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Product Development Plan to Drive Integration of Emerging Technologies in FitWood Ltd.

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Abstract

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The aim of this thesis was to create a product development plan for FitWood Ltd. The intention to evolve FitWood's product development was to support the organization in achieving its goal of producing its first technological product before the end of 2025. The goal was also to share implementations that would develop the company's innovation culture. In addition to that, the aim was to increase the organization's knowledge about emerging technologies and to suggest the most competitive technology for the organization. The constructive research strategy with a deductive approach was chosen to achieve these aims of qualitative research.

FitWood manufactures and sells playroom active toys and home-exercise equipment that promotes Scandinavian design, multifunctionality, and well-being. The organization is in Tampere, Finland, and it uses subcontractors for producing its products. There are seven employees, including the researcher, who works as the organization's CEO. All of them participate in the product development process.

The information for the product development plan was produced using a theoretical framework, participant observation, and semi-structured interviews. The theoretical framework provided a theoretical base for the thesis and knowledge about emerging technologies for the organization. The theoretical framework leans on innovation, emerging technologies, and the Stage-Gate model. The Stage-Gate model was used as a framework for the product development process. The characteristics of innovation culture were used as a frame to evaluate the company's culture.

The observation was conducted to analyze and improve the organization's innovation culture and product development process. Interviews were organized to study and understand the future insights into emerging technologies from the leaders of technological companies. Additionally, the data from interviews were used to suggest the most competitive emerging technology for the organization.

Research findings showed that an innovation culture partially existed in the organization even though some characteristics needed development. The study revealed that the product development process was not documented and did not have a clear structure. Interviews showed how difficult it is to predict and follow emerging technologies.

The product development plan was the outcome of the research. The plan is divided into three chapters: development of the innovation culture, new product development process, and competitive emerging technologies. The development of the innovation culture suggests how the areas that needed development could be improved. The new product development process suggests a new model that is based on the Stage-Gate model. The competitive emerging technologies show important emerging technologies and what needs to be considered before taking them into use.

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1 Introduction

We are surrounded by weak signals, which are constantly changing our thinking about the future. A weak signal is the first symptom of a change or a sign of an emerging issue that may become substantial in the future. The weak signal can be seen to have three elements: the phenomenon itself, the signal, and the interpretation. The signals of the phenomenon can be seen in the news, services, stories, and events surrounding the subject. (Dufva, 2019a) The attributes of weak signals are novelty, surprise, challenge, significance, and delay. A weak signal is a sign of something new, and it is surprising to the interpreter. (Dufva, 2019b) How surprising they are, depends on the interpreter (Wartiovaara, 2022). They help us to challenge and broaden our understanding of the future, reflect on our issues, and identify new opportunities to build a better future (Dufva, 2019b; Wartiowaara, 2022). A weak signal has a potential impact on the future, but it requires time to mature (Dufva, 2019b).

There are many weak signals, which may have a great impact on the wellness industry. The commissioner, FitWood Ltd., has defined that these weak signals need to be recognized as early as possible for being able to continue its global growth. Discovering weak signals helps identify new emerging technologies. Rotolo, Hicks, and Martin (2015) describe emerging technologies as having five characteristics: radical novelty, relatively fast growth, coherence, prominent impact, and uncertainty and ambiguity (p. 34). Emerging technologies can be defined as a relatively fast-growing and radically novel technology that coherently continues to impact the socio-economic domains but has the most prominent impact in the future, so the emergence phase is still uncertain and ambiguous (Rotolo et al., 2015, 34).

The Commissioner's 3-year business plan defines emerging technologies as a critical factor in their future success. The goal is to develop the first technological product before the end of 2025. The organization needs to be developed before being able to launch its first technological product. The thesis helps the commissioner increase their knowledge of emerging technologies and develop their innovation culture and product development process to be able to integrate new emerging technology to their products.

The aim is to create a product development plan for FitWood. There are two main objectives of the study. The first objective is to explore competitive emerging technologies for FitWood. The second objective is to observe FitWood’s current product development process and innovation culture and suggest a plan to develop them.

The qualitative approach was chosen for collecting and analyzing the data. The primary research data was collected through semi-structured interviews and participant observation. The interviews were used to study and understand which of the emerging technologies the commissioner should follow. The observation was used to study how the innovation culture appeared in the organization and to understand the company's product development process.

The preliminary research problem is the commissioner's lacking knowledge of emerging technologies. The secondary research problem is the company's unstructured innovation and product development processes. The three research questions are formed based on two research problems.

1. Which one of the emerging technologies has the most competitive advantage in the future?

2. What needs to be developed for building an innovative culture?

3. What implementations need to be done for improving FitWood's product development process?

The researcher used a constructive research method in the thesis for being able to create objective solutions to the organizations' research problems. Constructive research is suitable as a research approach when the purpose is to create a concrete model, plan, system, or metrics (Ojasalo, Moilanen & Ritalahti, 2009, 65). Ojasalo et al. (2009) state that the existing theoretical knowledge and new empirical methods to collect data are needed to solve the problem practically and to create a new model (p. 65). The involved organization gets a theoretical and objective solution to its problem through constructive research. The organization must cooperate well with the researcher to get the best results. (Ojasalo et al., 2009, 66) The researcher has been working as the CEO of FitWood starting from January 2021. Since the researcher works in a leading position, he has a strong relationship with the organization.

2 Innovation

There are a number of theories about innovation in the business context. For that reason, it is important to understand which of the innovation theories are relevant for developing a company's product innovation process. In this way, the organization focuses its development resources on those areas that contribute to the implementation of its strategy. Understanding the definition of innovation is also critical to studying the right terms and theories for the organization's purpose.

Innovation is different than invention. The invention is a new idea, and the innovation is the commercial application and successful exploitation of the idea. Innovation brings something new into the business. (Backhaus, 2003; Kotler & Trias de Bes, 2015, 10; Pham-Gia, 2011, 16) Kamensky (2008) defines an invention as a new way to solve a technical problem and innovation as a new way to think and implement a new idea so that the organization's competitive advantage improves (p. 307). Creativity can be seen as a critical part of innovation since both of them highlight a new way of thinking and acting. The thinking and acting can be seen as creative if the outcome of the process is something new to the person in charge. (Kamensky, 2008)

There are two different kinds of innovations: radical and incremental innovations. Radical innovation has been seen as the only real innovation due to its phenomenal success worldwide, like Apple's success with its iPhone. (Kotler & Trias de Bes, 2015, 3) However, the innovation does not need to be as radical to be an innovation. Incremental innovation is step-by-step innovation where an already produced product or service is developed to be more innovative. The incremental innovation can be seen just as or even more necessary than the radical version. Step-by-step created innovation eventually may lead to a radical innovation where smaller innovations create a bigger innovation. (Jeannet, Volery, Bergmann & Amstuts, 2021; Kotler & Trias de Bes, 2015)

According to Joseph Schumpeter, there are two main patterns of innovations: the creative destruction pattern and the creative accumulation pattern. The creative destruction pattern describes the process where new ideas bring new businesses and destruct old businesses because they will become outdated. The creative accumulation pattern means that businesses evolve their business model to avoid being outdated by innovations. Innovation brings something new into the business. (Backhaus, 2003, 3, 294) Koivisto (2011) defines that innovation does not mean that it would be innovative outside of the specific group or issue, since the innovation may only affect

inside of a specific group or issue, which can be seen in the more modern way of describing the innovation in the 21st century (p. 18).

The innovation can be seen as an outcome of three elements of design thinking: desirability (human aspect), feasibility (technical aspect), and viability (business aspect) as shown in Figure 1. The needs of people, the possibilities of technology, and the requirements for business success are considered in this human-centered approach to innovation. (IDEO U, n.d.) Design thinking is a participatory and creative approach, but it has not been seen as future-oriented as it could be. Design thinking tries to find a solution that responds to the customer's needs. (Beghin, 2021) Brown (2008) states that design thinking can offer best practices and management ideas for leaders who are looking to have innovations in product development (p. 2). After all, businesses are looking for differentiation and competitive advantage to stand out from the competition (Brown, 2008, 2). The timing of the innovation needs to be evaluated before the market entry since the market needs to be ready to accept the innovation before releasing it (IBM, 2006, 28).

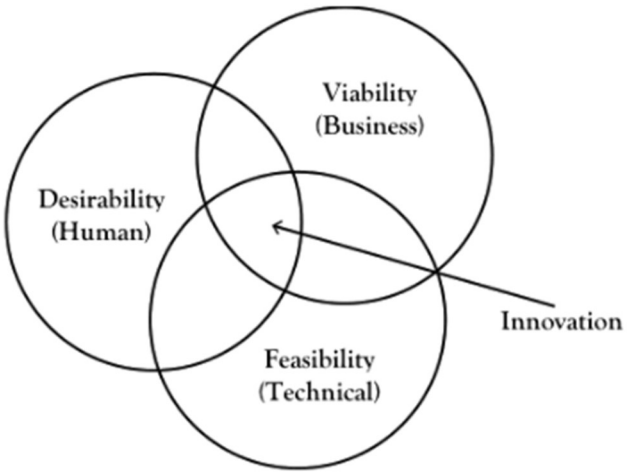

Figure 1. Three elements of design thinking to create innovation (IDEO U, n.d.)

Chesbrough, Vanhaverbeke, and West (2006) define innovation as a critical dimension of any dynamic approach to the business strategy since it allows the organization to defend and achieve a competitive advantage. Open innovation creates a new dimension to the innovation process because it combines internal and external ideas. It accelerates internal innovation and expands the markets for the external use of innovation by inflowing and outflowing knowledge. The combination of internal and external ideas capture more widely knowledge which can lead to better innovations. However, the broad knowledge and idea flow bring an issue to collecting and finding the best ideas. Having a system that filters the best ideas come more critical in open

innovation. That has been one of the reasons, why open innovation has got criticism. Open innovation can be seen as an effective process if it is managed well by the organization. (Chesbrough et al., 2006)

2.1 Innovation in business

The future has changed to be more complex and surprising than ever before. We are living in a constant change with unpleasant and pleasurable opportunities, and the change is made by humans. There are more people, businesses, and technological knowledge which allows us to be more innovative than ever before. (Sydänmaalakka, 2014, 19) Before workplaces had coffee breaks to innovate new things, but now we have digital tools to collect data which support us to be more innovative in a shorter time than ever before (Maury, 2020, 86). Human minds have invented all created simulations of almost everything so far. However, today artificial intelligence has been integrated into almost everything in our use, and it might be the future tool for inventing new things. (Brown, 2019, 309-310)

The drivers of innovations can be summarized in the following components: competitors' actions, new ideas from customers and strategic partners, emerging changes in the external environment, and integration of emerging technologies. These components have had a significant effect on the change of the organization's processes since they have been challenged to be more innovative. Following the competitors' actions has been one of the most effective ways to start the innovation process in organizations, especially if the competitors have got competitive advantages through their actions. The fear of losing the market share can help the business to think again and differently. The competitors' actions can also provide a good benchmark. Stakeholders' ideas can reveal better information about the market needs than trusting only in internal ideas. Understanding the stakeholders' needs reveal new opportunities that otherwise might have gone undiscovered. (O'Sullivan & Dooley, 2008, 37-38)

External links outside of the organization build a stronger ecosystem that collects more ideas internally and externally. The approach is broader, and it speed ups idea flowing. (Chouteau, Forest & Nquyen, 2018, 109) Organizations are constantly affected by changes in their external environment. These changes can be political, economic, cultural, or technological. The revolutionizing changes drive companies to innovate. Emerging technologies are often far too complex for any organization to develop them internally. Therefore, companies need to extend their rad to

external sources. These external sources can provide insightful information which drives companies to innovate something new. (O'Sullivan & Dooley, 2008, 37-38)

The external macro-environmental factors can give insightful information on which direction the industry is developing. The PESTEL analysis is an effective tool to analyze and monitor this development. It is a framework that analyzes and monitors political, economic, social, technological, environmental, and legal factors that are likely to affect an organization's present or future performance. Based on the PESTE-analysis a firm can deduce what kind of changes are possible in the company's industry near future. (Kamensky, 2008, 37, 141; Kunc, 2019, 57)

Innovation does not only mean an innovative new product or a service in the business environment since it can be also a new innovative replacement of a system. The innovation can be taking a place in ten different business areas which are profit model, network, structure, process, product performance, product system, service, channel, brand, and customer engagement. The profit model, network, structure, and process are focused on the innermost workings of an enterprise and its business system. The product performance and product system are focused on the company's offering. The service, channel, brand, and customer engagement are focused on building a better experience. The product system innovations connect or bundle the individual products and services together and create a robust and scalable system. These systems help firms to build ecosystems that defend against competitors and captivate and delight their customers. (Keeley, Walters, Pikkel & Quinn, 2013)

The new features or entirely new products are product performance innovations. Often product performance innovation has to be seen as a sum of innovation even though it is only one of the innovation types. The long-term competitive advantage is an exception rather than a rule when releasing a new innovative feature or a product since the product innovations are the easiest for competitors to copy. Patents deliver a more important role in product innovations when looking for a long-term competitive advantage. (Keeley et al., 2013)

Four characteristics have a major impact on developing product performance innovations. These characteristics are a customer-oriented approach, the product innovation cannot lean only to its functions, the product innovations need to be considered separately and other types of innovation need to be combined with the product performance innovation to have real success. The innovation needs to lean into the customer-oriented approach to have a wide potential in the market. However, it is also good to remember that the customers may not know what they

are looking for in the future. For that reason, the company needs to understand its customers deeply to build different future scenarios. (Kamensky, 2008)

The service innovations elevate products into compelling experiences during the customer journey. They make a product more enjoyable and easier to use and they reveal functionality and features customers might otherwise overlook. The main goal of channel innovation is to ensure that the users can buy what they want, when, and how they want it with minimal friction. The channel innovation builds sales channels that reach customers more effectively. The brand innovations create a stronger identity which ensures that the customers recognize, remember, and prefer the firm's offerings over competitors. The understanding of the customers' aspirations is at the core of customer engagement innovations. Great customer engagement innovations develop meaningful connections between customers and the firm. (Keeley et al., 2013)

The innovation is not only considered to be product-orientated in the business since the innovation can be also included in the business systems. The innovative profit models often challenge the industry's old assumptions about what to charge and how to collect revenues. As a result, it provides a fresh way to convert the company's offerings and other sources of value into cash. Open innovation can be seen as an innovative network model since its approach is a strong network based where the innovation is built by the feedback of the network. The innovative network can support a company to capitalize on its strengths while harnessing the capabilities and assets of others. Structure innovations are focused on restructuring company assets, human, hard or intangible, and creating value in unique ways. The core competency of an enterprise is often formed by process innovations. Patents or proprietary approaches are often also involved. The process innovations target to streamline the business processes like production or product design processes. (Keeley et al., 2013)

Kotler and Trias de Bes state (2015) that many managers complain that their companies are lacking creative talents (p. 6). The issue is not the lack of talented employees, the issue is the shortage of functional idea management. Although 96 percent of managers see creativity as essential to their businesses, only 23 percent have succeeded in making creativity an essential part of their business. (Kotler & Trias de Bes, 2015, 1,6) Innovation is essentially an outcome of systematic work or a process that needs to be managed. The line between innovation and business management is very thin, both aim at growth and profits, and both deal with the future. Innovation management should be included as a part of business development, but it should be driven outside the day-to-day business processes. Otherwise, the operative management might be too busy to innovate their processes. (Kettunen, Ilomäki & Kalliokoski, 2007, 37, 39-40)

Kamensky describes (2008) that there are two major success factors in strategic planning (p. 307). First, the company needs to create a successful strategy and be able to execute and update it, and second, the company needs to differ from competitors. To be able to execute both success factors better than competitors, the company needs to be more innovative than them. For that reason, innovation needs to be added to the company's everyday environment. (Kamensky, 2008, 307)

2.2 Innovative environment

The organization's culture has a vigorous impact on innovation. Working in an inspiring, curious, safe, open-minded, helpful, and honest environment nourishes innovativeness. Due to the fact that innovativeness is built into the firm's culture, the organization cannot be innovative without the right environment. Too often companies miss building their company's culture when listing innovation as their core target or value. (Kamensky, 2008) Group culture is one of the most powerful forces in the world, and strong group culture is a common thing among successful companies (Coyle, 2019, xvii). In a company with a well-developed creative culture, there is no one talking about the culture because the innovation is in the company's DNA, coded into its behavior. Another common factor in innovative cultures is that people show an interest in contributing ideas, and they are not afraid to give their ideas. (Kotler & Trias de Bes, 2015, 227)

People can learn more effectively, can manage themselves, and see new perspectives when they are having a positive mindset (Uusitalo-Malmivaara, 2014, 229). Proactive people focus their efforts on the things they can do something about, and the nature of their energy is positive. Reactive people, on the other hand, focus their effort on the weakness of other people, the problems in the environment, and circumstances over which they have no control. (Covey, 1989, 83) Freedom to exchange, fail, invest, imagine and experiment is a leading factor in innovation. The innovation cannot be planned easily since this may lead innovators to a lack of freedom. (Ridley, 2020, 359-360)

According to Chouteau et al. (2018), the innovation culture has five characteristics which are the presence of innovative leaders, innovative teams, innovative individuals, an innovative organization, and external links outside of the organization. Managers and leaders are key elements in the approach of the innovation culture since they lead the organizational change. The most innovative firms are led by leaders who have invented products, developed discovery skills, and have a

strong belief in changing the world. Other common factors are that innovative managers lead low power distance, and they have a high level of tolerance for uncertainty. Companies with high hierarchies often generate only managers' ideas instead of other employees'. Intolerance to uncertainty delays implementations of idea development. Innovative leaders build innovative environments with innovative teams. Encouraging individuals has been one of the most effective ways to build innovative teams. (Chouteau et al., 2018, 103-104)

Teams do the most innovative work since they create new innovative ideas. The team needs to share the same objects, values, and norms for being able to work fluently and equally. The structure of the innovation team plays an important role in having an effective team who works towards the same goal. The team must be composed of individuals with different skills like openness to new ideas, good communication, ability to challenge, trust and help others to do the creative work. Innovative individuals with superior discovery skills contribute significantly to the organization's innovation performance. Individuals need to experience empowerment and freedom for being able to contribute well to innovation performance. Statistically, these characteristics are experienced more often in low-level hierarchy cultures. Creativity can be an outcome of feeling secure, free, and empowered, but it is also an individual skill that should be considered while building the innovation team. Individuals who have high engagement level, are committed to the innovation process, and has a passion for the company's vision are particular driving forces and stimulate innovations over others. (Chouteau et al., 2018, 104-105)

The innovative organization needs to consider how the stage of the organization's evolution and the state of its innovation culture affect how the innovation process should be built. Therefore, the innovation process cannot be identical in every company. However, there are general philosophies that are common in all innovation processes. Innovation is everyone's business, disruptive innovation is central, innovation teams are small and well-structured, intelligent risks are taken, and business processes are developed to support innovators. There are two main drivers of innovation culture which are a flexible environment and an external focus. Flexibility during the innovation process has been seen as one of the critical drivers of innovation development since innovation development is not often linear. (Chouteau et al., 2018, 105-107)

Links outside of the organization build an ecosystem where innovation may appear or can be discussed with different stakeholders. Innovations are built in ecosystems where a network is central since this allows wider idea development and sharing of more perspectives. A benevolent view of the external environment eases and speeds up building external collaborations.

Therefore, the multiplicity and variety of internal and external contact points have been characteristic of an innovative organization. (Chouteau et al., 2018, 108-109)

Imber (2006) is in the line with Chouteaue et al. (2018) regarding the main characteristics of innovation. However, Imber highlights the individual-level factors more and argues the importance of the organization over others in the innovation process. Where the organization-level factors are needed in the innovation process, they are also often driven weakly in the organizations. For that reason, Imber sees that individuals have a substantial contribution to the successful innovation process. There are 5 individual-level factors: employees need to be adequately challenged, feel excited, have the freedom to complete tasks in their way, have a sense of control over work and their ideas need to be recognized. It links with a strong culture of innovation when individuals experience the listed factors. These factors are partly managed by individual leaders but they are also individuals' subjective experiences. Individuals have a strong influence in the innovation environment, so that is why it is important to have employees with superior discovery skills. (Imber, 2016)

The innovative environment encourages the use of discovery skills and it includes four principles: disruptive innovation is central, the preference for structured and small project teams, the innovation is everyone's business, and intelligent risks are taken. A natural innovation environment does not need a formalized process since it develops no matter what happens. However, the natural innovation environment rarely exists, so that is why the innovative environment needs to be managed by processes. (Chouteau et al., 2018, 106-109)

2.3 Innovation process

Seeing innovation as a process may provide useful insights into the managing process like identification of dependencies between various phases, the specification of deliveries, the definition of objectives and performance measures, and operative management and development activities (Kettunen et al., 2007, 89-90). There are a few components that are important to have in a successful innovation process. These components are the involvement of the whole personnel in ideation, active management of the innovation portfolio throughout the whole journey, effective capture of ideas, customer insights, and a strong link between the business and innovation strategy. Figure 2 shows eight detailed stages of the innovation process. All stages are not relevant for

every business. For that reason, the company needs to modify its innovation process based on its business type and needs. (Halme, 2019)

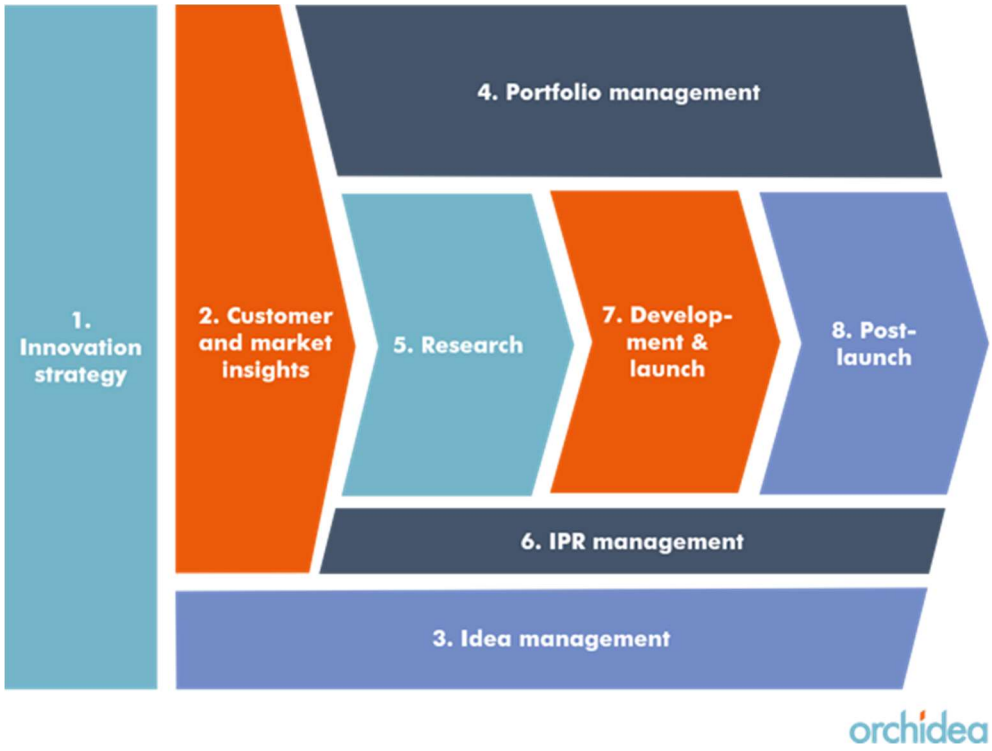

Figure 2. Innovation process (Halme, 2019)

Halme (2019) states that the innovation strategy is not a step in the process, it is a stage that defines targets for the process, and it should guide the decision-making during the process. The firm needs to strive consciously for multiple scenarios during the innovation process. This means that the company cannot force to pick ideas for innovation. For avoiding force, the firm needs to have a solid innovation strategy that leads the process. The strategy must spur the organization to think big. (Kamensky, 2008, 312) The innovation strategy needs to also have clear innovation goals so that it can be measured (Halme, 2019; Kotler & Trias de Bes, 2015, 200). Grant (2016) states that the parameters of innovation strategy need to change from metrics based on the industry and technology to ones based on valuing creative ideas (p. 283).

The second stage is to have the right tools and processes to collect customer, market, and technology insights. The third stage is the evaluation of ideas that are gathered throughout the whole process. The idea is to have a systematic process that evaluates and builds up the ideas and filters the best ideas to stages 5, 7, and 8. The portfolio management stage builds projects from defined targets and collected insights from stages 1 and 2. It should also include evaluation and monitoring protocols that define if these projects will be kept developing from stage to stage or if they

are discontinued. The research stage includes a deeper study of the developed idea, and it should show evidence if the idea is worth development or not. The IPR management stage includes steps to protect and commercialize inventions that have been developed in the process. The development and launch stage include all required steps to transform the idea into a launched product, service, process, or business model. The post-launch is an ongoing process to improve the developed product. (Halme, 2019)

According to Kotler and Trias de Bes (2015), innovation is not a linear process, rather it is a progressive process, but with detouring and backtracking. The innovation requires analogical, not sequential thinking, which is nothing, but creativity applied to a particular discipline. Therefore, the innovation process cannot be predetermined, but it must be the result of the interaction of a set of functions or roles performed by individuals. Instead of having a process that people follow, there are a group of individuals who design the process. The roles come first, and the innovation process is a result of interaction among these roles. The approach starts by defining the right roles for the innovation team and establishing goals, resources, and deadlines. The team needs to interact freely to create its process, so it must not be led by managers. (Kotler & Trias de Bes, 2015)

There are six roles: activators, browsers, creators, developers, executors, and facilitators, in the innovation team. The innovation activator launches the innovation process, and they lift the organization out of its routine and challenges what works today. The good activator provokes the team to think and wakes up the discussion. After the process has been activated, budgeted, and approved, other roles can set in. The mission of browsers is to gather information that supports, inspires, enlightens, and resolves whether the new idea should continue in the innovation process. They need to browse for descriptive information that quantifies the size and growth of markets and look for opportunities in specific product niches. The other task is to study customer needs by using qualitative methods. The information searching need to carry through the whole process, not only at the beginning. Creators are responsible for coming up with plausible ideas during the process. The creators can be trained, but there are some characteristics the creative people often share which are flexibility, tolerance of ambiguity, systematic approach, curiosity, independency, action-orientated and persistence. (Kotler & Trias de Bes, 2015) Abandoning poor ideas often is as important as developing good ones. This way limited resources can be released, and good ideas highlighted. (O'Sullivan & Dooley, 2008, 31)

Developers transform an idea into a tangible invention that can be marketed. The executors take care of everything to do with the execution and implementation. Their task is to bring innovation under development to the organization and the market. Facilitators ensure that the process

moves forward and does not cause unnecessary costs to the company. The following tasks are done by facilitators, approving investments, selecting the best innovations, inspiring the team when the process does not move forward, and permitting a launch of the innovation. These six roles together can create a successful innovation process as a result of creating innovations. (Kotler & Trias de Bes, 2015)

3 Emerging technologies

This chapter focuses on studying essential theories of emerging technologies, weak signals, and megatrends that may have the highest impact on the organization's industry. The chapter's three listed emerging technologies, the Internet of things, virtual and augmented reality, and artificial intelligence have been selected based on the organization's industry.

The evolution of digital technologies has substantially impacted how business is conducted. In order to compete in a business environment, companies need to adapt to the new digital environment. (Holotiuk, Klus, Lohwasser & Moormann, 2018) The digital evolution carries out new combinations of digital and physical components to produce novel products that change market and customer needs. (Amit & Zott, 2001; Yoo, Lyytinen, Boland & Majchrzak, 2012) Digital innovation influences the formation of a business model innovation and a company's performance due to the lack of internal knowledge of digital technologies and, hence, the need to obtain and merge complementary external knowledge (Hildebrandt, Hanelt, Firk & Kolbe, 2015; Holotiuk et al., 2018).

The definition of emerging technologies is debated in academic research, and it has different characteristics in a number of different studies. According to Cozzen et al. (2010), emerging technology presents both opportunities and challenges for technology strategies (p. 361). It is a term that is often used but rarely defined. Forecasting emerging technologies is difficult since forecasting is based on weak signals, and they can develop in different directions. (Roper et al., 2011, 16) Brey (2012) states that technologies that are still largely or fully at the research and development stage can be called emerging technologies (p. 1). We can only speculate about future technologies since the future of emerging technologies is still unknown, and that is why the term emerging technology causes ethical issues (Brey, 2012, 1-2).

New applications are adopted quickly due to the quick development of technology. Technology impacts people's daily life, operating methods, and structures of society. Technologies are not only developing rapidly since they are also becoming quickly embedded in our society. Emerging technologies have a significant impact on the development of society. It is also important to consider that these technologies include risks. For example, new technologies are geopolitically intertwined which may increase inequality. The creators have moral responsibility for the development of emerging technology to make them equal, sustainable, and valuable for the ecosystem. (Dufva, 2020a)

Five key characteristics qualify technology as emerging: radical novelty, relatively fast growth, coherence, prominent impact and uncertainty, and ambiguity. Emerging technologies can be defined as a relatively fast-growing and radically novel technology that coherently continues to impact the socio-economic domains but has the most prominent impact in the future, so the emergence phase is still uncertain and ambiguous. (Rotolo et al., 2015, 4, 34)

Dufva (2020a) lists seven key trends which are built up by emerging technologies: technology transforms operating methods, artificial intelligence applications permeate society, a new wave of digitization, growth of health technology, the production uses programmed organisms, cost of renewable energy is decreasing and importance of understanding technology. Automations change operation methods to be less time and cost-consuming. AI-related technologies create the most significant changes to the ecosystem in the short term. The use of digital technology is already part of daily life in human and service interactions, but it keeps developing rapidly with new technologies. The increased data enables health technologies to develop them to be more personalized and preventive as well as create new treatments. Synthetic biology and genetic engineering enable the modification of existing organisms for specific purposes. Energy production will become more decentralized where people produce their energy and sell what they do not need. Governments need to acquire new technological competencies for being able to keep individuals as a part of the progress. (Dufva, 2020a)

3.1 Weak signals

A weak signal is the first symptom of a change or a sign of an emerging issue that may become substantial in the future. The weak signal can be seen to have three elements: phenomenon itself, signal, and interpretation. The signals of the phenomenon can be seen in the news, services, stories, and events around the subject. (Dufva, 2019a) The attributes of weak signals are novelty, surprising, challenging, significant, and delay. A weak signal is a sign of something new and it is surprising to the interpreter. (Dufva, 2019b) How surprising they are, depends on the interpreter (Wartiovaara, 2022). They help us to challenge and broaden our understanding of the future, reflect on our issues, and identify new opportunities to build a better future (Dufva, 2019b; Wartiovaara, 2022). A weak signal has a potential impact on the future, but it requires time to mature (Dufva, 2019b).

The diffusion of innovation theory shows how actions of the population build weak signals and how these signals can be built up to megatrends (Molitor, 2003; Rogers, 1983). Rogers (1983) popularized the diffusion of innovation theory where adopters of innovation have been divided into segments based on how quickly they take innovation into their use. Segments are innovators, early adopters, early majority, late majority, and laggards. The innovators create innovations as well as they are the first ones to take innovations into their use. The early adopters come next who embrace the innovation. The majority comes after early adopters, and they are divided into early and late majorities. Laggards are against any innovations, and they take the innovation into use when it is necessary because of social pressure. (Rogers, 1983, 22-23) Figure 3 shows how weak signals, trends, and mega trends develop during the diffusion of the innovation process. (Molitor, 2003)

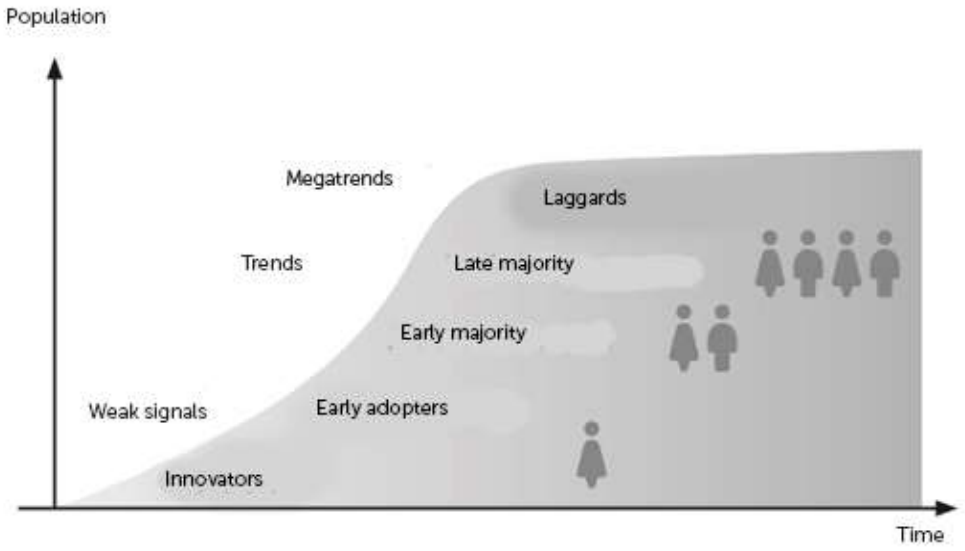

Figure 3. Weak signals, trends, and megatrends (Molitor, 2003)

Weak signals often break old thinking patterns, and they can be seen as odd, surprising, and even negative things. Innovators are looking for these odd innovations to test them. A single weak signal does not have value but combining a list of similar signals might be a sign of an upcoming trend. Early adopters follow innovators, but they do not start the trend. The innovation comes as a trend after the early and late majority take it into use. The innovation can be seen to achieve megatrend status after laggards have taken it into use. (Hiltunen, 2017)

3.2 Megatrends

Megatrends are familiar things, phenomena, and changes that are already happening and are likely to continue happening near future. Megatrends present the current trends and weak signals which are general directions of the current development and people's habits. (Dufva, 2020b) Megatrends are not meant to surprise the reader or if they do then it means that the reader is already outdated (Dufva, 2020b; Komonen, 2022). According to Hiltunen (2017), trends build mega trends after the late majority, and laggards take innovation into use. Megatrends have a long history with years of development and adoption in human life. The presumption is that the megatrends will have a significant impact on the market in approximately five to ten years. (Hiltunen, 2017)

Megatrends show the big picture of consumer behavior and motivation, business environment and impact, and useful insights into weak signals (Westbrook & Angus, 2022, 3; Dufva & Rekola, 2023). The megatrends may vary in different parts of the world, and that is why each report on megatrends needs to be critically read (Dufva, 2020).

There are four technology megatrends: cloud, big data, mobile and social technologies, which have a positive impact on business growth. The companies embrace these megatrends to craft new business models, develop new revenue streams or drive other material changes based on Harvard's research. The survey showed that most medium-sized public and private sector organizations have adapted these megatrends rapidly to their businesses. However, just adapting new technologies do not simply boost business outcomes. Firms that identify which core business capabilities they need to differentiate and transform these core capabilities with the right digital technology perform better than others. (Cray, 2014, 1, 5)

Although the crises in recent years have caused significant changes, the megatrends remain largely unaffected by radical changes. The role of megatrends is to remind us that we still need to restore nature's carrying capacity, ensure that technology and the economy are developed in a sustainable way, defend democracy, and address well-being challenges. (Dufva & Rekola, 2023) According to Dufva and Rekola (2023), these four listed megatrends are still megatrends in 2023. The recent year's crises can be a surprise to the population, but when studying them more closely, they consist of factors of the four megatrends. The big picture of change is shown in Figure 4. (Dufva & Rekola, 2023)

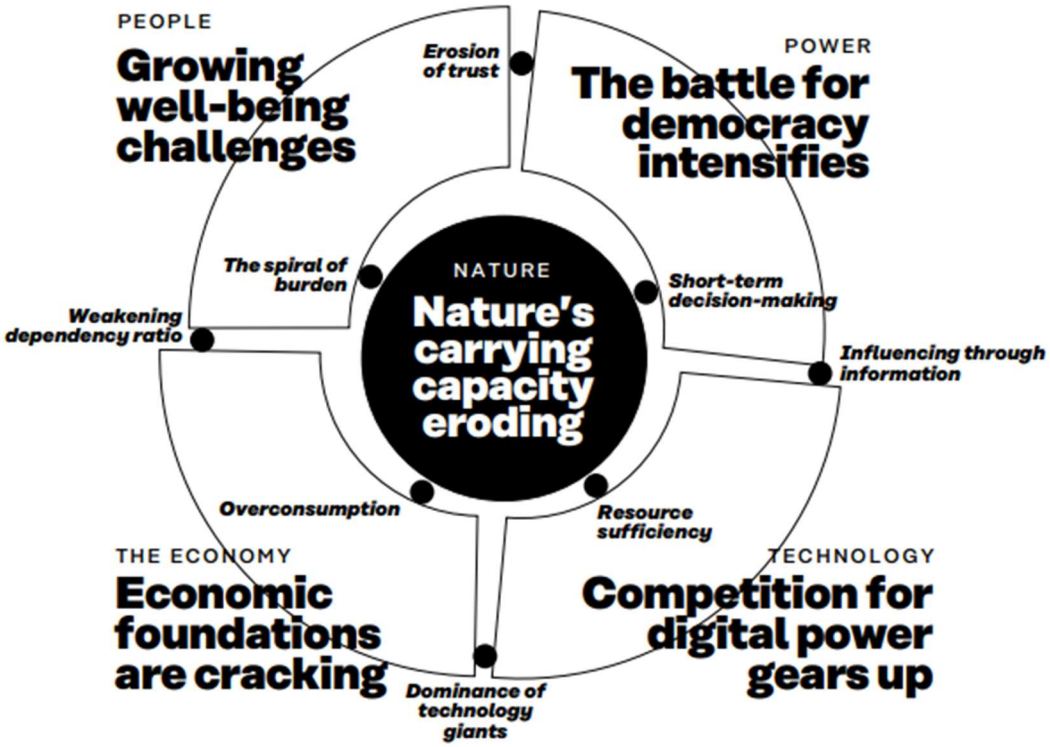

Figure 4. The big picture of change (Dufva & Rekola, 2023)

It is unlikely to fail if the business is based on megatrends since they evolve over long periods. Megatrends might be the most stable and trustable factor in strategic business thinking. (Komonen, 2022) Even though megatrends evolve for long periods, future success also depends on a clear vision of the future and foresight actions to predict the future. Figure 5 shows five elements of VTT's strategic foresight process to predict the future and prepare firms for it. The analysis of the starting point is important before scanning the environment to understand what kind of internal and external characteristics influence the starting point. Weak signals, trends, and drivers in the operating environment are analyzed in the scanning environment stage. Different future pathways are identified in the third stage of exploring alternative futures. The strategizing actions are considered after identifying all the different future scenarios. Lastly, co-creating new solutions is considered to develop the business model, organization, and offerings. (Jussila, 2022) A well-managed foresight process identifies new opportunities and threats, understands customer needs, identifies potential customers, and gains insights into the environment more effectively than others. Strategic foresight needs to be managed by business units or specific employees for being able to keep the process effective since companies that see foresight as a task for everyone have a lower performance. (Buder, 2020, 11-12)

Figure 5. Five elements of VTT's strategic foresight process (Jussila, 2022)

3.3 Macro forces of the health and educational toy industry

The macro forces have been selected based on the commissioner's two different product lines that focus on two different industries: health and educational toys. Additionally, competitive forces and regulatory environments were also considered in the selection process to ensure a comprehensive analysis.

Emerging technologies evolve in unexpected ways, sometimes they might be replenished with another technology, combined with other technologies, and evolve faster or slower. The macro forces: digital experience, analytics, cloud, the business of technology, risk, core modernization, digital reality, cognitive, and blockchain, and their time horizon expectations can provide insightful information from emerging technologies in the near future. Figure 6 presents these macro forces and their time horizon. The listed macro forces have evolved over Deloitte's research of the technology trends in the last 11 year years. (Buchholz & Briggs, 2020)

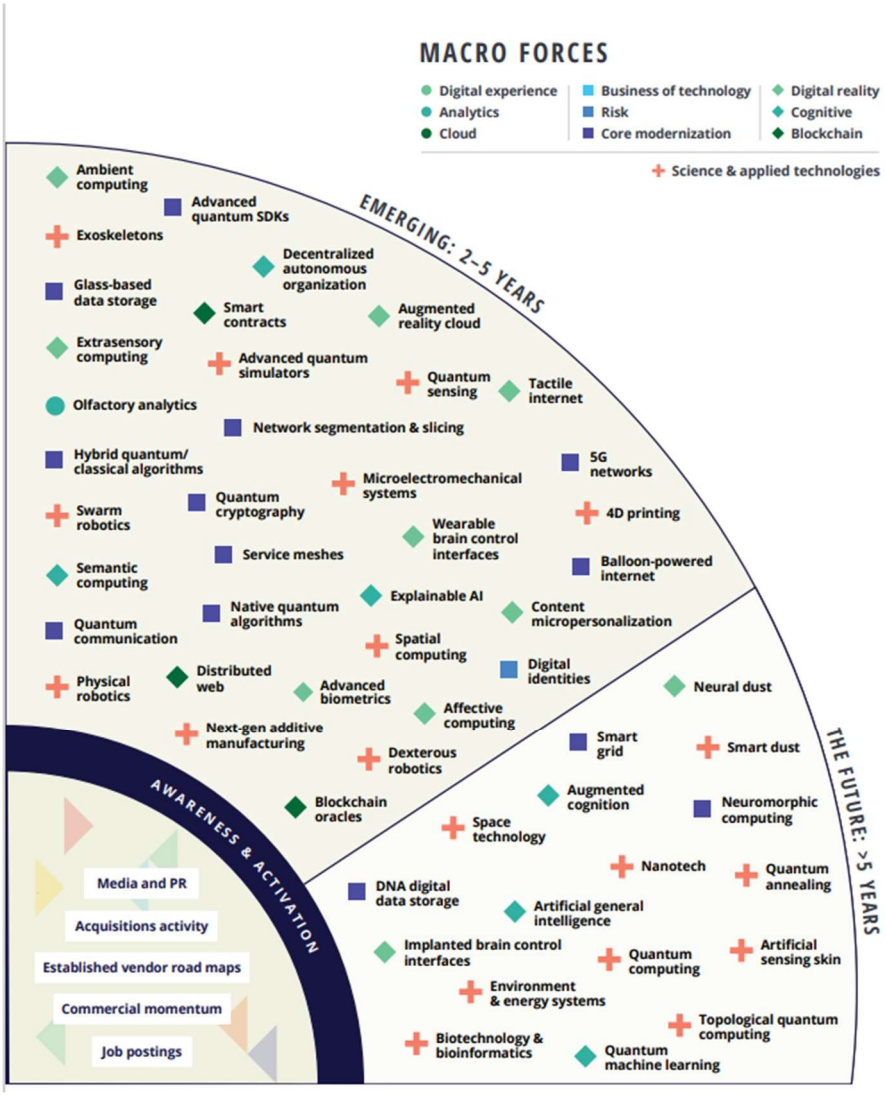

Figure 6. Emerging technologies becoming trends in the future (Buchholz & Briggs, 2020)

Companies need to understand in which industry they belong or in which they want to belong in the future for being able to follow specific trends, megatrends, and emerging technologies that are relevant to them. Firms that identify which core business capabilities they need to differentiate and transform these core capabilities with the right digital technology perform better than others. Therefore, it is important to follow and select the right emerging technologies for each company. (Cray, 2014, 5)

According to CompTIA Emerging Technology Community, the top 10 emerging technologies are artificial intelligence, 5G, the Internet of things, serverless computing, biometrics, augmented and virtual reality, blockchain, robotics, natural language processing, and quantum computing. Artificial intelligence, the Internet of things, and augmented and virtual reality can be seen to have a major impact on the development of the health industry. (Fitzgerald, 2020)

The future of the educational toy market relies on Internet-connected educational toys with high-tech innovations. These learning smart toys utilize embedded sensors and onboard electronics and their intelligence. The purpose of these toys is to develop a child's motor, social, solving, and creativity skills in a new interesting, and engaging manner. The educational toy market is expected to go through a revolution of emerging technologies in the future. Some of the major emerging technologies are IoT, AI, VR, and AR. (Fortune Business Insights, 2022)

The next three emerging technologies, the Internet of things, virtual and augmented reality, and artificial intelligence, are selected to provide deeper knowledge of the macro forces that may potentially change not only the commissioner's industries but all industries. The Internet of things and virtual and augmented reality can be seen as being involved in the commissioner's products in the near future, and artificial intelligence can be seen as making the product development process more effective.

3.3.1 Internet of things

The definition of the Internet of things (IoT) started as a visionary statement where billions of objects with embedded intelligence, communication means, sensing, and actuating capabilities connect over Internet protocol networks (Cirani, Ferrari, Picone & Veltri, 2019, 1). The concept of IoT refers to a new way of living and managing professional and current affairs via the Internet which gives new opportunities and threats for users. The environment also allows businesses and start-ups to innovate and offer new services and technologies. (Bouhaï & Saleh, 2017, 2)

Waher (2018) describes the Internet of things as an outcome of connected things which are not operated by humans to the internet (p. 2). Things need to make their own decisions and act alone since IoT is not operated by humans which has been seen as one of the greatest threats to humans. The connection to the Internet makes things vulnerable since they are reached by everyone and from everywhere which is the second threat of IoT. Even though some people see IoT as having a lot of threats, that is often caused by their unknowledge. (Waher, 2018, 2) The IoT can be summarised to have three components, Internet, physical object, and controller, sensor, and activators. The Internet is used to send, receive or communicate information with the connection to less powerful computing devices, and physical objects. The purpose of the controllers, sensors, and activators make people's life easier, and not to demand carrying and using a mobile,

computer, or any other very powerful computing device. (Bouhaï & Saleh, 2017, 120; McEven & Cassimally, 2013, 9,11)

The purpose of IoT is to link people and objects everywhere and at any time. It is a scenario where objects, people, or animals are equipped with unique identifiers which automatically transfer the data over a network without the need for human intervention. The term Internet of things is a composition of two terms, Internet and things, where the Internet pushes towards a network-orientated vision and things move on generic objects to be integrated into a common framework. The fuzziness of the term comes when the issue is approached either an Internet-orientated or things orientated. The semantic orientation interprets the data which is collected through a physical object and shared on the Internet. The semantic approach plays a key role in the future to analyze and interpret the data. In Figure 7, these three orientations, things, Internet, and semantics, are highlighted and classified with reference to the IoT paradigm. (Atzori, Iera & Morabito, 2010)

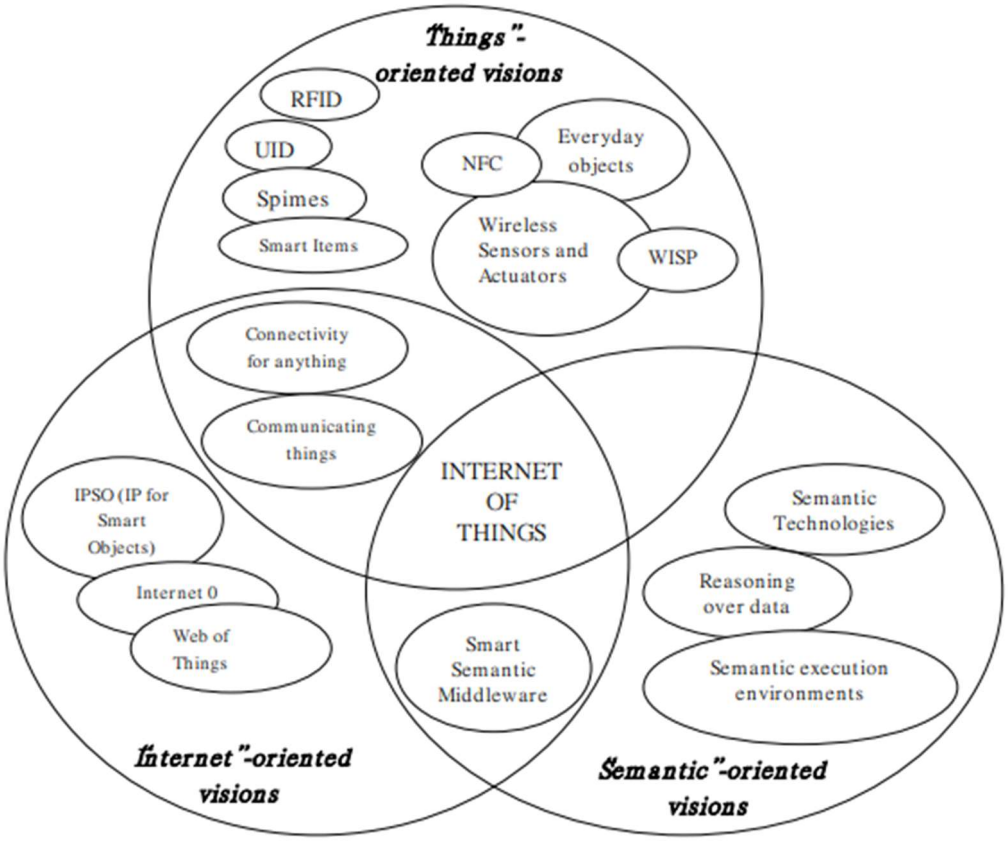

Figure 7. The core of the Internet of things (Atzori et al., 2010)

3.3.2 Virtual and augmented reality

Virtual reality (VR) gives the user an immersive multisensory experience in the model and manipulative world. The world uses displayed technology by showing real-time interactive graphics with three-dimensional models where the user can navigate. The user cannot also see the real world around him. (Kipper & Rampolla, 2012, 1; Mazuryk & Gervautz, 1999, 1-2) The field of VR went through a techno-economic revolution after the first Oculus headset, following other headsets from other companies, was brought to the market in late 2014. Before that, the development of VR was slow, and it was developed only by a few large industrial groups. (Arnaldi, Guitton & Moreau, 2018, 44-45) Durlach and Mavor (1995) described virtual reality as a combination of teleoperator and virtual environment systems in the middle of the 90s. The teleoperator system was seen as a machine that contains sensors and actuators which allowed the user to sense and manipulate the real environment. Even though, the Oculus did not include actual sensors, Durlach's and Mavor's description was close to it. (Durlach & Mavor, 1995, 1)

According to Mullen (2011), augmented reality (AR) is distinguished from virtual reality in that VR is involving complete and immersive 3D environments, and AR uses several technologies to create an annotated composite based on the real world. The combination of technologies that allow real-time mixing of computer-generated content with live video displays describes the idea of AR (Mullen, 2011, 2). Augmented reality overlays digital or computer-generated images, audio, video, and touch or haptic sensations in a real-time environment. Unlike VR, augmented reality allows the user to see the real world when using it. It is a combination of multiple technologies that work together to bring digital information into visual perception. AR technologies are commonly using only visual sense, even though they can be technically used to enhance all five senses. True AR has three characteristics, it combines real and virtual information, it operates and is used in a 3D environment, and it is interactive in real-time. The AR allows information that the user does not detect to be presented visually. (Kipper & Rampolla, 2012, 1-4)

The main functions of augmented reality can be categorized in two ways, the augmented perception of reality and the creation of an artificial environment. The augmented perception of reality brings awareness of elements of the environment through physical sensation. It may assist the user in the decision-making process when it provides useful information from the surroundings. For example, some app applications display virtual information on the screen which gives more detailed information about the environment, like how far is the closest restaurant. The creation of an artificial environment combines real and virtual by showing objects which do not exist in

the real world. It is used to showcase how objects would fit in a specific environment. For example, furniture businesses offer applications that display furniture in the right size on the user's household by using a mobile phone. (Kipper & Rampolla, 2012, 30-34)

3.3.3 Artificial intelligence

Artificial intelligence (AI) is the science and engineering of creating smart machines, especially intelligent computer programs. The idea of AI is to imitate and understand human intelligence, but it does not have to confine itself to biologically observable techniques. (Brown, 2019, 162; McCarthy, 2004, 2) Although AI is still not as intelligent and capable as the human brain, it is expected to act like a human brain with enhanced brain-like intelligence and computing power in the future (Brown, 2019, 163-164).

AI can be split into two main fields, generalized and applied artificial intelligence based on research and development work. Generalized artificial intelligence allows it to traverse between unrelated and vast topics and use cases just as a human being or beyond human general intelligence. Applied artificial intelligence is defined as an application of artificial intelligence that stimulates human thinking ability to achieve a certain task. Generalized artificial intelligence has still a long way to go before it is ready for enterprises. However, applied artificial intelligence is already delivering significant business value and it is commonly used in enterprises. For example, it is already used in smartphones for using Google Assistant and Apple Siri, and in cars with automated driving. (Brown, 2019, 162-163)

The development of machine learning has been one of the greatest factors to build trust in creating artificial intelligence which operates as a human brain for researchers (Haq, 2020, 19). Machine learning and artificial intelligence are sometimes used as exchangeable due to the reason of similar functions (Brown, 2019, 164). The programming of machine learning is designed to solve a particular problem by using algorithms that explicit domain-specific or rules-based programing. Machine learning uses the complex structure of algorithms to imitate the human brain. One of the most known algorithms is deep learning, which has got a lot of attention lately because of its fast development. (Haq, 2020, 23-26) Deep learning imitates problem-solving through the human brain, where queries are sent through sequences of ideas and allied questions to discover the solution. Human intervention is not desired in deep learning networks, since data

is processed through hierarchies of separate concepts, and it is done with the help of nested layers. Eventually, learning occurs through their errors. (Brown, 2019, 237)

AI will build a more advanced and protected future for enterprises and human beings. Although AI has existed for less than two decades, the enterprises that neglect it will be left behind in the competition. (Brown, 2019, 167-168) Building an AI application is complicated, and most enterprises do not know how to take advantage of it yet. Many organizations use AI applications without having a genuine understanding of how exactly make their decisions. The lack of understanding makes it difficult to tell if AI application makes correct and unbiased judgments. Therefore, organizations need to manage AI development carefully before it can be used on a full scale. (Hag, 2020, 13)

3.4 Business ecosystems

The business environment is rapidly changing, and it has come more competitive than ever before. It is not enough anymore to maximize added value and reduce total costs since customer habits are changing all the time and are more demanding than before. (Prakash & Deshmukh, 2010, 54) Constantly changing customer demands and operational environments are driving organizations to shift away from traditional business models to business ecosystem models (Lyytikäinen, 2020, 4). Economic communities known as business ecosystems are made up of various organizations and individuals that interact and rely on each other. These ecosystems are often centered around platforms and include key players such as customers, suppliers, and competitors. (Bosh-Sijtsema & Bosch, 2015) Within ecosystems, companies involve different stakeholders and share data to build new business opportunities (Lyytikäinen, 2020, 4).

The business ecosystem as a term is used inconsistently because the rising interest in business ecosystems has grown exponentially in recent years. The rising interest has meant new ways of using the term and developing new definitions. However, the major idea behind the term is to encompass any set of interacting suppliers, producers, innovators, customers, and regulators that have a collective outcome. (Jacobides, 2019, 13)

Digitalization, globalization, customer, and innovation-centered ideologies have forced companies to grow their ecosystem to include more stakeholders or otherwise, they are lacking needed knowledge. Ecosystems emerge as a result of digitalization. Nowadays, it is possible to connect a broad set of companies to deliver a customer solution. There is no need to focus anymore on one

segment since it is increasingly more reasonable to offer broader solutions for customer needs. They represent a new way to organize businesses where the system focuses on collecting knowledge from different stakeholders rather than creating ideas and solutions only internally. (Jacobides, 2019, 13-14)

The business ecosystem is required to get specialized knowledge from others since none of the firms has all the required knowledge (Moore, 2006, 2). The new type of innovation communities enables organizations to crowdsource ideas from their user and to use this knowledge to develop their current products or create new products (Yang & Han 2021, 456). Yang and Han (2021) state that crowdsourcing allows firms to collect more data from users which can be used for innovation development (p. 456). Organizational innovation communities (OIC) have been receiving increasing attention from firms as a new way to facilitate a company's innovation process, and there are already plenty of companies who are using it, but there are not too many firms who are managing peer interaction on digital innovation platforms. The analysis shows that more than 80% of high-tech companies listed in the S&P index have established OIC to benefit customers' inputs. (Yang & Han, 2021, 456, 464)

4 Stage-Gate model

The successful implementation of one of the emerging technologies needs a clear plan of how the product development process will be evolved. This way, the organization is ready to start implementing the plan step-by-step. It is also important to understand that the created plan needs to evolve during and after the implementation process for being able to keep the competitive advantage. This normally happens if employees embrace the organization's new innovative culture where the focus is always to develop the organization.

Just having a great product idea does not guarantee success. The organization needs to support the innovation process from the first idea until launching the product. Therefore, product development is a process that needs to be considered as a part of business culture and core processes. There are five proven traits of a good process: customer-driven focus, upfront activities, tough go/kill decision points, truly cross-functional teams, and top management involvement. These success traits need to be built into the company's DNA before being able to have a successful Stage-Gate innovation process. (Edgett, 2018, 1)

According to Mital, Desai, Subramania, and Mital (2008), the product development process starts by creating a strategy for it (p. 25). In order to develop a new product development strategy, these activities need to be performed: determine expectations for the company's growth with the new products, determine existing opportunities, gather information regarding the market, customers, and capabilities, create a list of existing products in the market, setting internal criteria for inclusion of new products, creating the product portfolio and managing the product portfolio to maximize profitability. (Mital et al., 2008)

The strategy is based on the company's vision, how it stands up from the competition, and what are the key processes to make a profit (Raatikainen, 2004, 60-61). The company's leaders, including board members, should have a clear vision of how different variables will affect the company's long-term goals. That is why the company's leaders decide its vision and goals. (McDonald, 1995, 16) The company's vision should be shared with employees so that the company will find the right state of mind for growing the business (Juuti & Luoma, 2009, 135).

Creating a new product development system is very different from a firm with or without an existing product development process. Establishing an entirely new product development system for replacing a previous one demand much more time before the organization can adopt it as a

new model because of the resistance to new things. For that reason, firms without an existing system can adopt a new system faster and without resistance. (Annacchino, 2007, 296)

Having a high-quality new product development system increases success rates by 40%. Only 30% of new product projects met sales and profit objectives if they do not have a high-quality system. The new product development system can be seen as a high-quality process if it contains seven critical success drivers which are a clear business focus, leveraging core competencies, targeting attractive markets, having innovation in the firm's DNA, leaders who are passionate about innovations, having right employees and tools and clear process plan. (Cooper, 2011, 56, 81-82)

Cooper (2011) defines the Stage-Gate as a new conceptual map for developing new products from ideas to launch and beyond (p. 83). It was originally developed to model the actions that winning product innovation projects and teams did. However, the results of the modeling showed that only a few successful product innovation projects were able to build other winning products. This research revealed that making a winning product is not too hard but making winning products one after the other is difficult, and it can be only achieved with a good system. (Cooper, 2011, 83-84)

There is a need for a model to successfully lead the product innovation process since there are too many firms that fail with it. These failed processes are often plagued by missing steps and activities, inadequate quality of execution, unreliable data, poor leadership, and missed timelines. The Stage-Gate model in simplicity consists of a series of stages followed by gates. During these stages, the project team does the work, obtains the needed information, and does the subsequent data analysis and integration. The decision to continue the idea or turn it down happens in the gates before moving the idea into the next stage. (Cooper, 2008, 213-14)

Stage-Gate is a business process to transform a company's innovative ideas quickly and profitably into winning new products. Over 80 percent of North American organizations use some type of a Stage-Gate product development model. (Edgett, 2018, 1) Edgett (2018) defines the Stage-Gate model as incorporating predevelopment activities, development activities, and commercialization activities into one complete business process (p. 3). The typical Stage-Gate process consists of discovering, scoping, designing, developing, scaling up, and launching stages as shown in Figure 8. These activities are designed to gather information and drive uncertainties down. The gates are quality-control checkpoints where collected information is reviewed and based on that knowledge it is decided if the new product idea will be forwarded to the next stage or if the idea will be put an end to. (Cooper, 2011, 100-101; Edgett, 2018, 4)

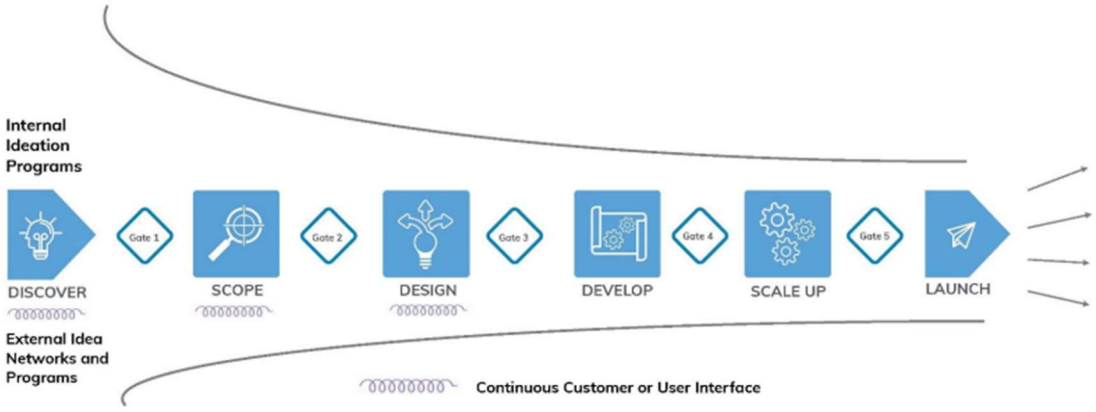

Figure 8. A typical Stage-Gate process (Edgett, 2018)

The business leader is driving the product development project through each stage. Each stage has its activities which are designed to collect specific information to help move the product development process to the next stage. Evaluations and go/kill decisions are made in each gate, before moving to a new stage. The risk and uncertainty are reduced by these activities in each stage. The discover stage is designed to uncover new product opportunities and generate new ideas. The scope includes quick preliminary research and scoping of the product. The design stage involves primary research which includes customer, market, and technical feedback, and it leads to a business case that includes product definition and the proposed plan for development. The actual product will be designed in the development stage, and it includes the plan of what is needed for full-scale production. The testing and validation of the new product happen in the scale-up stage. The commercialization of the product takes place in the launch stage where the full-scale operations of production, marketing, and sales begin. (Edgett, 2018, 4)

4.1 Discover

The goal of the Discover stage is to reveal market opportunities and generate new ideas (Edgett, 2018, 4). Cooper (2011) states that before starting the process there should be an idea screen meeting where it is decided if the new product development process will be started or not (p. 104). The firm's resources are evaluated, and project objectives and ideas are reviewed during this meeting (Cooper 2011, 104-105). In generating new innovative ideas and finding market fits, the organization needs tools and processes to collect technology, market, and customer insights.

Idea management is necessary to gather, evaluate, and develop ideas before approved ideas continue deeper development. (Halme, 2019) Using global market research tools, like Mintel, provides reports of new products that have been introduced around the world. These other products can be categorized based on the industry which makes it easier for the firm to get valuable market insights. New innovative products from other companies in the industry may also be very helpful for creating new ideas. (Mattimore, 2012, 200)

The goal of opportunity identification is to reveal different market opportunities and to assist to select the best ones for the company. There are four opportunities which are underused resources, new resources, internal mandate, and external mandate. Each of these may bring new valuable ideas for product development. Often underused resources such as excess production capacity can provide a new product opportunity. New sources, like emerging technologies, are one of the most used opportunities identificatory to create new product ideas. Product ideas can also come up from internal and external sources, so both need to be carefully taken part in the process. (Kahn, 2000, 55-56)

The most important success factors in developing and delivering new products are differentiation, solving major customer problems, and offering a compelling value proposition to the user (Cooper & Edgett, 2008, 5). The approach for product differentiation varies based on the price structure. A company that strives for low-cost production and competes based on charging less than competitors do not need to deliver as innovative products as premium products since the premium products which cost more need to justify the higher price in order to make sales. (Sanders & Huefner, 2011, 170)

According to Mattimore (2012), the organization needs to have a clear strategy for inventing ideas. The strategy normally consists of ideation tools, techniques, and thinking approaches to create new solutions. A company needs to go through the inventing process several times before being able to finalize a clear strategy for creating new ideas. For that reason, it is useful to test different techniques, thinking approaches, and tools before selecting the best working ones for the organization. The organization should not replicate another company's strategy since it is very rare that the same system would work for another company since they do not share the same human resources, market position, market area, customers, and goals. (Mattimore, 2012)

4.2 Scope

The new product ideas need to be investigated before starting to develop an actual product. This stage is largely desk research. (Cooper, 2011, 105; Edgett, 2018, 4) There needs to be a protocol for how newly identified product ideas are investigated before developing actual products. The investigation should consider the target market, product positioning, product attributes, competitive advantages, timing, marketing, financial, production, regulatory, and corporate strategy requirements, and possible scenarios. The goal of the investigation is to provide enough information about how the product idea would perform in the market. Based on the investigation, the development of the product idea will be discontinued or continued to build the actual prototype. (Kahn, 2000)

According to Cooper (2011), the scooping stage involves two main assessments: preliminary market, and technical assessments (p. 105). The preliminary market assessment contains relatively inexpensive activities like Internet search, describing the concept to the key customers, and asking for feedback from the network. The goal of the assessment is to determine market potential, market acceptance, and market size. The preliminary technical assessment focuses on studying and understanding what is needed to develop such a product idea. The purpose is to evaluate the technical and operations feasibility, possible times and costs to execute, technical, legal, and regulatory risks, and roadblocks. (Cooper, 2011, 105)

One effective way to investigate if the product idea has a demand in the market is to understand if the product solves the customer's problem. Solving a customer's problem and making his life easier shows that the product is compelling for the customer. Different measurements are needed to identify a buyer persona and to understand if the problem is common. The analysis of the customers who have this problem reveals if the market is enough big for making a successful business. It is also important to understand if the customer is willing to pay for solving the specific issue since sometimes customers may feel that the problem is not too important to be solved if it cost too much. (Myers, Stull & Scott, 2008, 44-46)

Before entering the design stage, the collected information through the preliminary market and technical assessments needs to go through the gate where it is decided if the product development is continued. Six criteria are normally analyzed before making a decision. These are strategic, product, and competitive advantage, market attractiveness, synergies, technical feasibility, and financial reward. If the product meets the company's six criteria then it is continued to the next step. (Cooper, 2011, 106-107)

4.3 Design

The design stage involves the detailed investigation of the product and the market whose purpose is to create a business case that includes product and project definition, project justification, and the development plan (Cooper, 2011, 107; Edgett, 2018, 4). There are certain properties to make a product useful to users. The properties can be internal, such as durability, corrosion resistance, and strength, or external, such as design, materials, ergonomics, functional, and visual. The designer needs to understand human needs for being able to select the right properties. For that reason, the process must be started by analyzing human and market needs before developing properties for the product. (Mital et al., 2008, 50-51)

Mital et al. (2008) define key steps of the engineering design process (p. 52). The first step is to define the problem and to study the needs and the environment. There needs to be a value system that states clear objectives and criteria for the product. System synthesis generates alternatives that need to be analyzed separately. The best product alternative will be selected after evaluating alternatives based on the listed objectives and criteria. The last step is to specify the selection before developing the actual product. (Mital et al., 2008, 52)

The design of the product idea should focus on building a competitive advantage that allows the product to succeed even in a crowded and established market. The competitive advantage can take many forms and it may include product attributes, sales methods, services, distribution, business models, quality, and other factors around the product. (Myers et al., 2008, 47) Competitive analysis is a part of this stage. The competitive analysis shows the number of competitors and what are their strengths and weaknesses. This information normally reveals if the product idea has competitive advantages or if it may help to develop the product idea's competitive advantages. (Cooper, 2011, 108)

The result of this stage is to have a business case for the project, a list of key success factors, and an action plan for the development stage. Before moving to the development stage, the idea needs to go through the gate where it is decided if the product development is continued or not. This is the last point at which the project can be discontinued before entering the heavy spending stages. Firms see this last step before the full commitment of the whole project organization. Therefore, this gate is often extremely carefully evaluated. (Cooper, 2011, 108-109)

4.4 Development

The actual design of the product will be developed in this stage. The stage also includes the design of the operations or production process required for eventual full-scale production. (Cooper, 2011, 109; Edgett, 2018, 4) There are four attributes for successful product development which are cost, quality, product development time, and development of know-how. The cost of developing and producing the product needs to be reasonable to create an actual product. The good quality of the product brings value to the product and guarantees customers to buy again. For being able to access the market, the product development time cannot be too long. Otherwise, competitors may come to the market earlier. Companies who develop successful innovative products one after the other reflect that they acquired the business know-how. (Mital et al., 2008, 18)

According to Annacchino (2007), there are four stages of product development which are market assessment, prototyping, core development and testing, and industrialization (p. 288). Market assessments include market, product competition, and other analysis which gives a realistic picture of the potentiality of the product. The product idea evolves into a real product during prototyping. During the prototyping stage, the feedback of customers is critical for being able to develop the product's competitive advantages. At the core development and testing stage, the final design of the prototype is given to the larger-scale test. The test provides validation to the product with final changes to the product before industrialization where the product is made manufacturable, and the manufacturing processes are developed. (Annacchino, 2007, 288-294)

The result of the development is not just a commercialized product since it also contains a plan for market entry. For market entry, companies normally create a marketing plan which includes marketing objectives and different analyses like industry, competitive advantage, and competitor analyses. Based on analyses, the marketing strategy, budget, and activities are planned. Without a good marketing entry plan, it is hard to make conclusions if the product has a demand on the market. (Cooper, 2011, 109-110; Kahn, 2011, 143-146) The post-development review commonly includes revised financial analysis based on new and more accurate data, evaluation of test and validation plans, and evaluation of detailed marketing and operations plans (Cooper, 2011, 110).

4.5 Scale-up

The designed product needs to be tested before commercialization in the lab, plant, or marketplace to verify and validate the proposed new product and its marketing and production plans (Cooper, 2011, 110; Edgett, 2018, 4). The commercialization stage is a pivot test where the product is carried to the marketplace and units are placed in the hands of customers. The goal is to have a final acceptance or rejection of the product by the customer. (Annacchino, 2007, 294-295; Cooper, 2011, 110) A product's life cycle begins after it is introduced to the market, even though there is very limited consumer awareness during this stage. The idea of the stage is to assess the initial demand by using valid tools and techniques for it. (Mital et al., 2008, 387) This stage yields sometimes negative results and the product idea will be returned to the development stage instead of discontinuing the product development process (Cooper, 2011, 110).

Testing the market before the actual launch is useful since it refines the marketing plan and ensures that it is comprehensible for the marketplace. Market testing can be divided into two categories of techniques: pseudo-sale testing and controlled sale testing. During the pseudo-sale, the actual product is not available for sale. The phase includes pitching or demonstrating the actual product and asking for feedback from potential users. Good results of the pseudo-sale test predict the likelihood of commercial success for a new product. The controlled sale means that the product is available for purchase in an exclusive market. Controlled sales typically reveal important information about the selling process, channels, and marketing actions. (Kahn, 2011, 164-166)

The result of the testing phase assists the firm to choose the right sales channels, and appropriate pricing models, and finding ways to communicate the value of the product. In addition, it helps to understand if the business goals, especially profitability, and revenue, can be matched with chosen sales, pricing, and marketing methods. (Myers et al., 2008, 51) The last gate before the launch opens the door to full commercialization. The center of attention is the quality of the activities, production, marketing, sales, and operations, done in the testing stage. If these activities have led to positive results, then the full-size market launch, production, and operations can be started. (Cooper, 2011, 111)

4.6 Launch

Full-scale production, marketing, and sales are the last step of the Stage-Gate process (Cooper, 2011, 111; Edgett, 2018, 4). The last improvements are done during this stage to maximize the gross profit (Annacchino, 2007, 295). There are three key factors for maximizing the profit during the launch phase which are getting awareness, ensuring availability, and getting repeat purchases. The firm's marketing department needs to make sure that the product gets enough awareness among customers for being able to maximize sales. The marketing should be planned well upfront since only fine adjustments can be made after products are launched. Good marketing should lead customers to buy the products, and then ensuring availability comes important. Otherwise, the customer may lose interest in the product. Getting customers to buy repeatedly shows customer satisfaction with the product. (Kahn, 2000, 163-166)

According to Annacchino (2007), the product should have a pre-launch before full-scale production (p. 399). The pre-launch should be targeted at a specific geological area, customer group, or sales channel. The idea of the pre-launch is to provide information on how production, sales, marketing, and other related product tasks work. The goal is that everything functions well, but if things do not go as planned, then it gives the organization possibility to final modifications before the full-scale production. The pre-launch does not feel critical when things go well but skipping it when things go wrong can be crucial. (Annacchino, 2007, 399)

According to an old business maxim, anything that is measured and watched is improved (Wickman, 2011, 116). Precise targets are essential for monitoring results. Monitoring is also necessary to evaluate the success of the objectives. The target of the monitoring is to evaluate succeeded and failed activities during the process, and it is done for improving the future process. The implementation of the monitoring involves three different steps: measure achievements by comparing original goals, analyze results, and take corrective actions based on the analysis. Measuring achievements and comparing them with objectives is the most important task to determine whether the targets have been met. Analysis discovers why there have been differences between goals and results. Taking corrective actions will develop the process. (Rope & Vahvaselkä, 2000, 170-171)

Post-launch review is typically done six to eighteen months after the launch. The project team is disbanded, and the product becomes a regular product in the company's product line. The collected data after the launch is gathered and analyzed to review the success. The reflection of the process is done, and strengths and weaknesses are listed to be able to develop the new product

development process for the next product idea. (Cooper, 2011, 111) The follow-up is necessary for the company to be able to move forward with the vision, and that is why creating different metrics helps the company to effectively follow up (Rope & Vahvaselkä, 2000, 170). It is important to collect a handful of critical numbers of your business since these numbers will allow you to monitor your business weekly, and quickly show which activities are on track or off track. Once these numbers are tracked, then you achieve the valuable ability to see patterns and trends to predict the future. (Wickman, 2011, 116)

5 Research strategy and method

The methodologies used in the research define results and information from the point of view of selected rules, methods, techniques, and instruments. The methodological rigor also affects the relevance and value of the study. (Saunders, Lewis & Thornhill, 2009, 93)

This study is qualitative research on Stage-Gate model development with a better understanding of emerging technologies, innovation environment, and product development process. The research is conducted to develop the commissioner's product development process and to gain knowledge of emerging technologies that can be useful for the company. A constructive research strategy with a deductive approach was chosen to achieve these objectives. Documentations from the literature review, participant observation, and interviews by the researcher were used as a part of the qualitative research.

Research strategy

A constructive research strategy encompasses the area of theory and does not require that research is based on solidity. It is more based on theories, hypotheses, and case studies, and is used to test theories. (Lukka, 2003) Constructive research is also known as design science research. The research does not have rigid patterns, although the used methodology has a normative character (Tuomi & Sarajärvi, 2009, 17). Design science research is approached provisionally since this mode of inquiry is emergent and evolutionary in its process. The research process is not typically linear and even the major stages often overlap. Early concurrent matters include choosing a topic, composing the study's statement of purpose, reviewing the related research literature, and drafting a central question. The purpose of constructive research is to develop designed artifacts with the explicit intention of improving the performance of the artifact. (Saldaña, 2011, 66, 78-79, 87)

Ojasalo et al. (2009) state that the existing theoretical knowledge and new empirical methods to collect data are needed to solve the problem practically and to create a new model. The involved organization gets theoretical and objective solutions to their problem in constructive research. The organization must cooperate well with the researcher to get the best results. Constructive research is suitable as a research approach when the purpose is to create a concrete model, plan, system, or metrics. (p. 65-66)

Qualitative research

The objectives of qualitative research depend on the purpose of the study. The result of qualitative research is often representing salient findings from the analytic synthesis of data. (Saldaña, 2011, 2) Qualitative research can be seen as on focusing a deeper description of the phenomenon, and the research often does not have a predetermined hypothesis. Instead of relying on numbers and frequency-type data, qualitative research often involves more detailed information from the study subject, and it may reveal non-written or non-communicated information which may affect results. (Weathington, Cunningham & Pittenger, 2012, 398)

Saunders et al. (2009) list two main approaches, inductive and deductive approaches, for analyzing and interpreting the collected data in qualitative research. In addition, the abductive approach can be seen as a third approach where it combines inductive and deductive approaches (Mitchell, 2018). Inductive research emphasizes a realization that the researcher is involved in the research process, gaining an understanding of the meanings humans attach to the phenomenon, less concern with the need to generalize, and a close understanding of the research context. The deductive approach focuses on using existing theories to formulate research objectives and questions. The analysis is guided by the theoretical propositions and explanations which may lead the theory to be disfavored by premature closure. In particular stages of the process, the deductive approach is likely to be more useful when the focus of the data collecting is clear. (Saunders et al., 2009) The weaknesses of inductive and deductive approaches can be addressed in the abductive approach by adopting a pragmatic perspective (Mitchell, 2018).

The process of deductive research starts by defining the research question and objectives and a clear framework and propositions. The clear aim of the research allows the researcher next to identify the number and type of organizations which to gain access to undertake data collection to meet your objectives. The literature shapes the data collection questions to be more focused on meeting objectives, and they lead the research project. The data collection can be commenced with an initial set of categories derived from the theoretical propositions and conceptual framework. This approach will provide key patterns and themes for data collection, and the analysis will be guided by these propositions and explanations with which you began. (Saunders et al., 2009, 524-525)

The reliability of qualitative research depends on understanding if it is the right method to study the problem and if the chosen methods to collect and interpret data are appropriate. Qualitative research can be the right method when obtaining an in-depth understanding of an individual, a phenomenon or a situation is necessary. Researchers are more interested in cause and experimental research rather than people's surface opinions as in survey research. The supportive

data collection methods like interviews and observations are focused on in-depth understanding. Therefore, the in-depth findings of the collected data are appropriate if the results are reliable. (Merriam & Grenier, 2019)

Semi-structured interview and participant observation

Saunders et al. (2009) explain that semi-structured interviews give the researcher opportunity to probe answers to the phenomena by varying questions based on the flow (p. 320). The semi-structured interviews are often used to explore and explain phenomena that have emerged from the interview. The researcher prepares a list of themes and questions which needs to be covered in semi-structured interviews. The list may vary from interview to interview. Interviewing the subject experts can be relatively unstructured, and the results depend on the researcher's activity during the interview. The researcher does not need to follow strictly the order of questions since it may vary a lot on the flow of the conversation, additional questions can be omitted during the interview to explore the research question more effectively. The interview will be audio recorded because of the nature of the questions and to collect all the data. After the interview, the record needs to be transcribed. (Saunders et al., 2009, 171, 320-321, 323-324)

Transcribing the interview immediately after the interview is important since it is still in the researcher's fresh memory. Otherwise, some of the insights or notes might be missed if they are not taken during the early transcribing. The entire interview is not necessary to be transcribed if it does not endorse your research questions, goals, and experience. The voice record must be safely stored for security purposes. (Saldaña, 2011, 44-45) The storing and record-keeping of research data and results inadequately is violating the reliable conduct of research (Finnish advisory board on research integrity, 2012, 33).

Participant observation is a method that is based on the ethnographic research traditions of anthropological studies. It is essentially the researcher's take on social action, whereas the interview is the participant's take. (Saldaña, 2011, 46) The researcher participates fully in the activities of the subjects and becomes a member of the organization by being able to share their experiences by not only observing what is happening but also feeling it (Gill & Johnson, 2002, 144). The participant observation is qualitative, and its emphasis is on exploring the meanings that people attach to their actions (Saunders et al., 2009, 228). The participant observation allows the researcher to participate in the process and to see how subjects work during each stage of the process, the observation will also reveal subjects' emotions and other non-verbal expressions

which may have a significant impact on the study (Gill & Johnson, 2002, 144-145; Saldaña, 2011, 46-47).

The credibility of research findings

The reliability of qualitative research involves establishing credibility, transferability, confirmability, and dependability (Juuti & Puusa, 2020; Kananen, 2014). The credibility of the informant can only be determined by the informant (Juuti & Puusa, 2020; Kananen, 2014; Merriam & Grenier, 2019, 35). Therefore, the research findings would be worth having approved by the informants. There might also be conflict about the findings since they may not be pleasant to the informants. Credibility can be improved by using multiple research methods, this is also known as triangulation. (Kananen, 2014, 132) The consideration of transferability means that the researcher must deduce if the research findings could be similar in another research environment and if the topic could be studied again. The deducing is based on the documentation of the research, so if the documentation of the starting point and interpretations are done well, then the transferability can be determined better. (Juuti & Puusa, 2020, 169)

The interpretations are based on the researcher's premises, and they typically vary by a researcher. The term confirmability means that a random researcher would end up with the same results. One way to improve confirmability is to have references to similar studies in qualitative research. (Kananen, 2014, 133) Dependability can be ensured with detailed documentation of the research. Strategies to ensure consistency is triangulation, the investigator's position, peer evaluation, and the audit trail in qualitative research. The triangulation strategy is to use multiple sources of data and collection methods. The critical self-reflection by the researcher regarding his influence in the research is done in the investigator's position strategy. The peer-examination strategy includes discussions with colleagues regarding the process of study. The audit trail provides detailed information about the methods, procedures, and decision points during the study. (Merriam & Grenier, 2019, 28, 31)

The necessary research permits need to be acquired, and all the research's rights, responsibilities, and obligations need to be agreed upon with all the parties within the research project. The research needs to follow the principles that are endorsed by the research community. Sometimes the researcher wants to see too strongly that his assumption will be the result which may mean that the researcher manipulates results unknowingly or on purpose. Misleading the results of the study violates the responsible conduct of research. (Finnish advisory board on research integrity, 2012, 30, 32)

The validity of the research findings refers to whether the findings follow what they look like (Saunders et al., 2009, 157). It indicates the degree to which instruments measure what they are supposed to measure. Therefore, other relevant pieces of evidence are searched to confirm the findings from our measurements. The relevancy of the evidence depends on the nature of the research problem and the judgment of the researcher. There are three types of validity: content validity, criterion-related validity, and construct validity. The content validity concern concerns which measuring instrument provides sufficient coverage of the topic under study. The content validity is valuable if the instrument contains a representative sample of the universe. The criterion validity is associated with our ability to predict the outcome or estimate the existence of a current condition. The construct validity measure measures correlations with other theoretical propositions. The degree of validity is scored by comparing the level of other propositions with the results received from using our measurement instrument. (Kothari, 2004, 73–74) The reliability of the results decreases with poor research skills, and it may even invalidate the research itself (Finnish advisory board on research integrity, 2012, 32).

6 Research of FitWood's innovative product development process

The implementation of the study is divided into three phases. Phase 1 discusses and analyzes innovative emerging technologies. Phase 2 analyzes and suggests ideas to develop FitWood's innovation culture. Phase 3 analyzes and suggests a Stage-Gate model for improving FitWood's product development process.

The preliminary research problem was the commissioner's lack of information on emerging technologies, where Phase 1 is focused. The secondary research problem was the company's unstructured innovation and product development processes, on which Phases 2 and 3 are focused. As a result, Phases 1, 2, and 3 should answer the following research questions:

1. Which one of the emerging technologies has the most competitive advantage in the future?

2. What needs to be developed for building an innovative culture?

3. What implementations need to be done for improving FitWood's product development process?

The qualitative approach was chosen for collecting and analyzing the data. The data for the study was collected through observation and interviews. The semi-structured interviews were used to study and understand the future insights of emerging technologies by leaders of technological organizations. The collected data was used to understand which of the emerging technologies could be implemented in the commissioner's products and which of the technologies could have a significant impact on the product development process in the future. The interviews were done between 50/22 to 14/23.

The participant observation was used to study how the innovation culture appeared in the organization and to understand the company's product development process. According to Potter and Hepburn (2005), the naturalistic recordings of participants' conversations can potentially reveal deeper information from the studied case than the traditional interaction between the researcher and participants. Naturalist records can include audio and video records of everyday interactions, documents like the researcher's diary, of interactions and other records of interactions. (p.21) The researcher participated in the organization's product development process to collect and compare the organization's current product development process to Edgett's (2018) Stage-Gate

model as shown in Figure 8. The researcher used the Stage-Gate model as a template when he collected notes on each step of the product development process. The template can be found in Appendix 1. The observation was done during weeks 45/22 - 3/23.

6.1 FitWood as a commissioner

FitWood has been founded in 2015 out of the passion for functional yet stylish exercise equipment with a mission to enable an active lifestyle and boost well-being without sacrificing design. Finnish nature, well-being, Scandinavian design, and green values are at the core of their business. The products are named by Finnish nature and the company uses birch plywood as the main material of production which is also commonly used in Scandinavian design. The company is currently working around its three passions: promoting active lifestyles and well-being, creating sustainable high-quality design products, and improving kids' development and versatile movement.

In the early years, FitWood focused to manufacture home exercise equipment, like wall bars, gymnastic rings, and ab wheels, for adults. During the last years, the new product category FitWood for Kids was developed which contains multi-functional active toys which develop children's fine or gross motoric skills. The company has also developed products that are suitable for kids and adults so that the product is widely used by all family members. The company is strongly focused on developing FitWood for Kids category during the next years because of the high market demand. However, they are looking to find new emerging technologies to be integrated into their home exercise equipment as well in the upcoming years.

The company sees that long-term business success and competitive advantages will be based on emerging technologies in both product categories. For that reason, they are looking to find ways to follow weak signals, build an innovative culture, and develop their product development process.

The researcher has been working as the CEO of FitWood starting from January 2021. Since the researcher works in a leading position, he has great insights into the company's current systems. However, he has not been following and developing actively the product development process earlier. His responsibility is to lead the product development process, but he does not do operative parts of the product development. The operations are done by employees. The product development process includes 6 employees and CEO. The team includes a product designer, production coordinator, logistic coordinator, marketing coordinator, and two sales representatives.

The participant observation gave him the possibility to study closer company's product development processes and to follow employees' tasks and actions during the process.

6.2 Implementation of the research

The observation and interviews were done after the theoretical framework of innovation, emerging technologies, and Stage-Gate model was collected to ensure that the researcher focused on the right things during the study.

Observation of innovation culture and product development process

The researcher participated in each stage of the product development process during weeks 45/22 - 3/23. There was a total of six employees observed. The researcher observed the team's meetings and individuals' work tasks regarding the product development process. In each observation session, the researcher collected notes for his diary regarding the product development process and the innovation culture.

The observation of the product development process focused on comparing how the steps of Edgett's (2018) Stage-Gate process were managed in the organization. The researcher created a list of questions for each stage, and he listed notes regarding each question in his diary during the participant observation. The goal of the notes was to answer the listed questions for each stage. The list can be seen in Appendix 1.

The different stages of the product development process were observed in different weeks, and they were not followed in strict order because the organization's product development processes were in different stages. The organization's new product, the KUMPU Montessori bookshelf, was launched in week 46, so for that reason, the observation focused on the Scale-up stage during weeks 45 and 46. Weeks 47 - 49 were devoted to the Launch stage. During weeks 50 - 52, the Discover and Scope stages were followed. During these weeks, the team focused on creating product ideas and collecting supportive data for a potential autumn 2023 product. The Design stage was observed during weeks 1 - 2, and the Develop stage of the new spring product 2023 was observed during week 3. The schedule is listed in Figure 9.

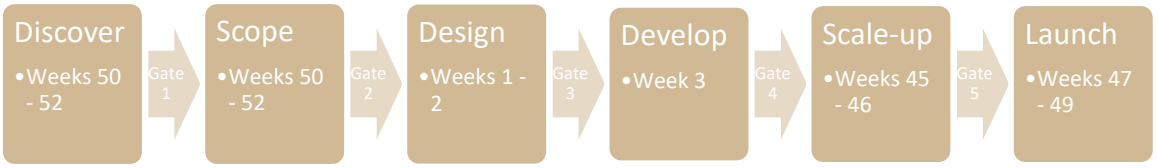

Figure 9. The schedule of participant observation during each stage of product development

The researcher used a diary to document all the interactions regarding the evaluation of successful innovation culture. The diary included a list of successful innovation culture characteristics that are listed in Appendix 2. The researcher documented positive and negative notes of the innovation culture during the participant observation. The diary was used to analyze how the innovation culture appeared in the organization.

Each diary note included a date, the product development stage that was observed, who participated in the observation, the topic of the discussion, the theme of innovation culture, and positive and negative notes regarding the theme. The example note from the diary can be seen in Appendix 3. Most of the notes were collected based on the observants' sayings. However, the researcher also listed behavioral actions, like how participants challenged, helped, and trusted other colleagues.

The results of each characteristic were divided into 5 different categories: high, above average, average, below average, and low. High means that all notes are positive, above average means that there are more positive than negative notes, average means that there are as many positive as negative notes, below average means that there are fewer positive notes than negative notes and low means that there are only negative notes.

Before each observation session, the researcher marked in his diary which product development stage and innovation role would be observed. This helped the researcher to focus on finding

answers to the right questions for the specific stage. The researcher also prepared the characteristics of the selected innovation role in his notes before each session. The role was selected based on the topic of the discussion and the number of participants. For example, in team meetings, the researcher frequently focused on innovative team characteristics, whereas when observing individuals, he analyzed innovative individual characteristics more frequently.

Interviews of leaders

Interviewees were selected from companies that were using or planning to use emerging technologies in their products or services. There were a total of four interviewees: Janne Hietala, CEO of Kelluu Oy; Mika Santanen, entrepreneur at Inpack; Tapio Marjanen, founder of iTapsa; and Veli-Matti Nurkkala, CEO of CSE Entertainment. The researcher selected these interviewees based on their expertise in working with emerging technologies. Janne operates with intelligent airships, Mika with industrial packaging, Tapio with smartphones, and Veli-Matti with metaverse reality.

The researcher sent a list of questions, an estimate of the meeting time, notes regarding confidential information, and information on what a semi-structured interview means before the meeting. All the interviewees were kept in Microsoft Teams. The interviews were done between 52/22 – 12/23. The meeting times vary from 12 minutes to 31 minutes. The researcher began the meeting by informing the interviewee that the meeting would be recorded and that if any terms were unfamiliar to them, they could always ask what they meant. Next, the interviewee was asked to give a short presentation of what they and their company do. After that, the questions followed the list of questions, but not in strict order, and there were additional questions based on the flow of the discussion.

The semi-structured interviews focused on two main topics: weak signals and emerging technologies. The first three interview questions focused on weak signals (Appendix 4). The goal of these questions was to understand how interviewees' organizations followed weak signals and how important they saw them. The last four interview questions focused on emerging technologies. These questions were selected to reveal interviewees' beliefs about the most valuable emerging technologies in their industries. Buchholz and Briggs' (2020) list of macro-forces in emerging technologies, as shown in Figure 6, was shown to the interviewees if they were not able to identify the most valuable emerging technologies. The list of macro forces helped to open the discussion of emerging technologies, especially since the term "emerging technology" has different definitions.

Two of the interviewees did not read the questions upfront. However, they were familiar with the terms, so it did not affect the discussion. Two of the interviewees were also so keen on the topic that their responses were longer, and they spoke more widely about the theme, whereas the other two gave shorter responses and stayed more strictly on the topic. The additional questions were presented mostly for these two eager interviewees since they led the discussion to new topics, like what needs to be considered when using new emerging technologies. The overall flow of the discussions was smooth with each interviewee.

Due to the nature of semi-structured interviews, the questions varied from the original ones to collect deeper information about the interviewees' beliefs about future emerging technologies and the way they collect weak signals. It is good to remember that emerging technologies may give companies competitive advantages. Therefore, interviewees may not have been interested in revealing their or their companies' future insights. As a result, the researcher needed to establish strong trust with the interviewees. The researcher gave a chance to remove part of the discussion from the thesis if the given information was confidential. Only one interviewee requested that a portion of the discussion be removed from the results.

Observing the interviews was as critical as the interviewees' answers to the questions because of the trustworthy information. The researcher evaluated the value of the collected information by observing the interviewees' actions, such as their level of commitment and enthusiasm. Understanding the interviewee's level of knowledge of emerging technologies was observed in order to determine how important they or their organization saw them. The researcher used an observation journal during the interviews. The journal included a list of actions that were taken during the interviews. The researcher added notes regarding these actions during the interviews. The notes were divided based on the level of action, these levels were high, average, and low. These notes were used to analyze whether the interviewees' answers were eligible.

The interview data was transcribed, coded, and themed. The researcher first marked phrases and words that revealed something related to the interview questions. These texts were collected in a list of notes. The texts with similar expressions were next grouped. These groups were added to a table, and each group was labeled. The joint concepts were formed to explain the expressions. An example of coding can be found in Appendix 5. The coding revealed a total of 15 concepts. These concepts were used to analyze and interpret the results of the interviews.

6.3 Results of observation and interviews

The results are divided into three sections. The first two sections focus on the results of participant observation, and the last section focuses on the results of semi-structured interviews. The participant observation is also divided into an analysis of the results of the appearance of an innovation culture and an analysis of the results of the product development process.

6.3.1 Innovation culture observation

The findings of the innovation culture observation are divided into five major categories: individual, team, organization, external links, and leader characteristics. All the categories consist of different characteristics that were followed during the observation. Each of the characteristics has been evaluated separately, and based on the evaluations of each characteristic, the researcher has analyzed the need for development. The notes from the observation diary were used to evaluate each characteristic. There were a total of 185 notes on innovation characteristics in the diary, which meant that there were an average of 30 notes for each role and 5 notes for each role's characteristics.

Innovative individuals

Six individuals were observed. The observation of individuals happened in group meetings as well as while following individuals' work. Individuals shared above average the characteristics of innovative individuals described by Chouteau et al. (2018), even though there was a lack of superior discovery skills and creativity. The results of the observation have been added to Table 1.

Innovative individuals	**Results**
Superior discovery skills	Below average
Empowerment	High
Freedom	High
Creativity	Average

Commitment to the innovation process	High
Passion for the company's vision	High
High engagement level	High

Table 1. Evaluation of the organization's individuals

Two individuals share **superior discovery skills**, which are associating, observing, networking, questioning, and experimenting. These individuals demonstrated associative and experimental abilities, particularly when developing new products and testing prototypes. One of the greatest associations was the way new functions were added to a new product idea. The individuals had a larger network that they used during the product development process. The network included many outside links. Observing abilities were demonstrated during prototype testing and group meetings, where individuals closely followed the actions and opinions of others. They were not afraid to question others' opinions in the meetings, either.

Individuals felt **liberated** and **empowered** by others, which was seen especially in group meetings and 1-to-1 conversations. Empowerment appeared especially during busy times when employees helped and motivated those who needed more help. The individuals had the freedom to choose the time of their work and if they worked remotely or in the office.

Creativity was evident in the three's working habits, where they devised unexpected solutions, such as innovating a new product or developing a new method of testing market demand. The other three, on the other hand, strictly followed given tasks rather than coming up with creative solutions. These three individuals appeared to believe that creativity is primarily for those who do creative work, such as product design.

Individuals shared the **company's vision** and wanted to be a part of its growth. This was especially noticeable during a quarterly meeting when people were actively participating in the discussion and curious about how the business was progressing. They also gave ideas on how the company can grow. Two individuals did not know the company's vision, even though they still felt passionate about the company's future. The individuals were **committed to the company's processes**, even though the innovation process itself did not appear in the company. The product development process was systematically brought forth by all individuals, especially during weekly meetings.

Everyone had the desire to express themselves and participate in developing innovations which can be seen as a **high engagement level**. However, two individuals did not attribute their opinions that well in group meetings. They attributed more to the process in individual discussions. According to Keltikangas-Järvinen (2012), It is easy to describe the differences between people using temperament traits, as they are visible characteristics. Everyone has their temperament. Temperament traits differentiate people from each other and affect their behavior in different situations, such as group discussions.

Innovative team

The observation of an innovative team happened during group meetings. The team shared above average the characteristics of an innovative team described by Chouteau et al. (2018), even though the communication and skill development need improvement. The results are listed in Table 2.

Innovative team	**Results**
Share the same values and norms	High
Well-structured innovation team	High
Different skills	Average
Good communication	Below average
Openness to new ideas	High
Ability to challenge, trust and help each other	High

Table 2. Evaluation of innovative team

The organization's core **values and norms** are honesty, transparency, humbleness, independent initiative, continuous self-development, and teamwork. The individuals' actions were independent, and they showed loyalty and transparency for other team members as well as a drive for continuous self-development that was also seen as a great passion for the company's vision. Their communication was also humble and honest. The team is **well structured**, and it works well together. Everyone had a clear position, which was well communicated to all team members in the organization.

Even though the team has clear positions, and each position needs **different skills**, some skills were not as mature as others. Four employees had less working experience than others, as evidenced by their skill level. However, the enthusiasm for constant self-development was building their skills better.

Weekly team meetings showed that **communication** did not flow smoothly with the team members during the week. There were three negative notes where employees expressed that they felt that they were left out of some communication during the past few weeks. The remote work seemed to add to the lack of communication since the remote workers seemed to miss more information than others. Four of the employees worked mainly remotely. The weekly meeting was beneficial in that it brought everyone together, and information was well shared, even though some of it could have been communicated earlier.

The team showed **openness to new ideas**, as seen by the fact that none of the ideas were turned down, and the ideation stage showed higher engagement than other stages during the product development process. During the team meetings, all employees showed the **ability to challenge** others. Members offered help for others during the daily meetings, especially when a member had less work than other members. Working as a team was based on trust since each member had a clear position in the product development process and they were dependent on each other.

Leader characteristics

The researcher works as a leader of the organization, so one of the leader characteristics, having created products, is based on his own experience, but the other five are based on the employees' evaluations. The evaluation was done as a part of the participant observation, where individuals evaluated the researcher's leadership characteristics during individual meetings with the researcher. The results are listed in Table 3.

Leader characteristics	**Results**
Have created products	High
Level of discovery skills	Above average
Belief in changing the world	Above average
Encourage individuals	Above average

Low power distance	High
High level of tolerance for uncertainty	Above average

Table 3. Leader characteristics

The leader has **invented a product and a service**. He invented the product while working as a sales manager at HighRoller Finland Ltd. The service was invented with a colleague, who continued the development of the service with a private company. Based on these inventions, the researcher does share this leadership characteristic.

The listed **discovery skills** for which employees were evaluated were associating, observing, networking, questioning, and experimenting. Employees unanimously agreed that he possessed skills in associating, experimenting, and observing. There were two negative notes regarding questioning and one negative note regarding networking. However, there were more positive notes than negative notes, so that is why the characteristic was marked as above average.

Two employees were unsure whether the leader **believe in changing the world**: the other four agreed. The characteristic was also seen as hard to evaluate because of its personal aspect. One of the employees thought the leader could encourage individuals more, while the other five thought the **level of encouragement** was adequate. Employees perceived the organization to be led by a **low-power distance**. There was one note, however, in that the leading character did occasionally share high power distance characteristics.

The high level of tolerance for uncertainty was seen as difficult to evaluate for two reasons. The first reason was that the leader had not yet faced difficult times in the organization. The second reason was that the leader did not express his feelings regarding tolerance of uncertainty. Nonetheless, there were only two employees who were not sure if the leader shared this characteristic, the rest agreed that he would share this characteristic.

Organizational context

The observation of an organizational context happened by following the daily habits of employees' work and during meetings. The organization did share four characteristics of an innovative organization, which were flexibility, external focus, innovation is everyone’s business, and small, structured teams. The remaining four characteristics are: disruptive innovation is central, intelligent risks are followed, and business processes need development. The results are listed in Table 4.

Organizational context	**Results**
Flexibility	High
External focus	High
Innovation is everyone's business	Above average
Disruptive innovation is central	Below average
Small and structured teams	High
Intelligent risks are followed	Average
Business processes	Average

Table 4. Organizational context

The **flexibility** of the organization was seen in employees' actions, like the freedom to choose where and how to work. Employees also had the possibility to create new solutions instead of following old processes. The organization showed flexibility with its stakeholders, especially with their manufacturers since they frequently asked for feedback on new product ideas from them. The feedback helped them to develop and design their new products.

The organization is customer-centered, which was seen in the way they collected product ideas and how they collected customer feedback during the product development process. Some of the product ideas were originally from their customers, and all of them were analyzed based on consumer trends or consumer surveys before being taken into consideration. As a result, the **external focus** was on the core of their business.

All employees contributed to the **innovation process**. However, two individuals did contribute significantly more than the others. These two individuals shared a similar level of personal bravery in that they did not filter their opinions as much as others. There was also one person who contributed much more in meetings where there were fewer people. Overall, innovation did belong to everyone's business.

Incremental innovation can be seen as a central part of the organization's product development process. However, the team was also keen to think of **disruptive innovations** during the ideation process. It seemed that the organization's limited resources did restrain the development of

disruptive innovations since these ideas were seen as too expensive and time-consuming. Members of the innovation teams did have clear roles, and the team was **well structured** since each employee knew well how everyone contributed to the team.

Intelligent risks are being followed, but the company is not anticipating them. The organization follows its competitors, industry changes, and emerging technologies monthly. The preparation was seen as important to avoid a significant impact of external risk on the business. Employees did follow **business processes** in their everyday lives. However, these processes were not documented, which causes issues when a new employee is recruited. Three employees also felt that there was not enough time to document or develop these processes.

Links outside of the organization

The observation of links outside of the organization happened by following employees' actions to follow and communicating with stakeholders. The main stakeholders were manufacturers, retailers, logistics partners, competitors, influencers, customers, and mentors. Because of the various positions, each employee communicated primarily with their field. For example, the production coordinator communicated primarily with manufacturers and the marketing coordinator with influencers and customers. The results of the organization's characteristics are listed in Table 5.

Links outside of the organization	**Results**
Benevolent view of the external environment	Above average
Multiplicity and variety of internal/external contact points	Low
Ease and speed of setting up collaborations	Average

Table 5. Links outside of the organization

The two employees who were more focused on designing and collecting data for new products had a wider **view of the external environment** since they actively followed the organization's stakeholders as well as used more tools to gather data from market changes. The rest of the team did lean heavily on these employees' knowledge of the external environment. Even though one employee felt that the notes about the external environment were not actively shared with all

members, all employees felt that the organization did have a benevolent view of the external environment.

The organization did not have **a variety of external contact points** in production, marketing, and logistics which was seen as an issue inside the organization. They were also lacking multiplicity in all internal and external contact points. The strongest contact points were retailers who did actively communicate with sales representatives.

Employees did **set up new collaborations** quickly and easily if these collaborations were part of their job. For example, sales representatives did actively set up collaborations with retailers and marketing coordinator with influencers. However, the harder thing for them was to build collaborations, which were not their daily working habits, like making collaborations with other brands.

6.3.2 Observation of the company's product development process

The findings of the product development process are divided into six major steps: discover, scope, design, develop, scale-up, and launch. The observation showed that the organization did not follow the same order of a product development process as described in Edgett's (2018) Stage-Gate process, but the findings are still listed under each phase of the Stage-Gate model.

The researcher collected a total of 194 notes regarding the product development process in his diary, which meant that there was an average of 32 notes for each stage. The notes were collected based on the observants' sayings during observation sessions.

Discover

The organization follows market opportunities occasionally by using different tools and communicating with stakeholders. The main tools to find product ideas are Google Trends, Helium 10, Allura, and eRank. Communication between retailers and consumers has been a good way to find product ideas. The weak link is not the tools or communication, it is the lack of a systematic way of working and interpreting the information collected by data tools.

The organization has identified its key indicators of winning products, which are multi-functionality, ecology, and design. This identification has already been considered when finding innovative product ideas. The process of creating innovative ideas is still unclear, and most of the ideas have

been born by accident so far. Currently, innovating product ideas are primarily the responsibility of the company's product designer.

The product ideas are evaluated by the team before deciding which ideas continue to the Scope stage. The product designer typically introduces different ideas to the team, and the team gives their opinion regarding each idea. After the discussion, the product designer, production coordinator, and CEO decide which of the ideas will be developed for the next steps. The evaluation seemed to work well.

Scope

The investigation of ideas happened already at the Discover stage. The investigation includes three main steps: competitor analysis, sales channel analysis, and production analysis. The competitor analysis focuses on searching for similar products in the market. The sales channel analysis is used to understand in which sales channels the product could be sold and if the channels are valid for the organization. The production analysis consists of technical points of view on the product, like potential materials, cost, and production tools.

The organization collected data from three main sources: customers, retailers, and the market. The customer data consisted of different surveys to measure the demand for the product. The retailer data was collected through surveys and interviews with the most important partners. The market data consisted of different kinds of metrics about demand, like sales numbers, competitors, reviews, customer habits, and keywords, from sales platforms, Amazon and ETSY, and Google Trends. Market data has been collected in each of the product development processes in the past, but customer and retailer data are occasionally collected.

The technical assessment involved three factors: production possibilities, safety standards, and logistics. The organization uses subcontractors for manufacturing their products, and their current subcontractors have limited tools and materials available, which limits the possibilities. Therefore, production possibilities are precisely analyzed during this stage. The analysis included possibilities for materials, production methods, and cost evaluation. The safety standards are discussed with a certification company that does European standard tests. The discussion helps the organization understand what the risks are and what kind of standards should be tested. The organizations' products are packed in flat parcels, and these parcels have different thresholds for weight and dimensions given by transport companies. These thresholds were analyzed while evaluating the dimensions and weight of the product.

The organization did not use any specific metrics for evaluating if the product idea is competitive enough to continue at the Design stage. The decision to continue the product development process was discussed with the team. In addition, the product coordinator and product designer presented all the collected data to the team during this meeting. Team members presented their opinions regarding the product idea and collected data during the meeting. Based on the discussion, the product designer, product coordinator, and CEO decided whether to move forward with the product idea.

Design

The organization has listed multifunctionality and Scandinavian design as the most competitive advantages of its products. These competitive advantages were taken into consideration by the product designer when she strived to create designs that stand out from the competitors. So far, the product designer has developed product ideas to be more competitive by herself. The designs were visualized and presented to the rest of the team, which assessed them and selected the most promising ones through a voting process. The voting process would be more effective if the sales, marketing, and logistics perspectives were considered in a more thorough and well-documented manner. The rest of the team did not provide support by giving ideas for designing competitive product designs during this stage. In one of the product development processes, the visualization of product designs was already presented during the Discover stage, before any collected data.

For certain products, additional research was necessary before making the development plan, especially if the designed product had new functions which were not considered during the Scope stage. The development plan was done during the Develop stage instead of the Design stage. The development plan consisted of a schedule for different actions that needed to be taken before the launch of the product. These actions included marketing, sales, finalization of the product, product description, standard tests, pricing, and product packages and manuals. While the current process proved efficacious, the team could still refine the steps involved, such as ordering prototypes and testing technical aspects, and deliberate on suitable production techniques and materials with the manufacturer. The development plan was evaluated by the team before it was decided to be followed. The evaluation was based on the experience of previous development processes.

Develop

Regarding the testing and evaluation of prototypes, the observations provided indicate that there were various methods used. These included durability testing, standard testing, technical testing, and testing with users. Additionally, the organization occasionally used third-party testing organizations. Even though the organization had multiple different testing methods, there was a lack of a test group of users. So far, the test subjects have been selected based on the family members and friends of the team members. The process for testing and evaluating prototypes involved creating a process flow, creating a reporting model to evaluate the prototype, and collecting feedback from users. It is important to note that the testing and evaluation process was ongoing until the final product is completed.

The operation plan and the development plan were seen as the same. Therefore, the operation plan also had development tasks inside of it, like prototype testing. The operation and marketing plans were formal, but both of them were quite minimal, and the team felt that both of them could be developed. The marketing plan did not even include the competitive advantages of the product, which the sales team could have used. There was no formal sales plan. The sales team followed actions from previous product launches, like pre-orders, rough estimations of sales, and active communication with retailers.

The commercialization plan was not measured or evaluated in any way, and the team did not even hold a meeting regarding it. It seemed that when product development gets this far, it is too late to stop the process. One of the employees even mentioned that there should be a way to critically evaluate the final prototype and its success in the market before moving on to the launch.

Scale-up

Observation of the launch process revealed that various actions were undertaken by the team. The marketing department created campaigns and offers for the sales team to use and sent products to influencers for promoting the launch. However, the team struggled with time constraints, and the marketing materials were incomplete. The sales team reached out to potential customers well before the launch through newsletters. They also contacted key clients individually and shared information about the product upfront. Despite their efforts, the team acknowledged that there was room for improvement in all areas of the launch process, from marketing to testing to customer outreach.

While some planning and evaluation occur, it seems to be ad hoc and inconsistent across the company. This lack of consistency and structure could potentially lead to problems in the launch,

such as poor performance or negative customer reactions. The three employees suggested that metrics should be developed highlighting the need for a more formalized process for the test phase. Metrics would allow for a more objective evaluation of the success of the launch as well as provide a way to measure the effectiveness of different strategies and approaches. Implementing metrics could also help to identify areas that need improvement and allow for adjustments to be made before the full-scale launch.

The company currently monitors order volumes but does not have any other evaluation methods in place. Employees emphasized the importance of having metrics and measures to evaluate the success of the launch and suggested conducting meetings and team discussions to review each step of the process.

Launch

There has been no planning for the final actions of the launch phase. However, there have been some implementations that have naturally happened based on how well the launch has gone. The organization has increased or decreased product manufacturing volumes, and marketing has been increased if the reception of the product has been poor. In this way, the organization has tried to push the product onto the market. The sales representatives have continued discussions with current and new retailers about starting to sell the new product.

The team keeps a feedback meeting regarding the launch a few weeks after the product has been released. During the meeting, all members share their feedback about things that have gone well and things that need improvement. The feedback is taken into consideration when developing the next product launch.

The organization follows only the sales volumes of new products weekly after the launch. The success of the product has only been measured by the sales volume, and if the volume is low, then the product has been easily dropped from active marketing. The team also discusses the new products in their quarterly meetings, where each member gives feedback on the products. The feedback is strongly focused on the marketing and sales actions of the product.

6.3.3 Semi-structured interviews with leaders

The findings of the interviews are divided based on the listed questions, as shown in Appendix 4. However, questions 5 and 6 were combined since question 6 did not reveal additional

information. The researcher listed 74 notes for coding and finding concepts for the questions. The discovered 15 concepts are shown in Table 6. There were also 18 notes about the interviewees' enthusiasm, level of commitment, and level of understanding. The notes are listed in Table 7.

Questions	Concepts
1. How important you see weak signals?	1. Level of importance
2. Which is more important trends or weak signals?	2. Timing 3. Competitive advantage 4. Risk 5. Rapid change
3. How do you follow weak signals or/and trends?	6. Personal skills 7. Difficult to follow 8. Communities 9. Network 10. Media 11. Competitors
4. Which of the listed macro forces do you see the most radical innovations in the future?	11. Artificial Intelligence 12. Working environment
5. What do you believe will be the most valuable emerging technology in your industry? 6. Are there any other emerging technologies which should be followed closely?	13. Industry variation
7. Do you have any other comments regarding emerging technologies?	14. Common sense 15. Focus on your own business

Table 6. Concepts.

Enthusiasm			Level of commitment			Level of understanding		
High	Average	Low	High	Average	Low	High	Average	Low
3	3	0	3	2	0	3	4	0

Table 7. Interviewees' actions

The topic of the interview was interesting for the interviewees since they were very committed and enthusiastic to share their views about emerging technologies. Weak signals, trends, and emerging technologies were familiar terms for the interviewees since no one asked what they meant. However, two interviewees highlighted that the line between a weak signal and a trend is hard to define.

Importance of weak signals

Interviewees were unanimous that weak signals are highly important to follow. Two of the interviewees also saw that finding and following the weak signals was highly difficult. Two of the interviewees did work in a business that was founded based on weak signals. Both used emerging technologies as a main part of their businesses.

B: *"Highly important. Everyone should focus on following weak signals."*

C: "*They are important but difficult to follow*"

Trends vs. weak signals

Weak signals were seen as more important than trends, even though one interviewee saw trends as safer to follow due to the difficulty of predicting the development of the weak signal.

A: *"You are always late if you follow trends."*

However, the timing of following or taking on a new emerging technology in its use was seen as critical. One of the interviewees experienced failure when he published emerging technology in the market too early. The development of early weak signals was also seen as too expensive by one interviewee. Everyone highlighted that weak signals can develop overnight, so following is highly important, and no one should afford not to follow new emerging technologies.

B: *"Being too early may ruin your whole business idea."*

D: "*Both are important, but if I had to choose one, I would choose weak signals since they may develop overnight."*

Following weak signals and trends

Personal skills came as a very important thing to following weak signals and trends. These personal skills included an interest in finding information, combining signals, and developing large networks. Different media sources were seen as great tools to find information using new emerging technologies. These channels were podcasts, social media platforms, forums, online communities, newsletters, and news. It was noted that the channels to be followed should focus on communities or people who have the newest information regarding the development of the specific technologies that are interesting to your field.

A: "*The right people with the right skills in the workplace will drive to find new weak signals."*

D: "*Overall, you need to follow the media widely to get a better idea of which new emerging technologies may develop faster than others*."

Interviewees highlighted the importance of market changes, and a good way to find these changes is to follow competitors and customers. One interviewee said that finding new competitors is effective through visiting technology exhibitions. Using different research tools was seen as important by one interviewee.

Most radical innovation

The interviewees were unanimous about the fact that artificial intelligence is the most radical innovation at the moment. One interviewee even mentioned that everyone should now follow it, or they will be left behind in the business. Everyone saw that AI will help them automate processes and speed up their product development processes.

> C: "*AI helps automate processes. It will change all industries."*
>
> D: "*AI changes everything, so it should be most important to everyone*."

Most valuable technology after AI

Besides artificial intelligence, the interviewees' answers varied a lot from each other's. Based on the answers, it was seen that it is more important to follow those emerging technologies that are specifically affecting your industry. Following other industries' emerging technologies may not share that important information. It could also be seen that predicting the most valuable emerging technology in the near future was very difficult if it had not been built up in the last few months like AI had.

Common sense with emerging technologies

Using common sense was seen as important when following and testing emerging technologies. Everyone highlighted that these technologies have a lot of risks, like that the development of new emerging technology may stop quickly or the technology may develop so quickly that your earlier investment may become outdated. Two interviewees highlighted that having a healthy critical attitude is an important skill when starting to use new emerging technologies.

> B: "*There are a lot of risks with AI, so consider everything where you use it carefully."*
>
> C: "*Having a healthy critical attitude toward new technologies will help you make the right choices*"

Information overload is enormous nowadays, and therefore three interviewees underlined that companies should focus on their business and industry and not follow everything. One interviewee stated that if you do not have problems, do not try to find solutions. It always works the other way.

A: "*First find a problem, then move your focus to find solutions, not the opposite.*"

6.4 Interpreting the observation and interview data

The participant observation showed that innovation culture partially appears in the organization, and it showed a list of characteristics that need development. The observation helped to understand the current product development process and to see which areas need development to perform better in the future. The interviews gave insights into potential emerging technologies, which may have a critical impact on the organization's product development in the near future.

Innovation culture

The commissioner's organization can be seen as an innovative culture based on the results of the observation. The result is based on the fact that each characteristic of innovation was found in the organization. However, nine characteristics needed development for building a stronger innovation culture in the organization. Four of these characteristics require more intense actions than others, like educating individuals and implementing a new kind of strategy for the organization. The characteristics that need development are listed in Table 6. The recommendations for the development of these characteristics are listed next.

Intense development needed	**Development needed**
Individuals - Superior discovery skills **Team** - Communication **Organization** - Having disruptive innovation in central	**Individuals** - Creativity **Team** **-** Different skills **Leader** **-** Belief in changing the world

Links outside of the organization	**Organization**
- Multiplicity and variety of external contact points.	- Following intelligent risk - Business processes

Table 6. List of innovation characteristics that need development

Employees with **superior discovery skills**, such as associating, observing, networking, questioning, and experimenting, are in short. To be able to develop these skills, the organization needs to either educate current employees on developing these skills or hire new team members who will share these skills. It is important to note that the organization needs especially persons who share strong associating, networking, and experimenting skills. Understanding which of the superior discovery skills needs the most development makes it easier for the organization to develop these skills.

Based on the observation, employees share **creativity** skills, but half of them do not attribute their creative ideas to the innovation process as well as others. Since three employees saw that the creativity was primarily for those who do creative work, it can be seen that the organization does not highlight enough that everyone's creative ideas are needed to have better innovations.

The remote work made the **communication** flow difficult since the employees do not meet each other daily, and the information was not shared with those who were not part of the discussion before the weekly meeting. Communication could be made more effective by using communication software that allows information to be shared more easily with the team. In addition, the team would need to be educated on how to use the chosen software and make sure that they leave notes of their discussions during the week there.

Due to their young age, the team did not have that much work experience, which seems to have affected their skills. The development of **different skills** happens naturally as employees get more work experience, but these skills can also be developed by actively educating individuals. Therefore, the organization could offer different education possibilities to deepen their skill levels. This could lead the organization to catch up with more experienced teams faster.

The leader has not effectively expressed his beliefs about **changing the world** to the team because the team does not know whether he is interested in changing the world or not. The leader should communicate his beliefs to the team more effectively so that all team members would know what they were.

The organization has found its competitive advantages with its innovations, but its innovations do focus more on incremental improvements at the moment. Moving from incremental to **disruptive innovations** might be difficult to do quickly, so for that reason, it might be better if the leader starts slowly encouraging employees to focus more on disruptive innovation thinking. This may lead the organization to focus on disruptive innovations in a few years.

The company follows **intelligent risks** actively, but since they are not anticipating these risks, it leaves the organization at risk of harm that could impact the organization's sustainability if the opportunities are not explored. Preparing different scenarios for intelligent risks could help the organization act faster if any of these risks occur.

The employees do follow **business processes** every day, but since these processes are not fully documented, it may cause issues if employees resign or when new employees are hired. Therefore, it would be important to start documenting all the processes as soon as possible.

The size of the stakeholder **network** varied based on the person who was in charge of that specific business area. The individuals who have superior discovery skills have a wider network than others, and their networks are more diverse as well. Consequently, developing superior skills may help individuals build wider networks. In addition, the organization should add a wider network as one of its targets for the upcoming fiscal year.

Product development process

The participant observation revealed that there is a need for development at every stage of their product development process. Some of the stages were also done in a different order. For example, scoping was already done during the Discover stage. The company did not have a documented product development process, which can also be seen as one of its weaknesses since the current process depends on its current employees. The risk of resignations makes the process vulnerable. The recommendations for developing each stage: discover, scope, design, develop, scale-up, and launch are listed next.

The **discovery** of new product ideas relies on the production coordinator and product designer, who are the only ones who search for new product ideas. The rest of the team does not actively participate in sharing product ideas, even though they are in touch with different stakeholders, like consumers, influencers, and retailers, who could also give useful insights about new products. These employees could start to actively communicate with stakeholders to find new product ideas, as well as actively trying to bring ideas to the production coordinator and product designer.

For example, sales representatives could search for new product ideas at the exhibitions in which they participate.

The discovery process also varied in each of the product development processes, which was caused by the lack of a systematic way of working. Documenting the process would be necessary to have a systematic way of working. The process should start with the search for ideas, which would include a search for market trends and weak signals, communication with stakeholders, and consumer and retailer surveys. After the search, there should be a systematic way to filter ideas that have the potential to become FitWood's products. After filtering, the feedback of the whole team would be needed before moving the best ideas to the Scope stage. The recommended process for the Discover stage is shown in Figure 10.

The team would actively participate in searching for new ideas, but the filtering would be done by the product designer and production coordinator. Before moving the best ideas to the next stage, feedback from the entire team would be gathered. For feedback, the product designer should create a list of notes ahead of time that reveals the possibilities and limitations of the filtered ideas. This would help with the evaluation of product ideas.

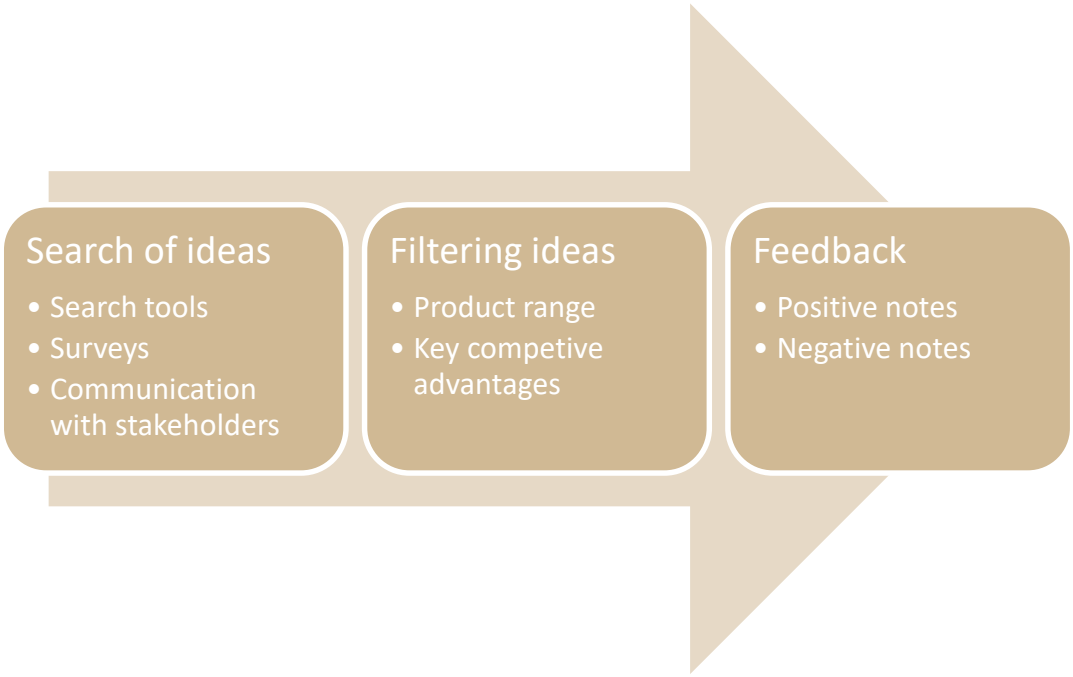

Figure 10. The recommended process of the Discover stage

The deeper investigation of the product ideas was already done in the Discover stage, but it should be done in the **Scope** stage since this would save time on the investigation of good product ideas. The investigation used a wide range of tools and sources, but not all product development

processes used the same sources. The reasons for not doing systematic investigations from process to process were a lack of time and a poor level of documentation. Having more time for investigation and documenting the process would make the data more reliable.

There is a need for new subcontractors to enable a wider range of possibilities in manufacturing. The new subcontractors would enable more materials and manufacturing technologies to be used in the organization's products. Having more subcontractors would also allow the organization to have better prices for its products. Otherwise, the technical assessment was well considered during this stage.

The evaluation of investigated data and technical assessments should include specific metrics that could be evaluated by the whole team. These metrics should indicate if the product idea has market demand and if it has the capabilities to be developed into a competitive advantage. These metrics would help the team evaluate if the product idea has the capabilities to survive the competition. Also, it is good to just collect other feedback that comes up in the team meeting since this may bring more ideas on how to develop the product in the Design stage.

The organization has clearly defined its competitive advantages on its products, which helps the product designer with the development of new ideas. However, the process has leaned on the product designer's ideas, and the rest of the team has not actively given ideas that could help the product designer. Therefore, the **Design** stage could start with a team meeting where all members would participate in giving ideas on how to make the product idea fit in the organization's product range. This would help the designer visualize ideas later.

After the product designer has visualized new potential product ideas, the rest of the team gives their feedback regarding these ideas and normally chooses the ones they think are the best. However, there have not been any metrics to help with the selection. Consequently, there should be metrics that consider how it could be marketed, the level of competitive advantage, the cost of the product compared to what the customer receives, and how the logistics can be done. These metrics would help make better decisions. This would mean that additional research could be needed for some ideas to discover these metrics if these are not defined in the previous stage. It is also good to remember that the final prototype may have changed a lot from the product idea.

The development plan was done in the development stage, even though it should have been done already in the Design stage since it would help the team evaluate the design and the plan before moving to the next stage. The plan would help the team to also evaluate how much time the

development process will take. This has a great impact on the discussion when the product can be realistically released. The development plan itself already included all the needed information.

The organization uses a variety of different testing and evaluation systems to evaluate prototypes during the **Develop stage**. However, they are lacking a group of test subjects. Currently, the lack of test subjects delays and employs the product development process. Collaborating with local kindergartens and schools would help the organization to have test persons. Otherwise, the evaluation of the prototypes is done with care.

There is a need to develop a commercialization plan for new products that would consider sales, marketing, logistics, and operations. The sales plan could have a strategy, revenue targets, sales channel strategy, pricing, promotions, and market conditions. The marketing plan should consider the product's key selling points, targeted customers, social media strategy, promotions, and pricing structure. The operation plan should combine sales and marketing plans as one strategic plan of execution to move forward with the product launch. It should also have milestones that will be followed after the launch.

Since the organization did not have a commercialization plan, there was no analysis done to determine if the launch would be successful. Everything leaned on the belief that the product will be successful based on all the research done before. The issue is that the earlier research only shows that there is demand, which does not mean that the product will sell without a market push. This step should be added as a part of the product development process before moving to the Scale-up stage since it could define if the organization has an effective plan on hand and would help measure success afterward.

Even though there was no commercialization plan, the organization undertook a lot of different launch actions during the **Scale-up** stage. By planning all the launch activities upfront, it would naturally improve the launch process. There was not enough time to prepare marketing and sales materials for the launch from the point where product pictures were received. For that reason, there should be an additional week for preparing the materials. The marketing was started just before the launch when it should have been started earlier to gain more attention.

The test phase does not appear since the final launch happens at this stage. The main reason for it is that the organization does not have any metrics that could be evaluated during the test phase. Adding metrics about sales volumes, interest level, customer feedback, social media engagement, and retailer feedback would help with the evaluation. Metrics would not only help identify results,

but they would also help the organization make implementations as it moved from the test phase to the Launch stage.

There should also be an evaluation system for analyzing the results, which could determine what kind of actions need to be taken. The evaluation should focus on how well launch actions were done and how these actions affected the collected metrics. It will be easier to evaluate which actions have affected which metrics after a documented list of launch actions and metrics have been collected.

The organization has naturally implemented different actions, like increasing manufacturing volumes and marketing budget, during the **Launch** stage if the launched product has had high sales volumes in the first few weeks after the launch. However, this work has not been systematic, and there has not been any action if the sales volumes have been low. For that reason, there should be a systematic way to work based on the evaluation collected at the end of the Scale-up stage. This should consist of different scenarios that can be followed based on the evaluation. By having example scenarios listed, it would be easier to decide on the next steps during this stage.

More metrics should be followed after the final launch. These metrics could be the same as those used in the testing phase. Some of the metrics should be tracked weekly in the organization's chart, while others should be tracked monthly. The weekly metrics should focus on sales and marketing results. The monthly metrics should focus on customer and retailer feedback and marketing engagement. It would also be important having more meetings after the launch where the team analyzes results. These meetings should appear at least a month, a quarter, and six months after the launch.

Emerging technologies

The interviewees saw that the most important emerging technology is artificial intelligence since it will have a huge impact on all business departments. It was seen that it would automate processes, reform jobs, and redesign the way we work today. For that reason, it may give businesses the most competitive advantage in the near future, or at least it is an emerging technology that cannot be dismissed.

AI does not integrate well with products, so it may not be the best-emerging technology for the organization's products. Even though the technology itself is important during the product development process. Interviewees' answers varied a lot regarding the most valuable emerging technology after AI. The interviewees' companies did focus on different kinds of technologies based

on their core businesses, which varied with the interviewees. In conclusion, it is important to follow those technologies that are close to the company's core business. For FitWood, these technologies are at least AR, VR, sensory technologies, and new materials.

The organization should focus to follow weak signals than trends based on the interviewees' answers since the weak signals may develop overnight and give more competitive advantage than trends. The skill of following weak signals is very important to the organization. The organization needs to focus on hiring people who have a high interest in finding information, the skill to combine information, and a wide network. The company should also encourage employees to follow emerging technologies through podcasts, social media platforms, forums, online communities, newsletters, and news.

New emerging technologies consist of a lot of risks, so the organization and its team need to evaluate emerging technologies carefully before putting them to use. The timing also needs to be very well evaluated since being too early does not give a competitive advantage.

7 FitWood's product development plan

Due to the confidential nature of the product development plan, a detailed overview of the plan cannot be provided. It was also agreed with the observed persons that their names would not be published, and the information obtained from the interviews would not be disclosed in detail by each person. However, the development of the actual plan and the main content of the plan are explained in this chapter. The plan was done between 12/23 - 18/23. The content of the plan was made to answer the research questions and share knowledge about the preliminary research problem, which was the commissioner's lack of information on emerging technologies.

The answers to each research question are divided into their own chapters, meaning that there are a total of three chapters in the plan. The chapters discuss the development of the company's innovation culture, a new product development model, and potential emerging technologies for the organization.

The innovation culture chapter focuses on sharing knowledge of characteristics of innovation culture, analyzing FitWood's current innovation culture, and recommending implementations to improve the culture. The characteristics are based on the thesis' theoretical framework of innovation. The analysis includes an evaluation of how the innovative culture appeared and how the innovation process was led at FitWood. The analysis is based on the results of participant observation. Recommended implementations are based on the interpretation. This chapter focuses on answering the second research question.

The second chapter includes a definition of the Stage-Gate model, an analysis of FitWood's current product development process, and a new suggested product development process. The thesis' theoretical framework of Stage-Gate is used for defining the Stage-Gate model. The analysis of the company's product development process is based on the six stages and gates of Edgett's (2018) Stage-Gate model, as shown in Figure 8. The analysis indicates how each stage and gate are currently processed and how they could be improved in the future. The product development process is a step-by-step plan that shows who is involved, what the objectives and metrics are, and what the different tools and evaluation criteria are for each step. This chapter focuses on answering the third research question.

The third chapter contains knowledge about the most competitive emerging technology, a list of actions to follow weak signals, a list of competitive emerging technologies, and recommendations

on how to evaluate new technologies. The topics were selected based on the research problem, the first research question, and the interpreted concepts of the interview data. The concepts are shown in Table 6. The most competitive emerging technology is based on interviewees' beliefs and supported by a theoretical framework. The list of actions to take for following weak signals is based on interviewees' sayings. The theory of weak signals is also defined to increase the organization's knowledge. The list of competitive emerging technologies is based on the theoretical framework of the thesis and the interviewees' beliefs. The recommendations to evaluate new technologies are strictly based on the interviewees' sayings. This chapter focuses on answering the preliminary research problem as well as the first research question.

8 Conclusion and discussion

The thesis is based on qualitative research done by collecting data from the literature, participant observation, and interviews. The commissioner's goal is to release its first technological product before the end of 2025. This goal conducted the process to select a topic that would help them achieve this goal. As a result of discussing the topic with the organization's board and team, the topic was selected to improve the organization's product development process so that they would start to create actively innovative product ideas.

The aim of this thesis was to create a product development plan for FitWood Ltd. The purpose to evolve FitWood's product development was to support the organization in achieving its goal of producing its first technological product before the end of 2025. The goal was also to share implementations that would develop the company's innovation culture. In addition to that, the aim was to increase the organization's knowledge about emerging technologies and to suggest the most competitive technology for the organization.

As the theoretical framework shows, adding new emerging technology to an organization's products demands a well-working product development process that is run by an innovative culture and tools to follow emerging technologies. The framework was too wide at some point in the process and was narrowed enough to be essential for the thesis after the understanding of the research got deeper.

The first research question was to study which of one of the emerging technologies would have the most competitive advantage in the future. The literature on emerging technologies was used to learn how emerging technologies develop from a weak signal to a megatrend, to understand macro forces in the wellness industry, and to understand the business ecosystems around emerging technologies. The interviews were done to get answers to the first research question. Interviews also gave insightful information regarding how to follow emerging technologies and evaluate risks regarding these technologies.

The forecast of emerging technologies is difficult since forecasting is based on weak signals, and they can develop in different directions (Roper et al., 2011, 16). Bearing this in mind, evaluating the success of finding the most competitive emerging technology for the organization is challenging. The future only shows if the selected emerging technology is the most competitive one. However, the research did give wide information regarding emerging technologies, which was the

organization's preliminary research problem. Based on this, the thesis has been successful in increasing the commissioner's knowledge.

The second research question was to study what needs to be developed to build a stronger innovation culture. The literature on innovation was used to understand what kinds of characteristics appear in an innovation culture. The participant observation focused on studying how these characteristics appeared in the organization's culture. The observation's results define which of the characteristics need to be developed for a stronger innovation culture. The innovation culture develops over time, so the actions cannot be seen instantly after implementing new things (Kamensky, 2008). Therefore, evaluating the results of actions will be seen long after they are implemented. Besides the final results, the organization is now aware of things that need development, and that can be seen as a success of this thesis.

The third research question was to study what implementations need to be made for developing FitWood's product development process. The Stage-Gate model was selected as a template for analyzing the company's current product development process and suggesting a new one. The theory of the Stage-Gate model was collected to gain knowledge regarding each stage of the product development process. The participant observation focused on studying all stages of the product development process in the organization. The observation revealed stages that needed development, which is already a success for the organization. The created product development plan for FitWood showed a plan of action on how to build a better-performing product development process.

8.1 Benefit for the commissioner

The benefit for the commissioner can be divided into three main parts: understanding the company's current status of the product development process and innovation culture, increasing knowledge about emerging technologies, and the actual product development plan.

Participant observation was used to study the organization's product development process and innovation culture. The observation did reveal that the product development process was not documented and was unsystematically led. In addition, it showed that there were improvements needed in the innovation culture. Understanding the organization's current status and the areas that need development can be seen as already beneficial to the organization. Without this

information, it would be difficult to start integrating new emerging technology into the organization's products.

The organization's lack of knowledge regarding emerging technologies was the main driver of the study. The theory of emerging technologies and interviews with the leaders were used to collect deeper knowledge regarding emerging technologies. Even though the results did not reveal an exact emerging technology that could be implemented on the company's products, they showed a list of technologies that could be beneficial for their business, not just for their products. The researcher was able to narrow the presented technologies in the actual plan to those that were seen as most important for the organization based on the organization's industry. This narrowing makes it easier for the organization to follow the right phenomena and emerging technologies. In addition, the interviews revealed a list of tools that make following more effective.

The actual product development plan included implementations for developing the innovation culture, the product development process, and the follow-up of emerging technologies. The organization will put the plan into use in 2023. The ultimate goal of the plan is to support the organization in achieving its target of releasing its first technological product before the end of 2025. Success will be finally determined by how well the plan works in practice.

8.2 Credibility and ethics

Ethical rules need to be carefully considered when doing research with informants. The informants and their sayings need to be protected, and it needs to be considered how the research may impact them. (Flick, 2015) The researcher informed employees upfront that they would be observed during specific weeks. It was also discussed that their names and their exact sayings are not published in the thesis. This was done to protect their confidentiality. The researcher did send instructions for the interviews upfront to the leaders. Each interview started by saying that interviewees can say if they do not want some part of the discussion to be used in the thesis. It was also informed that the interviews were recorded.

Research ethics addresses the fact that collecting and interpreting data is done ethically (Wertz et al., 2011, 84). The collected data from participant observation and interviews are treated confidentially, and the data will not be shared. The researcher has only access to the data, and the data will be removed after the research is published to protect informants.

The reliability of qualitative research involves establishing credibility, transferability, confirmability, and dependability (Juuti & Puusa, 2020; Kananen, 2014). The credibility can only be determined by the informant. It can be improved by using multiple investigators, sources of data, and collection methods (Juuti & Puusa, 2020; Merriam & Grenier, 2019, 35). The research's informants were the organization's employees who were observed and the leaders who were interviewed. The researcher did not present the findings of the observation and interviews to the informants, which can be seen as weakening credibility. However, the researcher had multiple sources of data, which can be seen as strengthening the researcher's credibility.

The consideration of transferability means that the researcher must deduce if the research findings could be similar in another research environment and if the topic could be studied again. The deducing is based on the documentation of the research, so if the documentation of the starting point and interpretations are done well, then the transferability can be determined better. (Juuti & Puusa, 2020, 169) The participant observation focused on determining the starting point of the organization's product development process and innovation culture. The data of the observation was documented, and the interpretations were based on comparing the results to the existing theoretical framework to determine the improvement plan. The organization's knowledge regarding emerging technologies was presented at the start, and the interpreted knowledge from interviews was presented in the product development plan. The documentation of the starting point and interpretations strengthens the transferability. Even though the topics of the research were general, it is difficult to deduce if the findings could be the same in different environments since the researcher focused on the needs of one organization.

The interpretations are based on the researcher's premises, and they typically vary by a researcher. The term confirmability means that a random researcher would end up with the same results. One way to improve confirmability is to have references to similar studies in qualitative research. (Kananen, 2014, 133) There are studies regarding the benefits of emerging technologies, innovation culture, and the product development process, but there are no studies where these three topics would be analyzed in the same study and using the same research methods. Therefore, it is difficult to have references to similar studies. Saunders (2009) defines that the goal of participant observation is to reveal delicate nuances of meaning, and it is used to learn more about the informants' actions (p. 342-343). Therefore, it can be seen as a good method for the research, where the organization's leader had to get deeper information about the innovation culture and product development process. Using interviews as a research method to study

emerging technologies can be seen as valid since the topic focuses on the future. Interviewees' beliefs may have revealed knowledge that would not have been revealed by other collection methods.

Dependability can be ensured with detailed documentation of the research. Strategies to ensure consistency are triangulation, the investigator's position, peer evaluation, and the audit trail in qualitative research. The triangulation strategy is to use multiple sources of data and collection methods. The critical self-reflection by the researcher regarding his influence in the research is done in the investigator's position strategy. The peer-examination strategy includes discussions with colleagues regarding the process of study. The audit trail provides detailed information about the methods, procedures, and decision points during the study. (Merriam & Grenier, 2019, 28, 31) The researcher used a diary for documenting the observation, and the interpretation was documented by listing notes under each theme of the observation. Finally, the recommendations to improve themes were presented in the product development plan. The interview data was recorded, themed, and coded. The recommendations for improving the company's capability to take emerging technologies into use were based on 15 documented concepts that came as a result of the coding. Detailed documentation strengthens dependability.

Critical self-reflection is needed in the research because the researcher works as a CEO in the organization. The position's positive sides were that the topic was carefully selected based on the organization's needs, the researcher was familiar with the organization and its employees, the researcher was driven to study the topic to be able to improve the organization and his leadership skills, and communication with employees was effective. The negative sides were employees' actions based on the leading position, it was harder to have interviewees with other leaders, objectivity to the research process, and analyzing his leader innovation characteristics.

Observer bias occurs when the observer uses her or his subjective disposition or view to influence the interpretation of events. The observer may not even notice this. Observants, instead, may change their behavior when they are being observed, which may lead to invalid data. This is known as the observer effect. (Saunders, 2009, 352-353) The researcher's position may have impacted both observer bias and observer effect during the process. The researcher listed notes about the sayings and actions of those being observed in the diary during each session. The interpretation was done based on the number of notes to minimize observer bias. The researcher was already a part of the product development process, so his presence was not new to the team. This can be seen by minimizing the possibility of the observer effect.

Validity is determined by the researcher's ability to effectively convey theoretical concepts through interview questions and the interviewees' understanding of them (Vilkka & Airaksinen, 2004). The validity was taken into account in the semi-structured interviews to understand the interviewees' beliefs about the development of emerging technologies. Lack of standardization in semi-structured interviews can reduce their validity, as it becomes harder to ensure consistency among different interviewers in asking questions and interpreting responses (Saunders, 2009, 381). Therefore, the researcher had a standardized list of questions to which he wanted answers. All the interviews were also recorded, themed, and coded, which strengthened the results. There was a total of four interviewees, which may have impacted the results. Having more interviewees could have brought more valid results. However, the interviewees were homogenous, and their answers followed each other, so having more interviewees may not have brought more valuable information.

In the evaluation of the reliability of a productized thesis, it is necessary to consider the overall package formed by the report and the product, as the product and the report are not unified. For example, the product may be well-made, but the reporting may be incomplete. (Vilkka & Airaksinen, 2004, 105) The evaluation of the report relies on the same criteria. The position of the researcher helped to guarantee that the right objects were studied, and the thesis was done for the organization's needs.

The thesis cannot be properly evaluated without reading the product development plan. Due to confidentiality obligations, the content of the plan will not be disclosed in detail in the thesis. However, the guiding teacher evaluates the coherence of the thesis and the plan. The product development plan is based on the theoretical framework of the thesis and the results of observations and interviews. Therefore, the connection between the product development plan and the thesis is strong.

8.3 Further studies

Further research topics could include studying the impact of the new product development plan on the organization's product innovations. This study could include an analysis of the new model after it has been in use for a minimum of a year and how it has impacted product development. It could result in new development ideas.

The organization's goal to have its first technological product before the end of 2025 could point them toward a deeper study of the selected technology and how it could be implanted in their new product.

In addition, it could be beneficial to study how AI can help the organization achieve its growth goals. AI may change the working environment significantly in the near future, so studying how it could be implemented in business processes in the future could not only be beneficial, but it could also be mandatory to survive in a competitive world.

8.4 Competence development

Due to the researcher's position, he had strong motives to develop the organization throughout the research journey, which influenced his learning. The researcher was inspired by emerging technologies, which led the topic to be too broad at first. During the thesis process, he was able to narrow the topic and focus more on the product development process. The research journey supported his growth by helping him focus on topics that were more relevant to the thesis topic.

Creating a product development plan was unfamiliar to the researcher at the beginning of the process. For that reason, the researcher spent a lot of time on the theoretical framework. During the process, he did narrow the theoretical framework to be more precise with the thesis topic. The learning of the product development process will support his growth in leading the organization and developing more competitive products in the future.

The literature and interviews regarding emerging technologies helped him understand that integrating new emerging technology into the company's products or business processes is not a simple process and needs careful evaluation. The researcher learned valuable tools, sources, and skills that help follow and analyze emerging technologies. Understanding the importance of innovation culture and its characteristics helps him create a stronger innovation culture and hire individuals with the appropriate skills. The thesis also taught that having a well-functioning product development process demands the right team, leader, stakeholders, and culture to get great results.

The researcher's workload was intermittently too high, which delayed the thesis process. Next time, he would reduce his workload to be able to constantly focus on the research and not have

breaks. The breaks also slowed the process since he had to work back to it after each break. Overall, the researcher achieved his goal to create a product development plan for the organization.

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APPENDIX 1: OBSERVATION PLAN OF PRODUCT DEVELOPMENT

1. Discover
    a. How are market opportunities followed and found?
    b. How are innovative ideas created?
    c. How are ideas evaluated before the next phase?
2. Scope
    a. How are ideas investigated?
    b. What kind of data is collected?
    c. What tools are used?
    d. How is the technical assessment considered?
    e. What kind of metrics are used to move ideas to the next phase?
3. Design
    a. How are the competitive advantages considered in the design of the product?
    b. How is the design of the product evaluated?
    c. What kind of development plan is done during this phase?
    d. How is the development measured before moving to the next phase?
4. Develop
    a. How are prototypes tested and evaluated?
    b. How are operation, sales, and marketing plans developed?
    c. How is the effectiveness of the commercialization plan measured before moving to the next step?
5. Scale-up
    a. What kind of actions are done during the launch?
    b. How is the test phase done before the full-scale launch?
    c. How are the results evaluated before moving to the last phase?
6. Launch
    a. What kind of final actions are done during the launch phase?
    b. How is the launch followed up?
    c. How are the results analyzed?

APPENDIX 2: OBSERVATION PLAN OF INNOVATION CULTURE

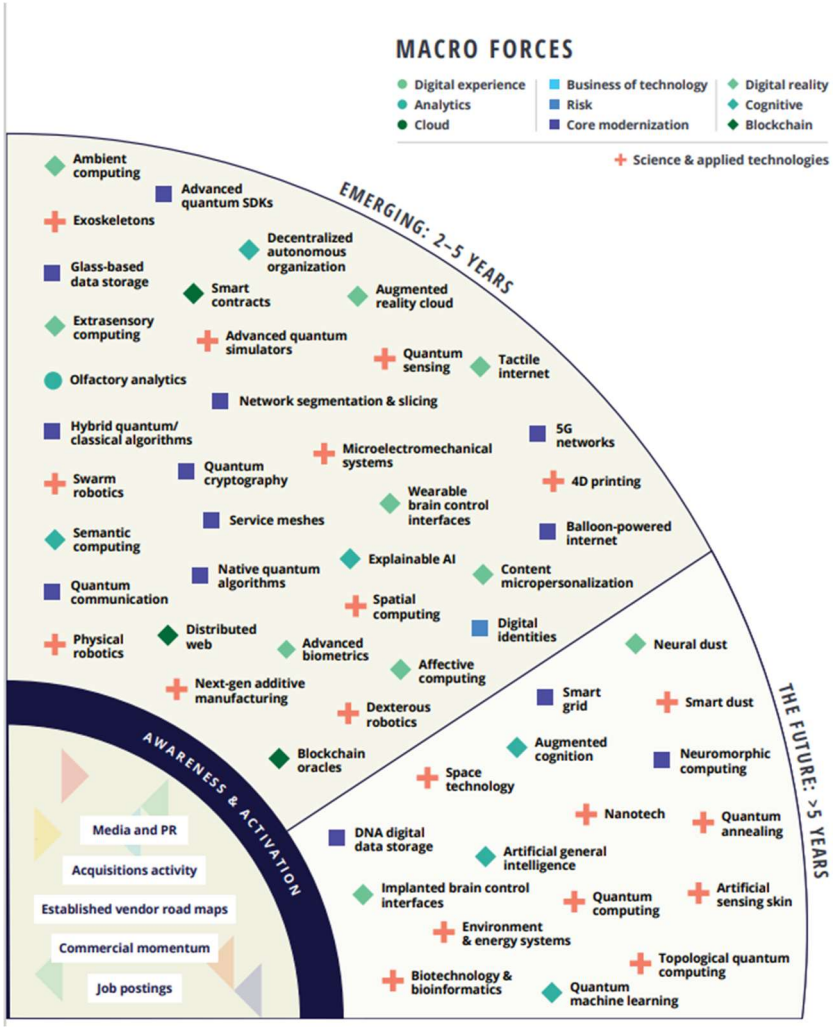
1. Innovation leader
    a. Have created products? Y/N
    b. Level of discovery skills
    c. Belief in changing the world
    d. Level of encouraging employees
    e. Low power distance
    f. High level of tolerance for uncertainty
2. Innovative team
    a. Values and norms
    b. Well-structured team
    c. Different skills
    d. Level of communication
    e. Openness to new ideas
    f. Ability to challenge, trust and help other
3. Innovative individuals
    a. Superior discovery skills
    b. Empowerment
    c. Freedom
    d. Creativity
    e. Commitment to the innovation process
    f. Passion for the company's vision
    g. Level of engagement
4. Organizational context
    a. Flexibility
    b. External focus
    c. Innovation is everyone's business
    d. Disruptive innovation is central
    e. Small and structured team
    f. Intelligent risks are taken
    g. Business processes that support innovators
5. Links outside of the organization
    a. Benevolent view of the external environment
    b. Multiplicity and variety of internal/external contact points
    c. Ease and speed of setting up collaborations

APPENDIX 3: OBSERVATION DIARY, EXAMPLE

Day	Product development stage	Notes regarding development stage	Participants	Topic	Innovation culture theme	Notes regarding culture theme
9.11.2022	Discover	A showcased a list of possible competitors' products that were trending in Amazon or Etsy. He had used Helium10 and Allura to find trending products. Each product where discussed separately. Each participant was allowed to bring their opinions and ideas based on these products. Team was able easily to narrow best ideas for deeper analyzing.	A,B,C,D,E,F	Product ideation	Innovative team - Openess to new ideas	A and B presented a list of potential product ideas which were discussed with all team members. Team discussed how these potential product ideas could be developed to create multifunctional products for FitWood. A, B, C, E were very active to come up with new multifunctional ideas. D and F weren't as active, but they gave their opinions everytime it was asked from them. They also shared a good things to consider with adding new functions to the product ideas.

APPENDIX 4: INTERVIEW QUESTIONS

1. How important are you to see weak signals?
2. Which are more important to you trends or weak signals?
3. How do you follow weak signals/trends?
4. Which of the listed macro forces do you see the most radical innovations in the future?
5. What do you believe will be the most valuable emerging technology in your industry?
6. Are there any other emerging technologies that should be closely followed?
7. Do you have any other comments regarding emerging technologies?



APPENDIX 5. THEME CODING, EXAMPLE

List of notes	Label of the box	Concept
A) You are always late if you follow trends A) By creating weak signals to trend, you make a huge success. It is all about timing. B) It is all about timing since being too early is not good too. D) Being too early may ruin your whole business idea. D) Both are important, but if I would need to choose one I would choose weak signals since they may develop overnight. D) Change is very fast. D) Developing might be too expensive, so do not start too early. D) All the weak signals will happen, it is just a question of time. D) Change is very fast. D) Both are important, but if I would need to choose one I would choose weak signals since they may develop overnight. B) Change is faster than before so that is why you cannot ignore new technologies. B) Change will be complex, just remember to start the use of AI asap.	Being a late, too early, fast change	Timing