Experimentation in new product development

Veera Kallio
Abstract
Experimentation has been gaining ground as a method used by the fastest-growing companies in the world. Similarly, experimentation is a critical concept in new product development. The importance of experimentation as a tool for learning has been recognised in the existing literature, and the current research has been able to map out factors that affect experimentation in a company. While the existing studies show how companies can support adopting a new practice, academic research lacks knowledge on how to support the adoption of experimentation.

The objective of this study is threefold. Firstly, the thesis aims to incentivise why new product development teams should adopt experimentation by assessing the foundational issues rooted in new product development. Secondly, the study seeks to research the factors that affect the adoption of experimentation with the NPD teams. Finally, the thesis focuses on mapping out the effects of experimentation on the NPD teams.

The study was done in collaboration with a global chemicals company, Kemira Oyj, by studying their teams working on new product development. The thesis was conducted as a multi-case study, observing four NPD teams, and the data for the study was collected in the form of participant observations, interviews, and available secondary data. The observations were conducted by working with each team on six different workshops over 11 weeks, and the 13 interviews were conducted at the end of the observation period.

The findings highlight that the foundational challenges impaired participants’ mental capacity, hindering experimentation adoption while identifying open communication and psychological safety as critical factors facilitating this process. The findings showcase that experimentation offered value to NPD teams by addressing these challenges and enhanced team collaboration, communication, and project clarity. The thesis contributes to the literature by improving the understanding of experimentation in new product development, emphasising the mental capacity required for experimentation and its positive effects on collaboration, communication, and project management. It reinforces the significance of communication and facilitation in adopting new practices, identifying perceived value as a critical motivator for sustaining these practices. Finally, the thesis provides practical implications to the teams and management by giving guidelines for tackling the foundational challenges and seeking facilitation around the experimentation process.

Keywords Experimentation, New Product Development, Practice Adoption, Adopting Experimentation
Tiivistelmä


Tämän tutkimuksen tavoite on kolmijakoinen. Ensinnäkin työ pyrkii perustelemaan, miksi uusien tuotteiden kehitystiimien tulisi omaksua kokeilemalla kehittäminen työskentelymallina arvioimalla uusien tuotteiden kehitykseisissä juurutuneita perustavanlaatuisia ongelmia, toiseksi työ pyrkii tutkimaan tekijöitä, jotka vaikuttavat kokeilemalla kehittämisrenkaan jalkautukseen tuotekehitystiimeissä, ja lopuksi tutkimus keskittyy kartoittamaan kokeilemalla kehittämisrenkaan vaikutuksia tuotekehitystiimeihin.


Avainsanat: Kokeilemalla kehittäminen, tuotteiden kehitys, toimintamallien omaksuminen, kokeilemalla kehittämisrenkaan omaksuminen
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1 INTRODUCTION

The topic of the thesis is experimentation in new product development. The thesis focuses on first identifying foundational challenges in new product development, then mapping out factors that affect experimentation, and finally on finding what effects experimentation has on new product development. The study is conducted in the context of new product development projects in a globally functioning chemical company. The projects are running as distributed because the products are developed by people representing different functions and working from different locations. The study is conducted as a qualitative multi-case study. This chapter introduces the background and motivation for the thesis, describes the research objectives, and finally lays out the structure of the study.

1.1 BACKGROUND AND MOTIVATION

Experimentation has been gaining traction due to the constantly increasing need to come up with new products and solutions for customers and develop products in an even shorter time (Trott, 2008). Similarly, experimentation has been the cornerstone of innovation and customer-centricity by providing a systematic approach to new product development (NPD), which aims to transform innovative ideas into tangible products (Thomke & von Hippel, 2002; Trott, 2008). The fastest-growing companies in the world can be seen to promote their experimentation-driven ways of working, and they function as frontrunners in showcasing how it is time to move experimentation out of the laboratory and onto everyone's agenda (Thomke & Euchner, 2020). Despite a general understanding of the potential benefits of experimentation, there needs to be more understanding of the factors affecting the adoption of experimentation within new product development or the effects of experimentation on the NPD process or teams.

Birkinshaw et al. (2008) have identified that the need to adopt a new practice within a company can stem from the demand for new solutions or dissatisfaction with the status quo. While adopting experimentation has not been widely researched, the concept of
practice adoption has been studied. Thus, adopting a new practice in NPD teams provides a context for understanding how to support the adoption of experimentation.

The process of experimentation has been defined as iterative cycles of designing, building, running, and analysing experiments that attempt to provide information regarding the project (Thomke, 2003; Thomke & Reinertsen, 1998). Thomke (2020) argues that while the framework for experimentation is relatively simple, the biggest obstacle to adopting experimentation is rooted in the existing organisational culture. Looking at the existing literature on organisational culture, Schein (1985) and Thomke (2020) agree that the cultural shift toward promoting experimentation requires unambiguous alignment between managerial actions, shared beliefs, and values, as well as encouraging an environment that tolerates failure, values data-driven insights, and encourages continuous learning.

According to Zeitz et al. (1999) and Ansari et al. (2010), the success of adopting a new practice within a company similarly depends on the cultural fit between the existing values, beliefs, and behaviour and the new practice. Similarly, Canato et al. (2013) have identified that in case of a high cultural fit, the adoption process might require less effort, whereas if the cultural fit is low, the adoption process can be more complex and demand more support. Furthermore, Schein (2010) has highlighted that effective practice adoption can be influenced by transparent communication, incentivising change, and providing frameworks and training to ensure the understanding of the new practice.

While the existing literature provides information on experimentation and practice adoption as separate topics, the gap remains in understanding how companies can support the adoption of experimentation. To research this gap, the thesis empirically investigates NPD teams undergoing experimentation. This study focuses on observing four teams that follow a facilitated experimentation process for three months in order to map out the factors that affect the adoption of experimentation.
1.2 RESEARCH OBJECTIVES AND SCOPE

The objective of this study is threefold. Firstly, the thesis aims to incentivise why new product development teams should adopt experimentation by assessing the foundational issues rooted in new product development. Secondly, the study aims to research the factors that affect the adoption of experimentation with the NPD teams. Finally, the thesis focuses on mapping out the effects of experimentation on the NPD teams.

The overall objectives of this study are summarised in the research questions:

1. What are the foundational issues in new product development?
2. What are the factors affecting the adoption of experimentation within new product development teams?
3. What is the effect of experimentation on new product development teams?

The study was conducted at Kemira Oy as a qualitative multi-case study. The thesis focused on new product development teams, and the case study was built around four different teams. The studied data included primarily semi-structured interviews and observations from the experimentation process. The observations were conducted in the context of multiple workshops facilitated by the researcher and run within a research timeline of 11 weeks, starting in early August 2023 and ending at the end of October of the same year. The teams functioned as focus groups, and six workshops were held for each team. The experimentation process in total entailed attending the workshops as well as executing experiments outside the workshops.

While the thesis aims to contribute to the existing literature by addressing the factors that affect the adoption of experimentation, from the point of view of the study, it is also considered essential to map out some practical implications for the NPD teams and the management. The practical implications should be regarded as guidelines to follow when supporting the adoption of experimentation within new product development teams.
The thesis contributes to the existing literature regarding experimentation in new product development by shedding light on the mental capacity needed for experimentation and finding practical positive implications experimentation has for collaboration, communication, and the project setting. Furthermore, the study enforces the existing literature on the value of communication. Similarly, the thesis contributes to the practice adoption literature by adding to the existing literature on practice adoption by shedding light on the value of facilitation in adopting a new practice. Finally, the thesis enforces the existing theory by finding the perceived value as a driver in increasing the willingness to keep the new practice alive.

The thesis provides practical implications to the NPD teams and management by encouraging the teams to focus on embracing experimentation as a practice through structured sessions for planning and analysing experiments. Regarding managerial implications, the emphasis lies in addressing foundational challenges and facilitating the process of experimentation.

1.3 Structure of the thesis

The study begins by presenting the relevant existing literature. The literature is reviewed by examining experimentation as a concept in new product development and practice adoption as a way of changing the organisation's ways of working by embedding a new practice. The third chapter explains the research material and methods used to ensure the collection and analysis of rich data. It sheds light on the case organisation and teams participating in the study. The findings that address the research questions are described in the fourth chapter of the thesis, followed by the discussion section. The discussion section reviews the theoretical contributions and practical implications, and avenues for future research are presented. In the end, the study's conclusions are presented to summarise the thesis.
2 LITERATURE REVIEW

2.1 EXPERIMENTATION IN NEW PRODUCT DEVELOPMENT

According to Trott (2008), new product development (NPD) aims to transform business opportunities into tangible products. When new products aim to offer solutions that have not existed before to problems that clients do not yet recognise, the product development process is left full of uncertainties (Sola et al., 2015). Increasing the learning speed during the development process will help clear the uncertainties and reach the product objectives faster (Lindgren & Münch, 2016). New products have been studied to offer growth opportunities for the company, thus the pace of developing new or improved products plays a role in determining the competitiveness of companies (Ansoff, 1968 and Trott, 2008).

Experimentation is said to be a key concept in the development of new products (Thomke, 2001). Thomke (2001) highlights how intentional and systematic testing of ideas is essential for creating new products and innovations. At its core, experimentation is a tool used for learning (e.g. Allen, 1966; von Hippel & Tyre, 1995; Thomke, 1998; Garvin, 2000). Despite having different methods and frameworks for experimentation, they all have in common the attempt to find a direction where the solutions lie (Thomke, 2003). Thomke (2003) has discussed the objective of learning and experimentation by defining experimentation as an active form of learning. Experiments are planned so that it is possible to manipulate the variables of interest, as opposed to learning by observation or through exploration, both of which can be said to be more passive forms of learning (Thomke, 2003).

When experiments are well-designed, they will generate information on either the objective of the experiment or the process itself (Thomke, 2003). This means that when experimenting during new product development, the experiments can focus on finding information regarding either the development process or the product itself (Thomke, 2001 & 2003). "When well structured and integrated into an organisation, experimentation generates learning that has implications far beyond the "laboratory" (Thomke, 2003, p.89). Similarly, Thomke (2003) argues that the learning rate is
affected by factors related to the process of experimentation and factors related to how this process is managed.

2.1.1 Benefits of Experimentation in New Product Development

The benefits of experimentation in new product development can be approached from different perspectives. The existing literature highlights the two most common benefits of experimentation: managing innovation (Thomke et al., 1998 and Thomke, 2001) and managing uncertainty (De Meyer et al., 2002; Sommer & Loch, 2004).

The process of experimentation has been linked to fostering innovation within companies: "At the heart of every company's ability to innovate lies a process of experimentation that enables the organisation to create and refine its products and services" (Thomke, 2001, p. 67). The concept of innovation is tightly knitted with developing new products and is seen as the base for creating new products for the market (Trott, 2008). Hargadon and Sutton (2000) have introduced the ability to test an idea quickly in an authentic setting as a critical step in supporting innovation in companies. Looking at innovation management and experimentation literature, it can be seen that the same values that have been identified to drive innovation also support experimentation as a way of working and thus, experimentation can be placed as a cornerstone of innovation (e.g. Thomke, 1998; Pisano, 2019; Leavy, 2020; Thomke & Euchner, 2020).

The identified drivers of fostering innovation overlapping with managing experimentation within companies include tolerating uncertainty and failure, as well as creating psychological safety (Thomke, 1998; Pisano, 2019; Leavy, 2020; Thomke & Euchner, 2020). Radical innovation requires accepting the risk of failing (Shalley & Gilson, 2004), while experimentation is often ambiguous, novel, and complex (Tuulenmäki & Välikangas, 2011). Learning to be comfortable in front of the unknown is thus a critical driver for experimentation, and celebrating curiosity helps to teach employees to tolerate uncertainty (Edmondson, 2019).

Companies that invest in developing new products must constantly balance with some level of uncertainty (Sola et al., 2015). According to Castellion and Markham (2013),
up to 40% of new products fail to deliver anything remotely close to the promised initial objectives. This uncertainty results from correctly identifying customer needs and the critical features of the products and finding the most suitable route to market (Castellion & Markham, 2013). Buxton (2000) argues that in new product development, it is more beneficial to be faster than others than to be 100% correct. In essence, the key to mitigating uncertainty in new product development is to develop the correct products quickly and cheaply (Brondoni, 2008). Experimentation provides the needed flexibility for developing new products due to quick iteration cycles (Thomke & Reinertsen, 1998).

Thomke and Reinertsen (1998) discuss how this flexibility lowers the cost of modifying a product in response to internal or external changes and efficiently responding to the customer's future needs. The faster the iteration cycles are, the earlier it is possible to make the needed changes to the product (Thomke, 1998). The cost of changes tends to get higher towards the end of the product development, and thus, intense experimenting leads to lower costs even though holistically turning the company towards a more flexible development path is an investment itself (Thomke & Reinertsen, 1998). To overcome the barrier of costly experimenting, managers must either implement new processes and technologies to fit rapid experimentation or implement methods that allow more information to be produced from each experiment (Sola et al., 2015).

2.1.2 THE EXPERIMENTATION PROCESS

Throughout literature, experimentation is described as a trial-and-error process that creates learning through an iterative cycle of actions (e.g., Thomke, 2003; Davenport, 2009; Ries, 2011; Thomke, 2019). These actions can vary depending on the type of experiment or the context (e.g., Thomke, 2003; Davenport, 2009; Ries, 2011; Thomke, 2019). However, to create opportunities for active learning, an experiment must be intentionally designed (Thomke, 2001).

Experimentation can be cut down to separate, iterative attempts to find a solution or at least a direction towards the solution (von Hippel & Tyre, 1995). Thomke (2003) has identified that, much like within the realm of scientific experimentation, the basis of
any experimentation process is separating an independent variable to observe the changes in the dependent variable. In practice, the execution of the experimentation process can be seen as involving a four-step iterative cycle presented in Figure 1 of designing, building, running, and analysing the experiment (Thomke & Reinertsen, 1998).

![Four-step iterative cycles](image)

**Figure 1. Experimentation as four-step iterative cycles, adapted from Thomke (2003)**

The process of experimentation begins with aligning the objectives (Thomke & Manzi, 2014). The essence of experimentation is to produce knowledge and learn from the experiments; thus, before scoping the experiment, the team needs to understand what they want to learn (Thomke & Manzi, 2014). Besides this, Hassi and Rekonen (2017) have noted that at the beginning of a project, the team should align on operational details and common ways of working to focus entirely on experimenting and learning during the project. "The essence of experimenting is to capture the learning it provides. This alone requires a lot of thinking and reflective discussion (time and effort from the
During the design step of the process, the existing ideas, prior experiments, and all relevant existing data are reviewed, and new ideas are generated through brainstorming (Thomke, 2003). Building and running the experiment will look different depending on the testing situation. The prototypes can be physical or simulations, and the test can be conducted in a laboratory or a natural environment (Thomke, 2003; Sola et al., 2015).

According to Thomke (2003), the most crucial step of the cycle is analysing the experiment since most of the learning usually happens at this point, and here, the bases for the next cycle are formed. One of three things can happen as a result of the learning: 1) the experiment setting can be disqualified, and the experimentation cycle will continue to step 1 with a new experiment 2) The experiment setting will remain the same, but the experiment itself will be iterated, or 3) the experiment is redeemed a success without a need to continue testing further, and the cycle will be closed. (Thomke, 2003)

This four-step cycle can be repeated many times over several iterations, and each step may require separate teams and individuals to work together to run the experiment (Thomke, 2003). The trial-and-error cycles can be seen as a process that repeats the 'generate and test' design alternatives (Simon, 1996). The higher number of iteration cycles during product development typically leads to better development solutions (Thomke & Reinertsen, 1998).

2.1.3 Characteristics of a well-designed experiment

The attributes related to a well-designed experiment include clear objectives, a testable hypothesis, and a feasible testing setting (Thomke, 2001 & 2019). Since learning has been identified as the critical objective of experimentation, a well-designed experiment allows for careful measuring and analysing of findings (Thomke, 2003 & 2019). Less expensive experiments allow for more iterations and, thus, more learning, so the
experiments should also be aimed to be inexpensive and allow for quick feedback (Thomke, 2003).

Thomke (2019) has built on the characteristics of a good business experiment by determining seven questions to be asked to run experiments that yield a high level of learning. 1) Does the experiment have a testable hypothesis? 2) Have stakeholders committed to abide by the results? 3) Is the experiment doable? 4) How can we ensure reliable results? 5) Do we understand cause and effect? 6) Have we gotten the most value out of the experiment? 7) Are experiments driving our decisions? Thomke (2019) highlights that while the answers might seem obvious, it is an important step of the process to properly and fully address them instead of assuming the answers.

Many different modes and strategies exist for experimentation (Thomke et al., 1998). Thomke, von Hippel, and Franke (1998) have studied how different experimentation strategies influence companies' research and development (R&D). In R&D, the problem-solving process typically consists of multiple sequential experiments and a single experiment is not expected to yield the needed results (Thomke et al., 1998). Thus, the strategic decision regarding the experimentation mode affects the learning rate from the experiments (Thomke et al., 1998). Experiments can be run in parallel, where the different alternatives are tested simultaneously, and thus, the analysis happens all at once from all the alternatives (Thomke et al., 1998). On the other hand, the experiments can be serial, where each alternative is analysed separately, and the learning can be used for a new iteration (Thomke et al., 1998). Thomke et al. (1998) discuss that the time, materials, and expenses typically determine which mode will be used.

2.1.4 Factors affecting experimentation

According to Thomke (2003), a culture where experimentation is used as a tool requires understanding which factors affect experimentation as a behaviour. "If testing is so valuable, why don't companies do it more? After examining this question for several years, I can tell you that the central reason is culture" (Thomke, 2020, p.3). Thomke (2020) builds on this by explaining that when businesses try to expand their
experimentation capacity, the most significant obstacles are not tools or technology but rather shared behaviours, beliefs, and values.

Schein (1985, p.17) has defined organisational culture as "A pattern of shared basic assumptions that the group learned as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way you perceive, think, and feel about those problems". A company's culture or shared behaviours, beliefs, and values are in a key position when promoting experimentation as a way of working (Leavy, 2020). Acknowledging the power the company's culture has when promoting experimentation means, we are taking the reins and directing the organisation where we want to go instead of letting the company drift mindlessly or "changing by not changing" (Harbott, 2021, ch. 5). Thomke (2019) has elaborated that the culture of experimentation can be supported through rewarding, cultivating the needed mindset, and giving access to the right tools.

The company management has a crucial role in steering the culture in a new direction and driving the factors that affect experimentation (e.g. Lee et al., 2001; Thomke, 2003; Hassi & Rekonen, 2017; Thomke, 2020). The key factors that can be influenced by managers identified from these multiple studies were values, rewards, and objectives that do not conflict with each other or the actions taken by managers (Lee et al., 2001; Thomke, 2003; Thomke, 2020). "Managers need to pay close attention to ensuring that actions, statements, and rewards are clear, consistent, and unambiguously aligned with expectations" (Thomke, 2003, p. 216-217). Lee et al. (2001) found that mixed signals, such as encouraging experiments while still punishing for failures, resulted in mistrust and confusion and ultimately discouraged individuals from experimenting.

Additionally, Hassi and Rekonen (2017) found that encouraging experimentation starts with the management giving a mandate, explicit permission and authorisation to experiment. In practice, giving the mandate to experiment can also mean putting suitable systems in place, allocating resources, investing in tools that facilitate experimentation and even designing the organisation to fit large-scale experimentation (Thomke, 2020). David Vismans, Booking.com's chief product officer, summarised
the central role of managers by saying that CEOs should ask themselves two questions: "How willing are you to be confronted every day by how wrong you are? And how much autonomy are you willing to give to the people who work for you? And if the answer is that you don't like to be proven wrong and don't want employees to decide the future of your products, it's not going to work. You will never reap the full benefits of experimentation" (Thomke, 2020, p.15).

Expanding the factors away from managers and towards the whole company, a critical factor in building an experimentation culture is the attitude towards uncertainties and failures (Thomke, 2020). "Everyone in the organisation, from the leadership on down, needs to value surprises, despite the difficulty of assigning a dollar figure to them and the impossibility of predicting when and how often they'll occur" (Thomke, 2020, p.4). Valuing surprises includes trusting the learnings that the experiments reap despite unexpected results; thus, data should always trump opinions (Thomke, 2020).

At an individual's level, creating experimentation behaviour requires specific psychological characteristics, particular cognitive abilities, and relevant know-how (Hassi & Rekonen, 2018). Hassi and Rekonen (2018) have identified that the needed psychological characteristics include tolerating failure and uncertainty and being open to learning. The cognitive abilities that enable experimentation behaviour are iteration between conceptual and abstract thinking, mental flexibility and divergence. Expanding the individual's know-how to support experimentation would include identifying uncertainties, designing valuable experiments, and collecting learning (Hassi & Rekonen, 2018). This means that the individuals need to know in practice what to do at each step of the experimentation cycle (Hassi & Rekonen, 2018). Building the relevant know-how can be supported through training and coaching the experimentation process and helping use new tools (Thomke & Euchner, 2020). The different factors and actions of different organisational actors supporting experimentation have been summarised in Table 1.
2.1.5 **AN EXPERIMENTATION ORGANISATION**

Thomke (2019) has introduced the concept of an experimentation organisation as a company where running experiments is a common practice, and the organisation can do large-scale testing. An experimentation organisation avoids the common pitfalls of big organisations, such as organisation silos, slow decision-making, and poor communication (Thomke, 2019). According to Thomke (2019), the experiments in an experimentation organisation spread beyond the laboratory into everything the company does. This includes management, decision-making and governance, but experimentation is also present in the individual's behaviour, shared beliefs, and the company's values (Thomke, 2019).

Thomke (2019) has mapped out five stages presented in Figure 2 to become an experimentation organisation. These five stages are awareness, belief, commitment, diffusion, and embeddedness (Thomke, 2019). The stages begin with the awareness regarding the importance of experimentation, but the company has no process, framework, or tools to conduct rigorous and intentional experiments (Thomke, 2019). In this stage, the company mainly learns passively through past experiences and

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**Table 1. Factors and actions supporting experimentation**

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<th>The organisation level</th>
<th>Factors and actions supporting experimentation</th>
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<td>Company</td>
<td>Company culture: behaviour, beliefs, values</td>
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<td>Management</td>
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<td>• Attitude towards uncertainty and failing</td>
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<td>• Being open to learn</td>
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<td>• Know-how</td>
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observations. In the last stage, the company has been able to democratise experimentation and individuals can run their experiments and use the tools provided by the company (Thomke, 2019).

While Thomke (2019) has been able to map out what it means for an organisation to be experimentation-driven, the question of widespread adoption of experimentation in a company is a topic that has yet to be addressed. Hampel, Perkmann, and Phillips (2020) have discussed the topic of experimentation in established firms by offering different settings for experimentation. One setting would be using one-off events like hackathons, where companies can access new ideas and use experimentation to develop these ideas (Fecher et al., 2020). The other option for a more permanent solution is establishing innovation labs or accelerators to integrate external innovation into corporate R&D (Hampel et al., 2020). Hampel et al. (2020) highlight that while there is work done that supports the use of these kinds of experimentation settings, there are blind spots when it comes to holistically integrating experimentation into the innovation process.

Figure 2. The stages of becoming an experimentation organisation from Thomke (2019)
2.2 PRACTICE ADOPTION

A practice can be said to be the sum of behavioural routines, the tools used, and concepts utilised when facing a specific task (Westphal et al., 1997). The practices within a company form the organisation's "way we usually do things around here", and thus, sometimes it might be difficult to stop and question them (Canato et al., 2013, p.1745). The demand or need for new solutions and practices can emerge when there is dissatisfaction with the status quo (Birkinshaw et al., 2008). This might mean that the organisation faces a new type of problem, where the current ways of working do not seem to function anymore, or then there might be a proactive search for new opportunities to improve how the company works (Birkinshaw et al., 2008).

Adopting a new practice begins with assessing the current situation to find where to focus strategically and align the business plan with the vision (Ulrich & Wiersema, 1989). When adopting a practice, there is a disruption in the standard way of working and exposing the company to novel things (Rosenkopf & McGrath, 2011). This exposure to novelty enhances organisational learning as the general tendency within organisations is to drift toward less novel behaviour and thus keep within the commonly known and recognised ways of working (Rosenkopf & McGrath, 2011). A current web of practices needs to change for a new practice to be implemented, which raises the possibility of a conflict between what individuals are asked to accomplish and how they traditionally manage organisational tasks, as well as how they believe things should be done (Canato et al., 2013).

2.2.1 THE FACTORS AFFECTING PRACTICE ADOPTION

One of the critical factors in successfully adopting a practice is the cultural fit of the new practice compared to the existing ones (Zeitz et al., 1999; Kirkman & Shapiro, 2000; Ansari et al., 2010; Sonenshein & Dholakia, 2012; Canato et al., 2013). Cultural fit determines "the degree to which the characteristics of a diffusing practice are compatible with the cultural values, beliefs, and practices of potential adopters", making it an important, or even the most critical determinant of the outcome of practice adaptation (Ansari et al., 2010, p.78).
In case of a high cultural fit, the adoption might require less effort, whereas if the cultural fit is low, the adoption can be more difficult (Canato et al., 2013). Moreover, in case of a low cultural fit, the practices will likely be modified to better suit the existing and already commonly accepted elements (Ansari et al., 2010). When the cultural fit of a new practice is seemingly low, the members of the organisation will constantly battle between "the way we usually do things around here" and "the way we are asked to do things now" (Canato et al., 2013, p. 1745).

While the organisational culture can be characterised by the established cultural values, beliefs, and behavioural norms of the company (Zeitz et al., 1999), a part of it is also the shared mindset or the organisation's tacit assumptions (Ulrich & Wiersema, 1989). The organisational culture might be complex to change directly, but the shared mindset, on the other hand, can be influenced, for example, through new experiences (Dweck, 1999).

Embedding a new mindset within the company includes exposing and questioning the tacit assumptions of the teams and the organisation (Guidano, 1987). Once we are aware of the unspoken rules and habits, a new mindset can be introduced by specifying the assumptions that should be spread across the company (Ulrich & Wiersema, 1989).

Since the company's objectives can change rapidly to keep up with the market needs, management by mindset instead of management by objectives offers a more sustainable approach (Ulrich & Wiersema, 1989). A mindset that focuses on and supports change creates space for the organisation to succeed under turbulent conditions and makes it easier to adopt new practices swiftly (Harrigan, 1985). Embracing a new practice requires tolerance of risk and uncertainty within the company, and thus, focusing on these attributes might make adopting a new practice easier despite a lower cultural fit (Benner & Tushman, 2003).

2.2.2 THE PROCESS OF ADOPTING A PRACTICE

Focusing on honest communication, incentivising change, and providing rules, frameworks, and training can be said to be the biggest drivers of implementing a new practice (Schein, 2010). Especially in the case of a seemingly low cultural fit, the
members of the organisation will need more help with making sense of the new practice (Sonenshein & Dholakia, 2012).

Incentive systems might work, but research shows that installing formal rules might work even better (Canato et al., 2013). This does not mean forcing new practices, but instead, Canato et al. (2013) argue it might mean forcing people to learn about the practices (Canato et al., 2013). Learning is a critical part of practice adoption since, in the absence of learning, companies and individuals simply repeat old practices (Garvin, 1993). Providing them with sources and time to learn the new practice will allow the feeling side of the brain to gain more information on why we should change how we operate (Sonenshein & Dholakia, 2012). When all the facts are learned, members of the organisation are put in a position where they can select or reject elements of the new practice intelligently rather than defensively pushing them away (Canato et al., 2013). This process of coerced learning exposes the individuals to new behavioural patterns, which in turn could result in an expansion of the company's cultural repertoire (Canato et al., 2013).

The feelings towards the new normal might evolve with time since exposure to the positive effects of the practical implications of the new practices and patterns can gradually help them be accepted (Canato et al., 2013). "If the new practice is experienced as having positive effects on organisational performance, members will tolerate moderate levels of dissonance, resulting in the gradual change of cultural beliefs as the new practice becomes incorporated in "the new way we do things around here." (Canato et al., 2013, p.1745)

Giving the members of the organisation some freedom in choosing how and which parts of the new practice will be implemented can also help with adopting the new practice (Canato et al., 2013). The resistance towards change can be minimised by involving the employees in the design of the new structures and systems (Beer & Nohria, 2000). Figure 3, adapted from Canato et al. (2013), visualises the practice adoption process, considering the existing company culture, coercive learning, and cultural change. The figure represents elements of the new practice to be adopted that are seen as incompatible with the core values of the company and will eventually get dropped or modified, while more surface change, such as the use of resources, can
happen within the cultural repertoire as a result of gaining comfort in front of the new practice (Canato et al., 2013).

Figure 3. Practice implementation, coercive learning, and cultural change (Canato, et al., 2013)
3 RESEARCH MATERIAL AND METHODOLOGY

3.1 CASE ORGANISATION

The case organisation Kemira is a global chemical company that focuses on providing chemistry-based solutions for water-intensive industries in over 100 countries. With over 5,000 employees on six continents, this Finnish company has a vision of creating more sustainable products for the future. As a company, Kemira focuses on its research and development (R&D) to provide chemistry with a purpose. They have 246 R&D experts in 3 centres: Espoo, Shanghai, and Atlanta. Of these three, the Espoo R&D centre is by far the biggest, with around 150 employees (Kemira, 2023). Kemira’s business is divided into two customer-focused segments: Pulp & Paper, which focuses on chemical applications and supporting paper and pulp producers, and Industry & Water, which supports municipalities and industries with efficient water use and sustainable resource management (Kemira, 2021).

Kemira regards itself as an innovative company with over 400 patent families and 2000 patents. Their research and development are driven by today’s most pressing issues: battling climate change, enabling circularity and the need for clean water (Kemira, 2023). The two segments lead the research and development at Kemira, whereas the Global Processes and Project (GPP) team governs the new product development process (NPD).

3.1.1 NEW PRODUCT DEVELOPMENT AT KEMIRA

The new product development at Kemira follows a traditional stage-gate process where a decision gate separates each stage, and the decisions on whether or not to move on to the next stage are made by different decision-making teams consisting of people from Kemira’s top management. While the NPD projects all follow the stage-gate process, some projects only go, for example, through the first and the last gate. A simplified overview of Kemira’s New Product Development process is presented in Figure 5. The process is divided into five gates that separate the corresponding stages.
Figure 4. High-level overview of the stage-gate process at Kemira

Discussing with the members of the GPP Team, they described that the length of the stages may vary depending on the project, and typically, the majority of the research experts are staffed in an NPD project, conducting multiple projects at a time. The project teams consist of a large team with assigned people representing various departments or teams, and an individual project team member’s involvement depends on many factors. A separate project steering team oversees the development of the project and makes the decisions on Gates 3 to 5, whereas the decisions regarding Gates 1 and 2 are made by a separate management board. All in all, product development forms a type of network around each project that includes people from different teams, but also customers and possible collaboration partners.

At each gate, the project team presents their results to the steering team, which then decides on the continuation of the project. However, the management team always has the power to veto the decision made by the steering team, and in some cases, the project manager is required to do further research after presenting the results the first time before gaining approval to continue to the next stage of the project. The decision-making process during the NPD process, as described in the instructions to the project management, is visualised below in Figure 6.
During discussions with the project teams and the GPP team members, it was clear that the company is focused on learning new ways to improve their new product development and to ensure they can provide novel and highly demanded solutions promptly to their customers. However, from the discussions in the workshops, the NPD teams have highlighted that this ambition for learning has yet to spread into action entirely, and the link between experimentation and growth has yet to be identified. Looking at Thomke’s (2019) stages of becoming an experimentation organisation in Figure 2, Kemira could be said to be entering the first stage of Awareness.
As a global company, Kemira’s new product development is typically a culmination of distributed development. The NPD process utilises the expertise of many different functions and teams. Depending on the stage of the project, the contribution of different functions, teams and roles are different. The first three stages heavily rely on efforts from the R&D experts, while the scale-up and commercialisation shift further to the business segments.

3.2 CASE TEAMS

The research follows four project teams to answer the research question of how to support the adoption of experimentation in distributed project settings. The teams and their projects are described in the upcoming sections in a way that allows the reader to gain an understanding of the nature of the projects without being able to identify the projects or the individual people working in the teams.

The teams were selected to participate in the study since they reflect well on the type of projects the company runs while developing new products. Both segments, Industry & Water and Pulp & Paper, were represented through the selected teams. While all of the projects were in the development stage, the timelines differed from team to team, meaning that some teams had just entered the development stage while others had worked on the development for over a year. In practice, this was reflected in the day-to-day tasks of the project team members as well as the team’s short-term objectives. The development stage of the projects in practice takes place in the R&D centres, and thus, the research personnel mostly do the day-to-day work in this stage. Due to this, the informants were mostly limited to research personnel. All team members participating in the study are described in Table 1 after the teams’ descriptions.

3.2.1 TEAM 1

Team 1 consists of nine people from the R&D, whereas the entire project team includes eight other people covering team members from Business, Project Management, Marketing & Applications, Sales, Intellectual Property management (IP), Product Safety and Regulatory Affairs (PSRA), and Engineering & Technology. The steering team for the project consists of three additional people, thus creating a group of 20
people working on the project. Different people are involved in different stages of the project, and the time resources of each person vary heavily. Six of the 20 people working on the project participated in the experimentation process, as visualised in Table 1.

Currently, the project is in the product development stage of the NPD process. The development stage is the 3rd stage in the process, and the goal is to find preliminary results that can be further developed in the scale-up stage. To get to the 4th stage, the project has to be approved in the next gate, which had been set for the autumn of 2023, around the same time the final workshops in the experimentation process took place. In this stage of the project, the work is mainly done in the laboratory, making the R&D personnel the most involved team members. The research and development team includes researchers and laboratory technicians, who all work on multiple projects simultaneously. The project manager, who also works as a researcher in the project, has the most significant time allocation for the project out of all the team members.

3.2.2 TEAM 2

Team 2 is also working on a project that has been running since the early-2022 and is currently in the development stage of the NPD process. The next gate for this project was scheduled to be in the autumn of 2023, similar to Team 1. Being in the development stage, the team currently spends most of the time in the laboratory, and thus, the R&D personnel are the most involved team members and spend the most time with the project. The time allocation of the R&D researchers and technicians varies again a lot. The time spent on this project varies between 5% allocation to 70%.

The team for this project consists of 6 people from the R&D side as well as five other project team members representing business development, product management, intellectual property (IP), and product regulation (PSRA). The steering team has an additional three members, making this a project of 14 people in total. Out of these 14 people, four attended the experimentation workshops.
3.2.3 **Team 3**

Team 3 is involved in 2 projects and one customer case simultaneously. Both projects have similar objectives; thus, the day-to-day project management overlaps on certain parts between the two projects and one customer trial. The first project started running in 2023 and has been in the development stage of the NPD process since the early spring of 2023. The next gate for this project is scheduled for the end of 2024. The second project kicked off during the autumn of 2023; thus, during the workshops, the work for the second project was only starting.

The project team consists of two different project managers, each leading one of the projects. From the R&D, they have seven team members besides the two project managers. The steering teams for the two projects overlap partly, but the projects have their business owners. Additionally, the project team has representatives from supporting functions such as business development, sales, IP and PSRA. The whole project team is 16 people in total. Out of these 16 team members, seven people attended the experimentation workshops all from the R&D.

3.2.4 **Team 4**

Team 4 is working on a project that started at the beginning of 2023 as an NPD project and passed the first gate during the summer of 2023. Similarly, as to the other NPD projects taking part in the thesis, the project is in the development stage of the NPD process. The next gate for this project is scheduled for the summer of 2024.

The project team is divided between two R&D centres. The research team consists of the Project Manager, four researchers and two technicians between the two locations. Additionally, the project team has people from other functions such as business development, Marketing & Applications, sales, IP, PSRA, Supply chains and Manufacturing making the whole project team 15 people. The business owner leads the steering team, with two more people in charge of steering the project. Seven people attended the workshops on the experimentation process regularly more than once, despite nine people being invited to join the process. Table 2 summarises the people attending the experimentation process from each team as well as the objective of the project.
Table 2. The teams’ compositions

<table>
<thead>
<tr>
<th>Team 1</th>
<th>Team 2</th>
<th>Team 3</th>
<th>Team 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Project Manager, Research Scientist, R&amp;D and Technology</td>
<td>• Project Manager, Sr Research Scientist, R&amp;D and Technology</td>
<td>• Project Manager / Small Project, Sr Research Scientist, R&amp;D and Technology</td>
<td>• Project Manager, Sr Research Scientist, R&amp;D and Technology</td>
</tr>
<tr>
<td>• Sr Research Scientist, R&amp;D and Technology</td>
<td>• Research Scientist, R&amp;D and Technology</td>
<td>• Project Manager / NPD project, Manager, R&amp;D and Technology</td>
<td>• Research Scientist, R&amp;D and Technology</td>
</tr>
<tr>
<td>• Principal Scientist, R&amp;D and Technology</td>
<td>• Technician, R&amp;D and Technology</td>
<td>• Sr Research Scientist, R&amp;D and Technology</td>
<td>• Principal Scientist, R&amp;D and Technology</td>
</tr>
<tr>
<td>• Technician, R&amp;D and Technology</td>
<td>• Application</td>
<td>• Research Scientist, R&amp;D and Technology</td>
<td>• Sr Research Scientist, R&amp;D and Technology</td>
</tr>
<tr>
<td>• Business Owner, Application Development Manager</td>
<td>• Development Manager</td>
<td>• Research Scientist, R&amp;D and Technology</td>
<td>• Technician, R&amp;D and Technology</td>
</tr>
<tr>
<td>• Automation Engineer, R&amp;D and Technology</td>
<td></td>
<td>• Research Scientist, R&amp;D and Technology</td>
<td>• Business Owner, Sr Product Line Manager</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Technician, R&amp;D and Technology</td>
<td>• Principal Application Specialist, Application</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Technician, R&amp;D and Technology</td>
<td>• Chemistry Manager, R&amp;D and Technology</td>
</tr>
</tbody>
</table>

3.3 RESEARCH METHODOLOGY

3.3.1 CASE STUDY AS THE RESEARCH APPROACH

The study focuses on analysing a concrete case in its temporal and local particularity, meaning the research is qualitative (Flick, 2002). Qualitative research aims to explore and understand different phenomena through an individual’s behaviour, activities, and local context (Flick, 2002). Since qualitative research studies do not try to find generalisable theories, the focus instead is on finding how extant theory operates examples (Eisenhardt & Graebner, 2007). Analysing qualitative data allows interpreting data to elicit meaning, gain understanding and develop empirical knowledge (Corbin & Strauss, 2008). The methodology or the way to think and study phenomena through the lens of qualitative research requires the researcher to be curious, creative, and data-driven (Corbin & Strauss, 2008). Qualitative data can provide a good understanding of the “why” something is happening (Eisenhardt, 1989). In-depth case studies focus on providing information regarding a phenomenon
and its context, and thus, they are an essential tool for qualitative research (Dubois & Gadde, 2002).

Case studies are empirical studies that aim for a detailed description of particular instances of a phenomenon that are typically based on a variety of data sources, and it is used to shed light on the boundaries of a real-life situation and a theoretical phenomenon (Yin, 1994). The research questions focusing on “how” and “why” provide an environment where the study will focus on situational behaviour instead of requiring a controlled set of events (Yin, 1994). Case studies can have different designs related to the number of cases and their relation to each other; however, each case can always be regarded as an individual experiment that stands independently as an analytical unit (Yin, 1994). This research studies four units of analysis formed by the four teams attending the experimentation process workshops; thus, the study is viewed as a multi-case study.

The number of cases taken into account in a study can vary depending on the nature of the study (Langley & Abdallah, 2011). According to Yin (1994), the single-case study is preferred when the theory can be predetermined or if the case forms a very extreme or unique incidence. However, Yin (1994) argues that multiple cases should be preferred if the researcher has the resources and time. Herriot and Firestone (1983) have argued that the data from multiple cases would be regarded as more compelling, and thus, multiple case studies increase the study’s trustworthiness.

Yin (1994) has discussed that the cases should be selected based on either providing similar results and thus reinforcing each other or then providing contradicting results but for reasons that can be anticipated. Eisenhardt’s (1989) logic for case selection is to choose multiple cases that are sharply distinct on one key attribute while similar in others to compare the cases and identify the elements that play a role in high and low-performing cases. However, Eisenhardt’s method first and foremost to theory building, which is not the objective of this thesis (Eisenhardt, 2021). Thus, when selecting the cases for the thesis, the aim was to follow Yin’s work (1984) on the literal replication logic of the cases. The literal replication was made more accessible as the teams were all in the same stage of the development process. Thus, the selected cases could have been predicted to yield similar findings across cases under similar conditions.
3.3.2  Grounded Theory

Grounded theory is a methodology of a systematic approach to collecting and analysing data used for qualitative research (Goulding, 2002). Grounded theory can be viewed as theory-building or, in some cases, as theory-elaborating research, depending on how the existing theory is used in the study (Bechky, 2003). Grounded theory supports the context of case studies as a qualitative research strategy since the objective is to find out how a theory is formed from the ground in the behaviour of the studied individuals (Goulding, 2002). The thesis does not rigorously follow grounded theory as a research methodology, nor does it aim for theory building. Still, the thesis implements some of the critical concepts of grounded theory regarding data collection and analysis.

Grounded theory has many forms that sometimes contradict or dispute each other (Timonen et al., 2018). While all grounded theory research should lead towards theory building, the practicalities of the research setting can affect whether or not it is possible to produce a theory (Timonen et al., 2018). Still, grounded theory’s core is letting the theories emerge from the data inductively rather than focusing on existing frameworks and theories (Timmermans & Tavory, 2012). Thus, the grounded theory process begins by gathering rich data using qualitative research sources such as interviews and observations (Charmaz, 2006).

As a research methodology, grounded theory differs from other qualitative methods through the iterative process of theoretical sampling. Charmaz (2009) has said that grounded theory begins with inductive data analyses but moves beyond induction to create an imaginative interpretation of studied life. From empirical observations to defining theoretical concepts, grounded theory produces substantive theory where the developed concepts have a high level of abstraction and a low level of generalisation (Locke, 2001).

To create a theory that evolves during the research process and is a product of continuous interplay between analysis and data collection, the research should use constant comparison, theoretical sampling and evaluation of the composed theory as research practices (Locke, 2001).
Due to time constraints and how the thesis was scheduled, the literature review was started before the data collection. However, the literature review continued alongside the data collection, and the review was revisited after the initial findings had been formed to support grounded theory practices and let the emerging data guide the study instead of the existing theory.

While in the early days of grounded theory, it was common to neglect the existing theory entirely before the empirical research, it has now been recognised that it is, in general, more and more difficult to completely disregard prior theories and experiences of the researchers’ (Timonen et al., 2018). Instead, according to Timonen et al. (2018), the focus of grounded theory in this study is on remaining open to the portrayals of the world as encountered and not forcing data into theoretical accounts.

This openness can be ensured by coding the gathered data without pre-existing labels in the form of open coding (Charmaz, 2006). The data will be further processed in memos, allowing the researcher to go back to the data in a constructive manner at any time (Charmaz, 2006). The research then follows the data that has been previously discovered, allowing for a flexible flow of the research where the focus is dictated by the data itself rather than existing theories (Charmaz, 2006). The details of how the data collection has been designed to be done in tandem with the analysis will be discussed in the upcoming chapter.

3.4 DATA COLLECTION

Data collection was done using qualitative research methods of semi-structured interviews, participant observations, and internal documentation for secondary data. The participant observations during the experimentation process and the semi-structured interviews were the basis for the primary data used to create the findings. The secondary data was used to learn the official procedures and processes related to the NPD process and the company and its strategy to ensure a complete understanding of different events related to the findings.

At the core of the data collection was the idea of gathering rich data that is suitable and sufficiently related to the empirical events (Charmaz, 2006). The data collection
was designed to be flexible in overlapping it with the analysis part, iterating the original design when needed, and adding data sources or seeking additional data when necessary.

The data collection process was designed to cater to rich and sufficient data gathering by working closely with the teams throughout the 6-month study. The overview of the flow and schedule of the data collection actions is presented in Figure 7. The data collection was divided into initial introductory interviews, workshops, and final interviews. Both interview sets were conducted in a semi-structured manner. However, the first interviews focused on getting information about the projects and the participants’ backgrounds. In contrast, the interviews post workshops reflected questions regarding the process and the factors affecting the adoption of experimentation. The data from the workshops was collected in the form of participant observations by observing the participants and their interactions as well as actively facilitating the workshops.

![Figure 6. Overview of the data collection process](image)

### 3.4.1 Participant Observations

The participant observations were performed in the form of workshops. The four teams each had six workshops over 11 weeks. The frequency of the workshops was fitted to suit the team’s schedules; thus, each team had a workshop every 1 to 3 weeks. Every workshop was held remotely using Microsoft Teams as the conferencing tool and Miro.
as a co-working tool. The data was collected from the workshops by recording and transcribing the sessions with participants’ permission. In total, the 24 workshops produced 37 hours and 40 minutes of data, which correlated to 1487 pages of transcribed text. The data from the workshops was summarised immediately after each workshop by writing memos and highlighting the possibly interesting or important parts of the transcripts.

The objective of the participant observations was to gain an understanding of the holistic setting around the experimentation process and to make descriptive observations. According to Spradley (1980), descriptive observation is a form of broad data collection where the observer attempts to document a wide array of situations, people, interactions, and artefacts without imposing preconceived categories or theories on what is observed. Thus, descriptive observation is characterised as open-ended by nature, aiming to capture the richness and complexity of a research setting as fully as possible (Spradley, 1980).

The degree of involvement in the activities observed was high due to the role of a facilitator. In participant observation, the observations are conducted in an active setting, and the observer can interact with the other participants and interfere with the activities of the research setting (Spradley, 1980). In general, participant observations require intensive longitudinal participation that allows the researcher to immerse themselves in the participants setting (Spradley, 1980). The longitudinal study setting was ensured by each team attending six workshops, thus offering repeated observation opportunities. Additionally, the workshops followed a similar structure to ensure a replicable research setting every time. This pre-planned structure is presented in Figure 8.
The structure of the workshops allowed the teams to focus on themes and topics that were important for the team presented. This also ensured a setting for rich data collection since the flexible nature of the workshops meant the direction of each workshop reflected the teams’ needs at a given time and allowed the observations to naturally rise from the conversation instead of forcing the workshops to a rigorous agenda. The key events of each team’s workshops are presented below in Table 3, while the teams’ experiments are summarised in Table 4. The canvases used in the workshops for facilitating discussion and designing, planning and analysing the experiments can be found in the Appendices.
Table 3. The teams’ milestones in the workshops

<table>
<thead>
<tr>
<th>WS no</th>
<th>Team 1</th>
<th>Team 2</th>
<th>Team 3</th>
<th>Team 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Introducing experimentation as a way of working and summarising expectations for the experimentation process</td>
<td>Introducing experimentation as a way of working and summarising expectations for the experimentation process</td>
<td>Introducing experimentation as a way of working and summarising expectations for the experimentation process</td>
<td>Introducing experimentation as a way of working and summarising expectations for the experimentation process</td>
</tr>
<tr>
<td>II</td>
<td>Aligning the objectives of the team for the workshops &amp; and going through a round of ideation on the way to reaching the objective.</td>
<td>Aligning the objectives of the team for the workshops &amp; and going through a round of ideation on the way to reaching the objective.</td>
<td>Aligning the objectives of the team for the workshops &amp; and going through a round of ideation on the way to reaching the objective.</td>
<td>Aligning the objectives of the team for the workshops &amp; and going through a round of ideation on the way to reaching the objective.</td>
</tr>
<tr>
<td>III</td>
<td>The team was still executing the previous experiment, the time was used to check-in on the progress and possible blockers.</td>
<td>The team was still executing the previous experiment, the time was used to check-in on the progress and possible blockers.</td>
<td>The team wanted to change the objective as they felt that the customer trial was progressing on its own.</td>
<td>The team wanted to change the objective to fit better their current needs.</td>
</tr>
<tr>
<td>IV</td>
<td>Analysing the previous experiment as a success and planning an iteration to follow as well as one new experiment</td>
<td>Multiple team members had to cancel their participation last-minute, and thus the workshop time was used to catch up on the project and the experiment with the PIM.</td>
<td>The team had not conducted the experiment and felt like the objective should be changed to reflect the project’s progress.</td>
<td>Analysing the previous experiment as a success and planning a new experiment to be conducted in the lab.</td>
</tr>
<tr>
<td>V</td>
<td>Analysing the previous experiments, due to the malfunction of the data software the response time experiment was blocked and the data session had to be done with incomplete data. Planned two experiments by again continuing to iterate the data session and conducting a new lab experiment</td>
<td>Analysed the experiment. The team saw that the execution began successfully, but towards the end the experiment got buried under more urgent work. Planned an iteration of the experiment and implementing the learnings.</td>
<td>The experiment owner was not present in the workshop so the team was not sure if the experiment was conducted. The team identified existing blockers in the execution of the experiment and went through possible solutions for the blockers.</td>
<td>Analysing the previous experiment as a success and planning a new experiment to focus on better managing the team’s tasks and assignments.</td>
</tr>
<tr>
<td>VI</td>
<td>Analysing the experiments. They were executed but again the data software was not working properly which created a blocker to get the best possible results. Reflected the workshops as a process and mapped out some goals for the teams for the future.</td>
<td>Analysing the experiment, they decided to keep using the task prioritisation board in the future. Reflected the workshops as a process and mapped out some goals for the teams for the future.</td>
<td>Reflected the workshops as a process and mapped out some goals for the teams for the future.</td>
<td>Analysing the experiment, they intend to continue the use of the kanban board, since they felt 2 weeks is too short a time to see a change in people’s habits. Reflected the workshops as a process and mapped out some goals for the teams for the future.</td>
</tr>
</tbody>
</table>
Table 4. Teams’ objectives for the process and experiment

<table>
<thead>
<tr>
<th>Team</th>
<th>Team’s objective for the experimentation process</th>
<th>The workshop number</th>
<th>Planned Experiments</th>
<th>The experiment was executed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Collect, and analyse data from the trials efficiently</td>
<td>II</td>
<td>A common working session to go through and analyse the data</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IV</td>
<td>Iteration of a common data session</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IV</td>
<td>New dose response trial</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>V</td>
<td>2nd Iteration of a common data session response trial</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>V</td>
<td>Laboratory test</td>
<td>Yes</td>
</tr>
<tr>
<td>2</td>
<td>Gather the materials needed for the next gate efficiently</td>
<td>II</td>
<td>A task prioritisation board</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>V</td>
<td>Iteration of the task prioritisation board</td>
<td>Yes</td>
</tr>
<tr>
<td>3</td>
<td>Executing the trial with the customer as agreed / Clarifying responsibilities in the project / Find barriers to packaging materials</td>
<td>III</td>
<td>Common working procedures</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IV</td>
<td>Laboratory test</td>
<td>No</td>
</tr>
<tr>
<td>4</td>
<td>Finding the best performance test methods / Increase the performance of a chemical</td>
<td>III</td>
<td>A test recipe</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IV</td>
<td>Laboratory test</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>V</td>
<td>Experiment: Kanban board</td>
<td>Yes</td>
</tr>
</tbody>
</table>

3.4.2 SEMI-STRUCTURED INTERVIEWS

The interviewing method was chosen to be semi-structured, as the objective of the interviews was to gather rich qualitative data (Corbin & Strauss, 2008). Since the experiences at hand were highly subjective and the intention was not to create a generalisable theory, the semi-structured interviews were constructed to follow the structure of intensive interviewing. In intensive interviews, the questions are created
to allow reflection and deep description (Charmaz, 2006). The key to the semi-structured nature comes from open-ended questions that function as a guide to the conversation and allow for focusing on specific parts or stories that are not predetermined (Charmaz, 2006). The objective was to be able to keep the interview format flexible, as is typical for semi-structured interviews (Kothari, 2014). The flexible nature of the interviews was used to focus on each individual’s experiences and build on the observations from the workshops.

All in all, 13 semi-structured interviews were conducted after each team had finished the workshops. The team members from each project could nominate themselves to be interviewed, and the final interviewees were selected by making sure the interviewees had attended the majority of the workshops. Table 5 presents the roles, teams, and career lengths at each interviewee’s company.

Similar to the workshops, the interviews were held remotely using Microsoft Teams. The interviews were recorded and transcribed within Microsoft Teams with each interviewee’s permission. The interviewees could choose the interviewing language to be either Finnish or English, regardless of their mother tongue. If the interview was conducted in Finnish, the quotes have been translated into English during the data analysis. The questions used as a basis for the interviews can be found in Appendices A and B in English and Finnish. The interviews lasted, on average, 58 minutes, resulting in 461 pages of transcribed data.
3.4.3 *Additional Secondary Data*

While the participant observations and semi-structured interviews were the key data collection activities, secondary data was collected outside these events. The secondary data was used to form an understanding of the company’s current situation by meeting with individuals who were not a part of the project teams but who might have a scaled view of the company and strategy. Additionally, some extra meetings and messaging
with the teams were used to backtrack the informants to ask questions arising from the data after the interviews.

The third type of additional data was access to the company’s internal systems to overview some of the official documents of the projects and access the company’s strategy and news channels. All secondary data was used to gain a deeper understanding of the primary data when needed or to seek clarification of the official processes. Thus, the singular events when this data was collected were not tracked.

3.5 Data Analysis

Due to the nature of the study, the data analysis was conducted by following the Gioia method (Gioia et al., 2013). The Gioia method is a systematic approach to conducting qualitative research (Gioia et al., 2013). The Gioia method aims to analyse the data in three steps: generating 1st-order codes, 2nd-order themes, and finally, aggregate dimensions (Gioia et al., 2013). The 1st-order codes were formed via open coding each interview on ATLAS.ti software. The generation of the 1st-order codes should be done by staying as close to the data as possible and approaching the coding without any predetermined structure. As Charmaz (2006) suggest, open coding was done by naming the codes with active forms of verbs to support the grounded theory’s focus on actions and processes. This also allowed the 1st-order codes to stay descriptive and narrative instead of interpreting them yet in this stage.

3.5.1 1st Step of the Analysis

The 1st step of the analysis process was to initially code the interviews and part of the workshop data. The coding of the interviews started with initial coding, which was done twice due to the first round producing 356 codes, which ended up being too large a number to proceed to combine the data into 2nd order themes. The second round of initial coding produced 181 codes, further narrowed down by combining and removing codes. Some codes ended up getting combined due to them describing similar actions or processes, while codes representing only a small extraction of the data were removed. Some examples of the initial coding and the combining process have been
collected in Table 6. The combining and clean-up of the initial codes led to 51 focused codes.

Table 6. Example of forming the 1st-order codes from combining the initial codes

<table>
<thead>
<tr>
<th>Raw Data</th>
<th>Initial Codes</th>
<th>Combined Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>We know very little about what they are doing there [on the business side]. I think it would actually help us to know more about the project.</td>
<td>The project team not knowing what happens in the business side</td>
<td>Low understanding between R&amp;D and business segments</td>
</tr>
<tr>
<td>Things should be done very quickly, but they don’t have the understanding that some things are not possible to do faster… They don’t understand that we are working as fast as we can. We are not just twiddling our thumbs</td>
<td>Low understanding between R&amp;D and the segments</td>
<td></td>
</tr>
</tbody>
</table>

3.5.2 2ND STEP OF THE ANALYSIS

After reaching a manageable number of focused codes, the 1st-order codes were structured based on differences and similarities among them to form 2nd-order themes. This process is similar to the process of axial coding (Strauss & Corbin, 1998), and the objective was to be able to leap into the theoretical realm of the data to assess what the codes might be telling us are the key themes (Gioia et al., 2013). The 2nd-order analysis was moved to Miro software to easily group different codes and provide a visual aid to the process.

The 2nd-order analysis started by grouping the 1st-order codes according to the action they represented or the effect the action had. The first round of grouping led to 15 groups, each holding a highly varying number of codes. The groups included, for example, Experiment Ideation, the NPD Process, The Value of Experimentation, Mental Capacity, Communication, etc. Out of these initial groups, the data groups were further combined in a few rounds of iteration to ensure the formulation of cohesive themes.
The 2nd-order themes were formed from the groups by continuously moving back and forth between the raw data and representative quotations, the 1st-order codes, and the research questions to be answered through the data. In the end, a total of eleven themes were identified, while the final 2nd-order analysis held 29 1st-order codes within the eleven themes. The number of the 1st-order codes had lowered from the total number of focused codes since the 2nd-order analysis left out some codes that did not fit the themes. Similarly, some of the focused codes were further combined to ensure they did not overlap.

3.5.3 3rd Step of the Analysis

The 3rd step of the analysis was to find the aggregate dimensions based on the 2nd-order themes. The eleven 2nd-order themes were divided according to their scope and relation to the research questions. The three aggregate dimensions identified were foundational challenges in new product development, factors affecting the adoption of experimentation, and the effect of experimentation on new product development. The formulated data structure is visualised in Figure 9.
- Low understanding between R&D and business segments
- Isolated work during product development
- The R&D facing unrealistic expectations regarding product development

The effects of the distributed project setting

- Impact of rigorous NPD structure on product development
- Low autonomy regarding the project teams' decision-making
- Impact of high hierarchy on communication and innovation

The effects of structural constraints and organisational culture

- The strain of working on multiple projects simultaneously
- Lack of time for learning hindering innovation

The effects of time constraint on focus and innovation

- Unclear responsibilities impeding efficiency
- Absence of clear short-term objectives within the projects

The effects of ambiguous responsibilities and objectives

- Low decision-making autonomy causing stress and frustration
- Lack of time impacting cognitive focus and creativity
- Impact of misalignment between team perceptions and management expectations

The effect of the foundational challenges to the mental capacity

- Impact of open communication and psychological safety on experimentation quality
- Team's dynamic affecting psychological safety

Open communication and psychological safety within the team

- Returning to old habits after the facilitated process
- Benefits of external facilitation
- Facilitation supporting understanding experimentation

Facilitating the experimentation process

- Experiencing the value of experimentation
- Demonstrating the value of experimentation

Value perception in adopting experimentation

Factors affecting the adoption of experimentation

- Foundational challenges in new product development

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3.6 VALIDITY AND RELIABILITY OF THE STUDY

Assessing a qualitative study’s reliability or validity is difficult (Robson, 2002). However, assessing the common threats to validity in qualitative research helps to increase the overall trustworthiness of the study (Robson, 2002). Maxwell (1996) has identified three threats to a study’s validity: description, interpretation, and theory.

Description refers to the inaccuracy or incompleteness of the data, which can be reduced by recording or transcribing the data (Maxwell, 1996). According to Maxwell (1996), the main threat to accurate interpretation lies in using an existing framework in the analysis rather than letting the findings emerge from the data on their own. A valid interpretation can be justified by charting and justifying the steps that lead to the interpretation of the data (Mason, 1996). Within theory, the main threat is not considering multiple or alternative explanations of the data, which can be tackled by not disregarding data that is inconsistent with the findings (Maxwell, 1996).
Different types of biases pose a threat to validity in highly qualitative research, where there might be a close relationship between the researcher and the informants (Robson, 2002). Robson (2002) discusses the potential biases, including the researcher reflecting on their previous knowledge of the topic and the informants and the researcher having interactions where one's action might influence the research setting.

Lincoln and Guba (1985) have suggested five actions to be taken to ensure validity and increase the credibility of the study: 1) actions that increase the probability of credible findings, 2) actions that provide an external check on the inquiry process, 3) actions that allow the hypothesis to be refined as more information is found 4) actions that ensure the checking of preliminary findings against the raw data 5) actions that allow to check the findings with the informants themselves. The actions taken to address these activities by Lincoln and Guba (1985) have been collected in Table 7.

<table>
<thead>
<tr>
<th>5 Activities to ensure validity (Lincoln &amp; Guba, 1985)</th>
<th>The actions taken during the course of the study</th>
</tr>
</thead>
</table>
| Increase the probability of credible findings         | • Having previous exposure to the company and working with them before allowing the study to begin by already being familiar with the culture and some processes and practices  
• Spending over 50 hours in total with the teams over 13 weeks, thus investing in learning about the teams and building trust  
• Using multiple methods to collect data allowed for different kinds of data to emerge and to test for misinformation |
| Provide an external check on the inquiry process       | • Using the thesis advisor fellow students for peer debriefing  
• Using the company’s representatives outside the project teams for debriefing |
| Refine the hypothesis                                  | • Revising the hypothesis with hindsight using negative case analysis  
• Allowing the data to take its course without forcing a hypothesis |
| Check the preliminary findings against the raw data   | • The preliminary findings were constantly being formulated during the 13-week period of data collection, which allowed to constantly check the findings against new data  
• Multiple memos were written throughout the process to highlight data that might be of interest later or that could be used to support the findings  
• Preserving the recordings meant that once all data was collected, there was a chance to go back to the raw data at any time |
| Check the findings with the informants                | • Member checking was done during the data collection by asking refining questions and ensuring understanding  
• Each participant was allowed to read the findings and check the accuracy of their data |
The reliability and validity of the study lie heavily in following grounded theory methods for gathering and analysing data. According to grounded theory, the quality and credibility of the study can be traced back to the depth and scope of the data (Charmaz, 2006). In order to reach a certain depth of data, the interviews were built in a semi-structured form. The description accuracy was managed by recording and transcribing the interviews, workshops, and other supporting meetings, and these transcriptions and recordings were retained for the duration of the whole study, enabling going back and forth between the raw data and the observations and findings.

Similarly, constructing grounded theory means analysing the data without a predetermined framework but instead letting the framework emerge from the data (Charmaz, 2006). The threats Maxwell (1996) points out regarding interpretation and theory are not a threat to grounded theory, where analysis is done by staying close to the data for as long as possible. Using the Gioia method for the analysis ensures that the inconsistent findings will be considered. Rather, there is a constant cycle between returning with the 1st and 2nd order themes to find the aggregate dimensions (Gioia et al., 2013).
4 FINDINGS

In this chapter, the findings of the study will be presented. The data revealed three aggregate dimensions: foundational challenges in new product development, factors affecting the adoption of experimentation, and the effect of experimentation on new product development. The aggregated dimensions are further divided into sub-chapters representing the 2nd order themes identified in the data.

When presenting the findings, all informants are referred to as participants, with a number differentiating them from each other. When bringing up information that could compromise the informant's identity or the project team, or if the information is regarded as highly sensitive, the informant will be referred to as an unidentified participant to further protect them and the team's identity. The environment of all extractions is specified by stating if the data is from the workshops or the interviews. In the case of the workshops, the number of the workshops is also brought up to ensure the needed context around the findings.

4.1 FOUNDATIONAL CHALLENGES IN NEW PRODUCT DEVELOPMENT

From the data, some foundational challenges related to the way new product development is organised could be identified. The challenges that were recognised were divided into four 2nd-order themes. Each theme is described in its corresponding sub-chapter: the effects of the distributed project setting, the effects of structural constraints and organisational culture, the effects of time constraints on focus and innovation, and the effects of ambiguous responsibilities and objectives.

The NPD process requires cross-functional collaboration, and thus, it has been designed in a way that allows multiple people to attend the product development. Regardless of the large cross-functional teams, the collaboration between the functions and individuals was observed to be sparse. The rigorously structured NPD process and the hierarchal organisation culture were analysed to slow down product development and cause communicational barriers between roles. The third challenge of time scarcity was observed to affect the focus of the project team, and the constant prioritisation was found to be straining. Finally, the teams seemed to struggle with unclear
responsibilities and a lack of short-term objectives, which were analysed to influence the efficiency of new product development.

4.1.1 **THE EFFECTS OF THE DISTRIBUTED PROJECT SETTING**

The data from the workshops and interviews revealed that the 2nd-order theme of the effects of working in a distributed setting would be reflected in three 1st-order codes: low understanding between the R&D and business segments, isolated work during the new product development, and in the R&D facing unrealistic expectations regarding their work in the new product development. The aforementioned topics came up in the workshops, when discussing how the teams' projects were progressing as well as in the interviews when discussing the downsides of the current NPD process.

From the data, it is evident that there is a low understanding between the R&D functions and the business segments. During the experimentation process, as well as in the interviews, the participants expressed how they felt like the other functions or the people working in the business segments did not understand their work. Typically, the topic of low understanding was discussed in terms of how fast the team can get some results and how quickly they can proceed within the NPD process. This led to the participants feeling the people from the business segments did not grasp the complexity of their work.

Participant 7, for example, discussed the topic in the interview by saying that the people from business segments did not understand that they couldn't work any faster since some things cannot be speeded up even by adding more resources:

> They don't understand that it is not so easily done. We can't just cut the tasks or shorten the timelines by adding resources. Things should be done very quickly, but they don't have the understanding that some things are not possible to do faster... They don't understand that we are working as fast as we can. We are not just twiddling our thumbs.

In addition to the participants feeling like the R&D work was not understood by the business segments, they also brought up that they do not always know what the people working in the business segments or the managers are doing regarding the project. In
the 2nd workshop, Participant 10, for example, discussed how the project team does not know what the steering team or the management is planning for the next steps of the project:

*We know very little about what they are doing there [on the business side]. I think it would actually help us to know more about the project.*

The low understanding seemed to drive a wedge between the R&D and business segments, causing an "us versus them" way of thinking. The separation could be seen to cause a lot of frustration and mental strain on the participants. In the interviews, the participants mentioned that the low understanding led to the teams wondering what was expected of them and where they should focus in product development. Similarly, during the interviews, many participants highlighted that the low understanding between R&D and the business segments was one of the key issues of the current NPD process. An unidentified Participant, for example, voiced this issue of disparity by saying that it does not feel like they play in the same team with the business side:

*It is what it is; on the business side, they say one thing and do another. We have had quite a bit of issues with them communicating with us unprofessionally and pushing their responsibilities down to us. They kind of delegate away their tasks, so most of us don't feel like we would be all playing in the same team.*

The second 1st-order code rose from the data as the effect of the distributed way of working was isolated work during the new product development. While the teams in charge of each product development project are large, the development work is typically not done as a team or in a collaborative manner. During the workshops, the teams highlighted how working as a team was not common for them. Similarly, in the interviews, the participants discussed how a common way for them to work is to conduct the tasks alone and then update the rest of the team in a meeting or through a report.
Additionally, some participants discussed that due to the distributed project setting, the team members were often not located in the same place, which in turn increased the isolated work. The physical distribution made it more difficult to collaborate on the project or even stay up to date on what the others were working on. However, the different physical locations were not the sole reason for the isolated work, but the data indicated that despite some of the team members sharing the physical location, the work was nevertheless siloed.

For example, Participant 13 explained in the interview how, before the experimentation process, the teams had a habit of working independently, which led to the work getting done in a distributed way:

> Well, at least now it's perhaps clearer that I think that we've also had a bit of a habit that everyone works a bit in their boxes, and once work instructions are just put out there, it is kind of random when they will get done. It's just assumed that the work will get done at some point.

Since the experimentation process required a high level of collaboration, the contrast to the way the work was usually done was big. In the 4th workshop, participant 4, for example, brought up this contrast by stating how they enjoyed working together:

> Usually, we do these kinds of tasks alone, so it is nice to have this kind of group work now and then.

The participants felt like the process helped them realise how the isolated work affected product development. Participant 5, for example, voiced this in the interview by saying that being alone might have been a problem for them before the process since the work was executed individually:

> Before, it might have been a small problem that we were too alone. One person did one thing, and another person did another thing.

Participant 5 further reflected that without the process, there might have been a risk that the people would have been too alone, and some results would not have been
analysed in the same manner, which would have affected the progress and results of the project.

The third 1st-order code emerging from the data was the R&D facing unrealistic expectations regarding product development. The participants described that they often faced unrealistic expectations from the management as well as from the business segments. The low understanding between the R&D and the segments could be traced to lead to unrealistic expectations related to, for example, the speed of different tests to be done during product development.

The challenge of unrealistic expectations was brought up both in the workshops as well as in the interviews. In the workshops, the topic was approached when discussing how the NPD project was progressing and when reflecting on what the teams would need in the future in order to do the development work better. For example, in the 6th workshop, Participant 12 contemplated that they received impossible wishes from the members of the steering team regarding what could be done within the scope of their project:

The impossible wishes are related to, for example, how the material functions. Of course, you need to dream big and have visions, but you have to take into account if your project is scoped to fit the dreams. Our projects last from 2 to 3 years, so we have to think if some wishes are realistic.

In practice, the participants expressed that the unrealistic expectations led to a lot of frustration since they did not feel like they were being heard, but rather that they were left to try to accommodate according to the unrealistic expectations. Feeling like the opinions or expertise of the R&D were not valued could, in turn, deepen the disparity between R&D and the business segments.

4.1.2 THE EFFECTS OF STRUCTURAL CONSTRAINTS AND ORGANISATIONAL CULTURE

The data uncovered that the new product development process is highly bureaucratic, with a complex decision-making and team setting. The NPD process is structured through different stages that are separated by decision-making gates. The decision-
making has been distributed to the steering team and management boards while the project team develops the product. Thus, the project team has low autonomy to make decisions regarding the project despite spending the most time with it. Furthermore, the data shows that the participants feel like there is a strict hierarchy within the R&D. The 1\textsuperscript{st}-order codes that were analysed to reflect high bureaucracy and hierarchy within the NPD are: rigorous structure of the NPD process slows down the product development, low autonomy slows down the product development, strict hierarchy within R&D creates communication barriers.

The data indicates that the NPD process being structured in a bureaucratic way leads to the process being heavy and stiff. For every gate, the materials need to be prepared and presented to the steering team and possibly to different management boards. The project managers described that this takes up a lot of their time, and they expressed that the process could benefit from being more centralised so that they do not have to spend time presenting the results multiple times.

The topic of the rigorous structure slowing down product development came up during both the workshops and the interviews. In the workshops, the teams discussed that they were not able to make quick decisions due to the heavy process. Despite the team having a clear direction where they would like to move with the project, the plans can get interfered with by the strict process. In the 4\textsuperscript{th} workshop, one team discussed that they know how they want to proceed with the project, but the NPD process does not allow a lot of flexibility. An unidentified participant voiced their frustration in the workshop towards the process by saying that they know that they can't proceed how they see fit since the next gate is coming too quickly:

\begin{quote}
\textit{We know what we can do now, but it is too late since we already have to go to the next gate.}
\end{quote}

Similarly, in the 2\textsuperscript{nd} workshop, Participant 8 described that there is no flexibility in the process. The team felt that they had finally started to find a way to get the needed results, but it was too late to proceed since "the next gate is already coming".
In the interviews, many participants mentioned that they thought it was good to have a process to follow and to guide the development work but that the NPD process was too heavy and bureaucratic. Participant 7 highlighted this in their interview by saying that the bureaucracy makes the process very time-intensive:

*The NPD process has been very bureaucratic... It's a lot of paperwork needed. That's the disadvantage... it is very time-intensive. Every time you have a gate review, that it's a lot of documents to fill in, and that's the disadvantage.*

In the workshops, as well as the interviews, the participants brought up how the company wishes to speed up product development. Participant 1, for example, expressed in the interview how the teams have been constantly told to be quicker:

*We have been told that we need to fail faster or that we cannot stretch out the project even if we do not get the needed results, but instead, we notify the management quickly so that the project can be closed.*

In practice, the rigorous structure of the NPD process was seen to cause a lot of frustration among the teams. The project managers felt like their time could be used better, and the teams felt like the process sometimes blocked them from moving forward with the development work. Additionally, considering the need of the company to speed up product development, the rigorous structure slowing down the projects can be seen to pose a foundational challenge for the new product development.

The data shows that besides the strict structure of the NPD process, the teams also have little autonomy to make decisions on behalf of their project. The second 1st-order code analysed to affect the high bureaucracy and hierarchy within the new product development was low autonomy, slowing down the product development. The participants described that they can arrange the laboratory work autonomously, but as Participant 7 discussed, the "bigger decisions" need approvals.

In the 2nd workshop, Participant 10 described the team's situation by explaining that they struggled to get the results quickly due to the distributed decision-making process.
Sometimes, the decision-making takes so long that the project needs to be refocused afterwards:

*We need approvals at every stage... It is quite difficult since even if we find something interesting, then we move up in the system, and every time, we need to have a confirmation from the steering group, and it takes time. Sometimes, we need to completely refocus the project.*

Participant 4, on the other hand, highlighted in the interview how the low autonomy is an issue since the groups making the decisions do not gather too often, and thus, the teams have to sometimes wait for the decisions for quite a long time. Additionally, the participant felt that if the project teams are constantly being pushed to be quicker and more flexible, this should also be reflected in the decision-making:

*The decisions should be made faster than once every three months. If we need to be flexible, so should they... They discuss these things in different groups, but we need them to make decisions faster.*

In addition to the decisions being made faster by the steering team and management, it was discussed how increasing the project team’s authority could be beneficial. Participant 13 discussed this by pointing out that the project managers have the needed know-how to make the decisions for their projects:

*In agile teams, the decision-making has been brought as low as possible; our project managers are smart enough to make decisions on their own. In practice, I always say that project managers have a lot of responsibilities and no authority at all.*

All in all, the participants seemed to agree that the lack of autonomy was one of the key factors hindering the product development process. Additionally, the consensus was that if the decision-making process was swifter, the team would, in turn, be able to be quicker with their development work.

The final 1st-order code that was analysed to be related to high bureaucracy and hierarchy within new product development was the strict hierarchy within R&D,
creating communication barriers. The hierarchy within the R&D was discussed to be related to how people's ideas are valued and what kinds of product development tasks different people are expected to do.

The topic of high hierarchy was only discussed in the interviews. A few people brought up how sometimes the ideas of certain people are dismissed or pushed down because of their role. Additionally, some people pointed out that people have very specific tasks. For example, the technicians typically always execute the laboratory tests, which creates bottlenecks to the development work. The tasks are not divided based on who has capacity but rather based on who typically does similar tasks.

Participants 10 and 25, for example, discussed how they thought the product development work could benefit from breaking down the hierarchical barriers and encouraging everyone to go out to the laboratory and experiment. Participant 25 highlighted that people learn more if they do the experimenting themselves:

Everyone is experimenting on their own to better perceive things. By doing it yourself, you see more than if you just make others do the work without creating your experiments.

Additionally, a few participants discussed how the hierarchy is also expressed in the way different people's ideas are heard and valued. An unidentified Participant described that sometimes there is a tendency to value scientists' opinions more than technicians:

If you feel like you are a valued member of the team, that your opinions are valued, and people feel like you could have input on a topic. Or is it more of a case that they think that you should be quiet if you are not a scientist, and they don’t think that you understand or know anything about the topic? Unfortunately, the latter happens here too.

In practice, the data revealed that the high hierarchy creates a separation between the technicians and scientists, which could lead to bottlenecks in product development. Additionally, not putting the same value on people's ideas and thoughts can lead to
lower psychological safety. If people do not feel comfortable bringing up their ideas, this can result in fewer ideas and fewer innovations coming up.

4.1.3 The Effects of Time Constraint on Focus and Innovation

The data indicated that one of the foundational challenges in new product development was the participants' lack of time and focus. R&D employees were typically staffed to multiple new product development projects at once, which meant that their day-to-day work included balancing the different projects and constantly prioritising tasks and projects. In addition to juggling the different projects at once, there is, in practice, no time left for learning, as the operational work fills up the schedules. The 1st-order codes that were identified to fit this theme of individuals lacking time and focus were the participants dividing their attention to multiple projects and the participants' lack of time for learning in their day-to-day work.

The data showed that constantly having multiple product development projects running simultaneously leaves the individuals to prioritise which project to focus on constantly. Having the continuous shift of attention from one project to another left the participants feeling like their concentration was being pulled apart.

The topic of working on multiple NPD projects at the same time was brought up, especially in the workshops when discussing how each team's project was progressing, as well as when discussing what the teams would need in the future in order to do their work better.

In the workshops, this topic was raised as one of the biggest elements that would induce frustration among the participants. Participant 7 explained this feeling in the 5th workshop by commenting that the situation has led to them needing to prioritise one project while “the others kind of stay behind”. In the 5th workshop, when reflecting on how the project is going, Participant 11 explained that there is some dissatisfaction with how they are expected to manage their time:

At the moment, it feels like you're being pulled in every direction; we have been discussing that we should bring back the old times when you
could only focus on one project at a time. This has seriously gotten out of hand.

Seemingly, the situation where each person is working on multiple projects at once has been an attempt to speed up the project development process. However, there seemed to be a consensus that the mental load of having to divide your attention to multiple projects led to the process being ineffective and slow instead of speeding things up. Participant 13 approached the same topic in the sixth workshop:

*We can't work in peace. Feels like it is kind of like running around, meetings without an agenda or materials... it eats away your concentration.*

Similarly, Participant 3 reflected on their current way of working and how they simply do not have the resources to proceed efficiently in the project development:

*The thing that causes the most friction is the scheduling. So, like how much time is scheduled for each step, because we do not have any more resources in use, and that means that our time and focus are being pulled in different directions, which causes issues in the schedule. We might not have enough time to get the needed results.*

In practice, the data suggests that juggling numerous projects leads to constant prioritisation among tasks, causing individuals to feel stretched thin and struggling to concentrate. However, participants noted that this approach increased mental strain, making the process slower and less effective instead of accelerating it.

The other 1st-order code identified to play a role with individuals lacking time and focus was the participants lacking time for learning in their day-to-day work. Not having time for learning was the effect of the participants being fully booked by the operational work and meetings. As a result, they described that they had no time left for learning or nurturing their curiosity despite viewing continuous learning as an important value.
The topic was discussed in the workshops when the participants had the opportunity to reflect on their work and the progress of the projects. In some teams, there was a consensus that there should be more time for learning. In practice, the participants wanted time to read scientific papers, attend conferences, and, in general, dive deeper into topics that touched on their project. Participant 7 described that being fully booked inhibited them from getting to know scientific literature:

*It's just when you're fully booked, you're fully booked, because for me, for instance, I need time to read a scientific journal, even on the more or less topics that I'm currently on, to know what's new happening. When you're reading, you get new ideas.*

Furthermore, participant 10 highlighted how important it was to leave time for activities that induce learning since it affects the ability to innovate. Being stuck in the office and doing operational work from day to day would lead to not being able to innovate.

Innovation often involves exploring new ideas, technologies, or methodologies. Without dedicated time for learning, teams might miss out on crucial insights, best practices, or emerging trends that could significantly impact the innovation process. Thus, the participants felt that it would be crucial to have time in their schedules for learning as this allows teams to stay updated and informed.

### 4.1.4 The Effects of Ambiguous Responsibilities and Objectives

The theme of ambiguous project setting was found to include the 1st-order codes: lack of clear responsibilities within new product development and the absence of clear short-term objectives within the projects. The data showed that some project teams struggled with understanding the role and responsibility of each person in the project development process. Additionally, multiple teams were observed to lack a view of their short-term objectives and rather rely on the official KPIs and Gates to guide product development.

The lack of clear responsibilities within new product development was approached from the point of view of not having any official guidelines to explain what is expected
from each person during the product development process. The NPD teams are fairly large. Together, 15 to 20 people take part in product development at some point, and thus, sometimes, it is confusing to understand what everyone's role is and what is expected of them. In some projects, this was found to be an issue, and not having clarity on everyone's responsibilities left some participants feeling like they were doing work that was not their responsibility and should be done by someone else.

The topic was discussed both in the workshops as well as in the interviews. In the workshops, the participants mentioned that there are no guidelines to specify what the responsibility of each person in the NPD team is. For example, Participant 12 reflected in the 6th workshop how they would need more open communication regarding the different responsibilities:

*We are missing open communication regarding the project team members' different responsibilities… it would be nice if everyone knew their role since, so far, that has not been the case.*

The issue of unclear responsibilities was further discussed to especially stem from the division of responsibilities between the R&D and other functions. Participant 15 spoke about this in the interview when asked about the communication between the different teams during product development:

*Not all of us seem to understand what their role or responsibilities are. The R&D has its own roles and responsibilities, and the other functions should have their own things, and they should understand what their responsibilities are.*

In practice, the unclear roles and responsibilities led to some participants doing work that was not their responsibility, simply because if they did not do it, then no one would. This would also cause a lot of frustration among the participants, who felt like the project was constantly relying on them to do extra work.

The other 1st-order code that the data revealed was the absence of clear short-term objectives within the projects. Many teams had no shared view of what the short-term objectives of the project were but rather used the official KPIs and the Gates as
objectives. Thus, the teams had no clarity on what the most important things were to achieve during each week of each month in order to ensure that they completed the needed work for a gate on time.

The topic was observed during the 2nd workshop when multiple teams had difficulties in coming up with a scope for the experiment process. When the objectives were discussed, it was evident that the short-term objectives had not been set for many people, and the workshop was the first time they discussed together what the things to achieve within the next weeks or months. The effect of not having clear short-term objectives was explained by the teams by saying that the weekly objectives were often discussed with only a small group of technicians and researchers instead of the whole project team.

The lack of short-term objectives could, in some cases, lead to unstructured development work. Furthermore, only focusing on the short-term objectives once approaching a gate could lead to sudden delays in the new product development.

4.2 FACTORS AFFECTING THE ADOPTION OF EXPERIMENTATION

The second overarching dimension identified from the data was the factors that affect the adoption of experimentation. The factors could be divided into four themes, all the themes affecting either the quality of the experiment, the experimentation process or the overall adoption of experimentation as a practice. The four themes will be described in the corresponding sub-chapters: the effect of the foundational challenges on the mental capacity, open communication and psychological safety within the team, facilitating the experimentation process and value perception in adopting experimentation.

The data analysis revealed several critical elements affecting the adoption and success of experimentation within the NPD project teams. Foundational challenges, including a lack of autonomy, time constraints, and misaligned perceptions between management and teams, significantly impacted the mental capacity required for effective experimentation. Open communication and psychological safety were identified as crucial catalysts for successful experimentation, emphasising the need for
a safe space where ideas could be freely shared and discussed. Facilitation emerged as a pivotal factor in supporting the adoption of the experimentation process, ensuring necessary guidance and know-how, especially post-process, to prevent teams from reverting to old habits. Additionally, the perceived value of experimentation, both in experiencing its benefits and effectively conveying its potential value, played a significant role in motivating teams to engage and commit to the experimental process and thus support the adoption of experimentation.

4.2.1 THE EFFECT OF THE FOUNDATIONAL CHALLENGES TO THE MENTAL CAPACITY

The foundational challenges identified from the data were found to affect the capacity needed for experimentation. The challenges of new product development that were discovered affected the experimentation process by causing frustration and confusion amongst the participants, which took up their mental capacity to focus on experimentation and the different tasks related to it. The 1st-order codes that were found to relate to mental capacity were lack of autonomy causes frustration amongst the participants, lack of time decreases the cognitive focus of the participants, and misalignment between team perceptions and management expectations confuses.

The lack of autonomy was seen to be the result of the high hierarchy and bureaucracy in the NPD process. In the workshops, the participants described how the current decision-making process and the lack of autonomy were found to cause frustration and stress. The topic was brought up by different teams when discussing how the participants felt about the project and how the project was progressing. The feelings of stress and frustration were reflected. For example, with Team 3, the management made decisions the team was not happy with, or Team 2 felt like they were "kept in the dark" related to the decisions being made.

Once decisions were made, the teams were expected to swiftly accommodate them, which was described as stressful. Participant 7, for example, explained in the 5th workshop that the management had decided to change the scope of the project, leaving the team to quickly put together the needed materials:
Again, the decision was made amongst the upper management, and the information had not reached the project owner or the business owner, which has been a bit stressful. The decision just fell to my lap at the last minute, and it was a very stressful situation to create all the materials in a day or two. The budgeting for the new project, all the plans resourcing and preparing materials for a Gate.

Similarly, Participant 12 brought up in the 6th workshop that the management makes the decisions without consulting the team:

The upper management makes the decisions without having conversations with us and asking if we even have the resources or time for these things.

In practice, the lack of autonomy related to the decision-making was seen to interfere with the participants' focus and lower their capacity to concentrate on the task at hand. Not being able to focus on the steps of experimentation could be seen to lead to experiments that provided little value or would be left undone, as was the case with, for example, Team 3.

The lack of time and having to constantly prioritise projects, which was identified as a foundational challenge of the current NPD process, was reflected in the experimentation process as interfering with the participants' focus and lowering their capacity to concentrate on the task at hand. Similarly, as in the previous 1st-order code, the lack of time that the participants felt increased the pressure and stress, which affected the workshops and, therefore, also the experiments.

The topic was brought up both in the interviews as well as in the workshops. In the workshops, the topic was discussed when catching up on how the project is proceeding, whereas, in the interviews, the topic was brought up when asking what the participants found difficult regarding experimentation or the experimentation process. In the interviews, many participants brought up the issue of time as being one of the things they felt most affected the experimentation process.
As described previously in the foundational challenges of new product development, the participants felt like they had little capacity to focus properly on one thing at a time, as Participant 16 described in the 4th workshop:

*It is a challenge that we have no capacity to focus on one thing at a time and dive deep into anything. Instead, it's just bouncing around, which is exhausting, and then it easily happens that nothing is properly achieved on time.*

This exhaustion caused by the lack of time translated into a lack of cognitive focus in the workshops. This could be observed in the workshops since if the team was under stress or a lot was happening in the development of the project, it was more difficult for them to stop discussing the hectic situation and turn their focus to what experiments could be planned to improve the situation. This was the case for teams 2 and 3. Participant 12, for example, brought up in the interview that one of the things that affected experimentation was a hectic work situation:

*A certain type of frustration was seen in some of the workshops if there was a hectic situation going on.*

Similarly, Participant 13 reflected on the interview process. One key thing that made the adoption of experimentation difficult was not being able to focus on experiments in the workshops:

*It was probably more like a therapy session with people opening up there. We probably could have gotten the most out of the process if we had focused on finding the areas where we could experiment, but now, sometimes, it just kind of formed into a venting session.*

Participant 10 highlighted in the interview how they could see that being stressed affected creativity, which was needed in order to experiment:

*If you're already stressed, you might not be so creative; it can narrow down your mind a little bit. So, I think it is important that you have time, that when you do it [experimentation], you can give it 200%.*
The last foundational challenge that was analysed to affect the mental capacity as a 1st-order code was the misalignment between team perceptions and management expectations, causing confusion. In the workshops, it could be observed that multiple teams had to constantly balance between trying to map out what the management and steering team were expecting from the project.

Teams 2 and 3 brought this up in multiple workshops: they had difficulties understanding what was expected from them, and the frustration stemming from this was often voiced in the workshops. In the 1st workshop, for example, Participant 11 explained not knowing what is expected from them on behalf of the steering team or "other parts like that". Participant 7 built on this in the same workshop by saying that it is not uncommon to have different views with the management on how the project should proceed, and they might get feedback only afterwards:

*We were struggling to get the results, and then we presented them, and they told us that we shouldn't have done it the way we did.*

Team 3 explained in the 4th workshop that the development of their project was often dictated by the urgent changes made by their steering team or management. Having to constantly accommodate these changes was perceived as straining, as Participants 12 and 16 discussed, "sometimes it feels that even within a day the project might change to a different one" and "if there are a lot of changes in a short time, it can be exhausting".

In practice, the confusion caused by the misalignment between the different parties affected the flow of the workshops and the experiments that ended up getting planned. Not understanding where the team should focus made it difficult for them to map out which type of experiments would be the most valuable to them. This type of confusion ended up taking up their mental capacity and taking away a lot of time in the workshops since the teams wanted to voice their feelings regarding the situation, and thus, the time could not be used to plan experiments.
4.2.2  **OPEN COMMUNICATION AND PSYCHOLOGICAL SAFETY WITHIN THE TEAM**

The second 2nd-order theme that was identified to affect experimentation was open communication and psychological safety within the team. The openness of the participants and the psychological safety they felt were recognised to affect the quality of the discussion and the number of ideas the team had. The experimentation process was discussed to require a level of openness from the participants since the steps of experimentation: scoping, ideating, planning, and analysing the experiments benefitted from people openly expressing their thoughts.

In the interviews, the topic of open communication was brought up by a few participants when asked what kinds of factors played a role in whether experimentation would be adopted as a practice. Participant 4, for example, highlighted how open communication is necessary since it helps with analysing the experiments as well as ideating new ones:

> This type of open discussion about the results was nice since, for one person, something can be very self-evident, and then for others, it might not. We all have different backgrounds, so when we open up communication, we might get new ideas. Someone else can see a correlation where you don't and have an idea about what to try. So, this type of open communication is needed.

Participant 3, on the other hand, discussed how the experimentation process requires openness from the team, and openness, in turn, requires a safe space:

> This requires a certain type of flow and openness from the project team. I feel like we have a good team in the sense that we are all equals, so everyone has a safe space to voice their ideas and brainstorm.

In practice, the data shows that if the participants cannot voice their thoughts openly, it is more likely that some points of view get buried under others, and not all ideas or factors will be considered when scoping, ideating, planning and analysing the experiments. Thus, open communication affects experimentation and the quality of experiments.
The effect of the team's dynamic on the feeling of psychological safety was identified as the 2nd 1st-order code related to open communication. In the interviews, the topic of psychological safety and the factors that affected the feeling of safety in a team was brought up by a few participants. The topic was mostly approached from the point of view of the team's dynamic or how certain individuals could decrease psychological safety. In practice, the participants felt that psychological safety was an unchangeable characteristic of the team, which was determined by who the team members were. Participant 3, for example, described that the flow of the team that affected how openly people were willing to talk was related to how long the team members had been working together and that there was nothing that could be done to ensure a good flow:

*Of course, how long you've been working together and what the flow of the work is has a lot to do with [feeling safe]. With some people, it's much easier to find that kind of flow than with some people, and you can't do anything to affect it.*

Similarly, Participant 11 discussed that the level of comfort was dependent on the team members. If they had had bad experiences regarding another person pushing down their ideas previously, it influenced how much they were willing to share:

*It is very uncomfortable to bring out your thoughts in a group. Sometimes, it feels like they might not be valid, or from the start, you think that some people, I'm not naming any names, will push them down. So, then, you don't really feel like sharing.*

Participant 13 elaborated on the same topic in their interview when asked if the company had ways to ensure a psychologically safe environment. They thought that while the company does provide training, it does not necessarily affect how individual people act:

*We do have this type of inclusive leadership training to support psychological safety, but sometimes it feels like some people just get labelled as being difficult to work with, and it's just accepted that that's how it is.*
Ensuring a good level of psychological safety could be seen as an important factor in experimentation. Improving psychological safety can create an environment where individuals feel more comfortable taking risks, sharing ideas, providing feedback, collaborating effectively, and embracing the iterative nature of experimentation, ultimately fostering a more innovative and productive experimental process.

4.2.3 Facilitating the Experimentation Process

The final 2nd-order theme that arose from the data is facilitating the experimentation process. The facilitation seemed to have a big effect on experimentation since the participants highlighted that the teams were not able to keep the experimentation process alive without the facilitation. The facilitation was discussed to ensure the needed know-how regarding experimentation and also to provide guidance regarding the process. The 1st-order codes forming this theme were: unable to experiment outside the facilitated process, facilitation ensures the needed know-how and guidance and understanding the purpose of experimentation made the process easier.

In the interviews, the participants discussed how after the facilitated experimentation process came to an end, the teams were not able to keep experimenting despite feeling like the process was beneficial and had provided value to the project. This topic typically came up when discussing which factors affect the adoption of experimentation and when asked if the teams have been able to keep experimenting after the process was over. Multiple participants brought up how it was easy to fall back into the old habits once there was no one to ensure the team stayed on track.

Participant 3, for example, reflected that despite trying to ask how the team should operate, instead of using the canvases given to them, the team had gone back to their old habits:

*I think we were able to adopt experimentation in a way, but I have to say that after the process was over, things have been again more difficult... I have tried to ask how to proceed and what to do, but our meetings now have mostly been just us looking at the same PowerPoint presentations.*
Participant 3 discussed that even though they remember the process and how they could operate, it is difficult to make a change without someone overseeing the process. Similarly, Participant 4 highlighted that it is up to each person and their routines if experimentation can be adopted:

*I don't think there was anything that would have made it [adopting experimentation] difficult. It's just up to each person since everyone is so hung up on their own routines... it's easy to fall back into the old habits, so someone needs to push us in the correct direction.*

Participant 10, on the other hand, expressed that someone needs to ensure that the team has the discipline to keep the new practice alive, or then people just go back to their old routines. The people from R&D were described as being heavily tied to their old ways of working, and Participant 12 discussed how they thought that it would be, in general, difficult to make a change within the R&D due to the people being so pedantic.

In practice, the data shows that not having the facilitated process to follow caused the teams to go back to their old ways of working instead of keeping the experimentation process alive. Thus, facilitation plays a significant role in the adoption of experimentation since, despite the teams knowing the process is beneficial and having the willingness and the know-how needed to experiment, it is difficult to build new habits.

The data indicates that facilitation would ensure the needed know-how and guidance the teams needed in order to experiment. Having the process facilitated meant that there was someone to teach the team the needed tools and themes but also that there was someone who ensured that the process was kept alive.

In the interviews, a few participants reflected that having someone facilitate the experimentation process was perceived as valuable and something that should be done in the future if there is a plan to make an effort to adopt experimentation in other teams. The facilitator coming from outside the company or at least outside the team was discussed from the point of view of the teams already being so busy that they would not have had the needed resources to facilitate the process on their own. Participant 5,
for example, explained that learning new methods requires energy from the team, and thus, having a facilitator would mean that the team themselves would need to put in less effort:

*It always takes a lot of energy and time to get to know new methods, so we could use a facilitator here in the future as well.*

Participant 10 highlighted that facilitation is important when trying not to fall back into the old habits:

*I also think that someone like you should come in once in a while and follow up because it's so easy to go back to earlier routines... One factor was that you facilitated. I think that's very important.*

In practice, the data reveals that the participants felt like having a facilitator ensured that they did not have to put the team's already scarce resources into trying to learn and execute a new way of working.

The last 1st-order code identified to be related to the facilitation was understanding the purpose of experimentation, which made the process easier. The data indicated that it is important for the participants to understand the practical aspects of the process as well as the purpose behind experimentation. Having training or another type of facilitation would ensure that the teams have the needed know-how and understanding about why experimentation is an important practice to adopt.

In the interviews, the participants brought up two opposing views regarding how easy the experimentation process felt for them. Some people felt that the process was easy since the process was similar to doing testing in the laboratory, while others felt that the experimentation process was difficult due to it being a new way of working. For example, Participants 1 and 7 described how the process was easy and familiar due to the nature of their work of conducting experiments in the laboratory:

*I think that, for example, participating in trainings or workshops helps to understand what to do in practice and what this is all about. [P1]*
The process is familiar to us from experimenting physically in the lab. I conducted experiments and then went through the results and continued with the positive results. However, I do understand that a similar type of work could be used in another type of work as well, iterating in the same way as in the lab. [P7]

However, going through a facilitated process ensures that even those who find the process to be difficult will get some guidance regarding experimentation. Participant 19, for example, brought up in the interview how participating in workshops or training helps to build understanding regarding experimentation:

I think that, for example, participating in trainings or workshops really helps to understand what to do in practice and what this is all about.

In practice, the data indicates that having a facilitator ensures that the needed know-how and purpose behind experimentation get discussed with the participants. Despite not being familiar with the process, facilitation can ensure that the participants understand the process and the purpose of experimentation.

4.2.4 Value perception in adopting experimentation

The third factor analysed to affect experimentation was the perceived value of the experimentation process. The data revealed that one key factor that the participants felt supported the adoption of experimentation was that the process of experimentation and the executed experiments were found to bring value to the team and the project. The value was approached from two perspectives, either being able to experience the positive implications of the process or being able to understand that the process is valuable even before experiencing it first-hand. Thus, the 1st-order codes that were identified to relate to the theme of the value of experimentation were experiencing the value of experimentation encourages participation in the process and conveying the value of experimentation encourages participation in the process.

Experiencing the value of experimentation affecting the experimentation process was found to incentivise attending the process. Furthermore, the data indicated that
experiencing the value of the experimentation trumped the negative emotions or suspicions the participants might have had before the process.

The topic was brought up both in the interviews as well as in the workshops. In the workshops, the topic was discussed mainly during the last workshop, when the participants were reflecting on the whole process and the things they had enjoyed or learned. For example, Participant 19 brought up in the 6th workshop how they had found the process confusing at the beginning and had not been attracted to the idea of experimentation, but seeing the benefits made them realise the process is useful.

Similarly, in the interviews, Participant 1 discussed that one factor that ensures the adoption of experimentation is to be able to get positive results from the experiments:

\[
\text{People might be against it at first, but if you get results that are positive, then people will for sure adopt it.}
\]

On the other hand, not being able to get any benefits from experimentation was discussed to increase the resistance to change. In the interviews, the adoption of experimentation was also approached from the point of view of resisting change. Participant 4, for example, reflected that one of the things that increases change resistance is not finding value in the new way of working in general:

\[
\text{This type of new way of working is never easy. There is always some resistance, and people are very stuck on their old habits... I think that if a person is not able to get something out of it and not get any new value out of it, there is no point in doing it.}
\]

Already during the workshops, it was clear that the participants were able to reap some benefits from the whole process as well as individual experiments. However, the weight of this perceived value only became clear in the interviews when participants highlighted this as a key factor in helping with the adoption process. When discussing which factors enabled experimentation in the team, an unidentified participant brought up how the process helped the development of their project:
The fact is that this project would have been a sad mess without this [experimentation process]. In my opinion, we made great strides forward precisely through the experiments. So, I found those experiments to be terribly useful, at least in this project. While it was perhaps a bit challenging and confusing at the beginning, once we started planning the experiment, we got more ideas regarding what could be done and what the purpose of the project was.

In practice, the data indicates that experiencing value from the experimentation process plays a role as a factor affecting experimentation. Experiencing the value can help motivate the process, whereas if experimentation had not been regarded as a valuable process, it could have been more difficult to push the teams into following it.

The second 1st-order code identified within the theme of the value of the experimentation process was conveying the value of experimentation. The data revealed that the participants were more likely to be willing to attend the experimentation process with an open mind if they could already understand the possible value of the process. Thus, being able to showcase some level of the value the process might provide for the teams was seen to encourage experimentation.

In the interviews, the topic was brought up by a few people when discussing which factors affect the adoption of experimentation. Before being able to experience the benefits, the participants felt it was important that the value of experimentation would be conveyed to the participants. Thus, the participants would have an incentive to attend the process from the start. In practice, the role of communication and training or other type of onboarding were listed as ways to convey the value of the process. Participant 4, for example, expressed that as a data-oriented person, getting some type of onboarding for the process could help to create a space where people are open to learning:

I think people need to be onboarded on why the process works and why it is a better way of working than before. I like facts and proof. I'm a very data-oriented person.
Similarly, Participant 5 brought up in the interview how good incentives are important when adopting experimentation:

*Having good communication and good incentives. I do not think that we are particularly against change, so I would say that we do adopt new ways of working if they are good and if they make our work easier.*

All in all, the data seems to indicate that conveying the value of the experimentation process through communication or training can help to incentivise the process. Offering incentives at the beginning of the process could help create motivation and drive initial engagement.

### 4.3 The Effect of Experimentation on New Product Development Teams

The final overarching dimension analysed from the data was the effect of experimentation on new product development. The impact the experimentation process had on the teams, and the project setting was identified to include three key themes: the impact on the team's collaboration, the impact on the team's communication, and the impact on the project setting. These themes are described in the corresponding sub-chapters.

The data revealed that the facilitated experimentation process had a positive impact on the previously identified foundational challenges. Fostering collaboration, communication, and clarity around the NPD project setting can help the teams avoid the pitfalls of the current NPD process, making experimentation an important practice for the product development teams to adopt.

#### 4.3.1 The Impact on Team's Collaboration

The positive impact of collaboration was identified from the 1st-order codes. Working as a team was found to be enjoyable; working as a team made the steps of the experimentation process easier and supported problem-solving. As one of the foundational challenges in new product development was the distributed project
setting, which resulted in sparse collaboration and isolated work, the impact of the collaborative experimentation process was highly brought up in the data.

The first topic that was analysed to describe the impact of the team's collaboration was how the participants appreciated the teamwork during the experimentation process. The data indicates that enjoying the time spent together in the workshops was beneficial since the workshops enabled important conversations and provided value to the project. Enjoying the collaborative approach plays a role in how willing the team is to work together during the process.

The data revealed how working as a team during the experimentation process was appreciated by the participants. In the workshops, as well as the interviews, many participants highlighted how much they enjoyed the collaborative work provided by the experimentation process. Participant 13, for example, discussed in the interview how nice it was to work together:

I thought working together was nice. I think it's a good way to approach things, to first think about the topics on your own and then share your thoughts with others.

A few participants brought up how, during the process, they learned that it is important to leave enough time for teamwork as opposed to how they typically operate in the new product development, as Participants 15 and 1 highlighted in the last workshop:

I learned that we need to have multiple brains involved in the same session. [P15]

I learned that we need more time to work together as a team. [P1]

Furthermore, since the teams are working from different locations, it is not evident that they get to work together often. Participant 25 reflected in the 4th workshop how the time spent together in the workshops has enabled exchanging ideas, despite working in a distributed setting:
Even if you are not on-site and you are far from each other, we have been able to have good teamwork, exchange ideas, and listen. It's really nice to work this way.

Besides getting enjoyment from the collaborative way of working, working as a team also had implications for the steps of the experimentation process. The data reveals that working as a team made the experimentation process easier: ideating, planning, and analysing the experiments were identified to be more effortless when done with the team. In the interviews, the factor that many participants mentioned as the first thing that enabled experimentation was the fact that they worked together during the experimentation process.

Bringing the team together for the workshops seemed to allow them to have important conversations, which was not self-evident due to the distributed project setting. For example, Participant 4 discussed in the interview how discussing the results together with the team helped them get new ideas:

*We were able to discuss the results together, which could lead to ideas coming up. We all have different fields of expertise, so even though our field of specialisation is not really the same for everyone, when you say things out loud, someone else might get an idea that you didn't... When you have a distributed team, it can be difficult to find that needed time together. So now that we were all together, you could talk freely about things.*

Analysing the results of the experiments together in the workshops enabled the whole team to be on the same page about the current situation regarding the project, as well as weigh in on what they should focus on next. Participant 5 described in the interview how analysing the results from an experiment together was not how the team typically operated, and thus, the experimentation process gave the team insight into how beneficial it is to go through the analysis together. Participant 5 explained that the analysis was commonly done by one person, who then provided the results to the rest of the team:
It is worth encouraging the project group to analyse and go through the results together. So, it is not just that one researcher analyses them alone and writes a report that no one will probably read in a long time.

The last 1\textsuperscript{st}-order code identified to reflect the positive impact of collaboration was how working as a team supported problem-solving. The teams encountered several different types of problems during the experimentation process. Some teams struggled to see the big picture of what was expected from the project and which actions would bring the most value, while others raised issues such as which chemicals to test in the laboratory.

In the workshops as well as in the interviews, the teams brought up that even though taking time away from everyone's busy schedules was not self-evident, it would be important to focus more on collaboration. However, making sure that there was time to get together to go over the problems that would arise during the experiment process was seen as helpful. Participant 13, for example, put it simply in the 6\textsuperscript{th} workshop by stating they have managed to find solutions to their problems when they just go through them together:

\begin{quote}
I've enjoyed the conversations. We should sit down together more, even though everyone is really busy, but when we go through the problems together, we always find a solution.
\end{quote}

During the 5\textsuperscript{th}, Participant 15 reflected that going through the problems together ensured that the team avoided making mistakes:

\begin{quote}
When we go through the problems together, we get new perspectives and maybe even avoid making mistakes and avoid doing useless work.
\end{quote}

Finding that the experimentation process supported collaboration and observing the positive implications of the collaborative work is significant since one of the identified foundational issues in new product development was related to how a distributed project setting leads to isolated work. Thus, it seems the experimentation process offers a method to bring the teams together and enable collaboration.
Similarly, the data indicates that despite the teams being very booked and thus possibly having difficulties in finding the time for collaborative work, it might be a time investment worth making. The teams, in general, found that the process helped them progress with their project, and thus, making time to be together seems to be a key to more efficient product development.

4.3.2 The impact on the team's communication

The second positive implication of the experimentation process was the improvement of the team's communication. The positive impact on the team's communication was identified from the 1st-order codes of the experimentation process supported team's communication, and the facilitation ensured open communication during the experimentation process.

In addition to the experimentation process requiring open communication, the participants brought up both in the workshops and in the interviews how the experimentation process had a positive impact on the teams' communication. The participants discussed that the experimentation process gave them new ways how to communicate, as Participant 7 expressed in the 5th workshop:

I liked that we were able to adopt new ways of communication within the project team.

The new ways of communication Participant 7 referred to be the new tools used by the team. The team needed to come up with new ways to communicate both internally and also between the other functions or management, and thus, they formed an experiment around that. The new way of communicating, the team chose to experiment with the use of a Kanban board. The idea behind the experiment was that the team had visibility into how the tasks and laboratory tests were progressing at all times, limiting the need to ask for updates.

When mapping out in which ways the participants felt like their communication, some discussed that simply being together in the workshops allowed the space for important discussions. Participant 5, for example, reflected that simply because their team was spending more time together, the communication was more effortless:
This process has, in a sense, made our communication better since there have been just simply more sessions when we are together, which naturally makes communicating easier.

Participant 4, on the other hand, felt that the experimentation process improved the team's communication since the team members were able to get to know each other better:

Especially the workshops helped us to get to know each other better. So, then it is also easier to discuss together when you know how people will react.

The 2nd 1st-order code of facilitation ensuring open communication was identified as impacting the way the process affected the team’s communication. When asked why the participants thought the experimentation process improved, many of them approached the question by stating that the facilitation played a big role in improving the communication within the team. The communication during the workshops was highly facilitated by using different exercises and canvases to guide the conversation.

Having the conversations facilitated in the workshops ensured that all team members could take part in the discussion. In the interview, Participant 11 brought up that having the workshop setting helped with getting different opinions:

I noticed that as a tool, workshopping was very beneficial when it came to improving our communication. We got to hear different opinions as well as the things that are important for others.

Similarly, Participant 13 reflected on the experimentation process in the interview. They highlighted the value of having a rigorous structure and facilitation for the conversations:

We are so different; some people are very impatient, and some are very researcher-minded and want to take their time... During the workshops, everyone had the opportunity to be heard. So, this method of communication, where we first think about things on our own for a
while, write our thoughts down and then present them to others and have discussions, seems to be working.

Communication is a key factor in new product development since it enables the teams to work cohesively and effectively. Thus, finding how experimentation affects the communication of the new product development teams is critical. Furthermore, one of the foundational challenges recognised from the data was the low understanding between the different functions. Focusing on improving communication in new product development might provide an answer to this challenge.

4.3.3 THE IMPACT ON THE PROJECT SETTING

The final 2nd-order theme discovered as an effect of the experimentation process was the positive impact on the project setting. This theme covers the 1st-order codes. The experimentation process fit well together with product development, the experimentation process increased clarity around the NPD project, the experimentation process helped to structure the development work, and the experimentation canvases facilitated experiment planning.

The experimentation process, which entailed the workshops and executing the experiments outside the workshops, was found to fit well together with the product development work. The high fit of the experimentation process to the development work ensured that the teams could benefit from the workshops rather than investing their time into something that would not be valuable.

In the interviews, the participants were asked in which ways they thought that the work done during the process supported their "normal" project work. While attending the process did require a time commitment, the participants did not feel like that time would have gone to waste, but rather that the process fit seamlessly into their typical way of working. Participant 1, for example, brought up in the interviews that experimentation as a way of working supported the project development completely:

*It supported our work 100 % because we simply developed our project [during the process], and we focused on things that we needed to do.*
Similarly, Participant 5 felt the same by stating in the interviews that the experimentation process supported their project work very well:

\[
\text{I would think that it was like a part of the normal project work. We specifically focused on the things that needed to be progressed. It was not like we would've wasted our time or anything... I think everything we did supported the project work very well.}
\]

The process supporting the development work is crucial since, in order to adopt a new practice, there needs to be value or some benefits that can be experienced. Additionally, the findings reveal that this type of work is beneficial for the teams, and thus, a facilitated experimentation process could be a key to battle the distributed and siloed working. Furthermore, adopting a new practice requires less effort if it fits well together with existing practices.

Beyond feeling like the teams could make progress within their product development, the teams described that the process provided clarity for the process. Previously, it was discussed that one of the foundational challenges within new product development was the teams lacked short-term objectives and were not aligned with the business segments or management. Thus, gaining some clarity in the project would play a role in solving these issues.

Both in the workshops and during the interviews, the participants brought up how the process had increased the clarity of the project. Some participants described how, before the experimentation process, they had lacked a clear plan or had struggled to understand the target of their project. Participant 3, for example, voiced this in the last workshop:

\[
\text{During the project, we have lacked time and a clearer plan on how to proceed... It felt like, previously, no one really even knew what the target was.}
\]

The lack of clarity regarding the targets or a plan was discussed to have been the result of not aligning well enough regarding the targets when the project started and later not communicating efficiently.
A few participants highlighted how the experimentation process helped to divide their work into smaller steps, which was further observed to increase the clarity around the project. For example, Participant 10 reflected in the 6th workshop that breaking the development down into smaller tasks helps the team to see the progress they are making:

*What I learned is that it's easier to work on a project and see benefits or steps taken forward if you really go into the small tasks of the project. Because that's one of the biggest challenges in R&D that we have long-term projects, you don't see the development even though things have happened, and you can visualise [the progress] by breaking it down.*

Additionally, according to Participant 10, visualising the progress in the workshops using templates enabled the team to open up the discussions related to the short-term tasks:

*I think some of the templates that we used were good because they simplified the complex questions... I mean opening up the short-term discussions in detail and aligning what we have to get done within a week or two or three. I think that is a good way to work in general.*

Since one of the foundational challenges was related to the lack of clarity around the projects, it is significant that the teams found that the experimentation process increased the clarity within the projects. Overall, having discussions around projects and objectives can provide a roadmap for teams, ensuring all the members are moving in the same direction.

The third 1st-order code that was analysed to be related to the experimentation processes' positive impact on the project setting is the experimentation process helping to structure the development work. The data showed that the participants felt like they could structure the project work better during the experimentation process. The structure was the combination of careful planning and constantly mapping out what tasks or tests to prioritise.
In the interviews, the participants brought up how the experimentation process had structured the product development work. For example, Participant 5 voiced in the interview how they thought that the experimentation process provided some structure to their work since it was easy to plan the next steps when the team was together:

*It [the process] brought some structure. It was clear that we had the sessions when we gathered all together in the same place... So, at least from that point of view, it was very clear, thinking together what we want to do next and what the things we need next are.*

The data revealed that many teams structured their projects using the official Gates to schedule the work. However, the Gates are typically months or years apart from each other, and thus, the teams could be observed to lack a structure for the short term. On the other hand, the experimentation process itself was highly structured. The workshops had been scheduled beforehand, and each workshop followed the same structure. Participant 23, for example, discussed how the experimentation process forced the team to think about the project in a structured way:

*The workshops forced us to think about the project in a systematic way... We looked at things from a different perspective. We picked out things from the workshops that helped us to think about things systematically and to prioritise.*

Having a highly structured experimentation process to follow was observed to enable the participants to focus on creating valuable experiments instead of focusing on operational practicalities. Prioritising valuable experiments over operational practicalities allows teams to maintain a focus on innovation, learning, and achieving meaningful outcomes within their projects, which can ultimately lead to more successful and impactful new product development.

The final 1st-order code that was identified to impact the project setting was the experimentation canvases facilitating planning. During the process, the experiments were planned in detail in the workshops. In practice, the planning was done by using
different canvases on Miro to help visualise the plan and ensure the team's alignment regarding the work to be done.

The topic of the experimentation canvases supporting planning came up in the workshops as well as in the interviews. The participants highlighted how the visualisation and careful dividing of the plans into concrete steps ensured a common understanding of the experiment. Participant 16 expressed in the 4th workshop, after the team had planned the experiment, how carefully dividing the work into steps works well:

*It is nice to divide the plans into small steps and assign who is doing what. I think it has been shown to work.*

Similarly, Participant 4 discussed in the interview how the canvases made the planning more concrete, as visualising the plans for the whole team to see meant that the participants did not need to rely on their memory regarding the tasks to be done:

*I liked the different canvases. For me, it made the planning process more concrete since we had to think about what still needed to be done with the project. It wasn't just inside your head. I think the tools were good in the sense that they made what needed to be done more concrete.*

Visualising the planning seemed to make it clearer what the team members expected from each other and what was to be done in order to reach their goals. Participant 3 explained in the interview how the team had had meetings where the planning was not so detailed, and there was no paper trace left on who was expected to do what:

*What made the whole process visible for everyone were the sprint cards, where we wrote the do-to lists and assigned tasks. It made things very clear. We have had project meetings where no memos are done on who is doing what. In this project, we heavily relied on the sprint cards to see who was supposed to do what.*

All in all, the canvases used in the experimentation process were regarded as facilitating the planning and adding clarity to the work to be done. In practice,
assigning the tasks between the team members and visualising the expectations could be observed to make the execution of the experiments more effortless since there was no ambiguity on who was executing which step.

4.4 SUMMARY OF THE KEY FINDINGS

This section summarises the key findings and visualising their relation to each other. The data revealed three aggregate dimensions within the scope of the thesis: foundational challenges in new product development, factors affecting the adoption of experimentation, and the effect of experimentation on new product development. These aggregate dimensions relate to each other in three regards. Firstly, the analyses revealed that the foundational challenges of new product development experienced by the participants impeded the experimentation process. The challenges related to the teams’ lack of autonomy, lack of time and misalignment between the team and management could be observed to lower the participants’ mental capacity needed for experimentation.

The second significant relation within the key findings was how the value perception regarding experimentation supported the experimentation process. Thus, the positive effects of how experimentation was identified to impact new product development were one of the factors that ended up driving the adoption of experimentation. The final aspect in which the key findings affected each other was the implications the experimentation process had on the foundational challenges.

Looking at how the findings are intertwined, the value of experimentation becomes evident. The inherent value experienced through the process affects experimentation, whereas experimentation was further observed to bring value to new product development. The value of experimentation affected the foundational challenges of NPD since the process helped with some of the foundational challenges experienced by the participants. Solving the foundational challenges of NPD, on the other hand, could be seen to improve the mental capacity needed for experimentation.
Figure 9. The relationship between the key findings
5 DISCUSSION

This chapter highlights the findings of the thesis in terms of the theoretical contributions and practical implications. The existing theory will be reviewed in comparison to the findings of the study in theoretical implications in order to map out how the findings support the existing literature and how they extend and add to the existing theory. The practical implications of the findings in this specific case study regarding team-level and managerial implications will be discussed. Lastly, the overall limitations of the study will be discussed, and suggestions for future research will be presented at the end of the chapter.

The objective of the study was to answer the research questions:

1. What are the foundational issues in new product development?
2. What are the factors affecting the adoption of experimentation within new product development teams?
3. What is the effect of experimentation on new product development teams?

The research questions were approached by studying in real-time how teams can adopt experimentation, the factors affecting this, and how the teams can benefit from experimentation. By pinpointing the foundational issues in new product development and their effect on the adoption of experimentation, the study was able to observe the correlation between the foundational issues, adoption of experimentation and, finally, the value of experimentation to NPD. Thus, the study aims to contribute to the existing literature in two regards: building on literature on experimentation in new product development and building on literature on practice adoption. Furthermore, regarding the practical implications, the study aims to provide guidelines for teams and organisations on what to focus on when deciding to grab the value of experimentation by adopting it as a practice.
5.1 THEORETICAL CONTRIBUTIONS

As presented in the literature review chapter, the existing theory recaps experimentation in NPD and its benefits. Similarly, the literature reviewed presents the factors supporting experimentation and practice adoption as separate topics. Despite literature on the benefits of experimentation, how experimentation-driven companies operate, and which factors ensure experimentation is done to provide value to the organisation, there needs to be more academic research regarding how to support companies at the beginning of this path.

Similarly, practice adoption is studied in the context of different fields to the extent that certain factors can be picked out to ensure the adoption of a practice, in general, is supported. However, little existing theory would consider experimentation as a new practice and how it can be adopted or supported in companies or the context of new product development. The following sub-chapters will address the existing literature and the theoretical contributions of the thesis from the perspective of experimentation in new product development and practice adoption.

5.1.1 CONTRIBUTIONS TO EXPERIMENTATION IN NEW PRODUCT DEVELOPMENT

The contributions to theory on experimentation in new product development are twofold. Firstly, the thesis maps out the factors affecting the adoption of experimentation in new product development teams. The thesis adds to the existing literature regarding new product development by shedding light on the mental capacity needed for experimentation and how the foundational challenges of NPD impede this capacity. Furthermore, the thesis enforces the existing literature on the value of communication. The second contribution to the theory of experimentation in new product development is the effects of experimentation on NPD teams. The thesis adds to the existing theory by finding practical positive implications to collaboration, communication and the project setting.

Some existing theories on experimentation can be found to address the mental capacity needed for experimentation. Hassi and Rekonen (2018), for example, have addressed the process of experimentation by stating that the process itself takes time and effort
from the team to reap the benefits and give space for reflective thinking. The study adds to the theory by emphasising the importance of the mental capacity to focus on creating valuable experiments. Further extending the existing literature, the findings bring up the mental strain caused by constant prioritising and feeling like there is a constant lack of time. The thesis found that the hectic schedules, a combination of multiple factors, caused difficulties in planning experiments. The lack of focus on experimentation led to the time reserved for planning to narrate the problematic situation instead of trying to find experiments that could improve the situation. Thus, the thesis further adds to the literature on how employee stress translates to the experimentation process by narrowing the individual’s mind and hindering creativity.

Thomke (2003), alongside Hassi and Rekonen (2018), emphasised how company management has a role in driving experimentation through clear statements and giving permission and authorisation to experiment. Thus, clear communication has been recognised as a factor from the management’s side and a critical characteristic of steering the organisation’s culture. However, the thesis contributes to the existing literature by highlighting the importance of open communication within the team. Open communication was found to have a vital role in experimentation due to it affecting how the team could express ideas or analyse the experiments.

The role of collaboration can be picked out as the third contribution to the existing theory around experimentation in new product development. From the existing literature, Thomke (2019) has identified siloed working as one of the prominent organisations’ characteristics, which would be avoided with large-scale experimentation. The thesis supports the existing literature since isolated work was identified as one of the effects of working in a distributed setting and, thus, also as one of the foundational challenges within NPD. However, the importance of collaboration is not otherwise emphasised in the existing literature, and there are no evident mentions regarding the role of teamwork in experimentation. Thus, the findings of this thesis add to the existing theory by highlighting how collaborating with the team supports experimentation.

The findings present how collaborating with the team enabled experimentation since it helped them solve problems and clear blockers that might have come up during the
experiments. Additionally, ideating, planning, and analysing the experiments together as a team made the experimentation process easier. Moreover, collaboration seemed to bring the participants enjoyment, which helped their willingness to experiment. Thus, the thesis contributes to the existing theory by shedding light on how teamwork supports experimentation.

Besides the thesis adding to the theory regarding different factors that affect experimentation, the thesis also mapped out how experimentation affects new product development teams. Thus, the second essential contribution to the theory of experimentation in new product development is the effects of experimentation on NPD.

The existing literature highlights the two most common benefits of experimentation: Thomke (2001) and Thomke et al. (1998) discuss experimentation as the key to managing innovation, whereas De Meyer et al. (2002) and Sommer & Loch (2004) bring up experimentation from the point of view of managing uncertainty. However, little existing information exists on the practical implications of experimentation to the NPD teams. Thus, the study contributes to the existing theory by finding implications in three significant areas: collaboration, communication, and the project setting.

Regarding collaboration, the thesis adds to the existing theory by bringing up how the facilitated experimentation process led to increased enjoyment in teamwork, making the experimentation steps smoother and aiding problem-solving. The thesis contributes to the literature by finding that communication improved significantly with experimentation canvases and facilitated sessions, enabling better understanding and coordination among team members and functions. The experimentation process also positively affected the project setting by seamlessly aligning with NPD work, providing clarity in project objectives, breaking down tasks for better visibility, and structuring development work effectively. Thus, the thesis adds to the existing literature by highlighting experimentation canvases in planning and clarifying responsibilities.

Overall, this thesis makes twofold contributions to the theory of experimentation in new product development. Firstly, it highlights the factors influencing
experimentation, emphasising the mental capacity required and how foundational challenges hinder this capacity while also underscoring the critical role of communication within the NPD teams. Secondly, the study explores the practical effects of experimentation on NPD teams, unveiling positive implications on collaboration, communication, and the project setting. It deepens the understanding of mental strain from constant prioritisation, adds the significance of open communication within the team, and highlights the role of collaboration in supporting experimentation within distributed settings. Additionally, the thesis contributes to the literature by outlining specific impacts of experimentation on teamwork enjoyment, communication enhancement through tools, and structured alignment with NPD work, particularly emphasising the use of experimentation canvases for planning and clarifying responsibilities, providing tangible methods to enhance NPD outcomes through structured experimentation.

5.1.2 Contributions to Practice Adoption

The contributions of the thesis findings to the practice adoption literature are related to the effect of facilitating the process and perceiving the value of the practice. The thesis adds to the existing literature on practice adoption by shedding light on the value of facilitation in adopting a new practice. Furthermore, the thesis enforces the existing theory by finding the perceived value as a driver in increasing the willingness to keep the new practice alive.

Garvin (1993) has brought up learning as a critical part of practice adoption since companies and individuals simply repeat old practices in the absence of learning. Similarly, Canato et al. (2013) have discussed the role of coercive learning as a driver in practice adoption, and Schein (2010) highlighted training as one of the biggest drivers in practice adoption. The thesis found that guiding the process through facilitated workshops was perceived as a valuable and beneficial act in adopting experimentation. Furthermore, the findings discuss that in the absence of facilitation, the teams were seen to go back to their old practices. Thus, the study contributes to the existing literature by extending the knowledge around learning and training by highlighting the importance of facilitating the process to be adopted.
The second contribution to the existing practice adoption theory is perceiving the value of a practice. The existing literature emphasises that exposing the team to the positive implications of practice plays a vital role in the practice adoption process since it can help the team members to accept the practice further (Canato et al., 2013). The findings of the thesis support this by stating that seeing the benefits made the teams more willing to keep the practice alive. Furthermore, the thesis findings align with the existing literature on how the positive effects of the practice overrule the discomfort of having to change the way of working and thus support the adoption process (Canato et al., 2013). The thesis contributes to the theory of Canato et al. (2013) by highlighting that getting exposed to the benefits of the practice trumped any negative emotions and biases the participants might have had before the process.

Overall, the thesis findings significantly contribute to the practice adoption literature in two key aspects. Firstly, it adds to existing knowledge by emphasising the role of facilitation in adopting new practices. Unlike prior literature that underscored learning and training as critical drivers, the study highlights the value of guided processes, mainly facilitated workshops, in successful practice adoption. Secondly, the thesis underscores the importance of perceiving the value of a practice in adoption processes, aligning with existing literature that emphasises exposure to positive implications as crucial. It further extends this understanding by revealing that witnessing the benefits significantly increased teams’ willingness to sustain the new practice, surpassing initial discomfort or biases.

5.2 PRACTICAL IMPLICATIONS

The thesis findings can be seen to provide some practical implications to the NPD teams as well as management. The practical implications touch on how to solve the foundational challenges identified and provide some guidelines regarding how to support the adoption of experimentation in distributed project settings. The practical implications summarise the factors supporting experimentation adoption by presenting some guidelines for the NPD teams and company management.
5.2.1 Implications for NPD Teams

Looking at the thesis findings, the most apparent implication to the NPD teams is to start experimenting. The findings showcase the value of experimentation to the teams by increasing collaboration, improving communication, and enhancing clarity around the project structure and planning. The NPD teams are encouraged to seek a structured approach towards experimentation by clearly scheduling the sessions when the experiments are planned and analysed and using the tools and canvases to visualise the experiments and tasks at hand. Furthermore, more minor practical implications can be picked out for the teams. These practical implications focus on collaboration, communication, and the team’s short-term objectives.

The team should pay attention to reserving time for collaboration. As described in the findings, collaborating with the team supported experimentation, especially from the point of view of ideating, planning, and analysing the experiments together as a team. Additionally, collaboration brought the participants enjoyment, which helped increase their willingness to experiment. As a result, the team should make sure that there is enough time allocated for them to ideate, plan, and analyse the experiments together.

In practice, ensuring that the team meets in official meetings and that there is time reserved for sharing successes, brainstorming, and learning together can help the team in the experimentation process. Not diminishing the value of having the team together and understanding that not all co-working sessions need to be meetings can ensure the team can build habits around the experimentation process.

The second practical implication for the teams is to ensure open communication since the findings suggest that the team found open communication to support experimentation, especially regarding ideation and planning the experiments. To ensure open communication, the team should use tools that help structure the experiment ideation and planning. Seeking facilitation for the process can further help the team keep communication open, as the thesis highlights that facilitation ensures that all team members can participate in the discussion.

The third aspect teams should consider is carefully setting short-term objectives for the NPD project. The findings show that the absence of clear short-term objectives
made narrowing down the experiments’ scope difficult for the teams. Not having clarity on the short-term objectives makes it less likely for the team to be able to plan experiments that truly drive the project forward. Thus, the teams should aim to create short-term objectives in addition to long-term objectives regarding the gates within the NPD.

5.2.2 Managerial Implications

The managerial implications focus on removing the foundational challenges of new product development and supporting the NPD teams in adopting experimentation. The managers are encouraged to seek out a facilitated process to help the teams adopt experimentation as a practice and to aim to convey the value of experimentation as soon as possible.

The thesis showcases how the experimentation process provided value to the NPD teams and helped them address some of the foundational challenges rooted within new product development. The foundational challenges that were seen to improve were collaboration over a distributed or isolated way of working, gaining clarity regarding the project and improving communication. Thus, the managers should invest in a facilitated experimentation process for the teams to reap these benefits. The facilitation was perceived as a critical driver of experimentation, while the findings showed that the teams could not keep experimenting after the facilitation ended. Furthermore, the facilitated process ensures that the teams have the needed know-how and guidance to experiment, and the facilitator can be used to incentivise the experimentation process.

The second managerial implication is to ensure clear NPD project objectives and unambiguous expectations for the NPD team. The study’s findings reveal that some teams struggled to understand their project’s objective or the expectations from the segment’s management or the other parts of the segment. Not fully understanding where to focus, the teams felt like they might be focusing on the wrong things, which could lead to inefficient product development. Not having a clear scope for the process makes coming up with valuable experiments more complex, and thus, the teams should have clarity on what the objectives are and what the management in practice expects from the team.
The third managerial implication has to do with giving the teams autonomy to make decisions regarding the NPD project. The thesis found that one of the foundational challenges in new product development was the highly bureaucratic NPD process and the lack of autonomy regarding the project teams’ decision-making. Simplifying the heavy decision-making process and trusting the project team to make some decisions independently could ensure that the team has more capacity to focus on product development than bureaucratic actions.

The fourth managerial implication is related to allowing time to focus on fewer projects at a time. The thesis suggests that the teams struggling with being involved in multiple NPD projects at once had difficulties in finding time and mental capacity for experimentation. To reap the benefits of experimentation and support the teams in their development work, the management should aim to limit the number of NPD projects each employee is involved in. Allowing the employees to fully emerge into one topic at a time would ensure they do not need to prioritise different projects constantly. Additionally, this would free some mental capacity that is needed for experimentation.

Finally, the management is encouraged to provide clear guidelines regarding the roles and responsibilities within new product development. The thesis found that one of the foundational challenges within NPD was the lack of clarity regarding the different roles and responsibilities of the people taking part in the development work. This was seen to lead to people doing work that was not their responsibility. It would also cause frustration among the participants, who felt the project constantly relied on them for extra work. Thus, to support an efficient product development process, the managers are encouraged to map out clearly what is expected from each person and their purpose in the project.

5.3 LIMITATIONS OF THE STUDY AND SUGGESTIONS FOR FUTURE RESEARCH

The study’s objective was first to identify the foundational challenges in new product development, then map out factors that affect experimentation, and finally to find the effects of experimentation on new product development.
The study was highly qualitative; thus, the findings represent a limited part of the research organisation during a limited time frame. While the constructivist qualitative study does not aim to produce generalisable results, it must be noted that there are clear limitations to how the study findings could be applied to other teams or companies.

Firstly, the number of focus groups was small in relation to the whole company. Studying four project development teams meant that the study included about 10% of new product development projects. Furthermore, other types of projects are running at any given time in the company depending on the function, and the NPD projects thus only represent a particular type of project.

Secondly, due to the strict time frame of the thesis, the data was gathered during a relatively short period. The projects typically can run for multiple years; thus, the study provided a look into specific events happening at a specific time. All four projects were in the same stage of the development process, thus representing a specific type of development work. The nature of the work can significantly vary in different stages of the process.

Lastly, due to the size and distribution of the company, some different national cultures and practices can be found within the organisation. Similarly, different subcultures can emerge between different offices, and the company’s context could only be described through the eyes of the teams in the study.

The study’s findings regarding the foundational challenges in new product development, the factors affecting the adoption of experimentation, and the effect of experimentation on NPD could be further validated through future research. By conducting similar research settings for projects in different stages of the NPD process, there could be a possibility of getting some clarity on how the nature of the development work fits together with experimentation as a practice. Similarly, the project stage could affect the perceived benefits of experimentation, further contributing to the overall value of experimentation.

Future research could be expanded to different functions, teams, and different types of projects. New product development projects inherently have some experimenting included, as laboratory tests are often required to gain knowledge of the product’s
function. Moving the focus of the research to other functions and different types of projects could help increase understanding of what different teams need to adopt experimentation as a way of working and help map out the different types of experiments that can be conducted in different parts of the company. Similarly, the foundational challenges could be experienced differently, and experimentation could be found to yield different benefits to different functions.
6 CONCLUSIONS

This thesis studied experimentation in new product development. The thesis first aimed to incentivise why new product development teams should adopt experimentation by assessing the foundational issues of new product development. Secondly, the thesis focuses on building an understanding of the factors that affect the adoption of experimentation. Finally, the thesis aims to map out the effects of experimentation on new product development teams.

The overall objectives of this study were summarised in the research questions:

1. What are the foundational issues in new product development?
2. What are the factors affecting the adoption of experimentation within new product development teams?
3. What is the effect of experimentation on new product development teams?

While existing literature regarding experimentation, its benefits and the process of experimentation does exist, this study provided new insights regarding the foundational issues of NPD, the value of experimentation and the factors that support experimentation as a way of working. The empirical study focused on four new product development teams and presented the case of a global chemical company.

This qualitative research unveiled how the current NPD process was shadowed by some foundational challenges of working in a distributed project setting, having a highly bureaucratic process and hierarchal organisation culture, lacking time for focus and innovation, and having ambiguous responsibilities and objectives amongst the NPD projects.

The study found that the foundational challenges affected the mental capacity of the participants, thus hindering the adoption of experimentation. Furthermore, the factors affecting the adoption of experimentation were identified to include open communication and psychological safety within the team, facilitating the experimentation process and perceiving the value of experimentation. The experimentation process was observed to provide value to the NPD teams and address
some of the foundational challenges. The practical benefits of experimentation include improving the teams’ collaboration and communication and impacting the clarity around the project setting.

The research questions were answered by first identifying the foundational challenges of new product development. The challenges were related to working in a distributed project setting, the structural constraints and organisational culture, time constraints, and ambiguous responsibilities and objectives. The second research question was answered by mapping out the factors affecting the adoption of experimentation in new product development teams. These factors included mental capacity, open communication and psychological safety, facilitation, and value perception. Finally, finding the effects of experimentation on new product development, the third research question was answered by mapping out how experimentation affected the collaboration, communication, and project setting of the new product development teams.


A. Semi-structured interview question base, English

The project and their role
- Role at Kemira
  ⇒ How long have you been in your current position?
  ⇒ What are the key activities you do in this position?
  ⇒ In your position, what are you expected to do/achieve at Kemira?

- What kind of other projects are you involved in now?
  ⇒ What is the project that you focused on in the experimentation workshops?
  ⇒ How would you describe your involvement in the project?
  ⇒ How do you think the project is going now?
  ⇒ Would you say the project is a typical project for Kemira? (why/why not?)

- How would you describe the current process for developing the products?
  ⇒ What are the positives and the negatives?
  ⇒ If you could change the process, in what ways would you change it?

Company culture & current situation
- How would you describe the current development culture at Kemira?
- How would you describe the current experimentation culture at Kemira?
- In what ways does the company value experimentation-driven development?
  ⇒ How is this visible?

- How do the existing tools support experimentation-driven development?

The workshops and experimentation
- During the workshops
  ⇒ What things can you name that helped you with experimenting?
  ⇒ What things can you name that blocked you from experimenting?

- In-between the workshops
  ⇒ What things can you name that helped you with experimenting?
  ⇒ What things can you name that blocked you from experimenting?

- What did you find easy with experimentation?
- What did you find difficult with experimentation?
- What did you enjoy about experimenting?

- Which factors made it easy to start experimenting?
- Which factors would guarantee that the team would continue using experimentation as a way of working?
Adopting a new practice

- In what ways were you able to adopt experimentation as a practice?
  ⇒ Which factors supported the adoption?

- How did the experiments/the process of experimentation support your “normal” work?
  ⇒ How did the experiments/the process of experimentation support the team’s work?

- If another project team begins to work in an experiment-driven way, which factors would help to make this process easy for them?

- If another team would try to adopt experimentation as a way of working, which factors would help with this?
  ⇒ Which factors would make this more difficult/what should be avoided?

Working in a distributed setting

- In which ways did experimentation support the team collaborating in a distributed project setting?

- How did the experiments support creativity in a distributed setting?

Management’s role

- In what ways does the management support experimentation as a way of working?
  ⇒ How is it encouraged?
  ⇒ How is this visible?

- In what ways does the management support the adoption of new practices?
  ⇒ How is it encouraged?
  ⇒ How is this visible?

- How would you describe the communication between the management, steering, and project teams?

- In which ways does the management have the same goals and objectives as the project team (regarding the project outcome)?
  ⇒ Are management’s expectations aligned with the team’s expectations?

- How do you express your feelings or ask for help from the upper management?

- What makes it easy to speak up when things do not go as planned?
  ⇒ What makes it difficult?

- Can you still think of some things that would block/help you with adopting experimentation as a way of working?
B. Semi-structured interview question base, Finnish

HAASTATTELU KYSYMYKSET

Projekti ja haastateltavan rooli
- Rooli Kemiralla
  ⇒ Kauango olet ollut Kemiralla/ kyseisessä roolissa?
  ⇒ Mitä tämä rooli pitää sisällään?
  ⇒ Mitä Kemira odottaa sinun roolissasi olevalta työntekijältä?

- Minkälaisissa projekteissa tällä työskentelet?
  ⇒ Mikä on projektin, jonka tiimillä oltit osaa kokeilemalla kehittämisen
    työpajoihin?
  ⇒ Miten kuvallisit osallistumistasi projektiiin?
  ⇒ Miten projektin eteen mielestäsi tällä hetkellä?
  ⇒ Sanositko, että projekti on tyypillinen Kemiran projekti? (miksi/miksi ei?)

- Miten kuvallisit tämänhetkistä tuotekehitysprosessia?
  ⇒ Mitkä ovat hyvät ja huonot puolet?
  ⇒ Miten prosessi vaikuttaa tuotteiden kehittämiseen?

Yrityskulttuuri & nykytilanne
- Miten kuvallisit tämänhetkistä kokeilemalla kehittämisen kulttuuria Kemiralla?
- Millä tavoin yritys arvostaa kokeilulähtöistä kehitystä?
  ⇒ Miten tämä tulee ilmi?
- Miten olemassa olevat työkalut tukevat kokeilemalla kehittämistä?

Kokeilemalla kehittäminen
- Työpajojen aikana
  ⇒ Mitkä tekijät edesauttoivat kokeilemalla kehittämistä?
  ⇒ Mitkä tekijät estivät kokeilemalla kehittämistä?

- Työpajojen välissä
  ⇒ Mitkä tekijät edesauttoivat kokeilemalla kehittämistä?
  ⇒ Mitkä tekijät estivät kokeilemalla kehittämistä?

- Mikä oli mielestäsi helppoa kokeilemalla kehittämisessä?
  ⇒ Mikä teki siitä helppoa?
- Mikä oli mielestäsi vaikeaa kokeilemalla kehittämisessä?
  ⇒ Mikä teki siitä vaikeaa?
- Mistä pidit kokeilemalla kehittämisessä?
- Mitkä tekijät tekiivät kokeilemalla kehittämiseen ryhtymisestä helppoa?
• Mitkä tekijät takaisivat sen, että kokeilemalla kehittäminen jatkuu teidän
  tiimissänne?

_Uuden toimintamallin jalkauttaminen_

• Miltä osin koet, että kokeilemalla kehittäminen malli saatiin jalkauttua
  teidän projektiitiiminiin?
  ⇒ Mitkä tekijät mahdollistivat tai estivät jalkauttamista?

• Miten kokeilut/kokeilemalla kehittämisen prosessi tukivat "normaalia"
  työtä?
  ⇒ Miten kokeilut/kokeilemalla kehittämisen prosessi tukivat tiimin
  työtä?

• Jos kokeilemalla kehittäminen toimintamalli haluttaisiin jalkauttaa toiseen
  projektiitiiminiin, mitkä tekijät edesauttaisivat tässä?
  ⇒ Mitkä tekijät teksivät tästä vaikeaa/mitä tulisi välttää?

_Työskentely hajautetussa ympäristössä_

• Millä tavoin kokeilemalla kehittäminen edesauttoi tiimin yhteistyötä
  hajautetussa projektiymääräissä?

• Miten kokeilut ja kokeilemalla kehittämisen prosessi tukivat luovuutta
  hajautetussa ympäristössä?

_Johdon rooli_

• Millä tavoin johto tukee kokeilemalla kehittämistä?
  ⇒ Miten kannustetaan?
  ⇒ Miten tämä tulee ilmi?

• Millä tavoin johto tukee uusien toimintamallien jalkauttamista?
  ⇒ Miten kannustetaan?
  ⇒ Miten tämä tulee ilmi?

• Miten kuivalisit johdon, ohjausryhmän ja projektiiryhmän välistä
  viestintää?

• Millä tavoin johdollan on samat tavoitteet ja tavoitteet kuin
  projektiitiimillä
  (projektin suhteen)?
  ⇒ Ovatko johdon odotukset linjassa tiimin odotusten kanssa?

• Miten ilmaiset tunteitasi tai pyydät apua ylemmältä johdolta?

• Mikä tekee puhumisesta helppoa, kun asiat eivät mene suunnitelmien
  mukaan?
  ⇒ Mikä tekee siitä vaikeaa?

• _Tuleeko sinulle vielä mieleen asioita, jotka estäisivät/auttaisivat
  kokeilemalla kehittämisen jalkauttamista organisaatioon?_
C. The experimentation canvases

![Experiment Card](image1)

![Sprint Card](image2)