



**CHALMERS**  
UNIVERSITY OF TECHNOLOGY



# **Implementing customer behaviour data analysis in a scaled agile context**

A case study of software development challenges at SKF

Master's thesis in Management and Economics of Innovation

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# Abstract

As markets shift from transactional one-time sales to continuous relationships between suppliers and customers, even large, traditional manufacturing firms are complementing their hardware products with software services as packaged solutions. To develop functionality that accurately meets the market needs, a key factor is understanding what provides value to the customer. This study aims to develop this understanding by identifying what challenges are faced when trying to create value through collecting and analyzing data about customer interaction with products, while also considering what role a scaled agile way-of-working plays.

The foundation for the research was built through a literature review, covering the fields of decision making, data analytics, user research, and agile software development. Using the knowledge gained, the specific topic of analysis was then probed further through twelve semi-structured interviews with key individuals at a case company that is working on improving its software development practices. The interview answers were analyzed using thematic analysis, which identified recurring thoughts that were eventually coded into six key challenges to successful implementation of customer behaviour data analysis: presence of other priorities, aligning the mindsets of stakeholders, building trust through transparency, understanding the value of user data, assigning ownership of the transition, and handling privacy and legal concerns. Additionally, a model was created to showcase how agile supports different user research methods, depending on their characteristics.

The findings of this study show that while basing decisions on objective data seems like an obvious call in theory, the actual implementation of such practice is often inhibited by various organizational barriers. Although previous research of general challenges with data analysis exists, this thesis contributes with a new perspective by looking specifically at customer behaviour. The visualization of the relationship between agile methodology and user research also breaks entirely new academic ground. Overall, the results hope to forward the discussion about the ability to meet and predict market needs through customer behaviour data analysis and agile processes. The case company and others in a similar position can rely on the findings to take steps in an appropriate direction, while further research with a broader scope of investigation is recommended to verify the results on a general basis.

Keywords: *Customer behaviour, data-driven decisions, data analysis, user research, agile software development, scaled agile*



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# 1

## Introduction

### 1.1 Thesis outline

The thesis is structured according to guidelines provided by Chalmers University of Technology for conducting a master's thesis project. The *Contents* section at the beginning of the thesis provides a basic overview of this structure, and a brief introduction to each of the main chapters will be provided below.

#### **Chapter 1: Introduction**

Establishes a background for why the topic of the thesis is a relevant field of study. Based on this, the scope, purpose, and limitations for the thesis are defined, and research questions outlined. Finally, an introduction to the case company is provided.

#### **Chapter 2: Literature review**

Delves into the theoretical foundation used to develop the research problem, and relevant interview questions used for exploring it. The material presented is also later used to discuss the empirical findings.

#### **Chapter 3: Methodology**

Details the steps involved in conducting the study, and the references used for constructing the research process. Reflects about the legitimacy of the research.

#### **Chapter 4: Results**

Presents the key findings from the interviews. The first research question is coded into categories representing challenges, while the second creates a new model showcasing the overlap between agile and user research methods.

#### **Chapter 5: Discussion**

Explains the contributions of the thesis toward academia, reflects over the methodology used, and recommends managerial steps for the case company to overcome its challenges. Points out areas of potentially interesting future research.

#### **Chapter 6: Conclusion**

Concisely summarizes the key findings of the thesis, in accordance with the research questions it set out to answer.

### 1.2 Background

Recently, the way of conducting business has changed from maximizing short-term transactions to establishing long-term relationships aimed to build trust with the customers (Vandermerwe & Rada, 1988). Seeking to establish more sustainable competitive advantage, manufacturing companies are increasingly complementing their physical products with related services such as software (Salonen, 2011), a transition known as servitization (Vandermerwe & Rada, 1988). Examples of software used in service-based business models are monetization apps and Internet of Things-related offerings, which create new business and market opportunities for manufacturing firms (Yang, Shen, & Wang, 2018). The new business environment sets tough requirements for companies to quickly respond to changes in customer demand (Tukker, 2004), and manufacturers can find it challenging to adapt their existing organizational routines. Furthermore, many firms are investing in data analytics with the objective of enhancing their decision making processes (Davenport & Bean, 2018). However, several challenges are involved in making such changes to routines (Katal, Wazid, & Goudar, 2013), and the transition therefore often tends to occur slowly (Davenport & Bean, 2018).

As servitization continues to spread, many industries move to embrace agile working methods (Conforto, Salum, Amaral, Da Silva, & De Almeida, 2014), which have become dominant within software development (McAvoy & Butler, 2009) as a reaction to the traditional waterfall processes being perceived as unnecessarily rigid (Highsmith, 2002). Agile meanwhile is built to withstand frequent requirement changes by continuously involving the customer, which is key for meeting the expectations in software development (Williams & Cockburn, 2003). However, the role of agile in encouraging data-driven decisions is largely unexplored. While it is known that agile has a strong focus on customer collaboration (Beck et al., 2001), its compatibility with direct analysis of customer behaviour are still not known.

Data-driven decision has been found to enhance the competitive advantage for companies, due to its reliance on objective metrics (Chen, Zhang, & Zhao, 2017). However, while many firms are investing in data analytics, it often fails to be embedded into the organizational culture (Davenport & Bean, 2018). Nonetheless, many companies are developing mobile apps in search of new business opportunities (Yang et al., 2018). Pointing out the value that data gathered from apps can bring, Chen et al. (2017) suggests further research into the challenges with big data implementation for mobile apps and user research.

### 1.3 Purpose and research questions

Building on the suggestion, the theoretical focus of this thesis is guiding large, established industrial manufacturing companies toward becoming more data-driven, relying on analysis of customer behaviour data to strengthen their software development practices. This is achieved by identifying what challenges are faced in such



a transition, and how working with an agile methodology influences the process.

More specifically, the thesis intends to answer the following research questions:

1. *What obstacles inhibit established industrial manufacturing multinationals from implementing data analysis of customer behaviour to improve their software development decision making processes?*
2. *How does an agile way-of-working influence the implementation of customer behaviour data in the decision making process?*

The thesis aims to contribute to its academic field by identifying a set of common challenges in implementing data analysis of customer behaviour and strive to be applicable to large manufacturing firms. Additionally, the relationship between agile and different user research methods will be explored to analyze its impact.

## 1.4 Limitations

The thesis is performed as a single-case study, limiting the scope to the operations of one company. This approach allows for a detailed understanding of the specific case to be developed, and facilitates access to knowledgeable stakeholders. On the other hand, the results of a single-case study are not necessarily applicable in a general context. How these this risk and other concerns related to the validity of the study are discussed further in chapter 3, *Methodology*.

Given its manufacturing background, a share of the case company's business comes from hardware manufacturing, but this study only involves itself with the software development side of the organization. The research topic is positioned in the software domain, and hardware product development by nature is a significantly different process. Furthermore, the field of agile methodology is more commonly used in software development, as in the case of the department where the project was conducted. The study does however rely on the specific implementation of agile at the case company, meaning that findings may to a certain degree be a result of local circumstances.

From a sustainability perspective, ecological, societal, and ethical concerns need to be addressed. The ecological aspect is not considered relevant, given that software products are non-material. The societal and ethical aspects bring up questions of privacy rights and cybersecurity, related to data collection. This legal aspect will be kept in mind as a potential obstacle related to the first research question. Concrete recommendations for how to deal with legal restrictions will be left to authorities with the proper knowledge as a potential managerial implication.

### 1.5 Context for the case study

To provide a real-world perspective to the research performed, a case study has been conducted at SKF in Gothenburg. Relevant details about the company's operations are laid out below, as learned during an initial interview with the researchers' contact person (J. McNamara, personal communication, 1 February 2020).

SKF is one of Sweden's most established industrial multinational manufacturing firms, with over 44.000 employees spread out globally. The traditional business model is hardware manufacturing of bearings, seals, and lubrication systems to industrial customers. However, the company has expanded its value proposition with a segment called *Rotating Equipment Performance* or *REP*, alongside traditional product sales. The REP segment packages complete solutions, where complementary services are offered to enable efficient performance of each hardware product throughout its entire life cycle. The share of revenue generated by REP business is growing rapidly, necessitating expansion of software development as part of the complementary service package.

At the Gothenburg offices, software development is housed at the Software Development Center, which is where the researchers were based during the duration of the project. The SDC is part of the Innovation and Business Development (I&BD) department, a key driver in ensuring the continued growth of the REP segment. Two central functions at the department are Product Management (PM), and Product Development (PD), which work together in generating new software offerings. PM is responsible for meeting business needs, and focuses on envisioning the long-term strategy of the department as a whole. PD consists of a number of development teams working together to implement the business needs received in practice and build software solutions.

The entire SDC works closely together, using scaled agile (SAFe) methodology and scrum to drive improvements. Currently, PM gathers input about market needs by communicating with the sales and marketing departments, and then channels that information along to PD. An acknowledged issue with this approach is that the development teams are relatively decoupled from the end users, making it difficult to achieve the quick responsiveness to sudden changes in market conditions, a central aspect of agile practice. As feedback or other information from the users passes through several steps in the organization, it risks changing as individuals involved in the process may misunderstand or perceive a situation differently than initially described. Consequently, the functionality built does not always match what is expected from the customer or the sales teams, creating unnecessary friction.

By introducing a more objective and direct way of learning about customer needs, the developers could better understand where to target their efforts. Monitoring how users interact with the software products and then analyzing that data would help the teams better understand and predict what the customer wants. This way, the risk of spending valuable time and resources on developing functionality that

turns out not to be useful to the customer is mitigated. Being able to accurately assess such decisions could generate previously unseen profits for both SKF and other firms in a similar situation.



# 2

## Literature review

This chapter aims to provide an academic background for the study. The researchers have reviewed existing literature in fields relevant to the research problem, in order to identify concepts to be used for developing interview questions that probe the right places. The concepts and studies encountered have been divided into four categories believed to contribute valuable input to the topic of the thesis. These areas are decision making, data analytics, user research, and agile software development, each of which will be explored in the following sections. At the end, a synthesis section is provided to summarize the main findings.

### 2.1 Decision making

Despite being an extremely wide subject, decision making is believed to play a central role in the underlying problem statement provided by the case company. Achieving a successful implementation of customer behaviour data analysis into software development centrally involves seeking approval and convincing the right stakeholders of its value. As such, some core aspects of decision making processes are covered, followed by an exploration of different frameworks describing the key roles involved in the process.

#### 2.1.1 Decision making processes

A commonly cited way of characterizing a decision making comes from Mintzberg and Theoret (1976), who describe the process using five steps. These begin with the realization that a decision is needed, followed by an evaluation of which options are available, before assessing the likely consequences for each of them. Once a choice is made, the decision is carried out in practice, and its impacts followed up on. Another prominent description of decision making comes from Simon (1955), who lists three key aspects: a choice between a list of alternatives, an expectation of certain results for each of them, and an order of preference between them. However, this characterization has been subject to criticism for being an oversimplification of reality. According to March (1991), it is unreasonably optimistic to assume that all potential consequences can be accurately assessed, and that no beliefs held prior to the decision will change during the process.

Clearly, the more information that is made available for inclusion in a decision, the more complicated the process becomes. This was acknowledged already over 60

years ago by Simon (1955), who discussed how the computational limitations of the human mind become an obstacle to improved decisions once the context surpasses a certain level of complexity. This is a result of the inherent difficulty in verifying the accuracy of large input volumes, as well as in comparing different sets of data (Simon, 1955). As such, the pursuit of more rational decisions really entails optimizing the allocation of the limited human attention, with developments often triggered by periods of low performance (March, 1991).

Any endeavour aimed to optimize decision making processes is further complicated by the impact of psychological factors on the decision maker (Simon, 1956). An individual heading into a decision making process will inevitably be forced to compromise and adapt some previously held beliefs and preferences upon meeting differing opinions, norms and traditions presented by the individual's organizational or cultural environment (March, 1991). Due to this, it is important to recognize the inherent difficulty in anticipating future consequences when the contextual factors are dynamic and subject to such uncertainties (March, 1991).

Particularly in a business setting, decision making processes are likely to involve multiple stakeholders with individual preferred outcomes. In such cases, March (1991) argues that the process can be divided into two phases. First, the stakeholders negotiate with each other until an acceptable compromise can be reached, at which point the individual responsibilities are executed in accordance with the agreement. Theoretically, diverging opinions should be aligned during the negotiation stage of the process, but in practice political gamesmanship often tends to influence the executional stage as well, necessitating continuous evaluation of alignment between stakeholders (March, 1991).

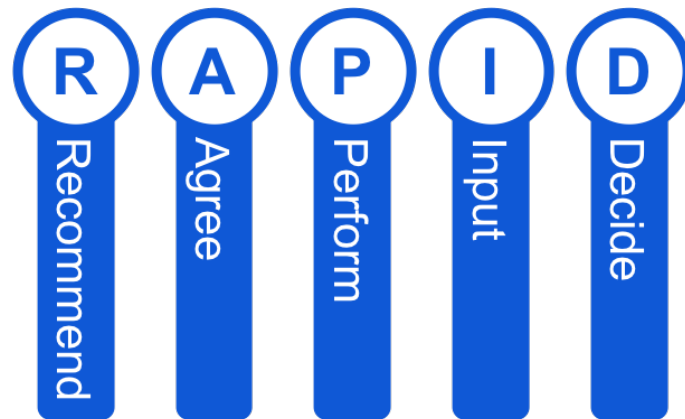
Decision making processes have always been omnipresent in any context where the way forward is not obviously clear (Mintzberg & Theoret, 1976). Optimizing decisions is highly important for all businesses looking to improve the efficiency of its operations, and the task is constantly increasing in difficulty as the world transitions into a largely knowledge-based economy (Milkman, Chugh, & Bazerman, 2009). More information is available than ever before, and the geographical spread of many businesses means that making the right decisions can have widespread impact across industry. The pressure on not making costly errors in judgment is fueling the search for optimization of decision making, where the same choice can be made regardless of which individual has to make the call (Milkman et al., 2009). Ideas for how to reach a more objective foundation for decisions are explored further in section 2.2.

### 2.1.2 Decision making roles

Many decisions are made by groups where multiple roles influence or are affected by the outcome. The *RAPID* framework introduced by Rogers and Blenko (2006) helps define roles in the decision making process, with the intent to enhance organisational performance. *RAPID* is used to categorise the decision makers into five

roles, where the name RAPID is an acronym for the different roles.

The *Recommend* role will collect the data, analyse it and then present the options. However, as the recommender gathers information, a preference for one of the options often emerges, making it challenging to stay objective. The *Agree* role represents the person who must give approval to the option put forward by the recommender, in order to have those plans proceed. The *Input* role acts as a consultant for the agree role, providing another perspective or additional data. The input role is often directly affected by the outcome of the decision, making it crucial to earn their approval. This is especially true in the case that the input role overlaps with the *Perform* role, which is responsible for the execution of the decision. If the recommend role and the agree role disagree and are unable to come up with a new proposal that satisfies them both, they can involve the person with the *Decide* role, to settle the discussion (Rogers & Blenko, 2006).



**Figure 2.1:** RAPID decision making roles (Rogers & Blenko, 2006).

Rogers and Blenko (2006) argue that these roles should be understood by all stakeholders involved in order to increase efficiency. In particular, who is in charge of the final decision needs to be clearly defined. Additionally, it is stated that the organisational performance increases if these roles are condensed, especially when the number of people with the agree role is kept to a minimum (Rogers & Blenko, 2006).

A survey by Davenport and Bean (2018) of senior executives from 57 large organizations about their analytics and presence of data-driven culture, found that an increasing number of firms are introducing new data-driven management roles. However, the survey in the study received mixed responses about how different data-orientated roles relate to each other, if they should be filled by internal employees or external new hires and what their responsibilities are. For instance, the majority of the respondents answered that the primary responsibility for Chief Data Officers was data strategy and results, however 37% set this responsibility to other C-level executives, and 24% answered that there is no single role that has accountability for the task (Davenport & Bean, 2018).

## 2.2 Data analytics

Perhaps even more crucial to the topic at hand, is understanding how analytics can be used to extract valuable insights from data that are collected. Correctly applied data analytics allows for more objective arguments to be brought to strategic discussions, which really stands to benefit corporations of all shapes and sizes. An introduction to these topics is provided in this section, explaining big data and its impact on decisions, as well as what to consider when moving in such a direction.

Understandably, data analytics has become a pressing area for firms. For instance, the survey conducted by Davenport and Bean (2018) surveyed found that a strong majority (97%) were investing in data analytics, big data, and artificial intelligence. Furthermore, the researchers discovered that *advanced analytics/better decisions* was the most commonly occurring objective for firms, and also a highly likely area for achieving success.

### 2.2.1 Big data

The term *big data* has become increasingly more prominent over the last ten years (Google, 2020), but the search for a single original source has so far been unsuccessful (Lohr, 2013). An investigative article by Diebold (2012) attempted to clarify the situation, finally concluding that the term probably originated somewhere in Silicon Valley in the 1990s, but could theoretically be credited to a number of different sources. Within the academic sphere, the earliest occurrences can be attributed to Weiss and Indurkha (1998), and Diebold (2000). The concept was later further explored by Laney (2001), who first discussed big data using the *Three Vs* model, which is still commonly used in organizations to this day.

This initial version of the model suggested describing big data from three aspects: the sheer *volume* of all the data available, the *velocity* of how the data are disseminated, and the *variety* of shapes and formats which the data appear in (Laney, 2001). A decade later, Beyer and Laney (2012) expanded the model with *veracity* as a fourth V, to also account for the reliability of data gathered and analyzed.



**Figure 2.2:** The Four Vs model of Big Data (Laney, 2001; Beyer & Laney, 2012)



Although the work from Laney (2001) is perhaps the most prominent, a number of other models and frameworks for describing big data have been published, taking different approaches. In a comparative paper of some of the main alternatives, Ward and Barker (2013) found that a recurring trend among all of them is listing size, complexity and technology as central aspects.

### 2.2.2 Data-driven decision making

The idea of data-driven decision making that relies on objective measures has become a commonly appearing aspect of business in recent years in business circles. For example, Provost and Fawcett (2013, pp. 53) define the expression as *"the practice of basing decisions on the analysis of data rather than purely on intuition"*. Brynjolfsson and McAfee (2012) argue that an important aspect of data-driven decision making is *"muting the HiPPOs"*, meaning that important decisions should not be based on the highest paid person's opinion, which can often be the case within overly hierarchical organizations.

Embracing data-driven decision making has been found to have a very positive effect on performance for businesses. For instance, Brynjolfsson, Hitt, and Kim (2011) studied 330 public companies in the US and observed an advantage of 5% in terms of productivity and 6% in terms of profitability for firms that effectively performed data-driven decision making. Davenport and Bean (2018)'s survey found that 73% of the organisations reported having gained measurable value from these initiatives, a significant increase of around 50% from the previous year. Furthermore, Chen et al. (2017) highlight that data-driven decision making enhances companies competitive advantages, as it provides a better understanding of the customers and markets. In the same article, such practice is also argued to improve problem solving, enable customisable and innovative products/services, as well as develop new organisational capabilities.

### 2.2.3 Challenges with data analysis

Although a great deal of benefit can be harvested from implementation of big data practices, making such changes also requires dealing with a number of issues. Katal et al. (2013) attempt to categorize the barriers to effective adoption of a big data-centered mindset, identifying several different areas to deal with.

The first area concerns the ownership of data, and how it relates to each individual's right to privacy and security. Big data allows organizations to discover information about users that they might not be aware of themselves, or consent to sharing voluntarily. Continuing, the data gathered needs to be readily accessible to use when making decisions, necessitating the establishment of effective infrastructure for storage and access. This infrastructure both needs to meet the desired requirements with regards to storage and process capacity, as well as ability to protect the data from competing actors looking to exploit the information. Performing efficient data collection and analysis also depends on involving people with the right technical

competence. The authors press the need to develop the internal knowledge of how to analyze large volumes of data, as it is not necessarily obvious what data should be selected, and how it should be used.

Focusing too much on a specific dataset can produce forced incorrect interpretations (Provost & Fawcett, 2013), and it is also possible for two different experts to look at the same dataset and come to completely different conclusions about causality (Dhar, 2013). Possessing sufficient capabilities is also key in managing the technical issues related to the aforementioned infrastructure required (Katal et al., 2013). Establishing a base level knowledge of machine learning and computer science is essentially required to be competitive in data-heavy industries (Dhar, 2013). Provost and Fawcett (2013) highlight that a key aspect for reaping the benefits of big data is ensuring that all stakeholders within an organization understand the purpose of such an approach. Managers and investors in particular need to grasp the basic principles of data science and align the company objectives with them (Provost & Fawcett, 2013).

Brynjolfsson and McAfee (2012) identify five critical areas for management to address when reshaping an organization to use big data; leadership, talent management, technology, decision making, and company culture. Leaders need to identify the new market opportunities and create an appropriate action plan, IT departments need to add new capabilities within data analysis and visualization, information and decision making power need to be grouped together, and decisions need to be made based on what is known and not what is believed (Brynjolfsson & McAfee, 2012).

When it comes to data-driven decisions, the survey from Davenport and Bean (2018) found that many of the corporations experienced a slow transition to a data-driven culture. Despite all of the firms trying to achieve such a transition, only one-third considered themselves successful. It is concluded that firms require programmes and trainings to enable data-related cultural changes (Davenport & Bean, 2018). This would protect the firms from new entrants and start-ups disrupting business, which was one of the greatest concerns revealed by the survey.

Davenport and Bean (2018) conclude that trends like AI and big data highlight the importance of analytics, but to succeed it is essential for the firm to respond by initiating clear responsibilities for data strategy and the results as well as systematically and effectively executing the required changes.

### 2.3 User research

With software products opening the door to collecting input using such a variety of sources and methods, it is a challenge for any company to reap the potential benefits from all its data, and even more so for those not mainly focused on software. As such, this section offers some insight into conduction of user research, and how metrics can be designed to learn important information about customers.

### 2.3.1 Learning from customer behaviour

Previous research, such as Chen et al. (2017) and Nambisan (2002), has found that it is essential to utilize data gathered about customer behaviour, customer involvement, and customer orientation in order to produce and disseminate market intelligence about products and services. Thanks to the rapid dissemination of technological improvements, understanding and predicting customer behaviour can be done more accurately than ever possible before (Gothelf & Seiden, 2017). The short product life cycles in software development allow for continuous changes to be made, creating the need for effective methods to learn about the customers. Consequently, traditional customer surveys tend not to be the best option, due to their slow and passive nature making them inadequate for targeted product development and personalisation decisions (Chen et al., 2017).

How exactly value can be extracted from analyzing customer behaviour depends on how such practice is set up. Gothelf and Seiden (2017) present examples from different industries, to demonstrate similarities and differences. For instance, in the clothing industry, Zara uses an approach called *fast fashion*, which means producing many designs in small batches, observing which ones sell the most to know where to increase production volume. Another example provided by the authors is Google, which runs thousands of small experiments when rolling out new software functionality, in order to learn how to tweak aspects a solution to best fit the end user.

Both the approach from Zara and the one from Google rely on observing customer interactions and adjusting the offerings according to what is learned from the observations. In software development, this methodology for tracking customer behaviour and testing different versions of the product is known as A/B testing (Young, 2014). Appendix A provides further explanation of the concept and how it can be used.

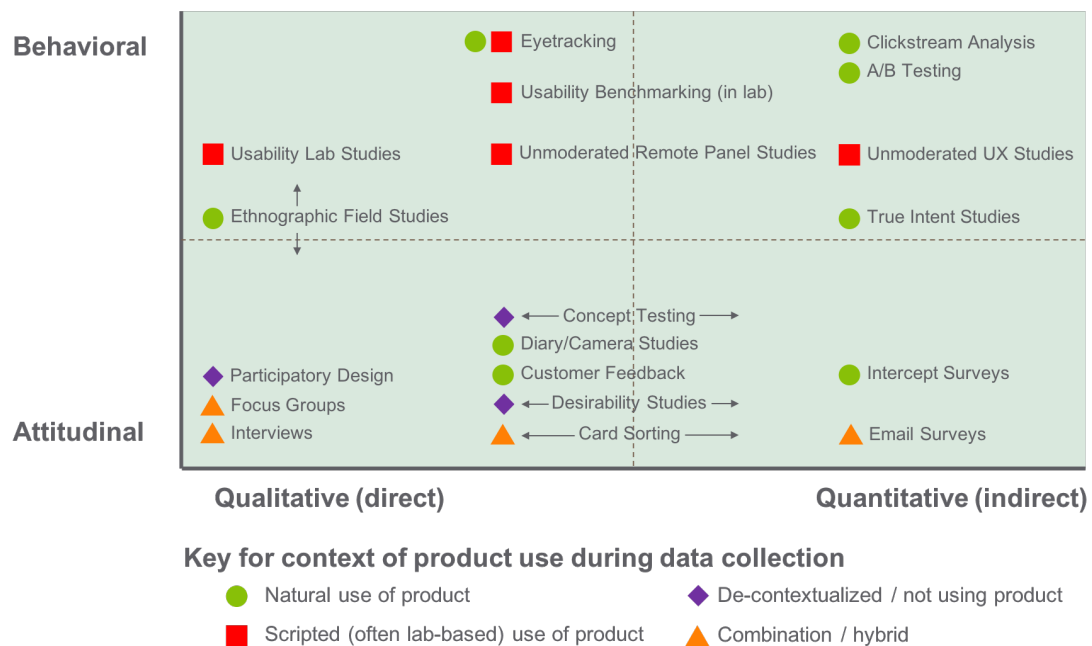
Another way of using customer behaviour to improve a business or service is through *personalisation*. Personalisation means developing a system that identifies different users and then adjusts the experience, content, or functionality depending on the individual user-profiles established (Schade, 2016). According to Zhou, Ji, and Jiao (2013), personalisation can be done on three levels: mass, segment, and individual. On a mass level, the offerings are developed by analyzing the entire population of users, and then tailoring for the average user. At a segment level, the users are divided into different groups, where the offering is modified according to the average preference within each group. Finally, the individual level adjusts the product to the individual needs, preferences, and behaviour of each individual user (Zhou et al., 2013). See Appendix B for more details on personalisation, and how it differs from the similar concept of customisation.

While it is beneficial to involve customers in development of products or services, the number of collaborations does come with limitations, as relationships can be costly and time consuming (Nambisan, 2002). The same author further argues that the effort required to manage a large number of relationships, risks resulting in valuable knowledge being overlooked, which could be other data sources that lead to product

improvements. These thoughts are echoed by Chen et al. (2017), who argue that firms can acquire valuable knowledge about the needs of their customers and develop improved offerings to meet them, by dedicating more resources to analyzing customer behaviour with products, without the costs related to managing relationships.

### 2.3.2 User research methods

As products and services increasingly involve software aspects, new challenges and opportunities emerge for large-scale user experience analysis, according to Rodden, Hutchinson, and Fu (2010). User research can be performed using a vast variety of different tools, and Rohrer (2014) provides an overview of the 20 most common ones, mapping them across three dimensions, and clarifying when each is appropriate to use. While the author argues that it is unrealistic for a single firm to use all methods described, a combination of various options is likely to produce more well-rounded insights. The three-dimensional framework is presented in Figure 2.3. The dimensions of this framework cover *attitudinal vs. behavioral*, *qualitative vs. quantitative*, and *context of use*. For the sake of brevity, the model will only be discussed in its entirety in this section, but Appendix C offers short summaries for each of the individual user research methods included for the interested reader.



**Figure 2.3:** A Landscape of User Research Methods (Rohrer, 2014)

The first dimension, attitudinal vs. behavioral, is the scale going from "what people say and think they do" to "what people actually do" (Rohrer, 2014). In the qualitative vs. quantitative dimension, the qualitative studies are based on direct observations or discussions, while quantitative studies are collected indirectly and mostly measured or derived from mathematical analyses and statistics (Rohrer, 2014). Quantitative research methods can also be used for validating hypotheses

made after qualitative research. Rohrer (2014) explains that qualitative methods are well suited in answering why or how to fix an issue, while quantitative methods provide better insight into questions about how many and how much, which can help with prioritization.

The context of product use dimension describes how or whether the participants use the product or service when being evaluated. This is categorised as *Natural* or *Scripted* use of the product, *Not using* the product during the study, or a *Hybrid* of the above (Rohrer, 2014). Natural use of the product is where the aim is to minimize the study's interference and not have the behaviour changed due to the knowledge of being observed. A scripted study is often done to gain knowledge about a specific usage aspect and is often used for re-designs. Studies where the product in question is not used are useful when examining issues outside of just the usability, for instance brand perception. Hybrid methods are creative ways of studying product usage, an example being participatory-design, which allows users to modify the product elements like layout and discuss how it better meet their needs.

PD PHASE:	STRATEGIZE	EXECUTE	ASSESS
<b>Goal:</b>	Inspire, explore, and choose new directions and opportunities.	Inform and optimize designs in order to reduce risk and improve usability.	Measure product performance against itself or its competition.
<b>Approach:</b>	Qualitative and quantitative.	Mainly qualitative (formative).	Mainly quantitative (summative).
<b>Typical methods:</b>	Field studies, diary studies, surveys, data mining, or analytics.	Card sorting, field studies, participatory design, paper prototype, and usability studies, desirability studies, customer emails.	Usability benchmarking, online assessments, surveys, A/B testing.

**Table 2.1:** User research methods and product development phases (Rohrer, 2014).

Furthermore, the research by Rohrer (2014) suggests that the choice of research methodology is influenced by what phase a product development process is in, and the pertaining objectives during that phase. Table 2.1 presents this by dividing the phases into *Strategize*, the early phase of product development, *Execute*, once the decision points has been reached, and *Assess*, when the product or service has an established user base and it is possible to measure how well it is doing.

### 2.3.3 User research metrics

Many user research methods can generate metrics, and Rodden et al. (2010) argue that user-centered metrics can be used to track key goals and influence product decisions. Much like argued by Rohrer (2014), Rodden et al. (2010) suggest that quantitative metrics should be used in combination with other qualitative research, for instance field studies, for it to result in better decision making. To assist this, it is possible to categorize the metrics in multiple ways, for instance hard vs. soft metrics (Rodden et al., 2010) or micro vs. macro conversions (Cardello, 2014). Hard metrics measure exactly what is happening, for example the count of active users. Soft metrics need further interpretation, for example the length of stay on a page, as the metric itself does not reveal the reason why the customer is on the page. Macro conversions are tied to the main goal, such as sales or having a customer upgrading their plan. Micro conversions, on the other hand, track behaviour that is linked or leading to the main goal, such as how much music the customer listens to, to indicate if they are likely to upgrade their plan (Cardello, 2014).

Rodden et al. (2010) emphasise that there has been significant progress in the development of off-the-shelf tools for the tracking and analyzing metrics for web pages and apps. The authors state that the established large-scale metrics are often focused on the business or technical aspects of a product. These are called *PULSE* metrics, with the acronym representing *Page views*, *Uptime*, *Latency*, *Seven-day active users*, and *Earnings* (Rodden et al., 2010). Using such metrics, it is possible to for instance analyze whether users are quickly leaving a product (low uptime), or if it is slow to use (high latency). This way, the user experience can be evaluated to predict how likely a product is to attract new users (Rodden et al., 2010).

However, the same research also found that these metrics are only loosely connected to user experience, which can make them problematic when used to evaluate interface changes. As an example, when evaluating the views per page metric after a change, the result may not be exclusively due to the change. The topic could have increased in popularity, or users could be confused and landed on that page due to a bad interface. Rodden et al. (2010) also state that sometimes a change negatively effects the user experience and results in more short term revenue, but can drive away users in the long run. Another example is that the Seven-day active users metric shows no level of commitment and does not provide any information about the frequency of visits, as it does not distinguish between new and old users (Rodden et al., 2010). They state: "*In a worst-case retention scenario of 100% turnover in the user base from week to week, the count of seven-day active users could still increase, in theory*" (Rodden et al., 2010, p. 2396).

Furthermore, Rodden et al. (2010) argue that many of the standard analytic packages can be too generic for user experience questions and hard to apply to the many different applications and interactions on the web, making them challenging to use effectively. For instance, it can be hard to handle the mass of data, define what to look for and what actions to tie the metrics to. When considering the shortcomings of PULSE type metrics, Rodden et al. (2010) created the *HEART framework* and

the *Goals-Signals-Metrics* process for better categorization of user-centered metrics, and in order to connect these metrics to product goals. The HEART framework covers both the attitudinal and behavioural aspect, which Rohrer (2014) uses in the Figure 2.3. HEART stands for: *Happiness, Engagement, Adoption, Retention*, and *Task success* (Rodden et al., 2010).

Happiness is the category of metrics used for the metrics that have attitudinal characteristics. These are subjective aspects of user experience and include satisfaction, perceived ease of use, visual appearance and chance that they will recommend the product to others. Happiness is often tracked over time using traditional surveys. Engagement evaluates for the user's level of involvement with the product, which includes the behavioral proxies, for instance the frequency, intensity, and depth of interaction over a specific time interval, best used in relation to average per user than just the total count. Adoption and Retention track the number of unique users in a given time period, solving the problem of distinguishing new users from old users. Adoption gives insight in how many new users start using the product in a defined time period, while Retention shows how many users are still using the product in a later time period. Finally, Task Success includes many traditional user experience behavioral metrics like efficiency (time it takes to do a task), effectiveness (the rate of completions in percent), and error rate. These can be measured on a large scale with a remote usability or benchmarking study (Rodden et al., 2010).

The Goals-Signals-Metrics process was set up to have metrics be useful and relate to goals (Rodden et al., 2010). First, the teams needs to articulate goals for the product, project or feature. Following this, which data sources can provide signals should be identified, and how the success or failure of these goals could be noticed from the signals. For example, the researchers suggest asking questions like "*What actions would indicate the goal had been met? What feelings or perceptions would correlate with success or failure?*" (Rodden et al., 2010, p. 2398). Ideally, these signals should be unique to the goal and not dependent on other unrelated factors. Lastly, it should be considered how the signals can be converted into metrics that can be used to track change over time and be presented using a dashboard. It is often better to use percentages, rations or averages over plain counts (Rodden et al., 2010).

### 2.3.4 Customer behaviour analysis in mobile apps

Although plenty of research clearly exists for user research overall, it appears that the specific topic of customer behaviour data analysis in mobile applications is relatively unexplored. One of few relevant papers encountered is a case study conducted by Chen et al. (2017), who argue that many mobile app developers are facing challenges when it comes to collecting customer behaviour data. This is shown in the following quote from the paper:

*"Data-driven decision making is becoming a critical tool allowing mobile app developers to not only understand customer behaviour but also to*

*design customised and innovative products and services in response to the consumer requirements and the changes in demand. "*

*- Chen et al. (2017, p. 427)*

Continuing, Chen et al. (2017) claim that by utilising big data analysis in mobile apps, firms can segment their customers into groups. This would enable the firms to understand their customers' behaviour and needs, in order to develop new solutions which can be tested on the different segments. Teams involved in the case study by Chen et al. (2017) were asked to define the importance of different functions to figure out how to weigh the functions accurately and understand which to optimize. The purpose of the research project is to show how a multiple analysis method of customer behaviour in mobile app usage can create value, by using three methods: RFM (recency, frequency, and monetary) aspect evaluation, link analysis, and association rule learning. For an in-depth explanation of these approaches, visit Appendix D.

Briefly concluded, Chen et al. (2017) provide a new perspective on how big data analysis can provide insights about what customer behaviour means. According to Wang, Voss, Zhao, and Wang (2015), such information can be used to predict market trends or develop product improvement strategies that affect the design of the products and services. Chen et al. (2017) were successfully able to identify customer preferences and patterns of function usage, as well as customer segments, core functions and how they related to each other. However, they recommend that firms invest in training their staff and invest in information technology and systems to achieve this, as this will enable them to develop routines about how to collect large volumes of customer data. Companies should then implement a data-driven decision making practice that utilizes the customer behaviour data across the whole organisation (Chen et al., 2017).

Finally, Chen et al. (2017) believe that further research in the field would be useful to further strengthen the arguments presented. More specifically, a longitudinal study on customer behaviour is recommended, to substantiate how new functions perform when they are being released or tested. Furthermore, it is highlighted that future studies could investigate organisational and cultural challenges faced when implementing this way-of-working (Chen et al., 2017).

## 2.4 Agile software development

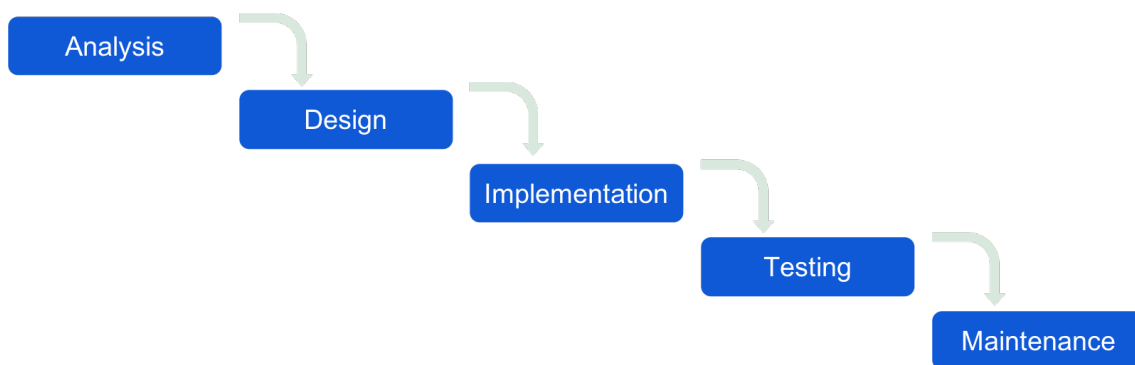
When looking into ways of improving the operations of a firm, a key factor is understanding the way-of-working, which in the case of software development often involves agile methodology to some extent. To create a base level understanding in order to discuss how agile relates to the implementation of user research methods targeting behaviour, the core ideas and principles of agile will be explored, as well as its implementation through *SAFe*, and the challenges involved in the process.



### 2.4.1 Evolution of product development processes

Historically, product development processes have generally been structured as a *Waterfall model*, where all efforts are directed at the present stage of the process, and only move to the next upon completion of the previous (Royce, 1970). The model was developed for traditional industries such as manufacturing, with the purpose of encountering any potential problems as early as possible in the process, to drastically reduce the costs and efforts required to fix them (McConnell, 1996).

Although hardware production was far more prominent during the emergence of the model, it has later been adapted for software development. For example, Bassil (2012) developed the *Waterfall Software Development Life Cycle Model*, which involves five key stages to be performed sequentially: analysis, design, implementation, testing, and maintenance. These are visualized in Figure 2.4. In a similar fashion, the commonly cited *Stage-Gate Model* (Cooper, 1990) also suggests placing decision points at important stages in a product development process to continuously verify the progress.



**Figure 2.4:** The stages in the Waterfall SDLC Model (Bassil, 2012).

However, the waterfall model has attracted a fair amount of criticism for being unnecessarily rigid and committed to a preset path. One of the arguments brought forth by Bassil (2012) is that traditional processes often run into problems with budget, delivery times, and client dissatisfaction. Requirements in reality often change over time, meaning that attempting to plan the entire process in advance comes with a significant degree of risk (Parnas & Clements, 1986). As an increasing number of projects started to call for additional flexibility, agile emerged as an alternative more capable of meeting such demands (Williams & Cockburn, 2003).

Gothelf and Seiden (2017) similarly argue that traditional techniques for product development fail to facilitate the two-way conversation between supplier and customer that is necessary in today's market. As an example, the authors discuss how book retailer *Borders* went defunct in 2011 after outsourcing to Amazon and losing the ability to directly communicate with its base of customers. Such cases have fueled the search for new tools, with the software industry leading this agile movement (Cooper, 2016).

## 2.4.2 Agile principles

Agile is an established work methodology for software development (McAvoy & Butler, 2009), that embraces change with a flexible, iterative and incremental approach (Beck et al., 2001), and emphasizes the *"voice of the customer"* Pinto (2013). Agile is also becoming increasingly prominent within other types of industry (Conforto et al., 2014), as a means to combat uncertainty (Cooper & Sommer, 2016), and generate higher levels of customer satisfaction and tighter budgets (Cho, 2008).

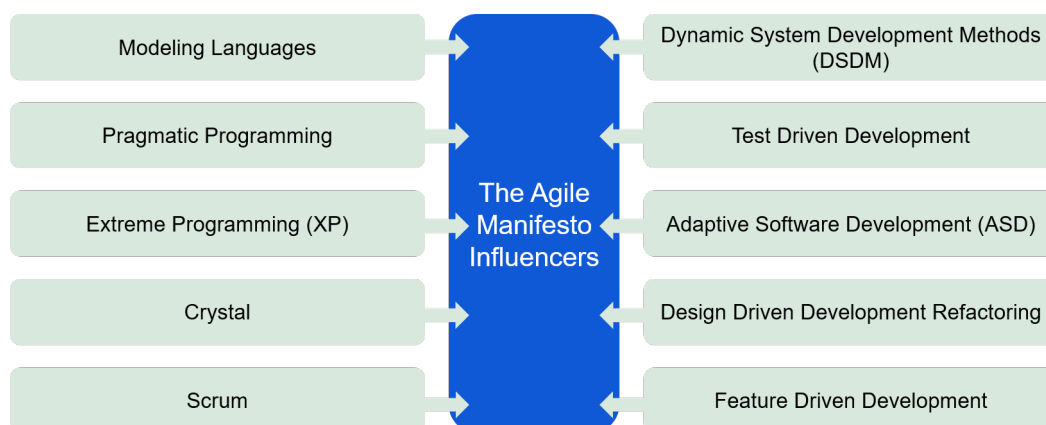
An early but still commonly cited explanation of agile comes from Goldman, Nagel and Preiss according to Highsmith (2002); the definition of agile being:

*"Agility is dynamic, context-specific, aggressively change embracing, and growth-oriented. It is not about improving efficiency, cutting costs, or battenning down the business hatches to ride out fearsome competitive 'storm'. It is about succeeding and about winning: about succeeding in emerging competitive areas, and about winning profits, market share, and customers in very center of the competitive storms many companies now fear (Goldman, Nagel and Preiss, 1995)".*

- Highsmith (2002), p. 4

### Agile Manifesto

It is noteworthy that many of the original ideas for agile were established by Beck et al. (2001), who developed the agile manifesto to guide the way-of-working and improve software development practices. The 17 contributors felt the need to move away from the traditional, rigid, document-driven approach, to more effectively be able to cope with changing requirements. The representatives contributed with knowledge from different practices and methods used in software development, which are aggregated into the model, illustrated in Figure 2.5 below.



**Figure 2.5:** Factors influencing the Agile manifesto creation (Hohl et al., 2018).

The influencers were then eventually refined further, creating what is now known as the *Agile manifesto*. Its four core statements, as laid out by Beck et al. (2001), read

as follows:

*"Individuals and interactions over processes and tools"*  
*"Working software over comprehensive documentation"*  
*"Customer collaboration over contract negotiation"*  
*"Responding to change over following a plan"*

While Beck et al. (2001) argue that the ideas on the left side are more important than the ones on the right, they also acknowledge that there is value in those on the right side. The core statements are also explained further through twelve principles, which can be summarized as follows (Beck et al., 2001):

1. Quickly and continuously pleasing customers with valuable functionality is the highest priority.
2. Changing requirements should be expected and welcomed even when appearing late in the process.
3. Minimize the waiting time between deliveries of working software.
4. Daily collaboration between business people and developers.
5. Motivate individuals involved through trusting them with autonomy, but support when needed.
6. Face-to-face conversations is the most efficient and effective way to communicate information.
7. Progress is mainly measured through working software.
8. The agile method is sustainable and will help stakeholders and developers stay on good terms.
9. Agility is strengthened through technical excellence and great design.
10. Simplicity is key, essential work should be prioritized.
11. Self-organised teams generate the best results.
12. Teams should regularly evaluate and adapt their behaviour to further improve efficiency.

According to Williams and Cockburn (2003), agile is an empirical, nonlinear process. They highlight that in an engineering context an empirical process stems from frequent short “inspect-and-adapt” cycles and short feedback loops. Agile considers changes in different ways and works by first dividing work into small batches, and then relying on a continuous feedback loop to guide progress (Gothelf & Seiden, 2017), which is highlighted in the following quote:

*"The ability to create a continuous feedback cycle is the most important thing we gain as our economy moves from the manufacture of hard goods to the production of software and the delivery of services built on top of software."*

- Gothelf and Seiden (2017, p. 8)

The authors further argue that the continuous conversation with the market through the feedback cycle takes many forms, including lean UX, design thinking, and de-

signers contributing with user-centered design, among others.

### 2.4.3 Scrum

One of the practices that enables implementation of agile and the continues feedback loop is *scrum*, which is designed to handle the increased need for speed and flexibility in product development (Takeuchi & Nonaka, 1986). Central aspects of scrum are setting ambitious goals, allowing a large degree of autonomy to teams, synchronizing individual and team efforts through transparent communication, closely monitoring market developments, and fostering internal knowledge in the organization (Takeuchi & Nonaka, 1986). After its initial conception in Japan, scrum was really established as the most prominent software working method by Schwaber (2004).

Through working with scrum and agile, decisions will improve over time, as agile is dependent on the new knowledge built during the development process. This is essential in being able to change direction and set new goals that match the constantly moving needs and requirements of the stakeholders (Nyman, 2010). Similarly, Cho (2008) describes scrum as an empirical process founded in transparency, inspection, and adaption.

#### Activities and tools

A key concept in scrum is dividing large projects into *sprints*. Sprints are short, continuously evaluated work cycles that allow for the iterative and flexible responses to the conditions at hand (Schwaber, 2004). In terms of content, sprints consist of *sprint planning*, *developing code*, *daily scrums*, *sprint reviews*, and *sprint retrospectives* (Schwaber & Sutherland, 2017).

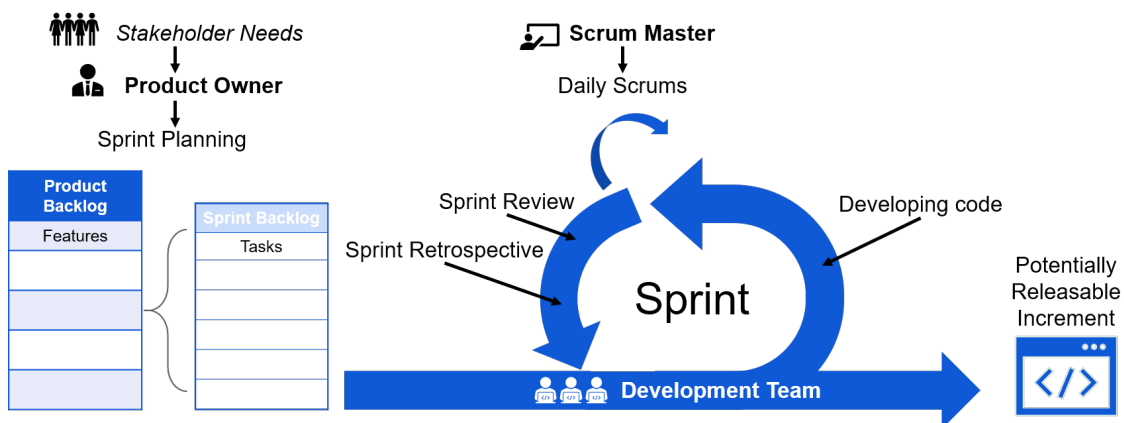
Sprint planning is where goals for the upcoming sprint are defined and a product backlog is created, to prioritize features for development. The product owner is often responsible for prioritisation, however other internal stakeholders and customers may influence the decisions. The backlog represents the work that needs to be done, and is broken down into smaller tasks for the developers, sometimes known as the sprint backlog. These tasks are put on to a scrum board for visualisation of who is working on what task. Furthermore, a burndown chart is often used to track the progress of completed tasks (Schwaber & Sutherland, 2017).

The daily scrum is a short meeting, where the team explains what has been done since the previous meeting, what will be done during the next day, and whether there are any constraints inhibiting the progress. Once a sprint is complete, the team conducts a sprint review, to inspect what has been completed and adjust the backlog accordingly. Additionally, reflection is done about what went well with the previous developments, and what did not. After the sprint review, the team has a sprint retrospective where people, processes, and tools are evaluated in search of improvements for the next sprint (Schwaber & Sutherland, 2017).

## Roles

Working with scrum is done using cross-functional and self-organised teams, which are designed for increased flexibility, creativity and productivity, and hold the responsibility for completing the agreed upon tasks during each sprint (Schwaber & Sutherland, 2017). Centrally involved in the work process are three roles: the *product owner*, the *developers*, and the *scrum master*.

The product owner is responsible for maximizing the value of the product by creating and prioritising features in the backlog, based on the requests and needs of the users (Schwaber & Sutherland, 2017). To successfully perform these tasks, the product owner needs to have authority and their decisions need to be respected by the team members. The backlog is then broken down into smaller tasks for the developers to code and complete in increments (Schwaber & Sutherland, 2017). The scrum master, who is sometimes also a developer, acts as a coach ensuring that all developers stick to the desired scrum process, by coordinating with the team members through the daily scrums (Schwaber & Sutherland, 2017). The concept of working with sprints is detailed in Figure 2.6 below.



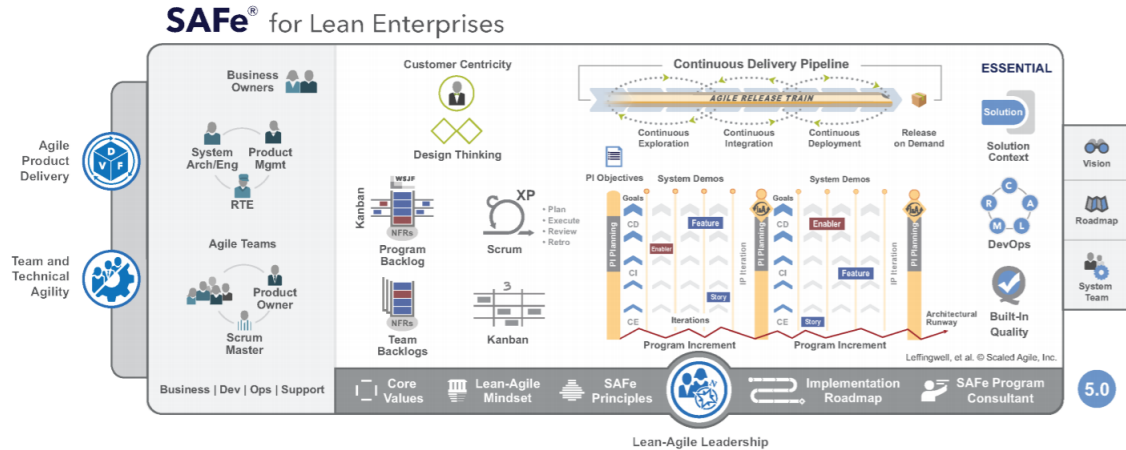
**Figure 2.6:** Description of a scrum work process involving sprints.

### 2.4.4 Scaled agile

While agile continues to be embraced by a growing number of companies, there are those who have levelled criticism against the frameworks for being designed to smaller operations involving only one or a few teams. For instance, Reifer, Maurer, and Erdogmus (2003) argue that agile fails if applied on larger scale across an entire organization with many interconnected teams. In order to address such concerns, the concept of scaled agile has emerged, with the purpose of expanding agile to handle the additional requirements present in larger organizations (Laitinen, Fayad, & Ward, 2000).

Scaled agile quite literally means taking the key principles used in smaller teams and disseminating them throughout the organization (Laanti, 2014). To provide guidelines for managing the scaling process, various frameworks have been developed,

such as *Scrum of scrums* (Agile-Alliance, 2020), *Large scale scrum (LeSS)* (Larman & Vodde, 2013) and the *Scaled Agile Framework (SAFe)* (Scaled Agile Inc., 2020a). Of these, SAFe is currently the most prominent one, having been adopted by over 30% of scaled agile practitioners (Link & Lewrick, 2013). Its core aspects are described visually in Figure 2.7.



**Figure 2.7:** The Scaled Agile Framework (Scaled Agile Inc., 2020).

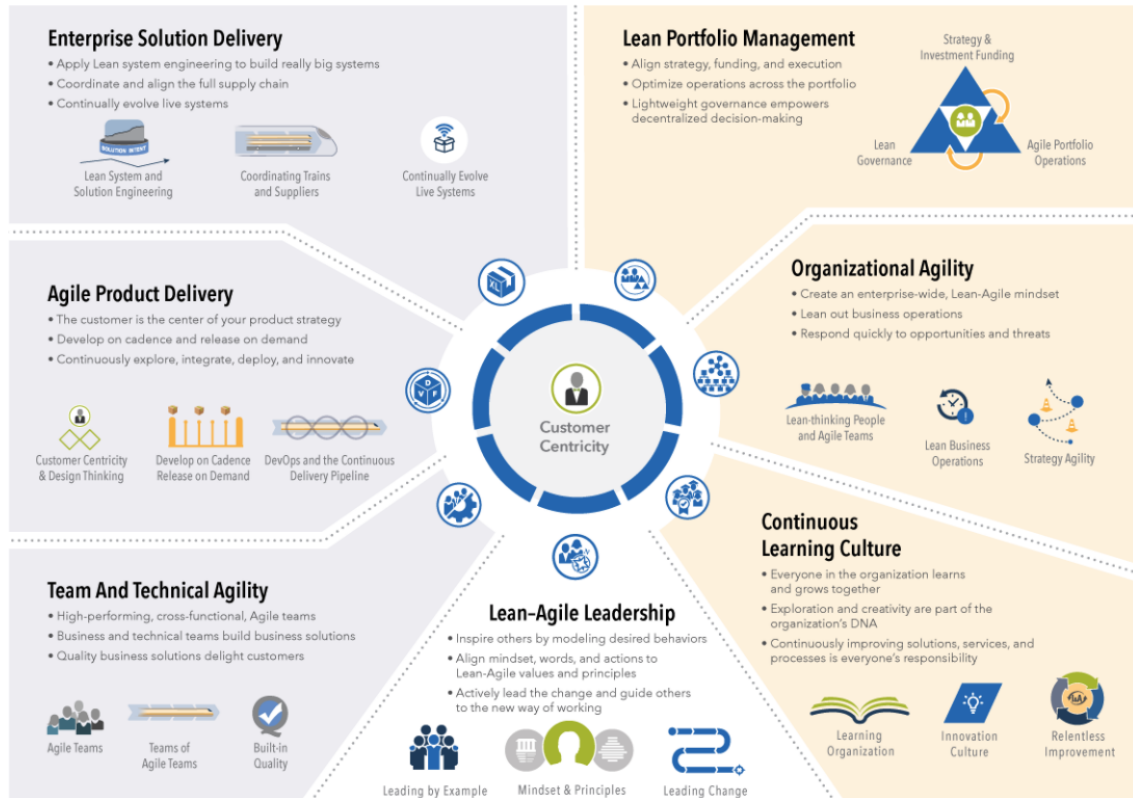
The SAFe framework is rooted mainly in three areas of knowledge: agile development, lean product development, and systems thinking. Extracting information from these sources, the SAFe framework has been built around four core values (Scaled Agile Inc., 2020a):

- *Alignment*: Ensuring that the entire organization is pursuing the same goal, while simultaneously stimulating autonomy by reducing top-down control.
- *Built-in quality*: Including quality as a central aspect at every stage of the product development process, rather than adding it as a separate stage later.
- *Transparency*: Building trust through honesty, both within the internal organization and with external partners.
- *Program execution*: Implementing the previous principles while also maintaining expected levels of production.

Complementing the core values SAFe has seven key principles. An overview of these principles is displayed in Figure 2.8. The agile team with product owner, scrum master, and development team also plays a central role in the SAFe framework, but it also expands to involve some additional roles (Scaled Agile Inc., 2020b):

- *Business Owner*: Holds the primary responsibility for business decisions relating to the Agile Release Train (all the agile teams grouped together).
- *Product Management*: Gathers input from customers and specify requirements for what functionality the development teams should build.
- *Solution Architect/Engineer*: Develops the technical vision to ensure compliance with customer demands.

- *Release Train Engineer*: Leads the work of the Agile Release Train, helping and facilitating the work for the teams.



**Figure 2.8:** The Scaled Agile Framework Principles (Scaled Agile Inc., 2020).

By relying on implementation of new agile techniques like release trains, portfolio backlog, and EPICs (larger pieces of work with a common objective such as a new feature) divided into business and architecture, SAFe attempts to reduce the aforementioned time-to-market through improving quality and productivity, while simultaneously mitigating risks involved (Turetken, Stojanov, & Trienekens, 2017).

In practice however, examples of successful implementation of SAFe have been relatively anecdotal (Turetken et al., 2017). Leffingwell (2010) points out that the framework relies heavily on principles and artifacts, without suggesting any clear guidelines for how to proceed with implementation. As such, many companies tend to struggle with figuring out what to prioritize when attempting a scaled agile implementation (Turetken et al., 2017).

Criticism has also been levelled at SAFe for breaking down large projects into different teams, resulting in a "more detailed plan" approach that does not consider uncertainties, therefore moving away from an agile sensing and responding approach (Gothelf & Seiden, 2017). Furthermore, Gothelf and Seiden (2017) argued that agile teams are turned into production teams with fixed requirements, limiting the organisation's capacity to learn from feedback.

### 2.4.5 Challenges with agile implementation

Although agile is overall considered a useful approach within software development circles, there are challenges to be overcome in order to achieve successful implementation in practice. Cao and Ramesh (2007) argue that the challenges tend to become more prevalent the more complex the organization is. This sentiment is echoed by Kontio, Höglund, Rydén, and Abrahamsson (2004), who point out difficulty in handling the competence management, managerial issues, communication, and relationships necessary in a larger organization, and call for further investigation of the topic.

Moe, Aurum, and Dybå (2012) also looked into challenges with implementation of agile in software development using a case study approach, and discovered three critical areas. First, ensuring that the individuals in each team understand and align behind the common objective of the team. Second, handling conflicts caused by unclear or counteracting priorities, to improve resource allocation. Third, executing the plan without having individual team members pursuing personal agendas.

Certain challenges also arise as firms attempt to transition from waterfall process to agile. According to Nerur, Mahapatra, and Mangalaraj (2005), one of the toughest challenges is having management release control and authority, to let the teams become more autonomous. Moving decision making power from management over to the development teams in this way can sometimes lead to internal conflicts. Therefore, adapting the business goals and changing the mindsets of both management and developers is key in ensuring a successful transition (Nerur et al., 2005). However, changing the mindsets and habits of all individuals involved in the process tends to happen slowly, according to Boehm (2003). Johansson and Heide (2008) argue that internal communication is the cause of many problems in the transition, and that involving a change agent to coach, communicate and train the team members could be beneficial.

The study by Nerur et al. (2005) also identified other challenges, which were categorized as either *managerial and organizational*, *people*, *process* or *technology*. The managerial and organizational challenges relate to culture, management style, and software development knowledge, factors which tend to change slowly according to the authors. The people-related challenges involve building trust and competence within the team, as well as establishing solid relationships with customers. The process challenges entail moving from a rigid way-of-working to the short-cycle iterative approach that emphasizes adaptability. Finally, the technology challenges pertain to choosing the right tools and techniques, and educating the team members on how to properly utilize them.

A study by Turk et al. (2014) evaluated the appropriateness for a company to choose agile as its software development process, and identified six important factors presented in table 2.2. However, Turk et al. (2014) do note that agile working methods can vary in practice and values depending on application domain, meaning that the limitations identified may not apply for all scenarios.



No.	Factors	Comment
1	Global distribution of operations inhibiting in-person communication	Especially problematic when involving the customer. Video-conferencing can help to some degree.
2	Fixed nature of subcontracting deals	Hard to plan deliverables and estimate costs. They recommend having a fixed and a variable part in the contracts.
3	Single-purpose of functionality built	Low reusability as software is often developed for a single purpose.
4	Incompatibility with larger organizations	Many of the communication, coordination and control mechanisms are more suitable for small teams.
5	Limited support for developing safety-critical software	Software that if fails has health risk to people or severe economical consequences.
6	Complexity and connected architecture of large systems	Inhibits change and can be expensive to change.

**Table 2.2:** Agile appropriateness factors (Turk et al., 2014)

In a paper similar to the research by Turk et al. (2014), Akif and Majeed (2012) argue that agile frameworks limitations are: *"Training, management, involvement, access to external resources, corporate or organizational size, distributed areas, sub contraction, developing large and complex systems, but still there are open areas where no significant research work has been done."* (Akif & Majeed, 2012, p. 1). It is also emphasized by the authors that research for agile in highly distributed environments is currently lacking.

Cho (2008) performed interviews and coded the responses to investigate the challenges specifically related to scrum, and established five areas: understanding the new documentation practices, communication between team members, managing to engage the customer in the process, distractions caused by open-space work environments, and perceived inefficiencies of scrum ceremonies.

Furthermore, Akif and Majeed (2012) also identified a large range of challenges with scrum practice using a survey. Among these, some key areas were lowered quality due to short work cycles, product incompatibility with previous releases, backlog management, reliance on poor metrics, coordination between teams, establishing documentation standards, and exaggerated optimism about teams' ability to work autonomously. The authors did however suggest that many of the risks can be mitigated through training the scrum teams.

### 2.5 Synthesis

This section summarizes some key ideas and concepts highlighted during the literature review, and clarifies how these help build a foundation for the research project in this thesis. The topics covered serve to either provide contextual understanding of an area relevant to this study, or present results from similar research that can be compared against the findings of this study. Furthermore, the literature review helped with drafting the interview questions.

The initial topic of decision making plays a role in providing context for why the transition toward a practice that is based in objective arguments is important for companies and individual decision makers. Additionally, the RAPID framework for considering roles in decision making (Rogers & Blenko, 2006) was used to create an understanding of which stakeholders can have an impact in a decision making process. The roles were helpful in making sense of how different roles in scrum and SAFe impact the decision making for software development, and aided in crafting research questions aimed to learn more about how each interviewee fit into the organization.

As the concept of optimizing decisions was explored further, a brief overview of data analytics was included, because such practice is a commonly used way to anchor decisions in objective measures. Stepping further towards data-driven decisions (Provost & Fawcett, 2013) is also the end goal of the first research question, which aims to identify the obstacles blocking that process. The case study by (Katal et al., 2013) and similar research was covered to get an idea of what obstacles could potentially arise with regards to implementation of data analysis more broadly.

Narrowing the scope of focus even further, the third section looked into how to learn about and predict customer needs more accurately through user research (Gothelf & Seiden, 2017). Information about the customer can be understood using a wide variety of tools, spanning between attitudinal and behavioral, as well as qualitative and quantitative (Rohrer, 2014). Which method is most appropriate to use is highly dependent on the industrial context, but a combination of different options is a recommended approach (Rodden et al., 2010; Rohrer, 2014). Learning about the tools available was an important step in order to understand exactly how customer behaviour data analysis can be implemented in practical terms, as it is evidently not necessarily obvious what method should be applied in a given context.

Moreover, it was evaluated how user research can be utilized to generate metrics that can be used to guide the pursuit of user experience improvement goals. The research project by Rodden et al. (2010) presented the PULSE and HEART frameworks, which demonstrated how companies can use pre-designed metric tools to analyze the customer behaviour data gathered from their products. Additionally, the case study by Chen et al. (2017) connected two central pillars of the thesis, software development and customer behaviour data, by showing that a multiple analysis method can create value from customer behaviour data in mobile apps.

The authors also recommended further research into the the organisational and cultural challenges of during the implementation of such practice, which is another key aspect of the first research question presented in this thesis.

Finally, the concept of agile software development was covered, as it relates closely to the second research question, which is intended to assess the relationship between the way-of-working of a firm and its customer behaviour data analysis practices. An explanation of product development processes transitioning from largely waterfall-based to increasingly agile (Williams & Cockburn, 2003), as well as the core principles of agile (Beck et al., 2001) and scrum (Schwaber & Sutherland, 2017) was provided to ensure that any reader unfamiliar with the topic would be able to understand the purpose of the methodology.

The field of scaled agile (Laanti, 2014) was explored to understand how the agile principles need to be adapted when applied to the contextual environment of a large, established firm with widespread operations, as in the case of SKF. Understanding how companies use frameworks such as SAgile (Scaled Agile Inc., 2020a) to adapt an agile practice across a large organization, a topic not thoroughly explored in the past (Kontio et al., 2004), is important for establishing an understanding of the working routines. The overlap between scaled agile operations and implementation of customer behaviour data analysis can now be explored, which is central to the second research question. No prior literature was found on this specific topic, so this thesis paper hopes to bridge the gap on how the popular development methodology agile fits with user research, as it is unclear today.

Challenges with agile were also included as a reference point, to be compared against the ones discovered in this study, in the same way that challenges with implementation of data analysis are included. It provides insight to where the challenges could be derived from and which are new or unique. Critical areas of agile were called out by various authors. Some of the most important to this research were communication (Kontio et al., 2004), alignment of objectives (Moe et al., 2012), releasing managerial authority to allow for autonomous teams (Nerur et al., 2005), and changing cultural mindsets in the organization (Boehm, 2003). Whether similar barriers present themselves when assessing the compatibility between scaled agile methodology and customer behaviour data analysis, is something for this thesis to discover.



# 3

## Methodology

This chapter aims to provide an overview of the methodology used when conducting the study. The research process was first designed in accordance with the suggestions from academia for a study with these characteristics. Following that, data was collected through interviews, and then analyzed with the purpose of drawing relevant conclusions. Finally, a reflection over the results was done to ensure their validity and quality.

### 3.1 Research design

While the topic of customer behaviour has been explored in previous research, its increased importance across all businesses in recent years means that its impact is still not entirely understood in the context of a traditional manufacturing firm. Easterby-Smith, Thorpe, and Jackson (2015, pp. 52-54) argue that with these circumstances, a constructionist approach is most appropriate to use. Constructionism aims to better understand the complexity of a situation by gathering input from relevant stakeholders, and using it to generate new theory within the area. In this case, the specific aim is to identify and map the challenges involved in accounting for customer behaviour data in software development, and see how embracing an agile way-of-working can assist in doing so.

Since the researchers do not possess any extensive prior knowledge on the topic, the exact direction of the study will be realized over time, as an increased understanding is built through the process. To accommodate for such flexibility, Easterby-Smith et al. (2015, pp. 54) suggest relying on a qualitative research method, where stakeholders can inform about the situation in a more expansive way.

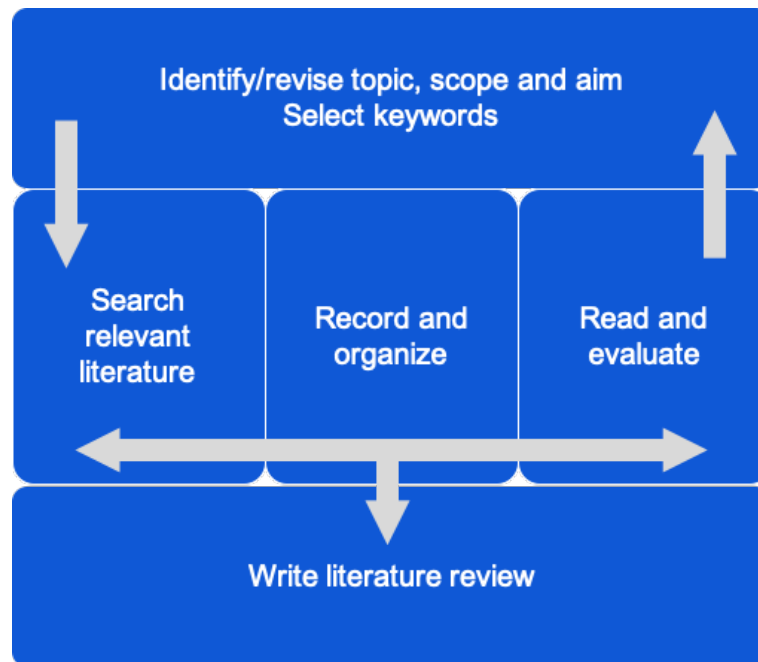
The context for the project is given by a single case study at a company, to allow for in-depth analysis of the specific case (Bryman & Bell, 2011), while simultaneously providing a connection to the real and practical world (Yin, 2003). By performing an instrumental single case study, new principles can be extrapolated and applied to other contexts (Siggelkow, 2007; Stake, 2005).

In order for such generalizations to be made however, it is imperative that the research process is clearly defined before any collection of data is performed (Yin, 2013). By relying on the suggestions discussed, the researchers aim to perform the study in an organized manner which allows for the results to prove applicable not

only for the case study company, but also in general.

## 3.2 Literature review

A literature review was conducted in order to establish an understanding of the role that customer behaviour data plays in software development, and how an agile way-of-working relates to the area. The review process was structured according to a model suggested by Easterby-Smith et al. (2015, pp. 16-17), which involves three stages as laid out in Figure 3.1. First, the boundaries of the study were set, and relevant keywords mapped out. Second, an organized collection of literature started getting built. Third, the collection was analyzed and important themes and ideas extracted. The process then continuously looped during the time span of the project, as new references were identified and the research scope revised (Easterby-Smith et al., 2015).



**Figure 3.1:** Literature review process used (Easterby-Smith et. al., 2015).

During the first information search stage of the process, a wide-sweeping 'trawling' approach (Selvin & Stuart, 1966) was utilized, which means casting a wide net to see what topics could potentially contribute to the content of the thesis. As references were collected, the importance of organized 'housekeeping' (Easterby-Smith et al., 2015, pp. 28-34), structured cataloguing of references, was addressed by relying on reference managing software Mendeley (<https://www.mendeley.com>) to store and categorize the articles. This way, the risk of work being repeated due to lacking record-keeping capacity was mitigated. Finally, the in-depth search for additional literature was done through a 'fishing' (Selvin & Stuart, 1966) approach, where more specific searches are targeted toward relevant topics and keywords identified throughout the reading process. Throughout the process as a whole, most findings were gath-

ered through Google Scholar searches (<https://scholar.google.com>), together with the Chalmers library database (<https://www.lib.chalmers.se>) which gave access to peer-reviewed literature in databases such as Scopus.

An example of a search string used in Scopus would be: *TITLE-ABS-KEY("Analys\*" AND "customer behaviour" OR "user behaviour" AND "mobile app") AND (LIMIT-TO(SUBJAREA, "COMP") OR LIMIT-TO(SUBJAREA, "ENGI") OR LIMIT-TO(SUBJAREA, "BUSI") OR LIMIT-TO(SUBJAREA, "DECI") OR LIMIT-TO(SUBJAREA, "ECON"))*, and one in Google Scholar would be *"data analytics" OR "big data" AND "challenges"*.

When selecting literature to be used, the criteria used to evaluate were importance and relevance, as advised by (Easterby-Smith et al., 2015, pp. 305-306). Articles considered important are original and frequently cited within their area, and were used to explain the general concepts of the area. Once a base had been established, more specific articles relevant to the area of study were used to expand the concepts further. All references included are believed to contribute toward the central arguments of the thesis as recommended by Easterby-Smith et al. (2015, pp. 306-307), within one of the four main topics: decision making, data analytics, customer behaviour and agile software development.

### 3.3 Data collection

Data collection was done through twelve interviews with employees at the case company. The interviews lasted between 40 and 80 minutes, and were scheduled over a period of eight weeks. For more detailed information, see Table 3.1 on the next page. The conversations were semi-structured, to allow the interviewees to elaborate and discuss the topics in-depth (Bryman & Bell, 2011), to fit the qualitative, constructionist approach of the study (Easterby-Smith et al., 2015, pp. 54).

Subjects were identified and selected with the intention of providing maximum variation in perspective (Tracy, 2019, pp. 135-136), by involving key stakeholders in the software development process from both management and the development teams. This way, both the top-down and the bottom-up viewpoints could be understood, as addressing the problem required alignment between them. An example of how this was accomplished is that all central roles from agile frameworks were covered, including the members of the scrum teams, and roles from the SAFe framework. A number of initial interviews were selected by recommendations of the supervisor at the company, but once interviews began being conducted, a snowball method (Tracy, 2019, pp. 135-136) was used to have each subject suggest other people to interview. This approach has been particularly useful for identifying subjects outside the department and site where the researchers have been located. An initial estimate for number of interviews performed was set at ten, by listing the key stakeholders, and considering the approximated appropriate number for a qualitative, semester-long study suggested by (Tracy, 2019, pp. 138). Whether to continue conducting interviews was continuously evaluated, to assure relevance and mitigate the

No.	Position/Role	Date	Style
A	Product Manager of mobile app <i>ProCollect</i>	Feb 28th	Video call
B	Director of Product Management and Product Development	Mar 3rd	In person
C	Product Owner of mobile apps <i>ProCollect</i> and <i>EnlightCollect</i>	Mar 4th	In person
D	Vice President of Marketing & Industrial Sales for the Americas	Mar 4th	Video call
E	Global Manager of the Software Development Center	Mar 11th	In person
F	UX Designer	Mar 18th	In person
G	App Software Developer	Mar 18th	In person
H	Director of Business Intelligence	Mar 19th	Video call
I	REP Business Development Manager	April 2nd	Video call
J	Global Manager of REP Design and User Experience	Apr 8th	Video call
K	Manager of Digital Solutions and One Development Initiative	Apr 15th	Video call
L	Agile Coach, Release Train Engineer, and Scrum Master	Apr 15th	Video call

**Table 3.1:** List of interview subjects.

risk of theoretical saturation (Glaser & Strauss, 2017).

The interviews were scheduled using the case company’s internal Microsoft Outlook calendar, with invitations sent out over email. Along with the request, a brief introduction to the project’s purpose was included, to ensure that each subject was properly informed about the area beforehand. Additionally, a general overview was given at the start of each interview, to clarify context and set the expectations, which is important to gain maximally useful input, according to Yin (2014).

As an aid for the interviews, a list of questions was developed beforehand. The template was designed to thoroughly explore the topics most relevant to the research questions (Easterby-Smith et al., 2015, pp. 138-140). Initially, some open-ended general questions were asked to better understand context, before moving on to experience-based and hypothetical questions (Tracy, 2019, pp. 147), where the subjects were asked to recommend courses of action. At the end, a catch-all question (Tracy, 2019, pp. 151) was also asked, to gather any additional thoughts on the topic that may not have been probed by the previous questions. The selection of questions was made through reflection over literature read, as well as through discussions with the supervisor at the case company. They were continuously evaluated and improved throughout the interview process, and certain questions were included or left out depending on the individual expertise of each subject interviewed. For instance, a separate template with in-depth questions about agile practices was used to interview the department’s agile coach, to benefit from their expertise. Complete



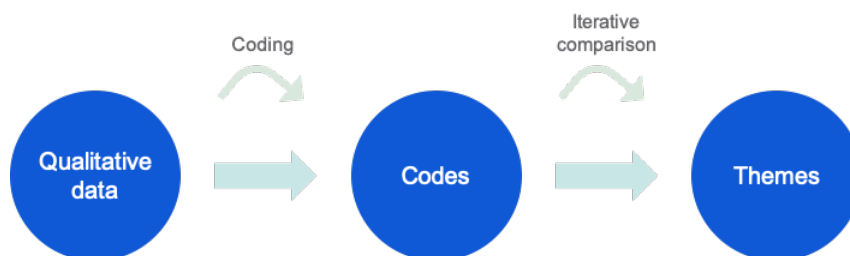
question templates for the interviews can be found in Appendix E.

All interviews were conducted in English for consistency. Both researchers participated in all of the interviews, with predetermined roles where one researcher led the interviews, while the other took notes, as per recommendation from Easterby-Smith et al. (2015, pp. 144-146). Originally, all interviews with subjects located at the Gothenburg offices were planned to be conducted in person, while those located elsewhere would be contacted through Microsoft Teams. However, due to the COVID-19 outbreak and subsequent reduction of in-office working hours, the majority of the interviews ended up taking place through Teams. Using the application *otter.ai* (<https://www.otter.ai>), the interviews were recorded and transcribed in real time as they were being conducted. The notes were taken as a backup safety precaution, to ensure that no important information would be lost in the case that the software malfunctioned. All automatically generated transcripts were also manually corrected for mistakes by the researchers. The interview subjects were also asked if they could be contacted again in the future, in case additional questions or uncertainties were to arise at a later date.

### 3.4 Data analysis

In accordance with the study's constructionist approach, the aim of the data collection was to gather and aggregate the experiences and perspectives of relevant stakeholders involved. By analyzing the data collected, the intended outcome was to gain new insight into the main research topic (Easterby-Smith et al., 2015), how established manufacturing firms can incorporate customer behaviour data to inform software development decisions.

Such conclusions were reached through performing thematic analysis, a version of grounded theory (Easterby-Smith et al., 2015, pp. 92-94, 192-194), of the interview transcripts. The views were categorized using codes, and then identifying recurring ideas or concepts by comparing them to map out themes. A visualization of the thematic analysis process is shown in Figure 3.2. Additionally, the relationship between agile methodology and user research relevant to the second research question was presented using a visual analysis to display overlapping and gaps (Easterby-Smith et al., 2015, pp. 197-199).



**Figure 3.2:** Description of the thematic analysis process.

In practice, the analysis was conducted using qualitative data analysis tool *NVivo* (<https://qsrinternational.com/nvivo-qualitative-data-analysis-software>). The interview transcripts were uploaded to the software, and coded with regards to question, as well as area of relevance. This way, answers from all respondents to each individual question could be compared to each other in an efficient manner. The answers were thoroughly analyzed by both researchers, marking and categorizing important sections. By observing areas of convergence and divergence of opinion between respondents, findings, challenges, and recommended courses of action could be identified and discussed critically.

## 3.5 Trustworthiness

A key purpose of research as opposed to simply observing a situation is generating more trustworthy findings that can stand up to rigorous scrutiny (Easterby-Smith et al., 2015, pp. 103). Therefore, the legitimacy of any research project needs to be evaluated according to certain criteria. Although various alternative models exist, four commonly cited criteria are credibility, transferability, dependability, and confirmability (Bryman & Bell, 2011).

Credibility observes whether the findings of the study appear to mirror reality (Merriam, 1998). By spending three to four days per week on-location at the case company for a month prior to beginning the interview phase to gain organizational context (Shenton, 2004), the researchers were able to familiarize themselves with the working methods and culture of the department studied, as well as identify key stakeholders. Triangulation of data was also used to compare ideas and perspectives from different interview subjects against each other (Denzin, 2017), to allow for a stronger case to be built where agreement was found, and critical discussion to be performed in areas of disagreement.

Transferability evaluates whether the results generated by the study can be applied in other contexts (Merriam, 1998). Although it is very difficult to prove that the findings of a qualitative study are applicable in other contexts, they can be viewed as example cases within a larger group (Stake, 2011). As such, a detailed description of the case context has been provided, so that future researchers can individually decide whether the findings can be transferred to their own work (Bassey, 1981).

Dependability appraises whether identical findings could be generated if the study were repeated on a different occasion, with all other factors staying the same (Shenton, 2004). Marshall and Rossman (2014) argue that this is particularly challenging in qualitative research, as the contextual factors are highly dynamic. The researchers have therefore aimed to clarify the situation to the greatest extent possible, by describing the case study in chapter 1, *Introduction*, and laying out the research design used in an earlier section of this chapter (Shenton, 2004).

Confirmability assesses the degree of objectivity in the study (Shenton, 2004). Even when relying on legitimate methods and tools, a certain level of bias is inevitably

present and needs to be acknowledged (Patton, 1990). The involvement of two researchers helps in this regard, allowing for triangulation to cancel out individual biases held through discussion (Denzin, 2017). Triangulation of data from multiple interview subjects also mitigates the risk of selective choice of answers. Furthermore, the detailed explanation of the methodology used allows readers to go through the audit trail and assess the confirmability for themselves (Shenton, 2004).

### **3.6 Ethical concerns**

A separate, but important aspect of any study is ensuring that it is conducted in a manner that is in accordance with certain ethical concerns. Following a list of guidelines suggested by Bell and Bryman (2007), the researchers have taken a few actions with ethics in mind.

First of all, the dignity of the interview subjects has been guarded to encourage participation, by asking non-confrontative questions that uphold their preferred identity (Tracy, 2019, pp. 145). Second, subjects were offered the option to skip any question that they did not feel comfortable or capable of answering in an informed way. Third, consent from each subject was obtained before starting to record the interviews, and was granted in all of the cases. Fourth, the subjects have been anonymized in the final report, in order to protect the privacy of each individual. Fifth, all data gathered during the study have been handled with care paid to any confidentiality concerns. Sixth and final, the researchers have made an effort to be as transparent as possible in communication with all stakeholders involved. Continuous communication has been maintained with supervisors from both the case company and university side, providing updates to ensure that both parties believed the work to be progressing in an appropriate direction.



# 4

## Results

This chapter presents the results gathered from the interviews conducted during the research process. To provide a clear link back to the research questions that the thesis set out to answer, the chapter has been divided into two main sections, representing the two research questions. The first section presents findings regarding challenges in moving toward a data-driven practice, while the second section details how an agile way-of-working encourages different user research methods.

### 4.1 Research question 1: *What obstacles inhibit established industrial manufacturing multinationals from implementing data analysis of customer behaviour to improve their software development decision making processes?*

This first section will map out the key challenges identified for why the case company has not been able to monitor and analyze their customers' behaviour, to better understand and predict how the products should be modified by the teams. The main areas highlighted in the interviews were *presence of other priorities, aligning the mindsets of stakeholders, building trust through transparency, understanding the value of user data, assigning ownership of the transition, and handling privacy and legal concerns*. Each will be explored separately below, with quotes included to provide relevant context to the interview responses.

#### 4.1.1 Presence of other priorities

The most frequently mentioned explanation for why customer behaviour data are not better used to inform software development decisions, was the prioritization of other objectives (Interviewee A, B, C, E, F, G, J, L). When asked about what factors inhibit the case company from implementing a more data-driven practice, Interviewee J described the situation as follows:

*It's just prioritization. We choose not to do it, we choose something else instead.*

*- Interviewee J*

Interviewee A and B highlighted the fact that the company started out as a traditional manufacturer and still earns a large share of its revenue through hardware products. It is difficult to shift resources over from the systems related to those legacy products to software development, because the existing customer base is still expecting delivery as previously. According to Interviewee A, if new functionality developed is not compatible with existing systems, customers will be disappointed with the product and existing revenue streams jeopardized.

*The issue for us in that area is that we still have heavy load of legacy devices and customers depending on them. We still need to dedicate resources to those things, and therefore we are not able to move in the quick and agile way that we would like to. But, we are getting there. We are rapidly changing the roadmaps, planning for product obsolescence and streamlining our solutions, so that we don't have multiple devices but a family that can be adapted to different industries.*

- Interviewee B

Similarly, Interviewee E emphasized the challenge in having such an operational change approved. Often, the discussion comes down to a choice between improved data collection and analysis, versus a feature that is directly visible to the end customer. Customer-facing features will almost always be prioritized in this case, as it is generally much easier to demonstrate an obvious business value for the company for those features.

*I would say time for implementation is one of the biggest challenges. To have it prioritized. Getting the approval to prioritize these kinds of things is always the difficult part, because it doesn't provide that instant business value. So, that's where it can be down prioritized.*

- Interviewee E

From the perspective of the development team, the topic of what delivers direct and immediate business value was also raised as an issue (Interviewee F, G). With management looking to meet financial objectives, the directive down to the development teams is to focus efforts on developing new functionality, rather than to thoroughly research the customer's actions. Whenever something is finished, another request is always waiting in the backlog to be built.

Amidst this rush, addressing the need to ensure that the products are equipped with quality and scalability that is sustainable in the long run can fall between the cracks, according to Interviewee G. Discussing along a similar path, Interviewee F explained that when short-term thinking allows such issues to be overlooked, the result is sometimes that more complicated problems arise further down the line. These may then require more time-consuming corrections than if dealt with at an earlier stage in the process.

*I think one of the difficult things is that it takes time to do research,*

*gather data, and implement features that will give data and information. It will be a while before you can actually start seeing the fruits of the labour. Sometimes we don't have time for that, because we need to build this or that, even if theoretically we would maybe have saved time if we had done this chunk beforehand.*

- Interviewee F

*We see the value of [doing research], but there's too much focus on delivering new stuff instead of thinking about the long-term quality. From the top down, there's such a pressure to deliver stuff regularly. What the customer sees gives an impression of SKF. If we deliver something that is slow or gives a bad user experience, it damages our reputation.*

- Interviewee G

The sentiments were also echoed by Interviewees J and K. Interviewee J recalled bringing up the fact that considering customer behaviour through data analysis was not made a priority at various product demos, and was kindly requested to stop asking. This led Interviewee J to perceive that neither Product Management nor Product Development are assuming responsibility for dealing with the problem, leaving it undone altogether. Interviewee K argued along the same lines, indicating that any task that is not a key aspect of the daily work routine easily becomes overlooked when faced with prioritization.

*Often, you'd be met with 'Yeah, this sounds interesting, but we will do these features first, because that's not a priority.' For me, it should be a priority. In your business model, it should say 'We are going to learn the impact of XYZ by doing this'.*

- Interviewee J

#### 4.1.2 Alignment of stakeholder mindsets

Any initiative attempting to restructure the operations of a firm will be met with a certain degree of resistance from stakeholders interested in maintaining the previous order. While it is possible to proceed without full agreement between all parties involved, it is generally preferable to address such issues head on.

When asked about the belief in expanding the use of data for decision making at the company, Interviewee F pragmatically expressed that what is supported in theory may not end up taking place in reality. Most people voiced support for using data-driven decisions when asked; however, the interest level was found to decrease if such a transition would require changes to the daily routines.

*I think that this is one of those things that in theory, everyone thinks are good. Being data-driven is the way to go, but in practice, I think it's a bit harder to embed it into the culture or the way of thinking, because right now I don't think it's quite like that.*

- Interviewee F

The feeling that extending the collection of data would be unilaterally supported within the teams, was not shared by all interviewees even in theory. Interviewee C called into question whether all development team members perceived the same value in customer behaviour data, and argued that some transitional inertia could stem from this cause. The fact itself that the situation is perceived differently among interviewees, further indicates a lacking clarity around the level of alignment at the department.

*I think sometimes the mindset within the teams inhibits us from changing. I have heard some developers saying that they don't believe in user behaviour data, and that it doesn't add as much value as people think. I don't think it's the majority, though. If we would decide that this is very important and push for it, then we could absolutely implement it.*

- Interviewee C

Ultimately, the idea would be to have the entire organization to follow the same guidelines for collection and analysis of data. Seeing such an idea through to successful implementation centrally involves two stages, according to Interviewee K. First of all, guidelines for the new working process need to be developed. Second, there needs to be a way to follow up on whether the teams are actually sticking to the protocols.

Interviewee K, who is involved in the *One Development Initiative*, a project aiming to unite the company behind a single defined way of working, mentioned that the implementation of the initiative is proving to be complicated. Although the current principles being suggested are still a work-in-process, they are already being brought to the development teams to try out. However, the teams have often defined their own best practice for working, and are not particularly interested in switching. Instead, they might have a look at the principles suggested and adjust them to fit the existing working pattern.

*[The teams] see a benefit, but they are not transparent in responding back to us about how it works for them, or how they're doing. Then they use this as a base layer and tweak it in their direction, which means that we don't have the same principles. We have the same base layer with different flavors of the principles or tools.*

- Interviewee K

With the concept of defining central principles currently being run as an initiative on the side of the regular business, those tasked with its implementation currently lack the authority required to enforce compliance with the principles. What this demonstrates is that ideas need to be embraced by management at least to a certain degree, in order to mandate their implementation further down in the organizational hierarchy.



*We need to get the buy in [from management], because I can't tell a team 'Follow these principles'. I don't have the authority, because it spans across all teams. That's on the one hand good, that we have independent teams, but if you don't have the authority, people will take the outcome and it becomes a black box.*

- Interviewee K

The mindset within the organization also matters on a broader level. Interviewee A and B both pointed out that certain individuals and segments of the company still focus primarily on maximizing hardware product sales, instead of selling a complete solution. With such a focus being placed on the products themselves, the value of complementary services such as software easily gets lost in the discussion.

*There is or at least has been a mindset in the organization that we can just transactionally sell products, which makes it quite difficult for our sales organization to change the culture, the way of thinking. They shouldn't be selling products anymore, they need to be selling performance.*

- Interviewee A

### 4.1.3 Building trust through transparency

Another topic mentioned as a key driver in unlocking hidden potential for further innovation was improving the transparency, both internally at the firm and toward the customers (Interviewee A, B, K). It goes without saying that being open and honest is central in order to build collaboration between parties, but it can also play an important role in getting the data-driven transition accomplished.

Internally, transparent communication is important for departments and functions to coordinate with each other. Interviewee A explicitly expressed that improvements in this domain would be useful, believing many stakeholders to currently be rather secretive about their operations and resources. Interviewee H further pressed on this concern, mentioning that the business intelligence team does not always receive access to all the relevant information.

*I think getting the communication process set correctly is key. Being more transparent and open, we've got to get better at that. Sometimes, we can be quite protective of what we do. We're improving, but we could do even more with the two-way communication. We need to educate our stakeholders about what they can provide to us.*

- Interviewee A

Without establishing trust between collaborating departments and functions at the company, there is also a greater risk of them interfering in each other's areas. As an example, several interviewees perceived that the business side of the company has become very disconnected from the development teams who builds the products.

When the sales teams are not correctly informed about what new functionality to expect, they form their own expectations, which can generate friction if those are not met by what is eventually delivered.

*The way SKF is structured with the new value proposition decouples the business side from development and puts it under the sales organization. At times, they tend to mandate how things should be. Then we become more focused on new products to be sold, rather than developing solutions to support the value proposition.*

- Interviewee B

When employees at one location of the company feel the need to cross functional lines and get involved somewhere else due to not receiving the right information, their expertise is not being utilized in the place where it can provide the most value. Continuing with the example about finding a balance between business and technology, Interviewee I mentioned that the sales department often specifies what should be built down to a high degree of detail.

*The sales organization has ownership of the business side. As they also have a good understanding of the technical side, they tend to mandate how things should be, instead of coming with the actual needs and letting the teams decide how to solve them.*

- Interviewee B

As a result, the development teams sometimes feel that they are handed a blueprint for a solution, rather than an explanation of the underlying need. Interviewee C pointed out that this approach fails to provide them with the entire picture of the problem situation, shoehorning them into a solution based on the interpretation of the sales team, instead of letting the developers creatively decide what is the best way to address the actual customer need. Interviewee A illustrated this issue in the following way:

*It's very easy for our customers to say "I need this box and I need it red", but quite often they don't tell us what the business value is. What is the need that we're trying to solve here? What are the benefits of having it be red? Why don't we have it in blue? What's the consequence of that? Getting the right information in the right format is really important to allow us to go back the other way and have a dialogue.*

- Interviewee A

Furthermore, Interviewee K highlighted how rare it is for companies to be entirely transparent with its failures, out of fear of embarrassment or punishment. However, more often than not, more can be learned from a failed endeavour than a success story, and innovation is stimulated when innovators do not need to stress about the risk of making mistakes. Interviewee K therefore argued that all companies should embrace a culture of encouraging trial and error as a means to break new ground.

*We need to create a different failure culture within the company, that's super important. In all companies, by the way. They are all facing the same problems. I think the old industrial companies are driven by sharing success, but not sharing problems and failures. You don't have any screw-up sessions. I've never seen an enterprise that said 'Now we're doing a screw-up session and our CEO is telling everyone what he did wrong'.*

*- Interviewee K*

#### 4.1.4 Understanding the value of user data

Another aspect brought up in a number of interviews was the difficulty in quantifying how much value can actually potentially be gained from implementing a more data-driven practice. Interviewees A, C, H, I, and J all touched upon how the degree of uncertainty involved pursuing something that has previously not been done before is an extra hurdle to jump over when seeking approval from the necessary stakeholders.

*How much value could we get from that type of information? I don't know, because we have not used it before.*

*- Interviewee A*

In order to properly implement more data into the decision processes at a company, it is imperative that the right competences can inform how to proceed. Several interviewees argued that the company already possesses the competence needed, suggesting that any issues are not related to a lack of resources, but rather how those resources are utilized.

*We have the capacity to make improvements within this area. [The teams] have the knowledge and the competence to do what is needed to capture and analyze the data, it is just not being done right now.*

*- Interviewee E*

Interviewee C expanded even further on the topic, pointing that there are limits to what can be learned from looking at data. While data analysis can be useful for identifying and addressing problems with functionality that is already installed, it does not necessarily help discover new functionality that would be beneficial to the user. Henry Ford is famously quoted for saying that *"If I asked people what they wanted, they would have said faster horses"*. In a similar manner, looking to data gathered from an existing software system may not reveal all hidden potential within that system. It is important not to consider data-driven decisions as a perfect solution, since they are dependent on what data are being fed into the system to begin with.

*You never know if [the customer] is missing a functionality that actually doesn't exist in the system. How do we know that? It's not shown in the data. Data-driven decision making is good to evaluate the functionality*

*of the system as it is, but it's hard for you to innovate with only data.*  
- Interviewee C

Nevertheless, Interviewee J highlighted the importance of using data to better understand where to target efforts and make improvements within the existing system. By having the developers invest their time and resources in developing functionality that matters most to the end user, the risk of work hours being spent on features that are less often interacted with is mitigated. Interviewee J illustrated this point further with an example, which follows below.

*Say that we have a button that says 'Download report as a PDF'. We have two designers working on that, one with the aesthetics, and one with the functionality. When someone clicks on the button says generate a PDF, it will create this beautiful, lovely PDF. However, they've probably spent a collective time of 20 hours, and we don't even know how many people click on that button. We could have just had a simple button there, and monitored what percentage of users click it. If nobody is, why bother? There are other things that we can solve.*

- Interviewee J

### 4.1.5 Assigning ownership of the transition

All interview subjects were asked to lay out a strategy for how the case company easiest could start transitioning toward the desired data-driven state. A wide variety of suggestions were offered, which indicates that it is not entirely obvious where such an initiative would ideally be driven from, in order to optimize its chances of success.

Interviewees A, C, E, and F all suggested that the idea should in some form be pushed by the development teams themselves, taking a bottom-up approach. The teams are the ones directly affected by the change in terms of daily work routines, meaning that they have the most benefit to be gained from making improvements.

*The ideas need to come from the development teams, because those guys are the ones that are going to be able to use that data in the most efficient ways on a day-to-day basis. I could quite easily say it should come from [the CEO] or [the CTO], but they're not going to get any direct value from that. It has to be traveling from the bottom up.*

- Interviewee A

The suggestion was specified in even greater detail by Interviewees C and E, who both considered the User Experience team as the central driver in the change process. This was motivated by the fact that UX are the ones responsible for the front-end functionality that the end user directly engages with, which is the area where new things could be learned from monitoring and analyzing the user behaviour.

*I really believe that this topic needs a driver and I think the UX team is*

*a good place because they would gain most of it when they are designing and developing systems. It doesn't necessarily mean ownership of collecting customer behaviour data, but rather acting as a driver or engine in the process.*

*- Interviewee C*

On the other hand, Interviewees B, D, G, and H argued that top management needs to be involved in driving the idea in order for it to be embraced within the organization. The argument in favour of this position is that even if good ideas are presented by the teams, achieving widespread dissemination throughout the firm is difficult unless a certain degree of support is provided top-down from management level. This closely relates to Interviewee K commenting that authority is a key factor in ensuring compliance with guidelines.

*It needs to start at the top. I would say that it even involves [the CEO]'s leadership team, for each functional area. Functions can push things and it's great to have the ability to take ownership and the autonomy to do things, but if there's not support from the top, they risk getting squashed. Leadership needs to at least support it and say 'We need to do it, and this is how.'*

*- Interviewee H*

Attempting to find a compromise somewhere in the middle, almost all of the interviewees also once again highlighted the need for alignment between different functional areas. Interviewees D, E, H, and J particularly stressed the need for business and technology to work together, to ensure that the right information about the needs is channeled from sales to the development teams.

*I think that business has to inform [software] development of what the needs are. [The UX team] should be telling sales 'I need to get you in front of a customer, so that you can tell me better what my customer needs' and then the developers need to go and build that.*

*- Interviewee D*

While sticking to the belief that the development teams should be pushing for the change from the bottom up, Interviewee A also called attention to the importance of involving a broad spectrum of competences. While the developers know best how to proceed with the implementation, taking input from other sources in the organization to understand the value proposition in a broader sense is vital to make sensible improvements.

*The team in Gothenburg are excellent developers, but don't have such a broad knowledge of condition monitoring. I'm sure they'd tell you the same thing. I've worked with the products for many years, so I understand what works and what doesn't. That's why it's important for us to work together.*

- Interviewee A

### 4.1.6 Handling privacy and legal concerns

A more practical but nonetheless crucial aspect referred to in a number of interviews was that of being able to meet all legal requirements for collecting and handling data (Interviewee A, C, H, I, J). Although what can be learned from monitoring user movements within the software products is relatively limited and not particularly sensitive information, concerns were raised regarding compliance with regulation such as GDPR.

Interviewee C explained that GDPR particularly is treated very carefully, since the penalties for failing to comply with its rules are proportional to the total revenue of the company. For a large, global manufacturing firm, such penalties could easily reach very high levels. According to Interviewee J, reservations about GDPR are also caused by the fact that there is no real clarity around what practice is acceptable and what constitutes a violation.

In addition, Interviewee A commented that despite the non-sensitive nature of the data in question, many big customers are extremely concerned about the privacy of any data that relates to them. This increases the pressure to demonstrate that any data will be stored with proper consideration paid to IT security.

*The biggest hurdle that we have today, and this comes directly from our sales guys, is IT security. Particularly with big companies like oil and gas, they are very, very protective of their data. Even though what we acquire is vibration data, squiggly lines. What can we steal from that? The issue is, to get it we often need access to the customer's infrastructure.*

- Interviewee A

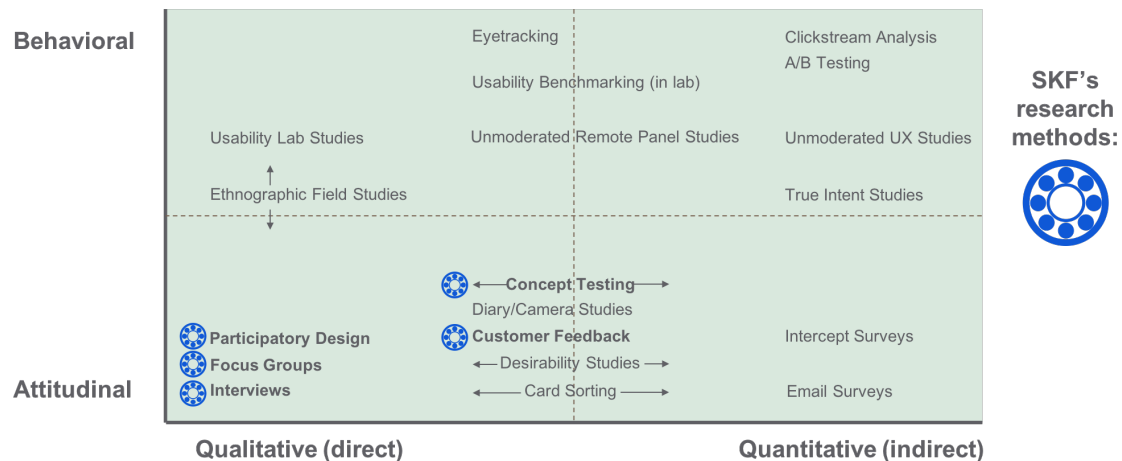
## 4.2 Research question 2: *How does an agile way-of-working influence the implementation of customer behaviour data in the decision making process?*

This section will present the findings surrounding what user research methods are currently included in the work processes at the case company, specifically with regards to the usage of the agile methodology framework *SAFe*. Following this, the influence of agile on the different user research methods is mapped on a landscape, creating a new model. Thereafter, other initiatives that support the model will be introduced, before finally listing observations that support agile when implementing customer behaviour data analysis.

In addition, the challenges identified in the previous section have validity for the second research question. The main obstacles that were found, such as presence of other priorities, alignment of stakeholder mindsets, building trust through transparency, understanding the value of user data and assigning ownership of the transition are all tied to the company's operations. The development centers work with the SAFE framework, and therefore it is important to acknowledge that many of the obstacles discovered are governed by its processes.

#### 4.2.1 User research at the case company

The software development centers at the case company currently utilise five user research methods: *participatory design*, *focus groups*, *interviews*, *concept testing* and *customer feedback*. These were mentioned in several interviews, for instance how clickable wire frames are used for concept testing (Interviewee C). The comments were later verified with the supervisor at the case company. When these are plotted on the *Landscape of User Research Methods* graph (Rohrer, 2014), it can be seen that the current practice mostly covers attitudinal and qualitative research methods, represented by the bottom left quadrant. The user research methods currently used by the case company are marked in Figure 4.1 in bold text, with a blue ball bearing.



**Figure 4.1:** Current user research practice at the case company mapped on the Landscape of User Research Methods (Rohrer, 2014).

When the interviewees were asked whether any customer behaviour data are currently gathered, the answers were often some version of "No" (eg. Interviewee C, E, F), frequently explained by the prioritization issue. Another recurring explanation was that the only data gathered comes from one of the more qualitative and attitudinal approaches and that no data are received from tracking of behaviour (Interviewee E, G). This is concisely illustrated in the following quote from Interviewee F:

*We are not really performing any tracking right now.*

*- Interviewee F*

However, in a few cases (Interviewee G, J) it was mentioned that some high level tools had been set up in a few of the apps, for instance Google's *Firebase*, a mobile and web application development platform that can be used for tracking data. Unfortunately, these tools were not believed to be extensively used, or only used to provide high level data. Others explained that the data that is collected is for example number of licenses, but nothing on the usage of the products.

*Right now, we're not looking so much at for example Firebase or other statistics for the apps. We have it set up and I think our Product Owner is looking at it sometimes, but I don't believe that it's used very much.*

*- Interviewee G*

### 4.2.2 Agile methodology and user research methods

The findings indicate that the agile way-of-working with the SAFe framework at the case company is not supporting or encouraging the implementation of behavioural and quantitative user research methods, which ties back to why it is continuously not prioritised. This is acknowledged in the following statement from Interviewee J, that highlights the problem when working with SAFe:

*Where we are now, the way of working is not supporting using customer input so much. It's not built into the mechanisms. For instance, two weeks from now, we will start a new phase of the product. That will be three months of work, and we have a bucket of things that say, "Ready to be built." That bucket will have EPIC tickets that have context, identifying the problem. This way, when people start building it, they can go to these tickets and get a better understanding of what they're trying to solve. That's how SAFe is running right now, but there is no mechanism for handling getting things ready. They just are. It's a bit of a black hole.*

*- Interviewee J*

The agile way-of-working and the SAFe framework do not seem to have any built-in process that encourages quantitative and behavioral user research methods, the way it has been implemented. Consequently, no tracking or A/B testing was happening even when there were a few apps that had started setting up tools. To provide further clarity on how this works, an expert agile coach, Interviewee L, was asked about how data analysis of customer behaviour would fit into the SAFe framework. The answer provided reads as follows:

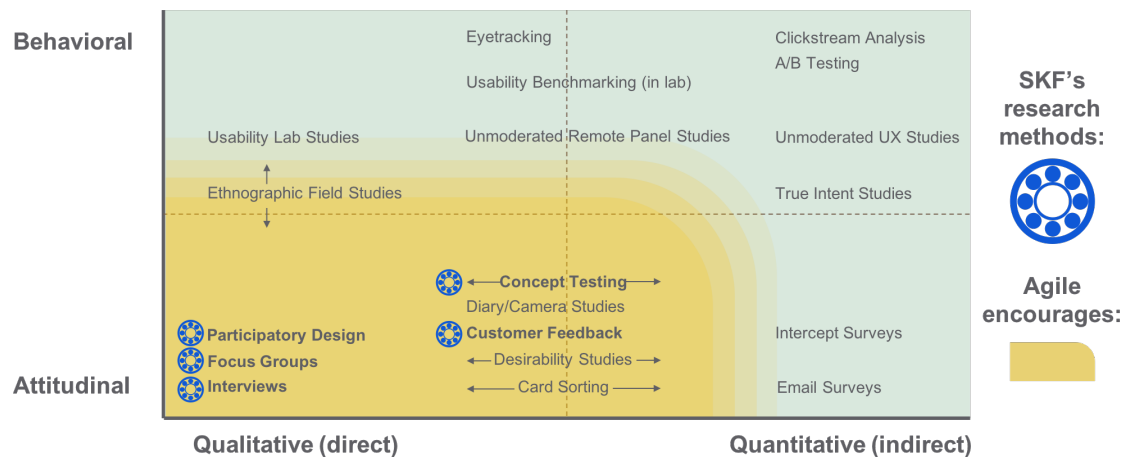
*The framework doesn't care about what we are working with, so you can put whatever job you want into each and every work package. For me, it's just a way of handling all the work, to be coordinated with what you're doing. You can do whatever you want. It's a list of job that you need to do, and you coordinate by working agile.*



- Interviewee L

It was also found that there are no mechanisms that support or encourage behavioural and quantitative user research methods built into the SAFe framework, at least as it is implemented at the case company. However, it is arguably still fully possible to start with data analysis of customer behaviour, because it is treated just like any other software feature for development.

The interviews captured that agile appears to mostly emphasize aspects that support the attitudinal and qualitative side, explaining that the case company demos products as a way of looking for feedback. Interviewee E argued that the traditional way-of-working at the case company is centered in the voice of the customer and is hardly using data to see what the customer is actually doing. When taking all this into consideration, the findings suggest a new model that maps how agile encourages different user research methods, as seen in Figure 4.2 below.



**Figure 4.2:** User research methods encouraged by agile methodology mapped on the Landscape of User Research Methods (Rohrer, 2014).

The area that agile covers, displayed in yellow, is not a hard border and but rather shifts depending on the agile methodology used and its implementation. As such, just like in the Rohrer (2014) model, placement of the methods is not precise. The model does not intend to claim that agile encourages exactly all methods covered, but rather methods with attitudinal and qualitative characteristics in general. The findings from the interviews and the way agile portrays handling the customer justifies this model.

### 4.2.3 Additional initiatives supporting user research

Another central finding that supports the model presented in Figure 4.2 is that other initiatives looking to improve the internal processes were found at the case company. These other initiatives are positioned outside of the agile SAFe processes that the development centers use, and are pushing for more quantitative and behavioural

user research methods.

An example was first brought to the researchers' attention by Interviewee J, who mentioned the *One Development Initiative*, which is trying to create central work principles for all development teams. The topic was explored further with Interviewee K, a key stakeholder involved in running the initiative, who went on to explain its purpose in the following way:

*The idea is to build core services that are re-usable for SKF to build solutions much faster. Simply said, it's a micro-service architecture approach where services are built with a single function, working together to develop the capacity of the entire digital platform. This digital platform is then used to more efficiently build solutions for different organizations. These core services are very generic, and ideally re-usable for all of SKF.*  
- Interviewee K

The *One Development Initiative* is one of these core services, and is meant to help bring the case company's experiences together and find some common ground for development. This includes learning from mistakes and success as well as capitalizing on similarities. The initiative is not tied to the development centers where the apps are developed, because the whole organisation is in need of digital software solutions. An example of a project could be bringing two or three data sources together and creating a dashboard. Another example was provided when Interviewee K was asked if there are currently any customer behaviour data handling standards in place:

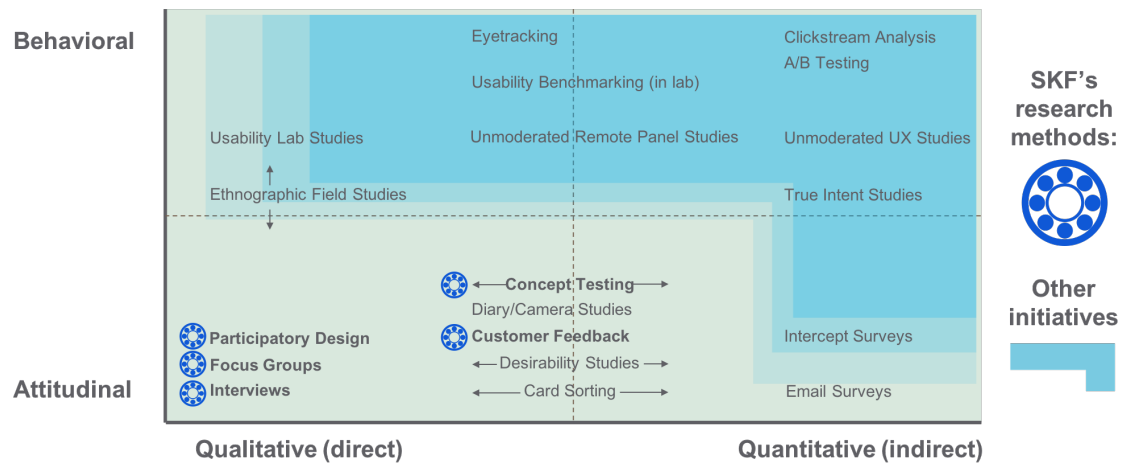
*Within the initiative, not yet. That being said, we do have some other stuff. For example, in India, a mobility team in the app domain developed core metrics for how to measure and track the customer behavior, but it is still pretty individual.*

- Interviewee K

Currently, the initiative is creating architectural principles to be shared with the organization, which are meant to be used as guidelines for software development. As an example, one of the drafted principles is "*Minimum Metrics Microservice - each microservice provides defined metrics to a central service for analytics, health status and improvements*". Depending on if and how this is implemented, it may support the behavioural and quantitative user research methods. The way that Interviewee K runs the team, goals and KPIs for tracking work may also be beneficial. Furthermore, the way they work with objective metrics from the services and real feedback could possibly be applicable to other parts of the organisation. The topic is explained in more detail in Appendix F.

These findings reinforce that agile mostly encourages the bottom left quadrant of the Rohrer (2014) model, attitudinal and qualitative methods. Other measures are being run from outside of the SAFe processes at the case company, in order to try

and benefit from the behavioral and quantitative research that is missing. The case company is exploring other initiatives to help potentially reach the the top right quadrant, behavioral and quantitative methods, as illustrated in Figure 4.3. These are however in an early phase, so it is unclear what the progress will look like, and what other user research methods will be supported. The initiatives at the case company do not cover all the methods under the blue shape, but rather serves to illustrate where initiatives could provide new value.



**Figure 4.3:** User research methods opportunities for other initiatives mapped on the Landscape of User Research Methods (Rohrer, 2014)

#### 4.2.4 Agile methodology and customer behaviour data analysis

The main focus of this paper has been to identify obstacles and what role agile plays when a firm tries to implement customer behaviour analysis. However, there were also some positive aspects that favour such a transition, of which the most relevant are identified in this subsection.

One aspect of agile that favours the potential implementation of customer behaviour analysis is the continuous learning culture, which is one of the SAFe principles from Figure 2.8. The current learning culture is shown to be focused on the voice of the customer, but this could be changed to also include prediction through behaviour tracking. Continuous feedback is at the core of agile and as mentioned below:

*Agility lives from continuous feedback. If you don't get feedback, you're not working in an agile mode.*

- Interviewee K

This mentality is well suited to also incorporate customer behaviour analysis through utilising attitudinal and qualitative user research methods. Similarly, the agile manifesto point "Responding to change over following a plan" would favour inclusion of

customer behaviour analysis. This could also provide additional insights that help please the customer with valuable software continuously, in accordance with the first of the twelve agile principles. Some of the interview subjects (eg. Interviewee C and I) even acknowledged that their customers do not always know what is best for themselves, speaking in favour of adding tracking as a predictive tool.

Another aspect of how parts of SAFe can work well with customer behaviour analysis is that the case company has in the last year started working with architectural EPICs. EPICs are a larger piece of work with a common objective such as a new feature, and the architectural EPICs focus on more structural back-end aspects of the development. This was captured by Interviewee E, who was asked why customer behaviour is not gathered to a larger extent:

*I think it has been prioritized down. The focus has been creating a product that can be used right away. There has been a lot of pressure to get those products out, rather than also looking at the input on the usage. The way that it has been previously is that when you work in projects, you get a bunch of features to do. The parts that are not customer features haven't been taken care of - the product ownership. We have now grouped it into business EPICs and architectural EPICs. We need to put time into the architectural ones, and that's where this kind of parts that come in. It's not a business value. Our customer doesn't care if we have that, they care about if we have a new feature. This is where we need to work on increasing the emphasis on architecture.*

- Interviewee E

This shows that agile and SAFe have potential to help an organisation start learning from customer behaviour analysis, but it has still not been successfully implemented at the case company. Consequently, these findings indicate that it may not be enough.

# 5

## Discussion

This chapter is divided into four sections. The first discusses the academic contributions by analyzing the findings and explaining their significance and relation to previous work. The second reflects on the methodology used in the study. The third suggests areas for exploring related topics in future research. Finally, the fourth outlines managerial implications for how the case company and others similar to it can deal the identified challenges.

### 5.1 Contributions to research

This thesis set out to explore how companies can track user behaviour within its software and apps to better inform development of functionality. Specifically, the thesis intended to answer the two research questions first mentioned during the *Introduction* chapter, and are once again mentioned below:

1. *What obstacles inhibit established industrial manufacturing multinationals from implementing data analysis of customer behaviour to improve their software development decision making processes?*
2. *How does an agile way-of-working influence the implementation of customer behaviour data in the decision making process?*

The study's first finding is the identification of six areas that appear to work against established manufacturing firms when attempting to expand the usage of customer behaviour data analysis for software development. As a reminder, these are compiled as a list in Table 5.1 below.

Challenge 1:	Presence of other priorities
Challenge 2:	Alignment of stakeholder mindsets
Challenge 3:	Building trust through transparency
Challenge 4:	Understanding the value of user data
Challenge 5:	Assigning ownership of the transition
Challenge 6:	Handling privacy and legal concerns

**Table 5.1:** Obstacles inhibiting implementation of customer behaviour data analysis.

*Challenge 1: Presence of other priorities* was arguably found to be the most pressing

obstacle to achieving progress. Making the time to conduct thorough user research does not bring an easily recognizable direct value to the customer, and therefore tends to fall down the priority order. When compared to the previous research presented in the literature review, the topic has not been encountered as an explicit factor in any other papers, indicating that it is a new and unique finding within the field. This holds especially true with regards to analysis of customer behaviour data, but could possibly also apply to big data analysis overall.

*Challenge 2: Alignment of stakeholder mindsets* was also fairly unanimously agreed to be an issue by the interviewees. Existing revenue streams from legacy products, along with deeply rooted cultural norms about the correct way of practice, make it difficult to convince all involved stakeholders of making changes to the processes. This topic is commonly recurring within literature on organizational behaviour, but has also been discussed in the context of data analysis implementation previously. For instance, Provost and Fawcett (2013) discuss the importance of aligning the entire organization behind a common goal, with regards to the implementation of big data analytics. However, this finding expands the concept more specifically within the domain of customer behaviour data analysis, as it is clear that key stakeholders need to align if the increased prioritization discussed in challenge 1 is to be reached.

*Challenge 3: Building trust through transparency*, both within the organization and toward the customer, is imperative in encouraging any kind of process innovation. If the goal of improving the efficiency of the operations is to be reached, all departments and functions need to focus their efforts on their specific area of expertise, while exchanging the right information with others around them. Succeeding at such practice is especially challenging for large firms like the case company, as operations tend to spread out globally, making continuous in-person dialogue more difficult to schedule (Turk et al., 2014). Additionally, the finding relates somewhat to the suggestion that communication is a commonly featuring challenge in agile implementation, as discussed by Kontio et al. (2004) and Nerur et al. (2005).

*Challenge 4: Understanding the value of user data* emphasizes the impact of uncertainty, as the implementation of an entirely new practice brings with it a large degree of uncertainty. If the relevant decision makers are to be convinced that implementation of customer behaviour data analysis is the right path to pursue, it must first be explained, in simple terms, what new value can be extracted. This is noteworthy, because the general consensus tends to be that data-driven decisions make firms more productive and profitable (Brynjolfsson et al., 2011), while this finding indicates that there are limits to what can be learned from data. Moreover, this shows that the mindset for developing through hypothesis testing or A/B testing (Young, 2014) is currently not dispersed throughout the case company.

*Challenge 5: Assigning ownership of the transition* was found to be area of lacking clarity at the case company. Although many different groups of stakeholders would potentially stand to benefit from the changed practice, it appears that none feels the need to assume responsibility for driving the change. This finding further de-

velops Davenport and Bean (2018)'s research about the Data Officer role not being clearly defined, and shows that the responsibilities for implementing data analytics across an organisation is even more uncertain when many stakeholders are involved. Furthermore, Davenport and Bean (2018) also warned that transition processes are often slowed down when ownership and responsibilities are not clearly assigned.

*Challenge 6: Handling privacy and legal concerns* is an expected finding in any study that relates to the collection of data about users. The topic has been discussed in various previous research, such as Katal et al. (2013) highlighting the need to pay rigorous concern to privacy-related legal aspects. However, this study found that it also applies for the customer behaviour data and that there is a great amount of uncertainty across the organization about how to ensure compliance with regulations.

The identification of the six aspects that inhibit implementation of data analysis of customer behaviour covers some organisational and cultural challenges. This overlaps with the research gap emphasized by Chen et al. (2017), who called for further research into the topic, after finding that value can be created by using a multiple analyses method approach on mobile app usage.

In summary, there is some previous research on challenges from the context of pure data analytics that have touched upon similar ideas. However, since the studied topic of this paper was more specific and orientated towards customer behaviour analysis and agile, these six findings still provide a new angle of analysis and contributions to the academic field. There is less overlap found with the researched challenges in agile. More interestingly, there are also areas that appear to be undiscovered or not emphasised in previous research.

The second major finding was discovering that agile both has qualities that favour the implementation of customer behaviour analysis and some that do not encourage it. The role agile plays at the case company revealed the latter, while simultaneously observing that other initiatives outside the development centers' normal work processes. Furthermore, it was found that behavioural and quantitative research methods are being used at the case companies' development centers. These findings have led to the creation of a new research model, *User research methods encouraged by agile methodology mapped on the Landscape of User Research Methods, as seen in Figure 4.2*. The model shows that it is possible to link the fields of agile, user research and data analytics which was not found to be done before when the researchers reviewed academic literature.

The academic contributions from the second research question is therefore the creation of new theory in form of a model that shows a new way of thinking about agile's role in product development. The findings are interesting because they also question aspects of agile methodology, by showing that it may not be that supportive of implementing data-driven decisions.

This begs the question if the methodology needs to be updated. Should perhaps

a new agile principle be added that encourages behavioral and quantitative testing as well? Such a principle could theoretically suggest something similar to *"Complement the frequent customer feedback with quantitative behavioural analysis of how customers use the product"*. This would help balance both types of feedback, which is believed to be optimal by both Rohrer (2014) and Rodden et al. (2010). Bearing in mind that the way agile and SAFe is implemented at the case company impacted the results, it may be that agile is more supportive if implemented differently or if another framework than SAFe is used. However, judging from agile's principles and theory in combination with the findings at the case company the above questioning is justified.

### 5.2 Reflection on the study

Looking back on the research process from the end of the study, the researchers overall feel satisfied with the methodological approach chosen. Given that both researchers possessed limited knowledge about the topic of the thesis beforehand, pursuing a qualitative, constructionist path and steering the direction of the study as more knowledge was gathered from literature and interviews worked out well. The decision to conduct a single-case study did prove useful for gaining access to a broad range of stakeholders to provide a variety of perspectives, which was again helpful for establishing the initial contextual understanding of the case company and its operations.

Having the initial couple of interview subjects selected on recommendation from the case company supervisor helped identify the most relevant stakeholders, while the snowball method used afterward generated a number of interesting additional interviewees which could have been otherwise overlooked. Preparing a question template beforehand ensured that all topics could be covered within the interview time frame, but allowing the interviewees the opportunity to expand freely when desired generated a lot of useful additional information that could not have been gained from the questions alone. The use of predetermined interview roles as interview leader and secretary made the discussions easier to follow, while simultaneously producing useful notes about key takeaways. Finally, the transcribing and recording software reduced the post-interview transcribing workload immensely, while also allowing the researchers to revisit the audio files at later stages.

For categorizing and presenting the data gathered during the interviews, thematic analysis proved to be an appropriate framework, since the interview transcripts included a lot of unstructured raw data. By coding the transcripts and then finding overlaps between the code categories, six areas (or themes, as they are called in thematic analysis) could eventually be identified for the first research question, while information related to agile was defined as a separate theme. The NVivo software aided greatly in performing the analysis, given the large amount of data to be processed. Similarly, the visual analysis used for showcasing the results to the second research question proved successful, given its close relationship to a model from previous research.



That being said, there are some limitations to the study. First, the choice to perform a single-case study means that the results have not been verified across multiple companies or industries. The researchers would have liked to broaden the scope to include other actors, but had to set reasonable limitations within the predetermined time frame of the study. Second, additional rigour could have been added to the study by iterating back to a verification round of interviews once the results were compiled. Third, the results could have been verified by involving additional information sources, such as observations or review of internal documents. Fourth, the reduced office hours caused by the COVID-19 outbreak meant that all initially planned interviews could not take place.

When considering alternative explanations to the findings, the researchers believe that the size of the organisation may be a contributing factor. Furthermore, the fact that the majority of the case company still works with a waterfall process while agile is a relatively new addition for the development centers may have impacted the results due to inexperience involved in the processes.

### **5.3 Calls for further research**

As a consequence of the methodology reflections presented in the previous section and the results discovered and discussed, the researchers would like to make some recommendations for how the topic of this thesis could be investigated even further in future studies.

Since the study has explored a new area rather than aimed to test existing theory, it would be interesting to see its results compared to those of a similar study on a company from a different industry. Additionally, the same study could be performed across multiple firms of similar characteristics, to allow for more rigorous evaluation of the generalizability of the results. Moreover, researching the topic over a longer time frame, as this is believed to have been the main limitation in this context. All these ideas could provide insight and potentially confirm the validity of the six obstacles as well as the new model presented. Further research could also be conducted exploring if it is more favorable to implement data analysis of customer behaviour by having other initiatives drive the change or if it is better to adapt the specific implementation of agile.

Future researchers with a better knowledge of software development could also engage the topic on a more practical level. A pilot project could be set up to track data and implement data analysis of customer behaviour in order to observe if the process is subjected to the challenges that have been identified in this paper.

Additional research could also be on how firms have overcome obstacles when implementing data analysis of customer behaviour. Any such project would obviously first have to identify a firm that has already been successful with implementing customer behaviour analyses. On this topic, the following section will present some

suggestions for how to proceed. These should however not be considered exhaustive by any means.

Finally, the findings suggest that perhaps the agile principles (Beck et al., 2001) and manifesto becoming slightly outdated. Is the agile framework SAFe also not considering this aspect enough? Instead, there is a strong emphasis on collaboration with the customer, frequently releasing software for demoing and listening to the customers' feedback. Further exploration of this topic is left to other researchers.

### 5.4 Managerial implications

Six challenges in transitioning to a software development process informed by tracking of user behaviour were identified by this study, and have been explored in-depth in chapter 4, *Results*. Besides their academic implications, which have already been discussed, some practical actions can also be recommended to the decision makers at the case company and other firms faced with similar issues, in order to equip them for overcoming the issues discovered. The recommendations have been shaped by ideas and concepts encountered both during the literature review process, as well as during the interviews themselves. The interviewees were all asked to envision a roadmap for working toward the desired state, and the input has been taken into account when outlining the suggestions presented during this section.

#### 5.4.1 Making user research a priority

The findings indicate that the most pressing area of improvement is making thorough user research a bigger priority. Realizing that other features were being prioritised, and that other initiatives were being run outside of the regular processes provides two managerial options.

The first option would be to push expanded user research as an external initiative, for instance by involving a tiger team that could jump between products and collaborate with teams as needed. The team would aim to find opportunities for implementing user behaviour analytics across the organisation. It could start by identifying what data are valuable, and what tools would be appropriate to use. Once implemented, the team would then support the development teams in keeping the operation running. To achieve success, such a team would need to be multi-functional, involving competences from software development, data science, and business. For instance, involving the expertise of a Google Analytics researcher could be interesting to consider. Consequently, this approach would elevate input from the user to be prioritized alongside business needs and technical bugs, which currently tend to be considered more important.

The second option would be to embed more behavioural and quantitative user research methods into the existing way-of-working. This could for example be achieved by creating architectural EPICs targeting the area and pushing these down to the backlogs and sprints. Alternatively, it maybe possible to better emphasize the value

provided in terms of business insights, to have it included in business EPICs. To accomplish this, it is important that the key decision makers are convinced to change their mindset on the topic. A starting point could be to install a small number of behavioural and quantitative user research methods working across a certain time frame. Davenport and Bean (2018) points out that the transition to data-driven culture can be slow, suggesting that short time frames may be a good way to begin.

### 5.4.2 Utilizing a structured metrics approach

Regardless of which approach is favoured, applying the *HEART* framework (Rodden et al., 2010) for metrics would help ensure that different types of user research methods are included. Measuring these metrics would allow for greater coverage of the Landscape of User Research Methods graph (Rohrer, 2014), presented in Figure 2.3. The case company also has the option to evaluate the metrics that the One Development Initiative set up in India to see if they are applicable elsewhere. Furthermore, it could also be possible to learn from the way the One Development Initiative works with goal setting, the division of feedback, and KPIs as described in Appendix F. One way of working with goal setting and metrics is by following the *Goals-Signal-Metrics* process (Rodden et al., 2010). This includes articulating goals, identifying data sources that show signals and considering what signals imply success and what signals imply failure, and finally making these into metrics for tracking.

### 5.4.3 Aligning mindsets and assigning responsibilities

If any changes to existing work practice are going to succeed, it is imperative that all the relevant stakeholders are convinced that there are benefits to be gained from the changes. It is therefore essential that this way-of-working is encouraged at leadership level. Otherwise, it is likely to continue being prioritised down, as a certain degree of authority is necessary to have the teams stick to guidelines suggested.

The concept would ideally be implemented by the teams themselves, with support if necessary, as they have the best knowledge of the work being done and what to track. However, it is important that there is a common understanding within the organisation, and continuous discussions with all stakeholders, including leadership and even sales. Thus, it is recommended to separate the ownership of the change and the driver, i.e. who takes action and implements solutions. Involving an individual in higher management as a owner or champion for the change would facilitate dissemination throughout the organization.

Supporting the implementation at a team level can be done in multiple ways. One way, as previously discussed, would be to establish a partnership team that helps set things up. Another would be to hire or train user researchers, who have this responsibility as their main role, with a significant amount of their time spent on researching and testing hypothesis statements. This would however mean that management needs to specify requirements for things that should be tested. The user

researcher role would be similar to that of a Recommend role in Rogers and Blenko (2006)'s RAPID-model for decision making.

### 5.4.4 Dashboarding of data to facilitate understanding

In order to spread more understanding about the value and relevance of incorporating tracking of user behaviour data into the work routines, it would be helpful to visually explain exactly what data are being gathered. By using visual aids when presenting suggestions for approval, decision makers without detailed knowledge of the processes would more easily be able grasp the value of such proposals.

An easily understandable representation of the conclusions drawn from the data analysis, would also allow the sales department to explain development decisions to the end customer in an easily consumable way. One way to proceed with this is to start with a pilot involving a small part of the software, and develop a dashboard from which some basic user behaviour data can be retrieved. Piloting this type of dashboard would also allow for segmentation. This could be to cover different user roles or businesses in order to help know what questions to follow up on with who. Having Product Managers understanding the value of what these tools provide would also help communicate how monitoring should be further implemented down to the development teams.

Another important factor is involving people with the right technical competence for data collection and analysis. In order to create sufficiently beneficial dashboards, a possibility would be to involve Business Intelligence, as this function is familiar with these approaches. They would furthermore have knowledgeable data scientists that could be utilised. For the case company, it may be possible to collaborate with the Business Intelligence team, which has expressed using of data whenever they can to try to engage the right people.

### 5.4.5 Escaping legal issues

To alleviate the obstacles caused by uncertainty surrounding GDPR and other regulations regarding collection of data, the company should consult with its internal legal experts when designing the new processes. Since the data does not pertain any particularly sensitive topics, there should be no issue putting the idea into practice as long as proper authorities are able to advice on how to cope with privacy concerns. Once this is obtained it should then be spread to the relevant stakeholders. This should include the UX Designers as well as the Developers, Product Owners and Product Managers so that they are all aware of what can and cannot be done. This would mitigate the widespread uncertainties.

# 6

## Conclusion

This thesis has explored the software development practices of a large, global firm that has previously operated solely as a traditional manufacturer, but is expanding its offerings to include complementary software services. The purpose of the research has been to understand why data collected from tracking user behaviour within the software products are not used to inform development of new functionality, by identifying what barriers inhibit such practice. This topic has also been linked to agile methodology, by mapping how different user research methods fit into the agile way-of-working.

The investigation was conducted using a constructionist approach, performing a literature review to develop the knowledge to ask the right questions to relevant stakeholders. Relying on a single-case study allowed the researchers to gather in-depth insights from a wide variety of locations at the company. While the general applicability of the results generated needs to be verified by future studies with a wider perspective, they provide a starting point for any such endeavours. Such research could perform similar studies at other global firms across multiple industries, over longer time frames or follow the execution of a pilot project implementing customer behaviour analysis. Future researchers could also build on the findings of this thesis by exploring how overcome the challenges identified by studying a success case. This could shed light on whether the transition is more efficiently driven through initiatives or by making space for customer data in the existing way-of-working.

The main finding of this thesis is the identification of the six barriers that hinder successful implementation of customer behaviour data analysis: presence of other priorities, aligning the mindsets of stakeholders, building trust through transparency, understanding the value of user data, assigning ownership of the transition, and handling privacy and legal concerns. These barriers have contributed to a better understanding of the interplay between data analytics, user research, and agile, which provides new insight for academia and industry. Similarly, the second main finding, the new model portraying what user research methods agile encourages shows that it does not favour all types; however, some favourable aspects were discovered, such as frequent testing and the learning culture. Therefore it questions the agile methodology's ability to support working with data analysis and data-driven decisions when the collaboration with the customer has such a strong presence. Consequently, do the agile principles (Beck et al., 2001) need to be complemented?



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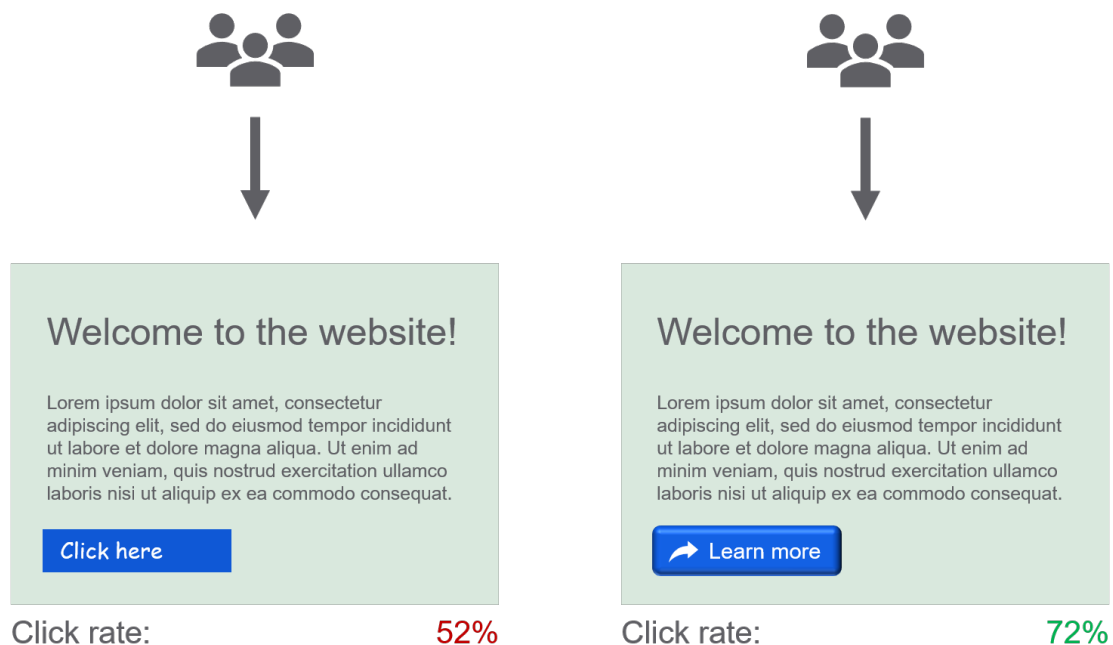
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# A

## A/B testing

A/B testing is a form of controlled experiment commonly used in software development, where different versions of a product can be tested simultaneously and then compared against each other (Young, 2014). The most common case involves two alternatives, A and B, where one is the original and the other has been changed with regards to one variable (Sauro & Lewis, 2016). A/B tests can also involve more than two versions, known as Multivariate testing, but the level of complexity significantly increases when dealing with multiple variables because it test all combinations of variables and requires more traffic (Kohavi & Longbotham, 2016).

A test is conducted by randomly subjecting half of a test group of users to the original version and the other half to the modified version. By measuring which option draws more traffic, the superior alternative can be pursued going forward in the development process (Kohavi & Thomke, 2017; Sauro & Lewis, 2016).



**Figure A.1:** An example of an A/B test.

The method has become more prominent recently, and also been adopted in other fields than software development (Sauro & Lewis, 2016). One reason is that it offers a way to base decisions on data directly from the intended end users, rather than

having to rely on slower methods such as interviews or surveys. Another benefit is that users do not know that their actions are being evaluated, mitigating the impact of changed behaviour due to being observed (Sauro & Lewis, 2016).

Such data can also be used for more objective evaluation of a decision (Kohavi, Henne, & Sommerfield, 2007). Instead of running into a common problem where the most senior stakeholder involved decides based on opinion, the voice of the customer is represented through the data gathered. Finally, the desired changes can be implemented immediately, as the desired functionality has already been developed (Sauro & Lewis, 2016).

# B

## Personalisation and customisation

The two terms can at first glance be thought to be exchangeable; however, this is not the case in the field of design, development and marketing. Customisation and personalisation are both aimed to improve the users experience and meet their needs (Babich, 2017). *Customisation* means giving the user the option to make changes to the system to fit their needs, for instance configuring content, layout, or system functionality (Schade, 2016). A common area where this is applied is the interface, where the user can select or move topics and functionalities of interest, or change the visual design, such as colours (Schade, 2016).

*Personalisation*, on the other hand is done by the system itself. The system is developed so that it identifies different users and then adjusts the experience, content or functionality depending on how the users have been profiled (Schade, 2016). Schade (2016) highlights that the main goal of personalisation is to match user needs or interests with their desired content and functionality. For example, this could be online retailers suggesting products based on past browsing or purchase history, or at a group level; have modifications based on location or role. Additionally, the researcher states that it can be used to restrict or grant access to certain parts of an application or software.

Zhou et al. (2013) presents three levels of personalisation from a marketing point of view: mass, segment and individual. Mass personalising is when the offerings are tailored for the average user by analysing the whole population. At a segment level the users are divided into different groups where the offering is modified according to the groups' preferences. Then at an individual level it is adjusted to the users' individual needs, preferences and behaviour (Zhou et al., 2013). Similarly, (Schade, 2016) present two types of personalization from a design/development perspective. The first, role-based personalisation, is when users are grouped on their characteristics (somewhat like Zhou et al. (2013)'s segment level), however, these are defined by the developers. The second type, Individualised personalisation, is based on algorithms or even artificial intelligence analysing an individuals behaviour and modifying the offering accordingly (somewhat similar to Zhou et al. (2013)'s individual level) (Schade, 2016). Zhou et al. (2013) further highlight that different types of personalisation can be combined.

Babich (2017) claims that historically customisation has been what users expect in their interactions, but that focus now has shifted towards personalisation. One of the reasons why is because that personalisation results in a lower transaction cost for

the customer (Babich, 2017). In customisation the user has to set their own settings which takes effort. Moreover, Godek (2002) found that customers tend to prefer personalisation if they believe that the firm providing the offering is more capable than them when it comes to identifying how to adjust the offering in order to meet their needs.

Tseng, Jiao, and Wang (2010); Zhou et al. (2013) argues that the internet, connectivity and sensor networks have played a role in enabling personalisation at an individual level, which is now seen in many industry sectors. Godek (2002) highlights that customer databases, interactive technology and smart recommendation have been contributing factors. Furthermore, he exemplifies with that firms can personalise through ranking options according to the predicted customer's preferences.

Firms are now exploring new innovative ways to meet individual customers needs rather than just focusing on larger homogeneous segments (Godek, 2002). This has led to the term design for mass personalization (DFMP), which is the concept of providing a positive user experience that satisfies many individual customers by offering personally unique products and services (Tseng et al., 2010).

However, some downside to personalisation is that if the system is too good at predicting behaviour some users can find this disturbing, additionally it requires frequent reviews to assure that the optimal personalisation is made to the right users (Schade, 2016). It is noteworthy that both personalisation and customisation are meant to increase a good experience or functionality, rather than fixing a poor one (Schade, 2016). For instance if a user is unable to find information or functionality on a site or in an app then the solution could be found in fixing the underlying architectural problem (Schade, 2016).



# C

## User research methods in brief

Rohrer (2014) describes 20 user research methods (p. 6-7):

**"Usability-Lab Studies:** participants are brought into a lab, one-on-one with a researcher, and given a set of scenarios that lead to tasks and usage of specific interest within a product or service.

**Ethnographic Field Studies:** researchers meet with and study participants in their natural environment, where they would most likely encounter the product or service in question.

**Participatory Design:** participants are given design elements or creative materials in order to construct their ideal experience in a concrete way that expresses what matters to them most and why.

**Focus Groups:** groups of 3-12 participants are lead through a discussion about a set of topics, giving verbal and written feedback through discussion and exercises.

**Interviews:** a researcher meets with participants one-on-one to discuss in depth what the participant thinks about the topic in question.

**Eyetracking:** an eyetracking device is configured to precisely measure where participants look as they perform tasks or interact naturally with websites, applications, physical products, or environments.

**Usability Benchmarking:** tightly scripted usability studies are performed with several participants, using precise and predetermined measures of performance.

**Moderated Remote Usability Studies:** usability studies conducted remotely with the use of tools such as screen-sharing software and remote control capabilities.

**Unmoderated Remote Panel Studies:** a panel of trained participants who have video recording and data collection software installed on their own personal devices uses a website or product while thinking aloud, having their experience recorded for immediate playback and analysis by the researcher or company.

**Concept Testing:** a researcher shares an approximation of a product or service that captures the key essence (the value proposition) of a new concept or product

in order to determine if it meets the needs of the target audience; it can be done one-on-one or with larger numbers of participants, and either in person or online.

**Diary/Camera Studies:** participants are given a mechanism (diary or camera) to record and describe aspects of their lives that are relevant to a product or service, or simply core to the target audience; diary studies are typically longitudinal and can only be done for data that is easily recorded by participants.

**Customer Feedback:** open-ended and/or close-ended information provided by a self-selected sample of users, often through a feedback link, button, form, or email.

**Desirability Studies:** participants are offered different visual-design alternatives and are expected to associate each alternative with a set of attributes selected from a closed list; these studies can be both qualitative and quantitative.

**Card Sorting:** a quantitative or qualitative method that asks users to organize items into groups and assign categories to each group. This method helps create or refine the information architecture of a site by exposing users' mental models.

**Clickstream Analysis:** analyzing the record of screens or pages that users clicks on and sees, as they use a site or software product; it requires the site to be instrumented properly or the application to have telemetry data collection enabled.

**A/B Testing (also known as “multivariate testing,” “live testing,” or “bucket testing”):** a method of scientifically testing different designs on a site by randomly assigning groups of users to interact with each of the different designs and measuring the effect of these assignments on user behavior.

**Unmoderated UX Studies:** a quantitative or qualitative and automated method that uses a specialized research tool to captures participant behaviors (through software installed on participant computers/browsers) and attitudes (through embedded survey questions), usually by giving participants goals or scenarios to accomplish with a site or prototype.

**True-Intent Studies:** a method that asks random site visitors what their goal or intention is upon entering the site, measures their subsequent behavior, and asks whether they were successful in achieving their goal upon exiting the site.

**Intercept Surveys:** a survey that is triggered during the use of a site or application.

**Email Surveys:** a survey in which participants are recruited from an email message."

# D

## Multiple analysis of mobile app usage

Chen et al. (2017) suggest the following three methods for creating value from analysis of mobile app usage.

### **RFM**

The RFM technique is used by Chen et al. (2017) in order to quantify customer value through analysing how recently (Recency), how frequent (Frequency), and how much a customer purchases (Monetary). A useful approach for segmenting customers in order to analyse their behaviour in relation to function changes. However, Güçdemir and Selim (2015) highlight that the definition, weighting and computation of the RFM components is defined by researchers and the problem at hand.

### **Link analysis**

The case also applies the data mining technique link analysis which is derived from graph theory. According to Berry (2004), link analysis is a well established method in the social science community in order to detect and analyse patterns in the relationships between organisations, people, and transactions. Furthermore, they state that in link analysis the two main components are nodes (the parts in the graph that have relationships) and edges (the relationship connected by two nodes) and that it is useful for visualising and understanding new characteristics for mining. Chen et al. (2017) also describe that centrality plays a crucial role in link analysis as it shows how important a node is from how centred it is in the network.

### **Association rule learning**

The third method, that is combined with the others by Chen et al. (2017), is association rule learning. In the case it represents patterns in groups of products and services. It analyses the likely hood of a customer using a certain function after it has used a prior function. For instance, if a customer adds a product to their online shopping cart there is a high probability that they add certain other related products (Chen et al., 2017). Association rule learning frequently used to identify correlations and can provide knowledge on what could be combined or customised (Chen et al., 2017).



# E

## Interview question templates

### Interview template 1 - used for Interviewees A-J

1. What department do you belong to, and what is its purpose?
  - (a) What is your role, and what responsibilities does it entail?
2. How are decisions made at your department?
  - (a) What are the normal decision made in your department?
  - (b) What information is used for making decisions?
  - (c) What works well with the decision-making process?
  - (d) Are there any problems and challenges involved in the decision-making process? Please explain them.
  - (e) How could the decision-making process be improved?
3. Are you currently using any data for decision-making?
  - (a) What data is used for making decisions?
  - (b) If so, are you using any customer behaviour data?
4. How do you know that a decision that you make is the right one?
5. What role does Agile methodology play?
  - (a) Does it work well?
  - (b) What challenges are there?
6. Are you currently gathering customer behaviour data in any way?
  - (a) What do you do with this information?
  - (b) Do you consider this data relevant? why?
7. What do you think customer behaviour data can be used for, and why?
8. Is there any other customer behaviour data that you would like to collect?
  - (a) Why are you interested in this data?
  - (b) Are there any obstacles preventing or inhibiting you from collecting it?
  - (c) How do you think these challenges can be addressed and what would your role be?
9. How do you think customer behaviour data is most effectively utilized in decision-making?
  - (a) Who do you see as responsible for aligning SKF in collecting customer behaviour data and having it used in decision-making?
  - (b) What steps would you recommend SKF to take in order to move in this direction?
10. Do you have any other thoughts on this topic?
  - (a) Do you know other people that would be interesting for us to talk to?

**Interview template 2 - used for Interviewee K**

1. What is your role, and what are its responsibilities?
2. What is the One Development initiative?
3. What benefits can be gained from the initiative?
4. Are there any challenges involved in implementing the initiative? What are they?
5. Does the initiative involve any following up to check if a decision that is made is the right one?
6. How can the initiative help improve the decisions made at the company?
7. Are there currently any standards for how to handle customer behaviour?
8. How can it be ensured that customer behaviour is accounted for in software development? How can it be made a priority?
9. Do you think the initiative is responsible and capable of driving such changes?
10. Do you have any other thoughts on this topic or know anyone else we should reach out to?

**Interview template 3 - used for Interviewee L**

1. What is your role, and what are its responsibilities?
2. What benefits do you think are gained by working in an agile way?
3. What challenges are involved in working with agile?
4. What is SAFe and how does it relate to agile methodology?
5. How is SAFe implemented by an organization?
6. Does the firm's characteristics, such as scope and industry, change the implementation strategy of an agile methodology?
7. Are there any differences when implementing an agile methodology in an established industrial manufacturing firm compared to other industries?
8. How are decisions made in an agile/SAFe way-of-working?
9. How is prioritisation handled in SAFe?
10. How are EPICs developed within SAFe? What steps are involved?
11. Who is responsible for doing the research needed when something is not ready to be built, and when does this happen?
12. How does the user fit into SAFe?
13. If we were to implement data analysis of customer behaviour, how would this fit into SAFe? Do you see any obstacles preventing such an implementation?
14. Can user behavior better be implemented into the process? How?

# F

## KPIs at the Digital Solutions team

The following extract from the interview K explains how the Manager of Digital Solutions's team work with setting goals and using KPIs as well as the division of objective metrics from their services and real feedback.

*"I can just tell a bit about what I did with my team. So, we had discussions last year, about how to set goals correctly. Quite often, you start with saying "This kind of whatever software needs to be developed". Then, you said "If this is developed within the timeframe or within the costs", it's a typical goal. You can easily measure it. The problem is that you have, especially in agile development, and with the dynamic in the business you have changes in priorities. You need to adopt to whatever you get new input from from the business, and then you have a lot of shifts. What I did in that it was my team was that we had some dedicated goals that are really in this direction, and then we had principles. I defined ten working principles for my team that were derived from our agile culture change journey that we started last year in September.*

*And these ten principles describe our values. Why we are doing things. What are our core cultural values? For example, that we say we are customer focused. This means we are delivering things to the customer, listening to the customer, understanding the customer. We want to deliver things that really matter to the customer. This means we have been focusing on the impact, not on the outcome. So not the number of code lines, it could be just one small piece of functionality that is automated and saves the customer a lot of time or has a better quality or these kinds of things. And from these values. I derived KPIs. It means I don't need to take this as goals, because the values we commit to are guided by the KPIs, if we are following our own values. If we talk about customer focus, we have a survey that we are using now starting this quarter, that the customer provides us feedback. And we have principles and values between the teams to know how we want to interact and support each other. And also here, I derived KPIs that guide the team itself without management interaction. I empower the team to do this stuff, but they should also see if they are on track or not. Because driven from the values, KPIs are defined. This means, how do I support as a team, the other team to make their services successful.*

*This is something I implemented, this is new for us. We will see how this works. But it is a different way of doing things instead of going and setting tough goals that are disconnected from the values. Then you have discussions about it, it's KPIs that the team can use to see if they're on track or not. They don't need me to say "That's*

*good or bad”, because it’s driven from what we agreed as a value within the teams. But this is purely for my team. With regards to centralized standards, we only have the architecture principles we are pushing out, we pushed out to the teams. We are on the way for quality assurance.*

*(....)*

*So there there are two ways of measuring the behavior. One is we need to understand what is used. This means that we need to have some metrics in the software itself. That gives us an understanding of what and how they are using it. This is the objective, logging of information. It’s not fully implemented, we are on the way to define this for the different services. Because you cannot have one metric for all services, because they are so different. You need to adapt it, but you need to have it in.*

*And the second one is you need to have the capability for the customer to provide feedback, what they like and what I don’t like. So therefore we develop for example a feedback service, as a core service that could be easily plugged in, with ready to use components into whatever you’re doing in SKF. This means you can just rate, one to five stars and put in a free text comment*

*(....)*

*Then, you have just two dimensions. The objective metrics from a service, and you have the real feedback. This means that you can distinguish between cool features that aren’t relevant to the key workflow, and features that are not used that frequently. "*

*- Interviewee K*





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