reconfigure its internal and external resources, competencies, and capabilities. DC, then, is about a company's capacity to adjust and develop in response to alterations in its external environment. The three main parts of the DC framework are sensing, seizing, and transformation. A firm's capacity to recognize and comprehend changes in its external environment is referred to as sensing. The ability of a company to seize opportunities or lessen hazards that develop as a result of these developments is referred to as seizing. The ability of a company to reorganize its internal resources and skills to suit the needs of the changing environment is referred to as transformation. For businesses operating in highly dynamic industries like the medical device industry, where technical breakthroughs and changes in regulatory rules can have a substantial impact on a firm's competitive position, DC can be a valuable framework. Businesses can enhance their capacity for innovation, adjust to changes in their external environment, and establish sustained competitive advantage by establishing DC.

According to one study by Castaer and Campos (2016) that looked at the connection between DC and innovation in the medical device industry, businesses that excel at DC are more likely to release new goods and technologies onto the market and have higher levels of innovation performance than businesses that don't. The study also discovered that businesses with higher levels of innovation are more likely to take part in DC-boosting activities like funding R&D, establishing strategic alliances, and acquiring complementary assets and skills. Similar to this, Teece et al. (2016) contend that DC can be helpful for businesses looking to implement managerial innovation and strategic corporate innovation management. Businesses can enhance their ability to recognize changes in their external environment, take advantage of opportunities, and adapt their internal resources and skills to meet the needs of the changing environment by building DC. This may entail creating novel goods and services, breaking into untapped markets, and implementing fresh company strategies. Similar to this, research by Helfat and Peteraf (2015) contends that businesses may create DC using a number of strategies, such as investing in human capital, creating social capital through partnerships and networks, and creating internal procedures and routines that support innovation and change. Figure 12 explains the factors involved in dynamic capabilities.

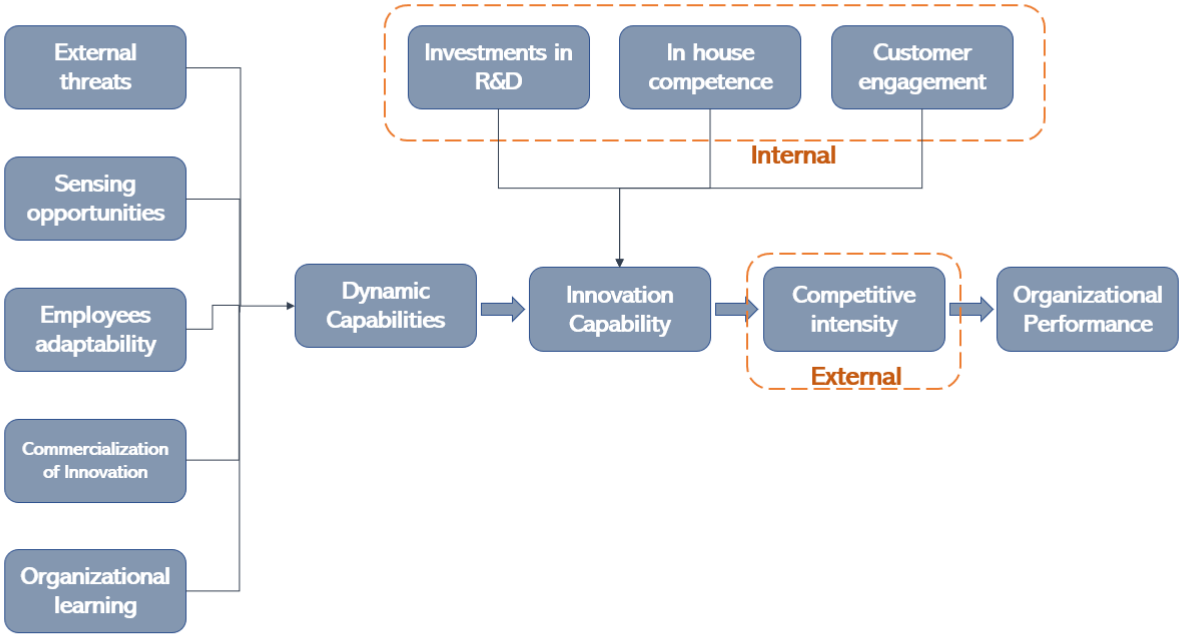

Figure 12: Dynamic capabilities framework

The advent of 3D printing technology is one instance of DC in action in the medical equipment sector. By utilizing this technology, businesses may quickly prototype and test innovative medical devices, saving time and money over using more conventional product development techniques. Businesses that create the DC to accept and use this technology can outperform their rivals by a wide margin. The creation of digital health platforms that let people keep tabs on and control their own health is another illustration. Businesses who are successful in creating the DC to create and market such platforms stand to gain from higher income as well as better patient outcomes and lower healthcare expenses.

However, creating DC is a continuous process rather than a one-time occurrence. Organizations must constantly evaluate their internal and external environments in order to adapt their strategies and resource allocation. A culture of creativity and a willingness to take chances and try out novel concepts and methods are necessary for this. According to Teece (2012), resource limitations may make it more difficult for smaller businesses to create and deploy DC. This can be as a result of a shortage of funds or other resources required to invest in new procedures, technologies, or human resources. According to Eisenhardt and Martin (2000), businesses without an innovative culture may find it difficult to apply DC. This is because DC calls for taking chances and experimenting with novel ideas and methods, which can be challenging for businesses with more cautious or risk-averse business models. In addition to those challenges, resistance to change in the organization and overreliance on existing capabilities can also be some hinderance for the implementation of dynamic capabilities.

To sum up, the DC framework is an effective instrument for businesses to establish and maintain a competitive advantage in quickly evolving contexts. Due to its resource-intensive nature, technological complexity, tight rules, customer focus, and dynamic market conditions, the medical devices business is a great fit for the RBV and DC frameworks. While DC permits examination of organizations' capacity for adaptation, learning, and market opportunity seizing, RBV aids in the identification of strategic resources and competencies that generate innovation and competitive advantage. Utilizing these frameworks enables a thorough investigation of how medical device corporations successfully manage innovation in the face of industry-specific difficulties and distinctive traits. Businesses can react to changes in their external environment and stay ahead of their rivals by establishing the capacity to sense, seize, and transform. The system does have some limits, though, and more investigation is required to fully comprehend its application in real life.

4 Empirical analysis

This chapter explains on the data gathering methodology used and an analysis of the data. The empirical analysis, which is based on a semi-structured interview with three managers and a survey given to the staff of the company, attempts to offer insightful information about the innovation management processes within a medical devices firm. By enabling the gathering and analysis of both quantitative and qualitative data, a mixed data collecting methodology can offer a more thorough understanding of the research issue (Saunders et al, 2007). In addition to validating results, this can paint a fuller picture of the research problem.

In Chapter 4.1, the methods for gathering data used in this empirical analysis are explained, along with the sample size and procedure used to get the data. Three managers from the chosen medical devices company were chosen through semi-structured interviews to collect qualitative data. Through this method, their viewpoints, experiences, and ideas pertaining to innovation management can be thoroughly explored. In order to collect quantitative data on how well the company manages innovation, a poll of the company's employees was also administered. To ensure a complete knowledge of the data collection process, the sample size and selection criteria for both the interview and survey are discussed in detail.

The analysis of the data is covered in Chapter 4.2, which also attempts to convey the thesis from a distance while addressing the research issues. Thematic analysis, which identifies common themes, patterns, and trends within the management responses, is used to examine the qualitative data obtained from the semi-structured interviews. This investigation offers insightful information into how managers at the medical devices company view strategic corporate innovation management and managerial innovation. In order to streamline the results and address the research issues raised in the thesis, it is essential to analyse the data that has been gathered. To provide a thorough knowledge of the application of strategic corporate innovation management and managerial innovation within the medical devices firm, the findings from the interviews and survey responses are triangulated. The analysis tries to provide a neutral and impartial point of view, drawing results that add to the general knowledge of innovation management strategies in the Finnish medical device industry. This empirical investigation intends to contribute significant insights and perspectives on the current status of innovation management in the chosen medical devices firm by using reliable data collection techniques and carrying out a complete analysis. The research results will play a critical role in formulating suggestions and guiding plans for upgrading innovation management practices within the sector, ultimately boosting the firm's competitiveness and encouraging innovation-driven growth.

4.1 Data collection

This thesis used a mixed methodology approach to ensure a thorough and collective data collection process. A semi-structured interview with three managers and a poll of the medical devices company’s employees were used to collect the data. This method sought to lessen bias and offer a comprehensive picture of the firm's innovation management methods. The managers were given a pre-set list of questions for the semi-structured interviews, assuring uniformity and comparability in the answers. The manager’s real names were known, but for the sake of privacy and anonymity, they will only be referred to as Managers A, B, and C in this thesis. Face-to-face interviews allowed for a deeper study of the participant’s viewpoints and experiences about innovation management. To elicit thorough views from the managers, a variety of innovation management-related topics were included in the set of interview questions. The questions comprised below:

1. Could you give an overview of the current innovation management procedures used by the firm? What techniques or approaches are used to promote innovation?
2. What are the primary obstacles you run into when trying to manage innovation within the company? Are there any particular obstacles preventing the medical device business from innovating?
3. What responsibilities do you feel you have as a management in the medical device sector to nurture and implement innovation? How can you help to foster an environment that promotes innovation?
4. What part, in your opinion, does leadership play in encouraging and fostering innovation within the medical device industry? How does leadership promote an innovative culture?
5. How do you see the potential of digital technologies to boost the industry of medical devices ability to innovate? Do you think any specific digital technologies have a particularly bright future for Finnish makers of medical devices?

6. Are there any noteworthy success stories or instances of how digital technology have been successfully incorporated to improve innovation processes in the company or in the industry? What were the main elements that made them successful?

Because the interviews were semi-structured, there was room for conversational flexibility, which allowed the managers to go into more detail about their experiences, ideas, and viewpoints. Inquisitive questions were utilized to go deeper into particular areas of interest, and the respondents were urged to give thorough responses. Face-to-face interviews allowed for the capturing of non-verbal cues and subtleties in responses, boosting the richness and complexity of the data gathered. Employees who worked on the creation of products and software, especially those involved in digitalization initiatives, were asked to complete the survey and the sample size was 35 people. To ensure easy access and widespread participation, the survey was distributed via the business' internal teams channel. This technique made it easier to get quantitative information on numerous elements of innovation management within the company.

The survey asked **15 questions** about methods for managing innovation. These inquiries were created to learn more about employee's opinions, first-hand accounts, and ideas for improving innovation management. Topics like the efficiency of present practices, difficulties encountered, the function of leadership, and the potential of digital technologies to foster innovation were all covered by the survey questions. For reference, the survey questions are included in Appendix 1 of the thesis. The personnel were given detailed instructions for the survey, emphasizing the value of truthful and correct responses.

4.2 Data analysis

A mixed-methods approach was used to examine the data from the semi-structured manager interviews and the employee survey in order to acquire a thorough understanding of the strategic corporate innovation management and managerial innovation in the Finnish medical devices industry. A thematic analysis was done on the qualitative information gleaned from the semi-structured interviews. To find repeating patterns, themes, and important concepts relating to innovation management techniques within the medical devices company, the interview transcripts were extensively examined and coded. An initial list of initial codes was created using open coding, which was later polished and organized into higher-order themes. The themes were honed and connections between them were investigated through a process of ongoing comparison and iterative analysis. To maintain openness and strengthen the reliability of the findings, the selected themes were reinforced with actual statements from the participants. In parallel, descriptive statistics and inferential analysis methods were used to assess the quantitative data gleaned from the survey replies. The survey data were compiled using descriptive statistics, such as frequencies, means, and standard deviations, to give participants' impressions of innovation management inside the organization a broad picture. To investigate the links between variables and test hypotheses regarding the variables impacting innovation management effectiveness, inferential analysis, including correlation analysis and regression analysis, was undertaken. A thorough knowledge of the study issues was then achieved through the combination of qualitative and quantitative findings. To enhance the interpretation and present a more nuanced picture of the innovation management methods and problems faced by the medical devices firm, the qualitative themes were triangulated with the quantitative results. Strenuous steps were implemented throughout the data analysis process to guarantee the validity and trustworthiness of the results. To improve the inter-rater reliability and reduce subjective biases, several researchers independently assessed the data and held conversations. To guarantee accuracy and agreement with the observed reality within the firm, the findings were also presented to and reviewed with corporate representatives.

4.2.1 Qualitative data analysis

This section is dedicated to analysing the interview results. As stated above, semi-structured interviews with three managers of a medical device firm have been conducted to gain more insights in responding to the research questions and in turn help to create a framework for innovation management and managerial innovation. This method helped in gaining a lot of insights as it was possible to ask additional questions apart from the six questions which have been designed for them. As already mentioned, to maintain confidentiality the personnel has been called Managers A, B, and C., in the section a collective summary of the discussion has been added in order to interpret and find common themes followed.

Manager A, who has been with the organization for 12 years, emphasized their creative management style. Through brainstorming sessions, cross-functional partnerships, and open innovation projects, the company supports a creative work environment and promotes employee innovation. They make use of cutting-edge tools like design thinking and agile project management. Despite not currently confronting any obstacles, recent advancements have slowed down. The business balances short-term and long-term objectives while integrating innovation with its vision. Despite the difficulties in allocating internal resources, managers are essential in fostering innovation. The medical device sector has been profoundly impacted by digital technology, which have made smaller, more portable devices possible and automated manual operations. Manager A described a popular mobile application without going into specifics. These revelations shed light on the organization's management of innovation, the function of managers, and the influence of digital technology in the Finnish medical device market.

Manager B, who has worked for the company for two years and has more than eight years of experience in the IVDD sector, talked about the company's approach to managing innovation. They admitted that there had been a recent decline in organization and follow-up, presumably as a result of project deadlines. Manager B proposed creating a special team or offering incentives to reward creative thinking. They understood how crucial a structured approach was for enhancing innovation management. There were difficulties in striking a balance between legal obligations and creative ideas, but Manager B thought it was doable with the appropriate strategy. They stressed the part that managers play in encouraging innovation and indicated an interest in talking with the management team about a framework. Manager B emphasized the company's progress in implementing new technologies while recognizing the impact of digital technology on the medical device business. They stressed the significance of developing a digital strategy and making a proactive effort to transform organizations. One example of a digital success was the launching of a mobile application for an existing device. Manager B expressed excitement about using the thesis framework to guide the company's digital ambitions.

Manager C, who has worked for the company for over ten years, talked about the organization's system for managing innovation. The chemistry department held informal meetings during coffee breaks, but there was no official procedure in place. Manager C stressed the importance of continuity and expressed hope for upcoming advancements. They emphasized the significance of patenting ground-breaking technologies while highlighting the difficulties in the field of chemistry. Manager C currently used an informal strategy of interacting with team members during coffee breaks and believed that managers have a role to play in fostering innovation. They did, however, acknowledge the necessity for a mechanism to record and manage ideas. As a result of technical improvements, the chemistry department was moving toward digital solutions for analysis and decision-making. Overall, they emphasized the necessity of strengthening innovation management, the value of patenting, and the expanding role of digital technologies in the field of chemistry.

Based on the interview, thematic analysis (figure 13) has been carried out and below are some of the common themes which was evident from the discussion,

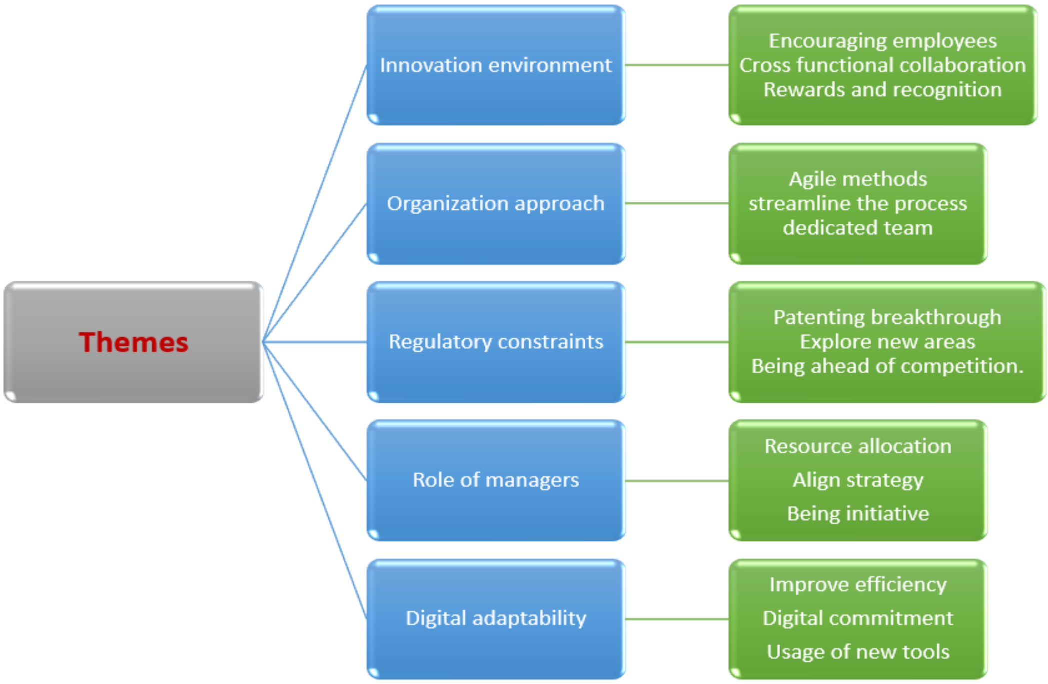

Figure 13: Thematic analysis based on qualitative research.

A number of recurring themes about innovation management and the impact of digital technology on the medical device sector were discovered once the transcripts were analysed. The importance of developing an innovative culture within their firms was stressed by all three managers. This required holding frequent brainstorming sessions, fostering cross-functional partnerships, and giving staff members the freedom to contribute their creative ideas in order to foster an environment that promotes and supports the production of new ideas. Manager A emphasized the implementation of a dynamic and forward-looking strategy that included cutting-edge practices like design thinking and agile project management. Manager B, on the other hand, had concerns regarding the lack of organization and follow-up in innovation management and suggested the need for specialized teams or incentive schemes. The industry faces challenges, notably with regard to the strict regulatory constraints that limit the creation of creative solutions. Manager B emphasized in particular how challenging it is to strike a balance between market demands and regulatory compliance. Manager C also highlighted the value of patenting ground-breaking technology to acquire a competitive edge, highlighting the difficulties in navigating particular fields without proper protection.

A key element in encouraging and fostering innovation within the enterprises has been the role of managers. All managers understood the critical role that leadership plays in fostering an innovative atmosphere, encouraging staff to share their ideas, and providing the resources needed for implementation. Both Managers A and B emphasized the necessity of managers setting up frameworks and allocating funds for innovation management. This entails developing a systematic approach to innovation and setting goals that are in line with the organization's vision. Medical device sector change has been attributed in large part to digital technologies. In order to increase productivity and decision-making, all managers recognised the growing significance of digital tools and procedures, such as digitalized documentation and data analysis. They emphasized the necessity for businesses to embrace a proactive commitment to digital transformation and build a digital strategy in order to take advantage of the advantages these technologies have to offer. Manager B also mentioned the development of more compact, smaller devices as well as new commercial potential made possible by digital technologies.

The managers cited specific accomplishments within their firms as success stories. Manager A brought up the successful rollout of a mobile application for a well-established medical product and the favourable consumer response it received. Manager B echoed this achievement and emphasized the company's ongoing digital advances. Manager C referred to unreported developments in the chemistry division that support the company's performance online. However, more explanation is not possible due to the sensitive nature of these discoveries. Finally, the transcript analysis turned up recurring themes on innovation management and the influence of digital technology on the medical device sector. These cover topics including how crucial it is to promote an innovation culture, how to deal with regulatory issues, how managers may encourage innovation, how to adapt new technologies, and specific examples of success inside the organizations. A thorough analysis of the topic matter of your thesis will result from fully comprehending and investigating these issues.

4.2.2 Quantitative data analysis

In the case of quantitative data analysis, the survey method has been utilized and shared among the employees of the firm to observe their perspectives. Using the mixed methodology gives us an overall picture of where the understanding of the firm is in terms of managers and the employees in innovation management. A total of **32 responses** have been received for the survey. A full list of the survey questions has been added to the appendix 1, however, a summary of the survey result and descriptive statistics has been carried out with the data has been explained in this section. I have summarised the analysis into three sections: What is the current state of the innovation at the firm? How managers and leadership team have an impact on the innovation management? And finally, what are the digital technologies impact and how well the company responds to it?

Current innovation stage of the firm: According to the survey results, a sizeable percentage of the firm's employees think an innovation management strategy should be put into place which was depicted in figure 14. The majority of respondents who were questioned about preferred techniques for managing innovation revealed a movement in favour of using an agile methodology. It is important to note that the replies were not uniformly favourable to one technique since some workers also supported design thinking and lean innovation as feasible strategies. These results provide credence to Manager B's contention that the firm's innovation management procedures lack structure. The lack of a definite majority preference among employees implies that there isn't agreement on the best strategy for managing innovation within the company.

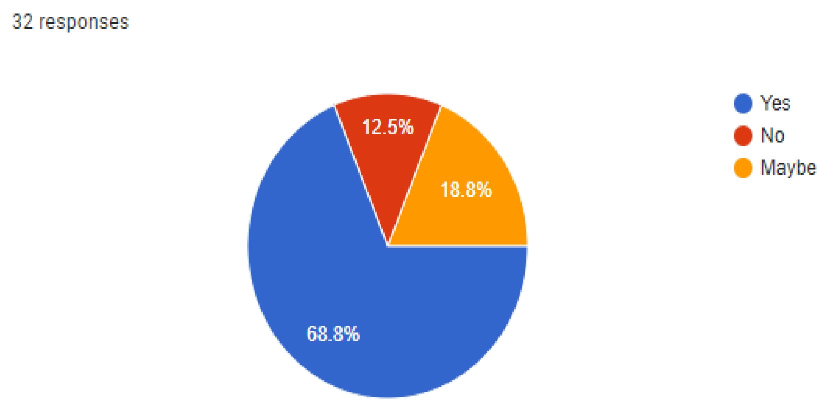

Figure 14: Response on whether innovation strategy is in place.

This disjointed answer demonstrates the necessity for the company to create a more clear-cut and organized framework for innovation management. It suggests that the situation right now can be characterized by a lack of direction and clarity in terms of innovative processes. Employees will be able to work toward a common vision and promote an innovative culture by implementing a well-defined plan that is in line with the company's aims and values. The firm can benefit from utilizing various methodologies and approaches based on the particular context and nature of the innovation initiatives by acknowledging the multiple perspectives among its personnel. The company might find it advantageous to think about combining components of the agile, design-thinking, and lean innovation approaches into a coherent framework that caters to the particular needs of the medical devices sector. In addition to this, most of them believes brainstorming session as the most the common ways of collecting innovative ideas followed but mostly in a non-formal way.

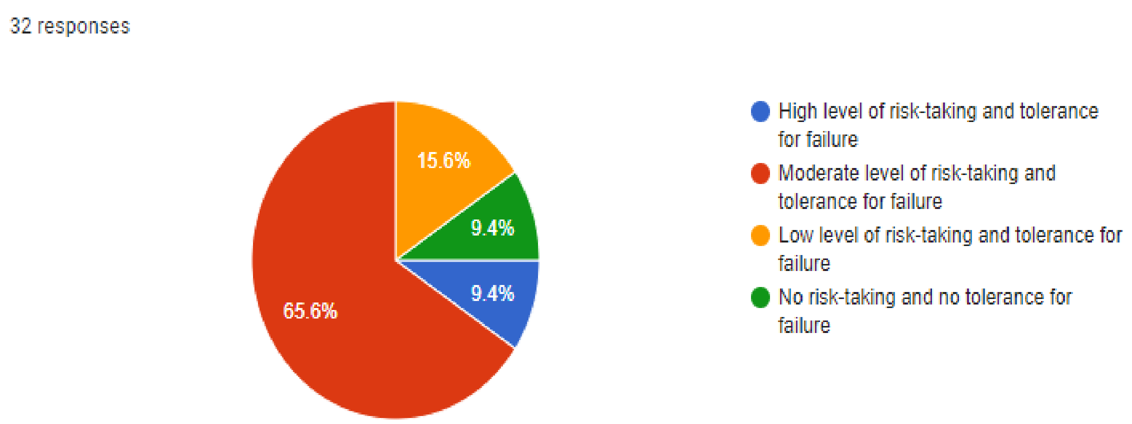

Figure 15: Level of risk taking in the firm.

A question about the company's attitude toward taking risks when it comes to innovation ideas was also included in the poll shown in figure 15. The majority of respondents said the company took moderate risks in these circumstances. This implies that the company is open to trying new things and taking measured risks, though perhaps not to the extent that some workers might like. Participants were then asked to rate how satisfied they were with the firm's current level of innovation. The average score was three out of five, indicating a modest level of satisfaction. These results suggest that although the company is advancing in terms of innovation, there is still potential for development.

Combining these survey results highlights the requirement for the company to create a distinct and well-defined structure for managing innovation. Although staff members believe the company to be relatively risk-taking, there is a desire for more proactive and intentional attempts to advance innovation. Employees may see opportunity for the company to attain higher levels of innovation if suitable measures and strategies are put in place, according to the moderate satisfaction rating. Additionally, in order to solve the modest satisfaction level, the company must be proactive in enhancing its innovation management procedures. This may entail putting in place systems for gathering and assessing fresh concepts, encouraging teamwork and cross-functional communication, offering support and resources for innovation projects, and actively fostering an environment that appreciates and promotes innovation.

Managers role: The poll contained inquiries targeted at learning how the employees felt about the manager's function in managing innovation. The findings showed that most respondents agreed on the significance of the manager's function in carrying out innovation within the company. This result is consistent with the qualitative study, highlighting the critical function managers have in promoting and fostering innovation. Respondents showed a desire for an innovation ecosystem within the firm when asked what managers might do to improve the current innovation approaches. This shows that staff members understand the importance of an environment that encourages innovation, including tools, procedures, and a culture that supports and nourishes fresh concepts. Also mentioned by a sizable percentage of respondents as a component managers should concentrate on to boost innovation is the significance of encouraging and rewarding risk-taking. This shows that workers think managers ought to foster an environment that actively encourages taking measured risks in order to pursue new ideas. Another important component that managers should stress is open communication, which emphasizes the value of open and inclusive discourse in fostering cooperation and idea sharing inside the company.

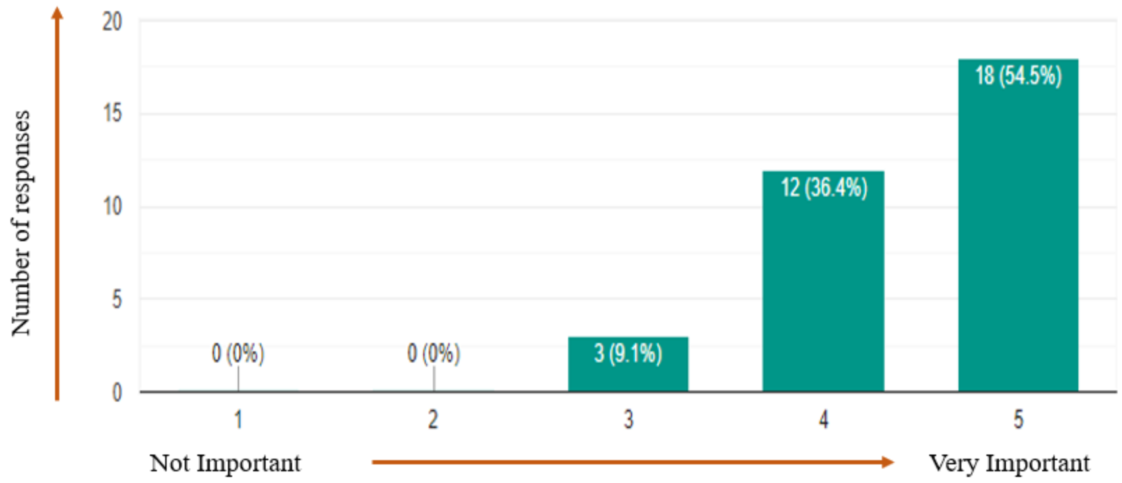

Figure 16: Response regarding the importance of managers.

Overall, these results highlighted in figure 16 clearly shows the crucial part managers play in fostering and developing innovation within the company. Employees are aware of the need for managers to provide an ecosystem for innovation, which entails developing procedures, providing the required resources, and fostering an environment that values and encourages innovation. Employees think managers should focus encouraging and rewarding risk-taking as well as encouraging open communication in order to improve the present innovation strategies. And also, they believe the leadership support and investment in R&D as a most significant driver of innovation in the firm.

How prepared for digitalization: The survey's last segment examined the firm's readiness for digitization. Overall poll responses show a good perspective for the company's capacity to adapt to new trends and developments in digital technology. This implies that the importance of digital transformation for the company is shared by managers and employees.

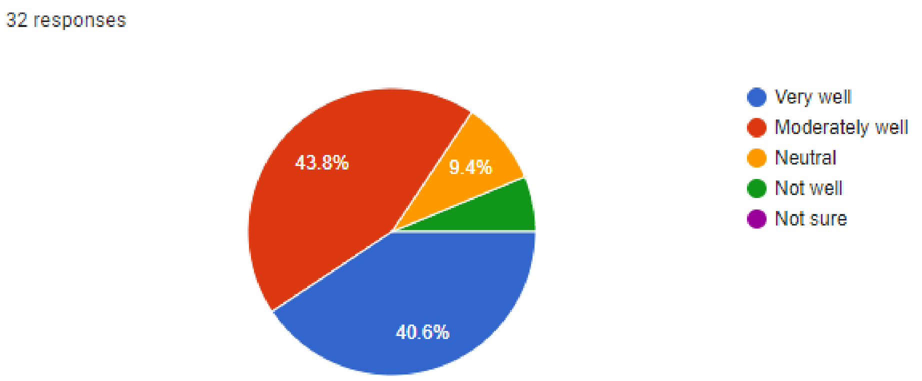

Figure 17: Firm responding to digital transformation.

The majority of respondents ranked the availability of competent workers and enough investments in developing digital infrastructure and capabilities as the top two priorities when asked about the aspects crucial to the implementation of digital technologies which was shown in figure 17. This highlights how important it is to have a workforce that is equipped with the digital skills and competences required to lead and manage digital initiatives. Additionally, respondents emphasized the need of obtaining outside assistance, indicating that the company might need to work with outside partners or consultants to integrate digital technology successfully.

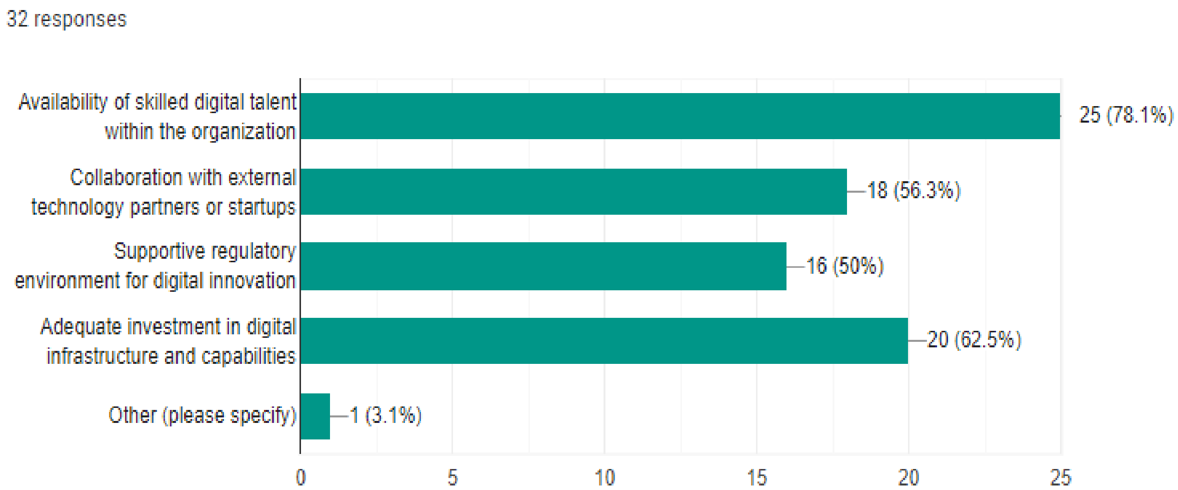

Figure 18: Factors considered for successful digitalization.

Additionally figure 18 shows, respondents stated that they thought having a strong digital infrastructure increased operational effectiveness and gave their company a competitive edge in terms of regulatory compliance and customer satisfaction. This emphasizes the understanding of the potential advantages that digitization can bring to the business, including process streamlining, industry standard compliance, and improved customer experience. The company should place a high priority on investing in digital infrastructure, assuring the availability of qualified workers, and taking into consideration external collaborations or help where appropriate in order to efficiently exploit digital technology. By concentrating on these crucial elements, the organization can improve its capacity to adjust to the digital world, take advantage of new opportunities, and maintain industry competitiveness. Overall, the poll results show a favourable assessment of the company's preparation for digitalization. It emphasizes how crucial it is to invest in the appropriate tools and expertise to successfully deploy digital technology. The company may increase operational effectiveness, negotiate regulatory obligations, and improve customer happiness by adopting digital transformation, ultimately presenting itself as a leader in the digital world.

In addition to the themes formulated from the qualitative analysis has been show in figure 19, there are few additional themes which can be observed from the quantitative analysis.

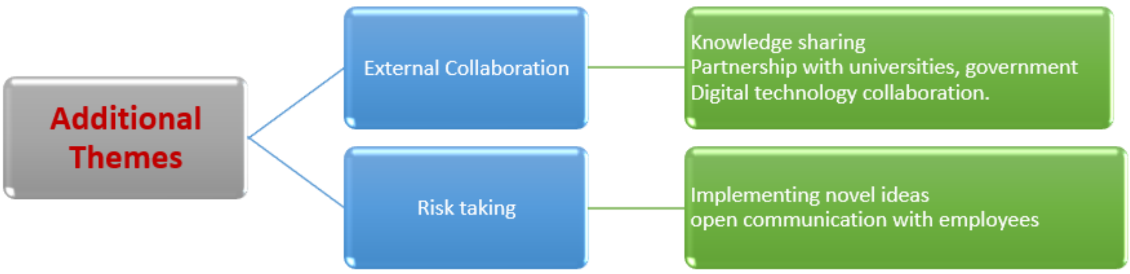

Figure 19: Additional themes formulated from quantitative analysis.

External Collaboration and risk taking is another factor which was predominant in the survey result which the firm has to consider in managing innovation and also in handling digital technologies implementation. When other partners, such as other businesses, research institutes, or consultants, are involved in the innovation process, this is referred to as external collaboration. You can learn a lot about how companies might use outside knowledge and resources to spur innovation by looking at the significance of external collaboration in the context of the Finnish medical device industry. Risk-taking is an essential component of innovation management since it entails accepting uncertainty and experimenting with novel concepts or methods that could result in game-changing inventions. Insights into how businesses may develop a culture that fosters calculated risks and supports innovation can be gained by looking at risk-taking behaviours and tactics within the framework of the Finnish medical device industry.

In order to address the research questions, the data analysis section offers a thorough examination of the gathered data, fusing qualitative and quantitative insights. The results of this study serve as the starting point for the discussion part that follows, where the ramifications and importance of the findings will be thoroughly examined. However, there are few limitations regarding the sample range and the opinion is explicitly from a single firm hence the process could not be applicable to the entire sector. The next section is about the framework derived from both literature review and the data analysis process.

5 Framework

This chapter explains on the framework which has been created to address the main possibilities and problems in implementing strategic corporate innovation management and managerial innovation in the Finland Medical Devices Industry. It is based on a thorough literature research and data analysis. This framework offers a structured method for businesses to improve their innovation capabilities and promote sustainable growth in this dynamic industry by drawing on existing research and empirical facts. Figure 20 gives an overview of the framework, which was developed for the thesis, further explanation is briefed below the diagram.

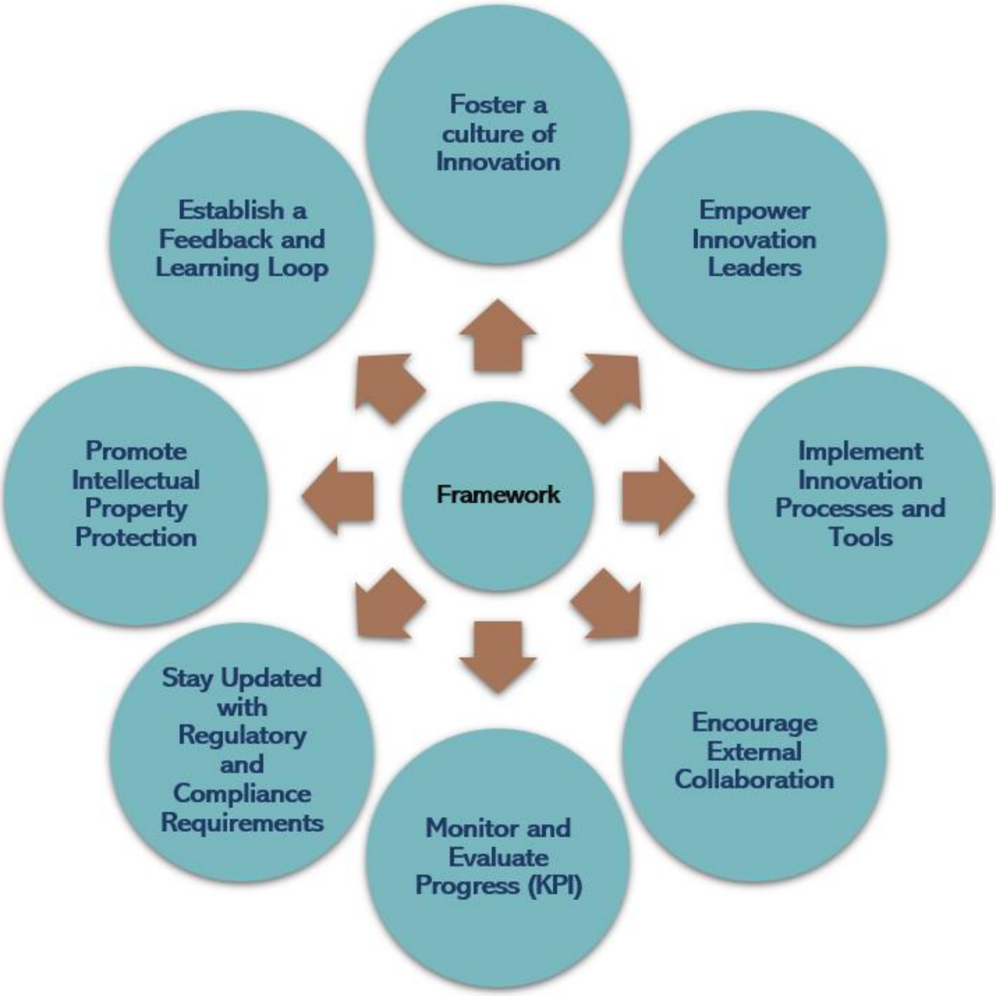

Figure 20: Framework for innovation management and managerial innovation.

Foster a culture of innovation

For medical device firms to succeed in today's quickly changing market, it is essential to create an organizational culture that supports and stimulates innovation (Amabile & Pratt, 2016). Organizations need to concentrate on a few important factors in order to promote an innovative culture. The Finland medical device market operates in a dynamic environment marked by technological breakthroughs, shifting legal requirements, and rising patient expectations. Medical device businesses must promote an innovative culture at all levels of the organization if they want to stay competitive. Companies may use their employees' creative capacity to produce ground-breaking concepts that address the needs of emerging markets thanks to this culture. Driving innovation in the sector requires fostering an attitude of constant learning, experimentation, and risk-taking.

Companies may encourage an entrepreneurial spirit and an openness to change by pushing staff to challenge conventional wisdom and investigate novel alternatives. People are empowered to take measured chances in this setting because they know that failure is seen as a worthwhile learning experience. Companies may build an innovative and resilient culture by welcoming experimentation and learning from failures. Fostering an innovation culture in the Finland Medical Devices sector requires cross-functional cooperation and open lines of communication. Communication problems and compartmentalized thinking can impede the exchange of ideas and restrict collaboration. Companies can promote idea-sharing and knowledge exchange by setting up methods for cross-functional collaboration, such as innovation workshops, brainstorming sessions, and collaborative problem-solving platforms. This makes it possible for various viewpoints to collide, which promotes the formation of fresh and worthwhile concepts.

Maintaining a culture of innovation also depends on praising and rewarding innovation initiatives. Companies that manufacture medical devices ought to put in place incentives and recognition systems for creative actions and results. This can be accomplished through innovation contests, recognition initiatives, and concrete incentives like financial incentives or chances for professional promotion. Companies may emphasize the value of innovation and encourage staff to actively contribute their ideas by recognizing and appreciating it.

Empower innovation leaders

For the Finland Medical Devices industry to advance managerial innovation and strategic corporate innovation management, it is essential to empower innovative leaders (Davila, Epstein, & Shelton, 2013). Effective innovation leaders are able to negotiate the complexity of innovation and have a thorough understanding of the medical devices sector. Organizations can provide the groundwork for fruitful innovation projects by selecting competent executives who exhibit these traits. These leaders must be able to inspire and encourage people, giving them a sense of direction and purpose, and they must have a clear vision for innovation. Along with having strong leadership qualities, it's crucial to give innovation leaders the tools and resources they need. Programs for ongoing professional development can give them the most recent information and resources in innovation management, enabling them to keep up with changing fashions, technology, and market dynamics. Supporting innovation projects requires adequate resource allocation, including funds, technological infrastructure, and research facilities. These tools give innovation leaders the tools they need to effectively explore fresh concepts, carry out research, and use creative tactics.

In order to empower innovation leaders, a collaborative atmosphere that promotes cross-functional cooperation and gives employees of all ranks the opportunity to contribute to innovation must be established. Leaders in innovation should promote the creation of cross-functional teams that include members from many departments and disciplines. Innovation leaders may unleash the organization's collective intelligence and drive innovation through promoting collaboration, a diversity of viewpoints, and interdisciplinary methods. Employee engagement and ownership are increased when given the opportunity to take part in innovation efforts because they feel appreciated and recognized for their work. Furthermore, it is crucial to form a focused committee or team for innovation governance. The task of supervising and directing the innovation management process should fall to this group. Clear roles and duties documented decision-making procedures, and effective reporting methods should all be part of the governance framework. This guarantees accountability and efficient administration of innovation initiatives and enables innovation leaders to coordinate their initiatives with organizational priorities and strategic goals.

Implement innovation processes and tools

In order to promote innovation in the Finnish medical device sector, it is crucial to put in place systematic, well-defined systems that direct the entire invention process. Organizations may successfully manage the various stages of innovation, from idea generation through implementation, by creating a systematic approach. This entails creating clear procedures for idea production, assessment, decision-making, and implementation (Tidd & Bessant, 2018). To guarantee that creative ideas are appropriately screened and in line with strategic objectives, clear guidelines, evaluation criteria, and decision-making frameworks should be established. Utilizing innovation tools can also help the invention process be much more productive and efficient. For instance, design thinking offers an iterative, human-centred method for solving problems that encourages empathy, creativity, and teamwork (Brown, 2008). Organizations may get profound insights into user needs, provide original ideas, and quickly prototype and test viable solutions by adopting design thinking principles. Agile approaches like Scrum or Kanban can also be used in addition to design thinking to promote cross-functional cooperation, iterative development, and adaptable project management (Sutherland & Schwaber, 2017). Through the use of these approaches, teams are able to work in brief iterations, prioritize features based on client feedback, and make continual improvements to the product or service while it is being developed.

Additionally, organized frameworks for managing innovation initiatives may be found in project management frameworks like the Stage-Gate method (Cooper, 2019). With this strategy, the innovation process is divided into separate stages, each with a set of gates or checkpoints where decisions on whether to move forward or stop the project are made. The Stage-Gate approach aids in risk management, efficient resource allocation, and project alignment with strategic goals. Organizations may negotiate the intricacies of product development, regulatory regulations, and market dynamics by putting in place a structured and methodical innovation approach customized to the medical devices business. The procedure ought to include phases like concept generation, selection and assessment, creation and prototyping, testing and validation, and implementation. Adding feedback loops and continuous improvement processes is also crucial for fostering creativity. Organizations can gain insights, learn from mistakes, and improve ideas and prototypes by doing regular reviews, evaluations, and feedback sessions (Liedtka, 2015). Organizations can iterate and optimize their inventions with the aid of this iterative methodology, ensuring that they successfully meet user wants and market demands.

Monitor and evaluate progress

Establishing and monitoring pertinent KPIs that are in line with strategic goals is crucial for managing innovation activities efficiently (Hauschildt & Salomo, 2007). These KPIs can measure things like the quantity of new product ideas created the number of launches that are successful, the revenue from new product launches, customer happiness scores, or the time-to-market for innovations. Organizations can evaluate the development and effectiveness of their innovation efforts by setting up clear and quantifiable KPIs. Organizations can learn more about the efficacy of their innovation projects by routinely monitoring and evaluating innovation progress against established KPIs (Trott, 2017). This entails monitoring and examining data pertaining to important indicators, gathering input from stakeholders, and carrying out routine reviews. Organizations can pinpoint their innovation management strategy's advantages, disadvantages, and opportunities for improvement by utilizing data analytics and feedback channels. The innovation management process must be adjusted and optimized using data-driven decision-making. Organizations can find patterns, trends, and bottlenecks that could affect the results of innovation by examining the data that has been collected. This knowledge allows for well-informed decision-making to solve problems, effectively allocate resources, and modify innovation methods as necessary (Nagji & Tuff, 2012). A culture of continuous learning and improvement is fostered by regular evaluation and feedback loops, which guarantees that organizational objectives are consistently met by innovative activities.

Additionally, it is extremely helpful to get feedback from a variety of stakeholders, such as partners, consumers, and workers, while evaluating the significance and practicality of innovations. Qualitative insights into the user experience, market acceptance, and prospective improvements can be gained through the qualitative input that is gathered through surveys, focus groups, and user testing. To acquire a thorough picture of innovation performance, this input should be considered along with quantitative data (Brown & Duguid, 2001). It helps to validate assumptions and enhance the results of innovation to include the voice of stakeholders and customers in decision-making.

Stay updated with regulatory and compliance requirements

A legislative system intended to guarantee the security, effectiveness, and calibre of medical devices governs how the Finnish medical device industry conducts business. To maintain compliance and minimize legal and reputational risks, businesses who innovate within this sector must stay current on the latest regulatory standards. Medical device rules and compliance standards might change depending on the classification of the item, its intended use, and regional market laws. To stay abreast of regulatory updates, organizations should closely monitor regulatory agencies like the European Medicines Agency (EMA) and the Finnish Medicines Agency (FIMEA), as well as global standards bodies like the International Organization for Standardization (ISO) (Aust, 2020). The design, development, manufacture, and commercialization of medical devices are impacted by the guidelines, directives, and standards that are frequently issued by these regulatory agencies. Actively monitoring changes, attending professional conferences and seminars, and participating in industry networks and organisations are all necessary to stay current on regulatory standards. Organizations should set up procedures for analysing and interpreting new rules and regulations and determining how they might affect innovation activities. This entails being aware of the precise specifications for testing, documentation, labelling, post-market surveillance, and risk management of products (Crispim et al., 2020). Organizations can make sure that their innovation activities adhere to the necessary norms and standards by proactively monitoring regulatory revisions.

In order to work together on compliance-related issues, firms should set up cross-functional teams made up of regulatory specialists, engineers, quality assurance personnel, and innovation leaders. Together, these teams can analyse legal requirements, spot weaknesses in the system, and create plans to assure compliance throughout the innovation process. For innovation activities to be following regulatory standards, regular communication and coordination between the regulatory and innovation teams are crucial (Kramer & Schulze, 2019). It is crucial to remember that regulatory standards may alter over time as a result of new technology, scientific discoveries, or modifications to international regulatory frameworks. Therefore, to maintain continual compliance, companies should set up systems for ongoing oversight and update procedures (Mohapatra & Nambiar, 2020). Organizations may manage the changing regulatory landscape and make sure that their innovation projects adhere to the relevant regulatory and compliance standards by remaining aware and proactive.

Promote intellectual property protection

Protecting intellectual property is essential for firms to defend their inventions and maintain a sustainable advantage in the fiercely competitive medical devices market. Inventions, designs, procedures, trademarks, and other types of creative and innovative work are all considered to be intellectual property. Organizations can protect their distinctive concepts, innovations, and brands from unauthorized usage and exploitation by promoting IP protection. Organizations should set up systems to recognize and seize ideas produced by their innovation initiatives in order to manage intellectual property effectively (Birkinshaw et al., 2016). This includes classifying and recording ideas, creations, and other intellectual property. Organizations can assess innovations' potential economic worth and choose the best protection tactics by methodically identifying and seizing them.

Securing important innovations requires spending money on IP protection mechanisms like patents, trademarks, copyrights, or trade secrets. Patents give inventions legal protection and give the inventor exclusive rights for a predetermined amount of time (European Patent Office, n.d.). Trademarks provide enterprises with the ability to create a unique market identity by protecting names, logos, and brands that are connected to goods or services (World Intellectual Property Organization, n.d.). Software, manuals, and artistic creations are all protected by copyrights (United States Copyright Office, n.d.). In order to maintain a competitive advantage, trade secrets must be kept secret. These include data, formulas, or production techniques (World Intellectual Property Organization, n.d.). Organizations may secure their ideas and stop unlawful usage or replication by rivals by investing in the proper IP protection methods.

To ensure proper filing and protection methods, businesses should work with IP lawyers or consultants who specialize in intellectual property rights (Birkinshaw et al., 2016). These professionals can help with conducting exhaustive patent searches, writing patent applications, navigating the complicated IP landscape, and, if necessary, enforcing IP rights. IP specialists should be brought in early in the innovation process to help identify patentable inventions, choose the best filing methods, and assure legal compliance. Furthermore, it is essential to create a culture of IP awareness and education within the company. Employees can actively assist in locating and protecting innovations by fostering a clear understanding of the value of intellectual property and the significance of protecting it. Employees can recognize and safeguard intellectual property in their everyday work via regular IP training sessions, workshops, and awareness campaigns (Gassmann et al., 2010).

Establish a feedback and learning loop

Organizations in the medical devices sector should set up a feedback and learning loop in order to promote a culture of continuous improvement and drive effective innovation activities. With the help of this loop, businesses may get input from many parties, such as clients, staff members, and outside partners, and they can also make use of knowledge gleaned from both successful and unsuccessful innovation projects. Understanding stakeholder's needs, preferences, and pain areas depends on encouraging feedback from them. Surveys, focus groups, interviews, and suggestion platforms are just a few of the methods that can be used to do this (Wixted & Colwill, 2017). Organizations may find areas for improvement, unearth new opportunities, and guarantee that innovation initiatives line up with stakeholder expectations by actively soliciting feedback.

For organizational learning, it's critical to collect lessons from both successful and unsuccessful innovation projects in addition to getting feedback. This entails methodically compiling and evaluating the results, difficulties, and critical learnings from each project (Tidd & Bessant, 2018). Lessons gained offer useful information that can be used in future endeavours, assisting in avoiding potential pitfalls and duplicating effective ways. Organizations can hone and enhance their innovation processes and strategies using feedback and insights gleaned from stakeholder feedback and lessons learned. Utilizing this data enables firms to take well-informed actions and make adjustments that improve the efficacy and efficiency of their innovation initiatives (Jansen et al., 2019). Organizations can adjust to changing market conditions, technological improvements, and customer wants using this iterative methodology.

The definition of key performance indicators (KPIs) is crucial for determining if innovation activities are successful. According to Trott (2017), KPIs offer quantifiable metrics that support organizational goals and show advancement toward intended results. Companies should create KPIs that reflect their unique innovation objectives, such as the quantity of new product releases, the revenue from innovations, or the degree of customer pleasure. For assessing the success of innovation projects, it is crucial to regularly measure and assess progress against certain KPIs. Data analysis, performance evaluation, and the identification of problem areas are all necessary for this (Jansen et al., 2019). Surveys, market research, and internal analytics are just a few of the data collection techniques that businesses can use to learn more about the effectiveness of their innovation projects. Organizations may find bottlenecks, recognize patterns, and make data-driven choices by gathering and analysing data. It enables companies to evaluate the results of their innovation initiatives, pinpoint prospective zones for improvement, and efficiently allocate resources (Trott, 2017). Organizations can improve their innovation processes, improve decision-making, and raise the likelihood of successful results by utilizing data-driven insights.

Encourage external collaboration

Partnerships and collaborations with external stakeholders should be actively sought after by organizations. Healthcare providers, research organizations, startups, and governmental organizations are just a few examples of these stakeholders. Access to outside expertise is a significant benefit of external collaboration. For instance, collaborating with healthcare professionals enables businesses to understand the clinical aspects of their inventions, comprehend patient demands, and confirm the efficacy of their medical products in actual use cases (Herzlinger, 2017). Working with research institutes gives access to cutting-edge technological and scientific developments that can spur innovation and open up new development opportunities (Chesbrough, 2019). Engaging with startups can help a company build an innovative culture by bringing new perspectives, entrepreneurial zeal, and disruptive ideas.

External collaboration provides access to other resources in addition to expertise. Partnering with external stakeholders can give companies access to resources such as money, technical know-how, specialized tools, and facilities (Herzlinger, 2017). These assets can considerably increase an organization's capacity for innovation and hasten the creation and dissemination of novel medical devices. Additionally, external alliances provide businesses access vast networks. Organizations can increase their network of business associates, potential clients, distributors, and investors through partnerships (Chesbrough, 2019). These networks offer chances for knowledge sharing, market insights, and new project collaborations. Engaging with other parties also improves the company's industry exposure and reputation, luring potential partners, clients, and talent.

Organizations should actively seek out possible partners, build connections that are mutually beneficial, and clearly define the goals and expectations of the cooperation in order to successfully engage in external collaboration (Zahra et al., 2019). Successful collaborations depend on developing confidence, keeping lines of communication open, and upholding intellectual property rights (Herzlinger, 2017). In order to interact with potential partners and take part in collaborative activities, organizations should also think about utilizing digital platforms and online communities (European Commission, 2021). By putting this framework into practice, businesses in the Finnish medical device sector may build a solid foundation for innovation and encourage a workplace environment that values innovation, risk-taking, and teamwork. With the help of this framework, businesses may more easily negotiate the complexities of their sector, adjust to new trends and technology, and eventually achieve sustainable development and competitiveness.

Overall, the framework offers a structured and comprehensive strategy to drive managerial innovation and strategic corporate innovation management, serving as a guide for businesses in the medical devices industry. Organizations that adopt this approach can position themselves as innovators, catalysts of change, and stewards of the changing requirements of the sector and its stakeholders.

6 Discussion

This chapter, which gives a thorough description of the research done, is an essential component of the thesis. It then compares the suggested framework with current techniques and pertinent literature after answering the research questions created for the study. Derived a theoretical framework that assisted in understanding and analysing the strategic management of resources, capabilities, and innovation in an organization. This framework included a resource-based view and dynamic capability. Additionally, the framework's shortcomings are acknowledged, and recommendations for additional research in the area of innovation management are made. The study's first research topic examines the challenges faced and current solutions used by companies working in the Finnish medical device sector. It became clear through meticulous data analysis and a thorough examination of pertinent studies that medical device companies can use a variety of strategies. Stage-gate procedures, encouraging cross-functional cooperation, and using user-centred design techniques are a few of them. These techniques have been acknowledged as powerful tools for encouraging industry innovation. The investigation did, however, also highlight the difficulties that organizations face. The regulatory framework for medical devices has become a substantial barrier. Innovation initiatives may face time, financial, and resource limits if they must adhere to stringent standards and regulations designed to ensure patient safety. Additionally, a lack of capital and resources makes it difficult for businesses, especially small and medium-sized ones (SMEs), to invest in and sell innovative projects. Additionally, there are additional challenges due to the hazy market conditions and changing reimbursement practices. For effective innovation management, navigating these risks and securing appropriate funding for cutting-edge gadgets are essential.

Secondly, in order to further strategic corporate innovation management, the study set out to look into the general roles of managers in encouraging and carrying out innovation inside a company. Several crucial responsibilities that are essential for the successful implementation of innovation management have been identified after a thorough assessment of pertinent literature and in-depth data analysis. These responsibilities have been briefly described in the section on the development of the framework, but they can be further explained. Managers must first and foremost create a supportive environment that encourages creativity. This entails creating a culture that appreciates and encourages innovation, taking risks, and constant progress. Employees should be actively encouraged by their managers to come up with and develop creative ideas by giving them the resources and assistance they need to turn these ideas into workable projects. Effective innovation management requires a clear vision and strategic directions. The organization's innovation goals must be communicated by managers and coordinated with the overarching corporate goals. Employees can better comprehend the strategic direction and direct their innovation endeavours towards desired results with this clarity of purpose.

Another crucial managerial duty is the distribution of resources. Projects involving innovation must be given enough financial, human, and technological resources to be supported. Allocating resources wisely guarantees that innovation efforts get the support they need and makes it possible for them to be carried out successfully. Additionally, managers must support cross-functional workplaces, dismantling silos and fostering cooperation between various teams and departments. Managers can leverage the organization's collective experience by promoting information sharing and incorporating different viewpoints, leading to creative solutions that go beyond conventional limitations. Innovation involves taking measured risks and learning from both successes and failures. The safest environment for experimentation and risk-taking should be fostered by managers. They should encourage employees to take measured risks and offer chances for ongoing learning and growth in order to promote an innovative culture. Innovation management, monitoring and evaluation are essential. Managers should set up systems to monitor the development and results of innovation projects. The success and impact of innovation activities should be evaluated using assessment metrics and key performance indicators (KPIs). To encourage ongoing growth and guarantee alignment with company goals, employees should get regular feedback.

The final research question sought to determine how digitalization can help Finnish medical device companies improve their capacity for innovation. The results show that even if digitalization has already had a big impact on the market, there is still room for improvement in terms of effectively managing innovation. The examination of interview transcripts and survey responses showed that current innovation management procedures frequently take place haphazardly, without accountability or traceability, such as during casual conversations or coffee breaks. The literature review does point out that a variety of digital collaboration and communication platforms are accessible to businesses for capturing creative ideas. These technologies give employees the chance to collaborate and generate ideas in a systematic manner. Medical device companies may develop a more organized and transparent approach for managing innovation, capturing ideas, and following the development of those ideas by utilizing these digital technologies.

The challenges that come with digitalization must be acknowledged, though. When using digital technologies for innovation management, it's important to take privacy issues, cybersecurity threats, and regulatory compliance into account. Businesses must create strong cybersecurity policies, abide by pertinent laws, and take proactive steps to secure data privacy and security in order to protect sensitive data and intellectual property. In summary, despite the fact that daily operations in Finnish medical device companies have become increasingly digitalized, managing innovation is still a challenge that has to be addressed. The current strategy lacks accountability and traceability because it relies on unofficial brainstorming sessions. Digital collaboration and communication tools, however, have the ability to simplify innovation management procedures by giving creative ideas a defined and responsible framework for development. To ensure the efficient and secure integration of digitalization in their innovation management procedures, businesses must traverse various obstacles relating to privacy, cybersecurity, and regulatory compliance. By addressing these concerns, medical device companies will be able to fully utilize digitalization as a tool for promoting corporate innovation within the sector. Some contributions have been made to the framework which was derived from previous studies.

Earlier research, such that done by West and Farr (1990), has emphasized the need of developing an innovative culture. They contend that businesses with strong innovation cultures typically have more creative and engaged workers. Furthermore, research by Amabile et al. (1996) and Damanpour (1991) emphasizes the importance of supportive leadership and an innovative workplace culture. Effective innovation leadership, according to research by Hargadon and Bechky (2006), is essential for fostering organizational innovation. They discovered that innovation leaders can have a major impact on the success of innovation efforts by having good communication skills, providing resources, and empowering their employees. Similar to this, Tushman and O'Reilly's (1997) study highlights the value of equipping leaders with the authority to question the status quo and promote innovation inside their businesses. Implementing organized innovation processes and tools is important, as studies by Chesbrough (2003) and Christensen (1997) show. These procedures may comprise stages for concept generation, assessment, decision-making, and implementation. Organizations can efficiently manage and streamline their innovation efforts by implementing such processes and using tools like innovation management software or concept management platforms. Studies by Powell et al. (1996) and Chesbrough (2003) make the value of external collaboration in innovation clear. They contend that working with external stakeholders, including as clients, vendors, academic institutions, and research facilities, can give access to fresh information, materials, and viewpoints. Chesbrough's suggested "open innovation frameworks" place a strong emphasis on the advantages of outside collaboration in fostering innovation.

For ongoing improvement, monitoring and evaluating innovation progress is crucial. Cooper (2008) and Davila et al. (2006) conducted studies on the efficacy of innovation initiatives. The amount of new product launches, revenue from new innovations, customer happiness, and employee participation in innovation activities are just a few of the different variables that KPIs might track. This enables businesses to monitor their development, pinpoint areas for development, and make data-driven choices. The medical device sector places a high priority on regulatory compliance. The requirement for firms to keep up with changing regulations and make sure that their innovation activities are in line with compliance standards is highlighted by studies by Kwon and Suh (2004) and Hossain and Kauranen (2016). Regulator criteria not being followed might have serious negative effects and legal repercussions. It's critical to protect intellectual property (IP) in order to maintain a competitive edge and allow businesses to profit from their discoveries. In their 2008 study, Fosfuri and Tribó emphasized the importance of IP protection tools like patents, trademarks, and copyrights in promoting innovation. Organizations should create policies and procedures to protect their intellectual property and make the most use of it. Maintaining innovation requires constant learning and development. The necessity of creating feedback systems, such as post-project evaluations, knowledge sharing platforms, and lessons learned sessions, is highlighted by research by Edmondson and Nembhard (2009) and Nonaka and Takeuchi (1995).

Organizations can use these systems to gather insights, learn from mistakes, and apply information to next innovation projects. Birkinshaw et al.'s (2008) study found that managerial innovation is crucial for fostering organizational adaptation and adapting to shifting market dynamics. It highlights the necessity for executives to regularly experiment with brand-new management techniques and organizational designs that support innovation. Employees can engage in innovative activities and contribute to the organization's overall innovation efforts with the support and structure that managerial innovation offers. Managerial innovation can assist in addressing specific issues and seizing opportunities in the context of strategic corporate innovation management in the medical devices business. Implementing cross-functional collaboration structures or agile project management approaches, for instance, might facilitate quicker decision-making and accelerate innovation cycles.

However, the framework created for implementing managerial innovation and strategic corporate innovation management in the Finnish medical device industry offers a useful road map for businesses looking to improve their capacity for innovation. But it's important to recognize the constraints this framework imposes. First and foremost, it is important to consider how niche the Finnish medical device market is. The applicability and usefulness of the framework in various contexts may be impacted by factors including industry dynamics, regulatory frameworks, and market conditions that vary among locations or industries. Second, the existence of sufficient resources and organizational support are necessary for the framework's implementation to be successful. The smooth adoption and implementation of the suggested solutions may be hampered by restrictions such tight financial restrictions, a lack of managerial commitment, or organizational reluctance to change.

The framework also presupposes precise identification and evaluation of chances for external collaboration and risk-taking tactics. The anticipated results may be undermined, and overall innovation efforts hampered by inaccurate evaluations or insufficient implementation of these components. It is significant to notice that the framework makes no explicit mention of any organizational or cultural impediments to innovation. Cultural characteristics, such as sensitivity to risk, reluctance to change, or established hierarchical structures, may offer difficulties that need for specific techniques and a nuanced approach to be overcome. Last but not least, the framework might fail to appropriately take into consideration unanticipated disruptions or quickly advancing technical breakthroughs that could have a substantial impact on the efficacy of the suggested tactics. To guarantee that the framework is current and receptive to developments in the sector and the larger business environment, continuous monitoring and adaptation are essential.

In conclusion, it is critical to be aware of these limitations even if the framework offers businesses involved in the Finnish medical device industry a useful place to start when looking to improve their innovation management procedures. Organizations should approach the framework with an understanding of these limitations and make the appropriate tweaks and adjustments to fit their unique difficulties and circumstances. By doing this, businesses may make the most of the framework's advantages and potential while also overcoming its inherent difficulties in the pursuit of managerial innovation and strategic corporate innovation management. These results demonstrate the requirement for a strong framework that takes into consideration the complexity of the Finnish medical device sector. Through the provision of rules and strategies for strategic corporate innovation management, the suggested framework seeks to address these issues. The framework is made to help organizations overcome the highlighted challenges and use the current approaches to spur innovation by incorporating insights obtained from the interview and survey data.

Recognizing the framework's limitations is crucial, though. Every business should be aware that it operates within a distinct context and that it has certain opportunities and difficulties. As a result, not every company will find an exhaustive solution in the framework. Future research in the area of innovation management should examine how the framework can be tailored and modified to fit different organizational contexts. In addition, future research might examine how well the framework functions in realistic settings and how beneficial it is.

7 Conclusion

The development of an innovative management framework has been thoroughly investigated in this thesis, with an emphasis on the responsibilities and tasks of managers in the Finnish medical device industry. A solid foundation for this work has been built through extensive background investigation and analysis. The assessment of the literature included a wide range of academic works that offered insights into the theories, models, and best practices for innovation management across different industries. Through conversations and exchanges with experts from the medical devices professionals, practical issues have been assiduously addressed in addition to the theoretical investigation. These discussions had as their goals gaining a thorough grasp of how innovation management was being used at the time as well as identifying any gaps or difficulties that firms in this sector were currently experiencing. The knowledge gained from these debates has been an invaluable tool in the creation of the suggested framework.

The implementation of managerial innovation and strategic corporate innovation management within the Finnish medical devices sector has been studied in this thesis using a mixed-methods methodology. The study combines quantitative data from a survey that received responses from 32 employees with qualitative information from interviews with three managers. This thorough approach gave us a deep understanding of the industry's innovation management difficulties, possibilities, and present methods. According to the literature review cited in this thesis, it is important to promote an innovative culture, empower innovation leaders, use efficient processes and tools, promote external collaboration, track progress using key performance indicators (KPIs), stay abreast of regulatory requirements, support intellectual property protection, and create feedback and learning loops. The insights gained from the use of multiple data collection methods to support and enhance these conclusions.

The manager’s experiences, viewpoints, and difficulties with innovation management were thoroughly explored through the interviews. Their observations produced insightful qualitative information that offered a detailed perspective of the state of innovation practices throughout Finnish medical device companies. On the other hand, the survey gathered quantitative information from a wider sample of workers, giving a more comprehensive view of their opinions, attitudes, and experiences with innovation within the company. The thesis has acknowledged the critical function that managers do in promoting and supporting innovation inside their firms. The goal of the research was to pinpoint key areas where managers' participation and leadership are essential for effective innovation management by carefully examining the responsibilities and tasks of managers. In order to ensure that the framework reflects the practical elements and is in line with the unique needs and challenges faced by managers in the Finnish medical devices industry, these findings have been summarized and incorporated.

It's crucial to recognize the limits of this study, though. The study used a mixed-methods approach with a small sample size and was industry-specific. The results might not fully represent all Finnish medical device companies or other industries. Future studies might increase the sample size, include more industries, and investigate how digitalization will affect innovation management over the long term. In conclusion, this thesis advances knowledge of managerial innovation and strategic corporate innovation management in the Finnish medical device sector. The mixed-methods approach, which includes management interviews and employee surveys, offers a thorough understanding of the opportunities and problems faced by firms in promoting innovation. The created framework provides useful advice for businesses looking to improve their capacity for innovation, with digital technology playing a key part.

Conducting a longitudinal study to evaluate the long-term effects of the suggested innovation management framework in the Finnish medical devices industry could be one of the future research paths for corporate innovation management and managerial innovation. A comparison of innovation processes in various industries could shed light on how adaptable the framework is. Investigating the framework's potential for incorporating cutting-edge technologies like artificial intelligence and machine learning could improve the innovation process. Investigating the link between organizational culture and innovation as well as methods for developing an innovative culture would also help us understand how to manage innovation in the medical device sector.

Overall, the Finnish medical device sector has benefited greatly from this thesis substantial contribution to the subject of innovation management. In order to create a framework that tackles the unique challenges and opportunities faced by managers in this area, it blends rigorous academic research with practical insights. This report provides helpful advice for managers and organizations looking to improve their innovation capabilities and foster strategic corporate innovation within the medical devices industry by bridging the gap between theory and practice.

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Appendix 1: Survey questions for quantitative analysis

Framework for implementing strategic corporate innovation management and Managerial innovation in the Finland Medical industry.

Thank you for participating in our survey on strategic corporate innovation management and managerial innovation in the Finnish medical devices industry. Your insights are valuable in helping us understand the current practices, challenges, and opportunities in this field. Your responses will remain anonymous and confidential, used solely for research purposes. The survey will cover various aspects related to innovation management and the utilization of digital technologies in the medical device industry. It should take approximately 12-15 minutes to complete.

Participation is voluntary, and you may withdraw at any time. Your input, regardless of your role or expertise, is valuable to us. There are no right or wrong answers. Your responses will contribute to a comprehensive understanding of innovation practices in the Finnish medical device sector.

harishgopalramesh@gmail.com Switch account

Not shared

* Indicates required question

Does your medical device company have a formal innovation management strategy in place? *

- ◯ Yes
- ◯ No
- ◯ Maybe

Which of the following innovation management methods is currently utilized within your company ? Please select all that apply. *

- ☐ Design thinking
- ☐ Lean innovation
- ☐ Agile methodology
- ☐ Stage-gate process
- ☐ Other (please specify)

How does your medical device organization capture and evaluate innovative ideas from employees? *

- ☐ Idea submission portals or platforms
- ☐ Innovation challenges or competitions
- ☐ Regular brainstorming sessions or meetings
- ☐ Other (please specify)

What are the main challenges or barriers you have encountered in managing innovation within your organization? Please select the challenges from the options below and provide any additional comments or insights. *

- [ ] Lack of dedicated resources and funding for innovation activities
- [ ] Limited cross-functional collaboration and knowledge sharing
- [ ] Difficulty in translating innovative ideas into tangible outcomes or products.
- [ ] Resistance to change and risk aversion within the organization.
- [ ] Other (please specify)

How would you describe the level of risk-taking and tolerance for failure within your medical device organization's innovation efforts? *

- ○ High level of risk-taking and tolerance for failure
- ○ Moderate level of risk-taking and tolerance for failure
- ○ Low level of risk-taking and tolerance for failure
- ○ No risk-taking and no tolerance for failure

Which of the following factors do you believe have the most significant impact on driving innovation within your company? Please select the top three factors. *

- [ ] Company culture and leadership support
- [ ] Access to external innovation networks or ecosystems
- [ ] Investment in research and development (R&D)
- [ ] Employee incentives and recognition for innovation
- [ ] Other (please specify)

On a scale of 1-5, how important do you think it is for managers in medical device firms to foster and execute innovation? *

1	2	3	4	5
○	○	○	○	○

In your experience, how does leadership contribute to promoting and supporting innovation within your organization? Please select the top two options that you believe have the most significant impact and provide any additional insights or examples. *

- [ ] Setting a clear vision and strategic direction for innovation.
- [ ] Providing resources and support to implement innovative initiatives.
- [ ] Encouraging and rewarding risk-taking and learning from failures.
- [ ] Fostering a culture of open communication and idea sharing.

To what extent do you believe that digital technologies can enhance the capacity for innovation in the medical device industry? Please rate your level of agreement with the following statement on a scale of 1 to 5 (with 1 being strongly disagree and 5 being strongly agree): "Digital technologies have the potential to significantly improve innovation capabilities in the medical device industry." *

1	2	3	4	5
○	○	○	○	○

In your opinion, what are the key factors that contribute to the successful integration of digital technologies for innovation in the medical device industry? Please select the factors from the options below and provide any additional comments or insights. *

- ☐ Availability of skilled digital talent within the organization
- ☐ Collaboration with external technology partners or startups
- ☐ Supportive regulatory environment for digital innovation
- ☐ Adequate investment in digital infrastructure and capabilities
- ☐ Other (please specify)

What are the main benefits or outcomes your medical device company has realized from integrating digital technologies for innovation? Please select all that apply. *

- ☐ Improved product development and time-to-market
- ☐ Enhanced operational efficiency.
- ☐ Facilitated regulatory compliance.
- ☐ Increased customer satisfaction
- ☐ Other (please specify)

On a scale of 1-5, how satisfied are you with the current level of innovation within the firm? *

1	2	3	4	5
○	○	○	○	○

How well do you believe your firm responds to emerging trends and changes in the healthcare landscape to drive innovation? *

- Very well
- Moderately well
- Neutral
- Not well
- Not sure

How important do you perceive external collaborations and partnerships for driving innovation in the medical device industry? *

- Extremely important
- Moderately important
- Neutral
- Not very important
- Not sure

What do you think are the best practices for promoting innovation within medical device firms in Finland? (open-ended question)

Long answer text