CHALMERS
UNIVERSITY OF TECHNOLOGY

Cross-team Decision-making: Challenges and Improvements in Large-scale Agile Organizations

Master's thesis in Management and Economics of Innovation

Tomislav Lastro
Simon Schuster

DEPARTMENT OF TECHNOLOGY MANAGEMENT AND ECONOMICS
DIVISION OF INNOVATION AND R&D MANAGEMENT

CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden 2024
www.chalmers.se

Cross-team Decision-making: Challenges and Improvements in Large-scale Agile Organizations

TOMISLAV LASTRO
SIMON SCHUSTER

CHALMERS
UNIVERSITY OF TECHNOLOGY

Department of Technology Management and Economics
Division of Innovation and R&D Management
CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden 2024

Cross-team Decision-making: Challenges and Improvements in Large-scale Agile Organizations

TOMISLAV LASTRO
SIMON SCHUSTER

Department of Technology Management and Economics
Chalmers University of Technology
SE-412 96 Gothenburg
Sweden
Telephone + 46 (0)31-772 1000

Gothenburg, Sweden 2024

Cross-team Decision-making: Challenges and Improvements in Large-scale Agile Organizations

TOMISLAV LASTRO
SIMON SCHUSTER

Department of Technology Management and Economics
Chalmers University of Technology

Abstract

Decision-making in large-scale agile organizations is characterized by complexity and dynamic interactions, necessitating cross-team integration and collaboration. Agile methodologies prioritize responsiveness and adaptability, yet the distribution of decision-making authority across multiple teams implied by agile can result in difficulties and misalignments, a gap insufficiently addressed in existing research. This master's thesis aims to explore the challenges and identify improvements associated with cross-team decision-making processes in large-scale agile organizations. Addressing this aim, a case study has been performed at Zenseact, a software development firm within the domain of autonomous driving, following a mixed-methods design consisting of a self-completion survey and semi-structured interviews. The study's results point to challenges in three overall areas across teams, which were challenges with information flow, collaboration and understanding, and complexities and coordination. POs and Developers encounter such challenges most frequently, while Scrum Masters and ART Leadership encounter them least frequently. Furthermore, the results show that improving cross-team decision-making processes is a complex and inter-connected journey, and requires improvements in areas of communication, responsibility clarifications, documentation, collaboration, and maintaining a balance between adaptability and predictability. The categorization into three main challenge areas provides a structured taxonomy for future research. Additionally, the improvement ideas identified in this study may be relevant not only for large-scale agile organizations but also for decision-making in complex and dynamic organizational environments more broadly.

Keywords: Decision-making, Cross-team decision-making, Agile, Large-scale agile, SAFe, Software development, Alignment, Collaborative decision-making, Decentralized decision-making

Acknowledgements

As we write these acknowledgments, we feel both happy and a bit nostalgic as we finish our five-year academic journey at Chalmers, with the last two years in the Management and Economics of Innovation Master's program. We are excited to share our gratitude and look back on what we have achieved with the support and guidance of many amazing people.

Completing this master's thesis has been an incredibly valuable experience, giving us important knowledge, insights, and experiences, not only within the subject studied, but also in the broader context of academic research and professional development. However, we could not have done it without the support of the individuals who guided us along the way. We want to express our deep thanks to these exceptional people. First, we would like to sincerely thank each and every one of the passionate Zenseact employees who participated in and encouraged our thesis. We would especially like to express our gratitude to Elisabet Eriksson, our industrial supervisor at Zenseact. This thesis could not have been carried out successfully without your support and belief in us. We would also want to express our sincere thanks to Constantin Bremer, our academic supervisor at Chalmers, whose knowledgeable advice, involvement, and commitment have been invaluable in supporting us during the entire research process.

Finally, we are extremely grateful for the opportunity to write our master's thesis at Zenseact, to be part of the people-at-heart culture and to contribute to increasing road safety guided by the vision "Towards zero. Faster.". We truly appreciate everything this experience has taught us, and we are confident that it will be of great use to us in our future careers.

Tomislav Lastro and Simon Schuster, Gothenburg, June 2024

Table of Contents

List of Figures

List of Tables

List of Abbreviations

Abbreviation	Definition
AD	Autonomous driving – A vehicle's ability to function using sensors, cameras, and artificial intelligence without the need for human interaction.
ADAS	Advanced driver-assistance system – A collection of technological features in vehicles designed to assist the driver in driving and parking to increase safety and comfort.
ART	Agile Release Train – A group of agile teams that develops, delivers, and operates one or more solutions in a value stream over an extended period.
EFA	Exploratory factor analysis – A statistical technique that groups measured variables into factors to reveal underlying relationships between them.
EM	Engineering Manager – A role that oversees engineering teams, manages people, approves certain expenditures, fosters team growth, recruits new team members, and supports the ARTs.
NDM	Naturalistic decision-making – A decision-making framework emphasizing context and experience over methodical analysis to examine how people make decisions in real-world situations.
PI	Planning Interval – A cadence-based timebox wherein ARTs deliver continuously and provide customers with value while adhering to PI objectives.
PM	Product Manager – A role that balances business requirements, technology, and user experience in developing a product's strategy, roadmap, and features.
PO	Product Owner – A role in agile frameworks responsible for maximizing the value of the product by ensuring that user stories meet the users' needs.
RASCI	A framework for decision-making that identifies who is Responsible, Accountable, offers Support, is Consulted, and Informed in order to streamline decision-making processes.
RAPID	A framework for decision-making that identifies who Recommends, Agrees, Performs, offers Input, and Decides in order to streamline decision-making processes.
RTE	Release Train Engineer – A servant leader and coach for the ART, facilitating processes and execution, managing risks, and ensuring ART-level continuous improvement.

RPD	Recognition-primed decision model – A decision-making model that describes how individuals identify patterns and draw from experience to make quick, effective decisions.
SAFe	Scaled Agile Framework – A framework for business agility that helps companies scale Lean and Agile practices across multiple teams and departments.
ScM	Scrum Master – A facilitator and coach for an agile team using Scrum, ensuring the team follows agile values and principles, and creates an effective work environment.

1. Introduction

Since their formalization in the Agile Manifesto, agile methodologies have revolutionized software development and project management by prioritizing individuals, working software, customer collaborations, and willingness to change (Fowler and Highsmith, 2001; Rigby et al., 2016). Agile methodologies disrupt conventional hierarchical decision structures as they spread from single teams to complex multi-team systems (Rigby et al., 2016). This shift is driven by the need for more agility and reactivity than traditional top-down management structures can offer, especially given the speed at which technology and industry developments are occurring (Lee and Edmondson, 2017).

Large-scale agile organizations, which according to the definition by Dikert et al. (2016) involve at least six teams or more than 50 people, present a unique context for decision-making that is characterized by complexity and dynamic interactions. In these environments, organizational decision-making is becoming more and more defined by the requirement of cross-team integration and collaboration (Moe et al., 2012). While there are many benefits to team autonomy and agility, implementing decision-making across several agile teams can be difficult. Coordinating team decision-making is crucial to ensuring that decisions from different teams are in line with one another and the organization's goals as a whole (Dybå and Dingsøyr, 2009). Cross-team decisions' inherent ambiguity and complexity make them ineffective and inefficient at scale, frequently resulting in disagreements, hold-ups, and strategy misalignments (Shapira, 1996). This makes it more challenging to maintain consistency and coherence throughout the entire organization.

Although research has been devoted to decision-making in agile software development, prior research has focused primarily on agile teams rather than large-scale agile organizations (Moe et al, 2012; Drury et al., 2012; Drury-Grogan et al., 2017). More specifically, there are limited studies on cross-team decision-making. While previous research offers insights into challenges and success factors for large-scale agile organizations (Dikert et al., 2016; Edison et al., 2021), these studies do not specifically address challenges and success factors related to decision-making.

Agile methodologies were initially intended for smaller teams. Expanding them to bigger, cross-functional teams creates new challenges like increased dependencies and organizational inertia, which can lessen an organization's agility and decision-making effectiveness (Dybå and Dingsøyr, 2009). The adoption of agile methodologies in many industries has resulted in a departure from old rational decision-making models, which were characterized by complete knowledge and well-defined problems, to more naturalistic and collaborative approaches in decision-making processes (Moe et al., 2012). When issues are less organized and solutions are emergent, this shift is especially noticeable (Zannier and Maurer, 2007).

Organizational decision-making in large-scale agile organizations therefore entails unique challenges not faced by individual decision-makers or traditional managerial processes. The adoption of agile methodologies has caused a change in the dynamics of decision-making from hierarchical to more decentralized and collaborative organizations (Lee and Edmondson, 2017). Teams' decisions at the project and product levels need to consider not only their immediate outcomes but also align with the broader business strategy to be successful in this environment (Moe et al., 2012). However, while Shapira (1996) points out that increased ambiguity and the need for close cross-team collaboration make this alignment difficult, Moe et al. (2012) believe there to be a need to further understand the difficulties agile teams and organizations face when aligning decisions across all levels.

1.1. Purpose and Aim

This master's thesis aims to explore challenges in cross-team decision-making processes in large-scale agile organizations. Further, it seeks to understand and provide insights into how these cross-team decision-making processes could be improved in large-scale agile organizations.

1.2. Research Questions

The research will seek to answer the following two research questions (RQs) to achieve the thesis aim:

***RQ1**: What challenges are impacting the cross-team decision-making processes in large-scale agile organizations?*

First, the thesis aims to identify and analyze the challenges faced when making decisions that impact the cross-team alignment between teams and levels. The objective is to provide a clear understanding of the hurdles and issues encountered in decision-making processes.

***RQ2**: How can the cross-team decision-making processes in large-scale agile organizations be improved?*

Second, the thesis aims to propose practical approaches to improve cross-team decision-making processes in large-scale agile organizations. This involves synthesizing insights gained from the exploration and analysis in RQ1 to offer actionable recommendations for improved decision-making.

1.3. Structure of the Report

This report is structured as follows: In Chapter 2, a theoretical background is given to create a comprehensive understanding of the thesis subject. Next, in Chapter 3, this study's methodology is explained. Thereafter, the empirical findings are presented in Chapter 4. In Chapter 5, the analysis and discussion take place, connecting the empirical findings with the theoretical background. Lastly, in Chapter 6, this study's conclusions, academic and practical implications, and future research propositions are presented.

2. Theoretical Background

This chapter introduces and addresses relevant theories on and close to the concept of cross-team decision-making in large-scale agile organizations. While there are substantial amounts of research that have been done on the concepts of decision-making and large-scale agile organizations, often from the point of view of individual agile teams' decision-making, there is little known specifically on cross-team decision-making processes in large-scale agile organizations. However, scaling organizations to include more cross-team dependencies often has consequences that complicate fundamental concepts explained in this chapter. As a result, this chapter aims to explain these relevant fundamental theories, concepts, and models that combined give a comprehensive understanding of the theoretical context in which this study has been performed. First, in Section 2.1, the concept of decision-making is introduced by defining organizational decision-making, explaining decision-making models, and addressing relevant decision-making structures. Thereafter, in Section 2.2, agile software development is explained with values and principles, methodologies, and insights from large-scale agile structures that perform cross-team work to an even higher degree. Lastly, in Section 2.3, the concept of decision-making is connected to the context of agile software development, providing information related to this study's research questions.

2.1. Decision-making

In this section of the chapter, organizational decision-making is explained with key concepts and challenges to underline its complexity and multi-faceted nature while providing a broad overview and strong foundation. Several decision-making models are explored to provide insight into how decisions are made under different conditions. This section starts with a broad description of organizational decision-making and its characteristics. It thereafter continues with rational models that assume logic and structure, before transitioning to more practical models with bounded rationality that introduce limitations of human cognition and information availability. Thereafter, it finishes with naturalistic models that address decision-making in real-world situations. Following, as decentralization and collaboration are key in large-scale agile organizations, decentralized and collaborative decision-making are introduced. Both decision-making models delegate authority and emphasize collective input, but also come with challenges in alignment and consistency. Therefore, it is important to understand these models to be able to enhance collaboration without sacrificing agility and responsiveness.

2.1.1. Organizational Decision-making

A decision is defined as the moment when a group or individual decides on a plan of action after considering several alternatives, both known and unknown (Drury-Grogan and O'Dwyer, 2013). On the other hand, decision-making is regarded as a process based on certain assumptions of values, preferences, and beliefs that lead to a decision (Simon, 1977). Furthermore, organizational decision-making shapes the directions, actions, and results of businesses, making the decision-making process an essential component of organizational behavior (Papadakis et al., 1998). The main problem in organizational decision-making is not so much choosing one option over another, but rather combining them and letting them draw attention to each other (March, 1996). Additionally, while there is no single or uniform definition of cross-team decision-making, the definition often seems to overlap with cross-functional team decision-making. In this context, cross-functional teams, which are teams with different functional expertise working towards a common goal, collaborate and use shared

information to make decisions (Krajewski and Ritzman, 2007; Cui, 2016). When scaling organizations and introducing a higher degree of cross-team work, new challenges often arise (Paasivaara and Lassenius, 2014). These issues could include difficulties in cross-team coordination, ineffective knowledge sharing between teams, or challenges connected to distributed projects (Leffingwell, 2007). Naturally, as these areas are often a part of organizational decision-making, it can be implied that cross-team work complicates the decision-making between these teams. Connected to this, cross-team decision-making in this study is defined as decisions made by two or more teams, or as decisions that have an impact on two or more teams. As illustrated in Figure 2.1, cross-team decision-making can be seen as a subcategory of organizational decision-making.

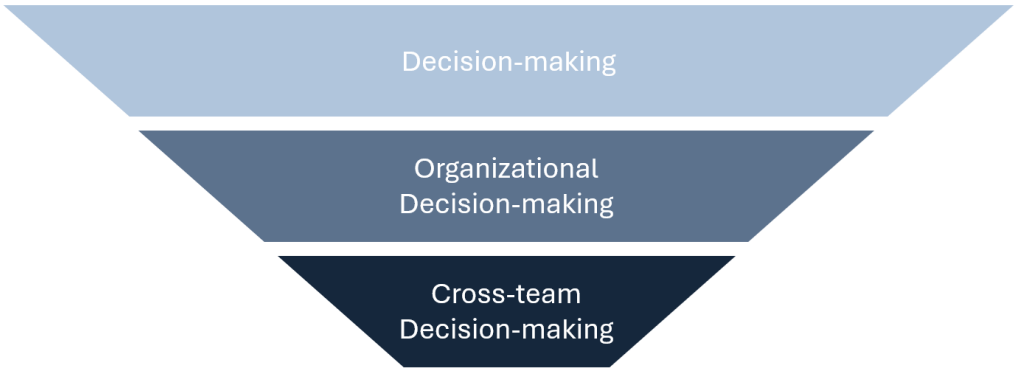

***Figure 2.1**: Funnel from decision-making to cross-team decision-making.*

Differently from individual decision-making, organizational decision-making takes place in organizations that are equipped with capabilities that help them deal with information-processing problems (Feldman, 1989). On the other hand, in organizational decision-making, conflict and uncertainty is the result of the complex interaction between systemic regulations, individual decisions, and strategic considerations (Coleman, 1986; March, 1987). Understanding these processes necessitates addressing various but related concerns and dynamics that set organizational decision-making apart from individual decision-making (March, 1996; Shapira, 1996). March (1996) offers a framework for comprehending how decisions are made inside an organization by highlighting essential concerns related to decision-making, whereas Shapira (1996) focuses on the dynamics of the organizational context around decision-making processes. To better understand what characterizes organizational decision-making, these perspectives are intertwined in the following two paragraphs.

In organizational contexts, decisions can be made using the *logic of consequences*, in which options are assessed and selected according to possible outcomes and preferences, or the *logic of appropriateness*, in which circumstances and rules govern behaviors (March, 1996). Shapira (1996) adds to this perspective by addressing the common uncertainty in organizational contexts that influences decision-making. Because of this ambiguity, decision-makers must frequently balance using rule-based and choice-based techniques. This is to handle complex situations that need flexible outcome-oriented thinking and rigid rules. It is further suggested that decision-making can benefit from clarity and consistency that promote predictability and systematic approaches, even while decision-making can thrive on ambiguity and inconsistency that enhances flexibility and adaption (March, 1996). As organizational decisions are made within a longitudinal framework, meaning that decision-makers are involved in ongoing organizational processes, commitment to the decision-making process often has priority over immediate decision accuracy over time (Shapira, 1996). Additionally, emphasizing the

sequential nature of decision-making processes, there is a need for reliable methods that adjust to shifting conditions that lead to uncertainty and inconsistencies (March, 1996).

Furthermore, March (1996) highlights the dual nature of decision-making processes: *instrumental*, focused on problem-solving, and *interpretive*, which aims to establish both individual and social meaning. This distinction draws attention to the dynamic interplay in the context of organizational decisions between pragmatic outcomes and symbolic consequences. Because of this, incentives are essential in defining the goals and actions of businesses (Shapira, 1996). They frequently determine how decisions are linked with both individual and organizational goals, and they have a significant influence on whether interpretive visions or instrumental goals drive decision-making. Alternatively, organizational decisions might be seen as the results of an interdependent system of different actors, institutions, and societal components, or as the work of autonomous individuals following their aims and identities (March, 1996). Incompatible identities and desires often give rise to these multi-actor systems, which cause miscommunication and conflict (Coleman, 1986; March; 1987). Furthermore, power struggles and dynamics influence decisions, which is consistent with the networked nature of the system and often tips the scales in favor of political considerations over objective analysis (Shapira, 1996). This illustrates the complex relationships that characterize organizations. The fact that managers frequently make the same decisions complicates this interaction even more and makes them rely further on tried-and-true methods and controls (Shapira, 1996). Depending on how authority and incentives are allocated within the organization, this repetition may either establish the systemic features indicated or support the autonomy of decision-makers (March, 1996).

In organizational settings, different types of decision-making can be distinguished which assists in understanding the significance and role each decision has. For instance, three levels of organizational decision-making could exist based on the goal of the activity: *strategic*, *tactical*, and *operational decision-making* (Moe et al., 2012). Decisions connected to broad organizational aims and objectives are included in the category of strategic decision-making (Moe et al., 2012). These decisions are frequently based on insufficient information and involve a process that takes a long time to complete. Tactical decision-making is utilized when concerns arise about identification and resource allocation, whereas operational decision-making ensures that the organization's daily operations are carried out (Moe et al., 2012). Another typology is proposed by De Smet et al. (2017), who divides decisions into three different categories depending on their scope and impact: *big-bet decisions*, *cross-cut decisions*, and *delegated decisions*. Big-bet decisions are high-stakes choices that have the potential to significantly alter an organization's course (De Smet et al., 2017). As a result, they are closely related to strategic decisions because they both entail choices with important long-term consequences. Conversely, cross-cut decisions are typified by their iterative nature and the difficulty of coordinating cooperation amongst different parties (De Smet et al., 2017). They also involve input from a variety of stakeholders throughout the business. These decisions are comparable to tactical decisions in that they both entail the distribution of resources and the synchronization of several functional areas. Finally, delegated decisions are routine tasks assigned to lower levels of the organization (De Smet et al., 2017). They aim to achieve increased engagement and faster execution through decentralized authority, which is similar to operational decisions in that both have the efficient day-to-day operations of the business as their primary focus.

2.1.2. Rational Decision-making

Rational decision-making historically stems from modern economic theories developed by Smith (1776) and emerged as a formal theory in the mid-20th century through the works of von Neumann and Morgenstern (1944). Therefore, rational decision-making is regarded as one of

the earliest decision-making theories. Decision-making is seen by rational theories as based on four things: a *knowledge of alternatives*, a *knowledge of consequences*, a *preference ordering based on consistent and subjective values*, and a *decision rule that is applied for selection* (March, 1996). If assumed that all alternatives, each consequence's probability distribution, as well as the subjective value of each consequence, is known, the alternative with the highest expected value should be selected (Schoemaker, 1982). However, the variability and risk of the distribution should be emphasized to moderate the expected value (Shapira, 1995).

Based on *rational choice theory*, rational decision-making models entail a series of steps aimed at optimizing results (March, 1996). Before creating and evaluating the choice criteria that are used to produce alternatives for comparisons, the problem must first be identified. The feedback loop is then closed by choosing, implementing, and assessing the optimal option (Organizational Behavior, 2017). Although this approach can help decision-makers solve problems, it frequently fails to capture the reality of organizational decision-making, where it is impractical to look for and evaluate every possibility due to time and resource constraints. The rational approach runs the risk of producing *analysis paralysis*, a condition in which excessive analysis paralyzes decision-making (Langley, 1995). However, under-analyzing a situation runs the risk of resulting in bad decisions, which Langley (1995) referred to as *extinction by instinct*, illustrating the difficult balancing act between effective and rational decision-making. Moreover, the difficulty of making good decisions is made worse by *decision fatigue*. As individuals make more decisions throughout the day, their cognitive resources become depleted, leading to a decline in decision quality (Tierney, 2011). This phenomenon, known as decision fatigue, can result in rushed decisions, making the balancing act between analysis paralysis and extinction by instinct even more difficult.

Modern theories of rational choice, however, have largely embraced the concept of bounded rationality as these models applied in organizational contexts with cross-team operations also introduce additional complexities, such as information retention, communication barriers, coordination issues, and conflicts (Holmstrom and Tirole, 1989; Kreps, 1990).

2.1.3. Bounded Rationality

Unlike rational decision-making, the *bounded rationality model*, which emerged with the work from Simon (1955), acknowledges the limitations of human decision-making ability. According to this approach, instead of carefully weighing all the possibilities, decision-makers deliberately reduce their options to a manageable range and select the first reasonable option, which saves time and mental effort by using this method (Organizational Behavior, 2017). The classic theory of perfect rationality, which maintains that decision-makers have unlimited time, information, and processing capability to enable them to make the greatest choice, is thus at odds with this model (March, 1996). Because of this, Simon (1955) argues that such assumptions are impractical considering human cognitive limits and environmental constraints found in real life. Understanding these real-world situations where judgments must be made fast and effectively with limited resources, often present in cross-team environments, has thus required a shift to a more pragmatic approach.

Since Simon's original formulation, several academics have developed the idea of bounded rationality. Heuristics and biases in decision-making were first described by Kahneman et al. (1982). These concepts show how humans make decisions based on biased shortcuts and consistently make mistakes while thinking under uncertainty. On the other hand, Gigerenzer and Goldstein (1996) investigated fast and frugal heuristics, which are straightforward guidelines that aid in making decisions rapidly and efficiently when faced with limited information. Furthermore, by challenging the idea that human actors are perfectly rational and,

consequently, strengthening organizational decision-making theories, bounded rationality has had a profound impact on several fields, including the development of behavioral economics and the integration of psychological insights into economic models (Thaler, 2000).

Bounded rationality, then, should provide a more realistic picture of decision-making by recognizing human limitations, enabling models that are not only more relatable and applicable but also more realistic (Simon, 1955). The idea also encourages decision-making that is quicker and uses fewer resources (Simon, 1956), which is frequently the case in dynamic situations. The application of heuristics reinforces this support by permitting decision-makers to operate more flexibly and adaptably in changing environments by employing quick and easy-to-follow principles that typically produce satisfactory results (Gigerenzer and Selten, 2002).

While it is often advantageous to follow the correct guidelines, suboptimal calibrated criteria might result in less-than-ideal decisions and the exclusion of options that may be more useful (Simon, 1956). Heuristics simplify decision-making, however, they can also introduce biases, such as overconfidence or flawed probability forecasts, that distort perceptions and result in systemic errors (Kahneman et al., 1982). Bounded rationality therefore requires cautious organizational decision-making to prevent problems brought on by limited search and analytical capacities, which could result in inefficiencies (Cyert and March, 1963). Moreover, decision-makers' limited cognitive resources restrict their ability to process information (Simon, 1955). Because of this, attempts can be made to use prior experiences to increase the effectiveness of decision-making, especially in complicated contexts with a lot of information.

2.1.4. Naturalistic Decision-making

In contrast to rational decision theories, which assume fully rational choices in simplified contexts, the concept of *naturalistic decision-making* (NDM) was based on studies of firefighters and refers to how people make decisions in real-world settings under time pressure, high stakes, and with complex and often incomplete information (Klein, 1993). The *recognition-primed decision model* (RPD) has become a central part of NDM theory and is widely applied across fields requiring rapid and effective decision-making under stress (Klein, 1993). This decision model explains how decision-makers can make quick decisions without comparing alternatives under pressure, as they utilize experience-based tactics like pattern recognition rather than formal analytical methods (Klein, 1993). Further insights have been compiled into NDM, emphasizing its relevance in dynamic and uncertain environments where traditional decision-making models fall short (Lipshitz et al., 2001).

Consequently, NDM is frequently linked to benefits like speed and efficiency since it facilitates quicker decision-making by depending more on intuitive judgment than thorough and time-consuming investigation, which is especially useful in high-stakes situations (Klein, 1993). Because of the dependence on judgment, NDM makes use of decision-makers' implicit knowledge and experience, which enables them to swiftly and precisely identify patterns and scenarios (Klein, 1993). Furthermore, NDM has proven to be successful in complex and dynamic circumstances where standard decision-making techniques are unfeasible due to time and information constraints (Klein, 1993; Lipshitz et al., 2001). NDM strategies, though effective, have been shown in studies to specifically improve performance for organizations in critical domains like emergency management, military operations, and healthcare (Lipshitz et al., 2001). As a result, they might not be appropriate for all scenarios involving decision-making, especially those that benefit from analytical and deliberative processes (Klein, 1998).

Moreover, NDM mostly depends on individuals' capacity to identify patterns, which might be skewed by individual experiences and possibly result in systematic mistakes (Kahneman and Klein, 2009). Therefore, the degree of experience and skill of the decision-maker has a

significant impact on the success of NDM, hence inexperienced practitioners may not achieve the same results when utilizing this model (Klein, 1998). Because they necessitate experiential learning and the development of situational awareness, which can be challenging to replicate in training environments, relatable NDM strategies are frequently more complex to teach than rule-based decision-making (Klein, 1993).

2.1.5. Decentralized Decision-making

In *decentralized decision-making*, which has emerged to a greater extent lately in cross-team and large-scale environments, decision-making authority is allocated to lower levels, usually permitting individuals or teams to make autonomous decisions (Takeuchi and Nonaka, 1986). From a management and organizational behavior perspective, Mintzberg (1989) explains how decentralized decision-making is crucial for adapting to local conditions, allowing organizations to respond more flexibly to environmental changes and local needs. Furthermore, Simon (1991) revisited the previous work on bounded rationality, highlighting that decentralization complements human limitations by placing decision-making closer to the information source and action, which is essential for complex and uncertain environments found in cross-team situations in large-scale organizations.

Decentralization eases the load on senior executives, facilitates quicker responses, and streamlines the decision-making process – all of which can help businesses cope with complex situations (Cyert and March, 1963). In addition, decentralization is said to improve organizational effectiveness since local units are more informed and aware of applicable circumstances (Olson, 1971). Additionally, the emergence of digital technologies has further reinforced the effectiveness of decentralized decision-making by reducing cross-team coordination costs and enhancing management via real-time data and analytics (Brynjolfsson and McAfee, 2014). As managers and teams can react more quickly to changes and opportunities due to the closeness to the issues, organizations are believed to be more agile and better positioned to respond to dynamics (Mintzberg, 1989). Consequently, decentralized units tend to better understand and meet needs and preferences due to their close relation to customers and markets (Williamson, 1975), improving decision quality and operational effectiveness (Brynjolfsson and McAfee, 2014). Decentralization can also foster a more innovative and creative environment by giving lower-level managers and employees more influence over decision-making (Mintzberg, 1989). Furthermore, employees are also associated with higher levels of job satisfaction, motivation, and dedication since they have more control over their work and may directly impact outcomes through their contributions (Hertzberg, 2003).

There is a risk with decentralized decision-making, nevertheless, because of inconsistencies in decisions and policy implications, as decentralization might cause dilution and difficulty for cross-team alignment (Cyert and March, 1963). Furthermore, disagreements between managers or organizational units may arise from increasing autonomy if goals are not appropriately aligned (Olson, 1971). This inherently leads to challenges in ensuring accordance with overarching goals while coordinating scattered decision-making processes, resulting in labor-intensive and complex efforts (Williamson, 1975). Senior executives may find it challenging to maintain sufficient control over the company as a result of managers and local teams making decisions that support aims that deviate from organizational objectives (Mintzberg, 1989). Therefore, segregated operations may be encouraged by decentralization, which makes it harder to maintain organizational cohesion and a unified culture.

2.1.6. Collaborative Decision-making

To strengthen cohesion across teams and move away from siloed operations, *collaborative decision-making* has evolved, as diverse groups have the potential to make more effective decisions (Organizational Behavior, 2017). Collaborative decision-making can be facilitated through decentralized decision-making authority since it encourages teams to work together. In early management theories, the *power with* view was emphasized rather than *power over* in discussions on power and participation in decision-making, highlighting the benefits of collaboration (Follett, 1924). In systemic approaches for choosing the most suited decision-making process based on situational specifics, collaborative methods have often been favored when complexity and cross-team impact is high (Vroom and Yetton, 1973). While negative aspects of collaborative decision processes are present, the groundwork for yielding superior decisions by understanding how to properly manage group dynamics has been laid (Janis, 1972). In connection, it is further argued that a diverse collection of independently deciding individuals is likely to make certain types of decisions better than individuals or even experts (Surowiecki, 2004). From an organizational and behavioral approach, Hackman and Morris (1975) conclude that collaborative decision-making leads to more effective cross-team functioning and better decision quality due to enhanced information sharing and increased commitment during the decision-making process. Moreover, it is noted that well-coordinated teams perform better compared to less collaborative teams since members share knowledge more freely and can synchronize actions (Kozlowski and Bell, 2003).

Since different viewpoints are combined and pooled in collaborative decision-making, creativity is improved and problem-solving enhanced, resulting in more inventive solutions that would not come from lone individuals (Surowiecki, 2004). Moreover, groups that work together to make decisions contribute a greater variety of resources and expertise to the process, which improves the quality of conclusions reached (Janis, 1972). Research also indicates that team performance and decision-making effectiveness are positively impacted by group cohesion and empowerment (Basadur, 1997; Balthazard and Cooke, 2004; Drury et al., 2012). Moreover, cooperation enables teams to allocate risk and accomplish a more thorough assessment of possible drawbacks, resulting in improved risk management (Vroom and Yetton, 1973). A range of benefits also result from including a variety of stakeholders from several teams in the decision-making process, including increased commitment, less resistance to changes, and an overall improvement in satisfaction with the choices made (Hackman and Morris, 1975).

One significant critique, nevertheless, is that collaborative teams are liable to *groupthink*, which occurs when members of the team withhold opinions they believe to be at odds with those of other members, leading to irrational or dysfunctional decision-making processes (Janis, 1972). The *Abilene paradox* is a different factor that contributes to ineffective decision-making (Harvey, 1974) and is comparable to groupthink. When a group chooses a course of action that no individual member would have selected if they were the only ones making the decision, this decision-making fallacy takes place (Harvey, 1974). Janis (1972) suggests creating distinct groups with distinct leaders to offer solutions for the same problem and designate a devil's advocate who can disprove the decision-makers' presumptions to prevent groupthink. This is also suggested by Kanter (2001) as a way to resolve the Abilene paradox, arguing that a judgment is good if it holds up well under examination. Moreover, even if the goal of collaboration is to bring people together, disagreements resulting from differing perspectives can cause conflicts, particularly in settings where there is no established procedure for resolving disputes (Hackman and Morris, 1975). Furthermore, because many stakeholders must be involved and differing views must be considered, collaborative decision-making processes frequently run the danger of lasting longer than expected, which delays the implementation

(Surowiecki, 2004). Naturally, because it can be more difficult to manage contributions effectively and guarantee that all opinions are considered, decision-making procedures can be more difficult in larger groups (Kozlowski and Bell, 2003).

2.2. Large-scale Agile Organizations

In efforts to address the uncertainty of customer requirements, changing business environments, and technology evolution, agile software development emerged in the late 1990s (Drury-Grogan et al., 2017). Dynamic and user-focused methods, characterized by short development cycles, continuous iterations and releases, and rapidly evolving requirements, were developed in favor of highly formalized thinking methods (Fowler and Highsmith, 2001; Schwaber and Beedle, 2001). Agile software development methodologies have since spread to entire organizations in various industries, although primarily among organizations developing software. According to Dikert et al. (2016), these organizations can be defined as large-scale agile organizations if they involve more than 50 developers or six teams working on the same product or project in the same organization.

This section first introduces agile values and principles and thereafter explains how the concept of agile went from the context of software development teams to entire organizations. As part of this, the agile methodology Scrum is highlighted. This is followed by an explanation of the Scaled Agile Framework (SAFe) as well as challenges and success factors for large-scale agile organizations. Thus, this chapter aims to create an understanding of the cross-team and large-scale context for the studied decision-making processes. While agile values and principles, as well as methodologies such as Scrum and SAFe, emphasize iterative development and prioritize flexibility, responsiveness, and stakeholder involvement, they also significantly impact decision-making.

2.2.1. Agile Values and Principles

Many characteristics of agile software development affect decision-making, such as its fast iterative and incremental environment, organic and flexible development, and focus on self-management (Austin and Devin, 2009; Moe and Aurum, 2008; Zannier and Maurer, 2007). Two perspectives are dominant in terms of agility enablement and evaluation: a *principle or value-based perspective* and a *method adherence-based perspective* (Drury-Grogan et al., 2017). While the former prioritizes principles and values over strict method adherence, allowing for an approach with more flexibility and adaptability, the latter entails the importance of following specific methodologies or procedures for project success (Dybå and Dingsøyr, 2008). The method adherence-based perspective is being adopted in most studies. However, there are limitations connected to these views (Drury-Grogan et al., 2017). Firstly, as agile is practiced in many ways, the concept of agility is vague and multi-faceted (Conboy, 2009). Secondly, agile methodologies are often applied as a hybrid, leading to them rarely being according to textbook (Gale, 2012).

Agile methodologies are characterized by a set of guiding values and principles rather than a fixed set of rules (Fowler and Highsmith, 2001). These foundational elements stem from the *Agile Manifesto*, which articulates values and principles designed to enhance the quality of development processes (Talby et al., 2006). Fowler and Highsmith (2001) encapsulate the essence of the Agile Manifesto's values as follows in Figure 2.2:

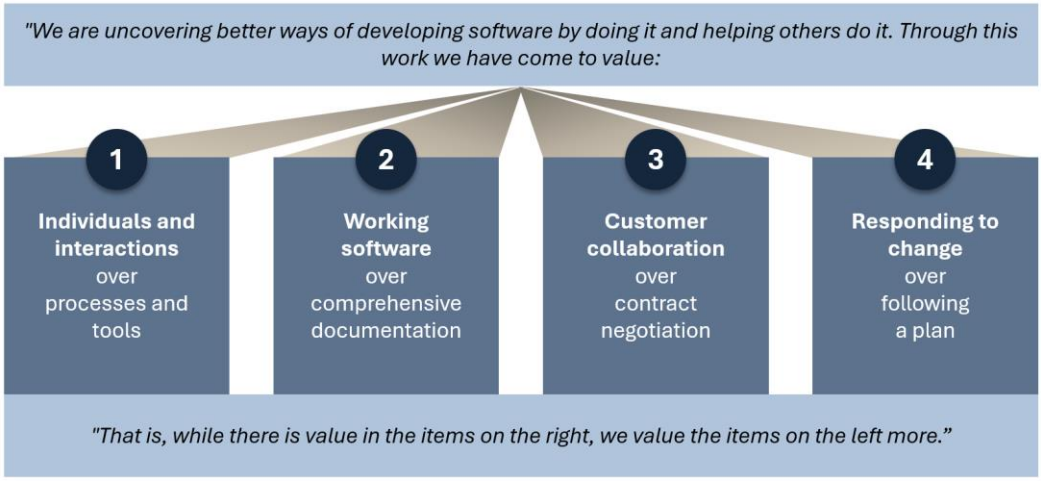

***Figure 2.2**: Agile values (Fowler and Highsmith, 2001).*

As the first value is focused on individuals and interactions, it means that the team structure in agile software development is regarded as "organic and flexible" rather than "mechanistic, bureaucratic, and formalized" (Nerur et al., 2005, p. 75). Due to this heavy emphasis on distributed authority among team members, decentralized decision-making is suitable for most agile organizations. Furthermore, developers are not restricted to specialized roles (Nerur et al., 2005), which improves operational decision-making in agile (Moe and Aurum, 2008). Therefore, collaborative decision-making is also exemplified by agile organizations. With the second agile value favoring working software over documentation (Fowler and Highsmith, 2001), a less rational approach is found in decision-making (Zannier and Maurer, 2007). As a result of the third value focusing on collaboration with customers (Fowler and Highsmith, 2001), project managers' focus has shifted from being a decision-maker to increasingly a facilitator and coordinator (Lindstrom and Jeffries, 2004; Nerur et al., 2005). Consequently, the teams are making the decisions (Drury-Grogan et al., 2017). With the fourth and last value being focused on adaptability to change, teams are being able to adapt and quickly respond due to the iterative and incremental nature of frequent releases (Dybå and Dingsøyr, 2008).

Additionally, Fowler and Highsmith (2001) outlined twelve principles on which the Agile Manifesto is based, which are detailed in Figure 2.3. These principles are foundational to implementing agile practices effectively.

***Figure 2.3**: Agile principles (Fowler and Highsmith, 2001).*

2.2.2. From Agile Software Development Teams to Agile Organizations

Agile methodologies were originally developed for small software development teams, where close collaboration and fast adaptations were often needed (Boehm and Turner, 2004). There are many such agile software development methodologies for teams, with Scrum standing out as being the most widely used (Maximini et al., 2018). As many large-scale agile methodologies used in organizations are built on Scrum, the framework, including its essential roles, artifacts, and activities, is elaborated upon in subsequent paragraphs. An overview of the framework can be seen in Figure 2.4. This is followed by an explanation of how the principles of agile and its methodologies have scaled to encompass entire organizations.

Scrum as a Framework for Agile Teams

The term *Scrum* was first introduced by Takeuchi and Nonaka (1986), who described it as a flexible and holistic strategy for product development, in which a Development Team collaborates intensively to achieve a common objective. However, it was not until the turn of the century that it was refined and popularized (Sutherland and Schwaber, 2007). Scrum is defined as an iterative and incremental framework designed to manage and improve development processes for projects, products, and applications (Sutherland and Schwaber, 2007), aligning with the principles outlined in the Agile Manifesto (Fowler and Highsmith, 2001). The development is organized around time-boxed intervals called *Sprints*, or cycles, during which predefined work items are finished. These Sprints start with the *Scrum Team* choosing tasks from a prioritized list of customer requirements, and committing to complete these tasks by the end of the Sprint. For the duration of the Sprint, these chosen tasks are locked in, and daily reviews, often called standups, are carried out to make any necessary adjustments and ensure that the team stays on track to finish the work. At the end of each Sprint, the team and stakeholders get together to discuss the results and incorporate feedback into the following one, with a focus on delivering a working product at the end of each cycle, right in line with the Agile Manifesto. However, it's important to note that Scrum is only a framework, and it first becomes fully effective when combined with other agile methodologies (Maximini et al., 2018).

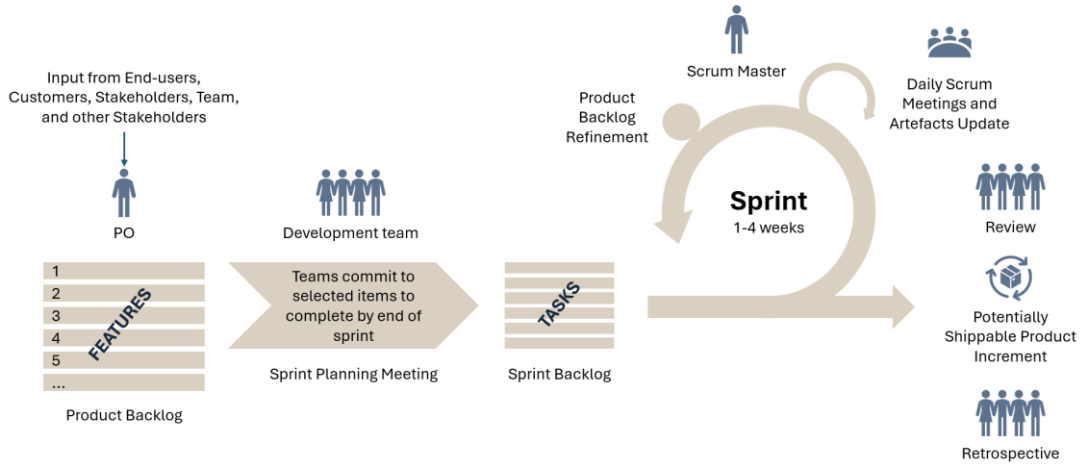

***Figure 2.4**: Overview of Scrum roles, activities, and artifacts (Sunderland and Schwaber, 2007).*

Scrum is structured around three key roles that make up the Scrum Team: the *Product Owner* (*PO*), the *Development Team*, and the *Scrum Master* (*ScM*) (Sutherland and Schwaber, 2007; Cohn, 2009). The PO is the focal point of product leadership, in charge of defining and selecting which product features and functionality to prioritize (Rubin, 2012). The responsibilities include keeping track of and sharing the goals that the Scrum Team is working toward, but it also involves refining and adjusting priorities by being the link between the stakeholder and the Development Team. This requires continuous communication of feedback. The complexity of this role increases depending on whether the product is intended for internal or external stakeholders, where the latter often involves higher ambiguity, posing the need for the PO to have strong communication skills, the ability for strategic decision-making, and the capacity to motivate the rest of the other members of the Scrum Team (Sutherland and Schwaber, 2007). The Development Team is in charge of developing the product following the PO's specifications and is made up of a diverse, cross-functional collection of people responsible for designing, building, and testing the desired product, such as programmers, UI designers, and testers (Rubin, 2012). The team is self-organizing, typically consisting of five to nine members who collectively have all the skills needed to develop high-quality, working software. Autonomy is important, and the Development Team is therefore empowered to choose the best course of action for achieving the project's objectives (Maximini et al., 2018). Likewise, collaboration and accountability are core principles, highlighting the value of committing to the Sprint goals as a group and cooperating to overcome challenges.

Assisting the Scrum Team by making sure procedures are followed and removing impediments, the Scrum Master functions more like a facilitator rather than a typical manager (Sutherland and Schwaber, 2007). The Scrum Master can be seen as a servant leader and coach who helps foster team dynamics and an environment of relentless improvement (Scaled Agile Inc, 2023e). This role is crucial for maintaining the workflow and resolving potential issues that can affect the team's performance. As such, the Scrum Master collaborates closely with both the Development Team as well as the PO. The Scrum Master can even be part of the Development Team (Sutherland and Schwaber, 2007), while also parallelly being responsible for creating an atmosphere that allows the team to effectively self-manage and adjust to changes.

In Scrum, there are three main artifacts designed to minimize documentation and enhance process efficiency: the *Product Backlog*, the *Sprint Backlog*, and the *Product Increment* (Maximini et al., 2018). These artifacts should be easy to access and transparent. The Product Backlog is a prioritized list of all project requirements, including an estimate of the time it would take to complete each item (Sutherland and Schwaber, 2007). The accuracy of these

estimates is determined by the requirements' clarity and priority. It is essential to maintain a shared knowledge of the backlog's contents between the PO and the Development Team which stresses the importance of collaboration between these roles (Maximini et al., 2018). Being a subset of the items from the Product Backlog, the Sprint Backlog lists what work is to be done during the Sprint, and by whom (Sutherland and Schwaber, 2007). Each work item is accompanied by a time estimate to help with effective task organization, just like in the Product Backlog. The Development Team delivers the Product Increment, a working portion of a product that should be prepared for delivery or stakeholder demonstration at the end of each Sprint (Sutherland and Schwaber, 2007). When a Product Increment satisfies the team's quality requirements and needs little to no additional work to be distributed to customers, it is considered complete (Maximini et al., 2018).

The Scrum framework refers to meetings as activities or events, intending to optimize the collaboration process (Maximini et al., 2018). A few primary activities make up the framework: the *Sprint*, *Backlog Refinement*, *Sprint Planning*, *Sprint Execution*, *Daily Scrum*, *Sprint Review*, and *Sprint Retrospective* (Rubin, 2012). To maximize efficiency, these events are all time-boxed, limiting the time in meetings. The Sprint, also known as an iteration, is the core event around which Scrum is structured, representing a work cycle aimed at delivering a potentially shippable Product Increment (Sutherland and Schwaber, 2007). Usually lasting one to four weeks, Sprints are kept at this length for the duration of the project to provide a steady delivery schedule. Moreover, this consistent rhythm is followed by all teams operating within the same system or product.

Before the start of a new Sprint, team members go through a process called Backlog Refinement where they make changes and set priorities for upcoming Sprints (Rubin, 2012). Refining the backlog can involve breaking down larger tasks into smaller, more manageable ones, clarifying success criteria, and adjusting priorities. Every Sprint begins with a Sprint Planning meeting, which aims to lay the groundwork for the upcoming iteration (Cohn, 2009). It has two primary objectives: firstly, the PO and Development Team collaborate to decide the scope of work for the Sprint, and secondly, the Development Team plans and allocates tasks. The process guarantees that all team members are aware of their responsibilities and the objectives of the Sprint, and the plan is captured in the Sprint Backlog (Rubin, 2012).

After the Scrum Team completes the Sprint Planning, the Sprint Execution starts, meaning that the Development Team, under the coaching of the Scrum Master, completes all task-level work required to complete the features agreed upon during the Sprint Planning (Rubin, 2012). The Development team is given full autonomy regarding how to carry out the work, self-organizing in a way that suits them best for achieving the goals of the Sprint. The Daily Scrum is a brief, daily meeting that helps the Development Team align their activities and track progress against the Sprint goals (Maximini et al., 2018). These meetings are intended to be less than 15 minutes long and take place at the same time and location every day. During these meetings, team members discuss what they are currently working on, potential blockers, and their next steps. The Scrum Master facilitates the meeting, helping to identify and resolve any obstacles that risk affecting the team's efficiency (Sutherland and Schwaber, 2007).

After a Sprint, the Scrum Team and stakeholders convene during the Sprint Review, where completed backlog items are shown and evaluated, often through a demo. Through discussions about achievements and challenges, the Product Backlog is adjusted to better meet stakeholder needs and project objectives (Sutherland and Schwaber, 2007). The Sprint Retrospective, occurring after the Sprint review and before the next Sprint Planning, is an opportunity for the Scrum Team to reflect on the past Sprint and identify improvements for the next (Rubin, 2012).

The event is led by the Scrum Master and focuses on identifying processes and practices that can be adapted to enhance the team's work.

Scaling Agile to Organizations

Because of its benefits, agile has gained popularity beyond small teams, especially in larger projects in larger organizations (Dybå and Dingsøyr, 2009). However, applying agile methodologies in larger organizations with cross-team work presents several challenges, such as integration issues and the need to strike a balance between plan-oriented techniques (Reifer et al., 2003). Additionally, large projects often increase the need for coordination significantly due to cross-team dependencies (Dikert et al., 2016), making it one of the most important challenges in large-scale agile settings (Gustavsson, 2017).

According to the definition by Dikert et al. (2016), where large-scale projects need to involve at least six teams or more than 50 people, large-scale agile organizations create complicated dependencies that can make the agile process more difficult. These dependencies frequently call for more formal documentation, counteracting the fundamental agile principles of limiting documentation and leveraging flexibility. Team autonomy, another core component of the agile philosophy, can occasionally result in misalignments with the organization's overarching goals or the objectives of other teams (Dikert et al., 2016). Such misalignments may give rise to divergent technical approaches or interpretations of agile techniques, leading to a fragmented environment and perhaps conflicts between teams. Maintaining a consistent and cohesive approach across teams can thus be difficult, particularly when teams have their own subcultures (Dikert et al., 2016). These differences may cause inefficiencies and dilute the advantages that agile is supposed to bring, such as responsiveness to change.

Regardless of these obstacles, numerous organizations have effectively leveraged the potential of agile by effectively implementing agile at scale (Rigby et al., 2016). To enable all teams to align toward shared business objectives, it is imperative that essential roles such as the PO are clearly defined and effectively implemented (Dikert et al., 2016). This is because clearly defined responsibilities lead to better decision-making and backlog management, which in turn allow for better synchronization of outputs from multiple teams. Giving teams the freedom to oversee their work and make decisions also contributes to success since it increases motivation and productivity (Dikert et al., 2016). However, this empowerment must be balanced with the need for inter-team coordination and alignment with the broader goals of the project. Finally, the alignment of the entire organization toward a shared objective is typically critical to the success of large-scale agile implementations (Dikert et al., 2016). This includes unified goals, shared visions, and consistent procedures across teams, all of which improve cooperation and reduce conflict (Rigby et al., 2016).

2.2.3. Scaled Agile Framework (SAFe)

Numerous frameworks have been developed to scale agile practices, with the *Scaled Agile Framework* (SAFe) being one of the most widely adopted (Putta et al., 2018). Created by Dean Leffingwell in 2011, SAFe offers an extensive collection of guidelines, practices, and concepts designed to help organizations better manage and coordinate multiple agile teams working on large, complex projects (Knaster and Leffingwell, 2018). SAFe integrates and extends Scrum practices and has a foundation formed by the Agile Manifesto, the ideas of Lean thinking, and DevOps. It promotes iterative development, frequent releases, and continuous improvement while also addressing the challenges that arise from scaling agile practices across teams and organizations (Knaster and Leffingwell, 2018). An overview of the framework can be seen in Figure 2.5.

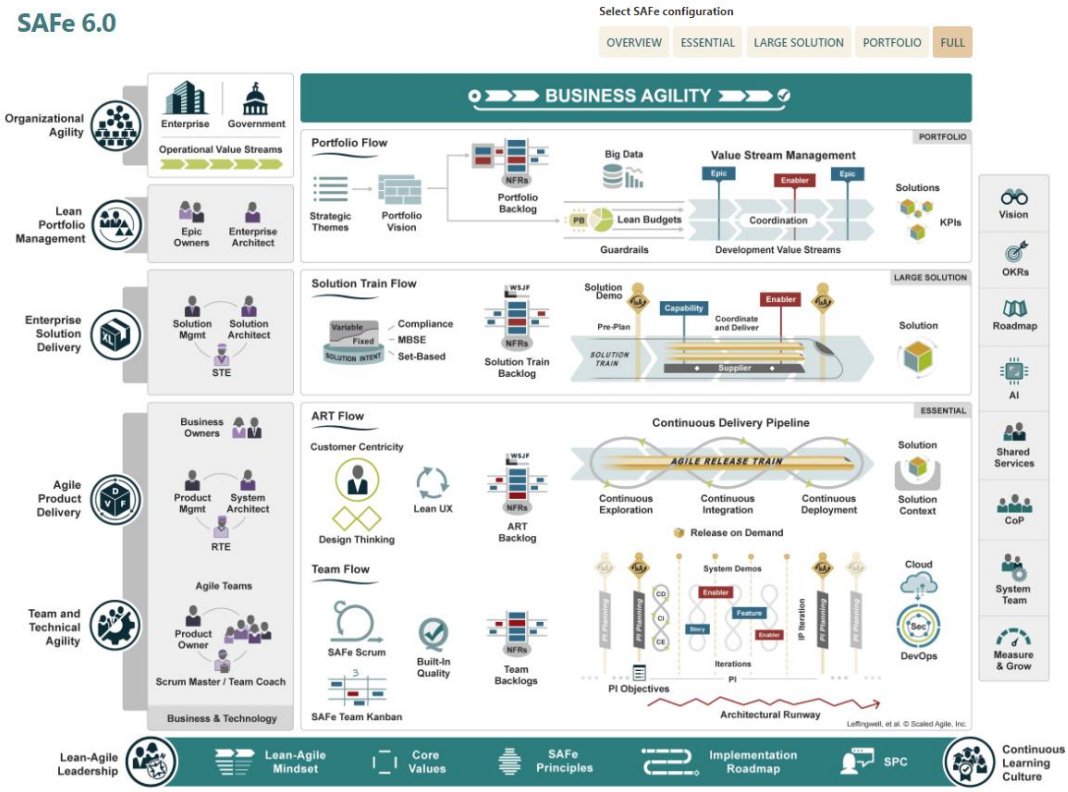

***Figure 2.5**: Full configuration of SAFe, version 6.0 (Scaled Agile Inc, 2024).*

SAFe introduces several roles, ceremonies, and artifacts to facilitate coordination and collaboration across teams. A central concept is *Agile Release Trains* (ARTs), which are teams of agile teams that develop, deliver, and operate one or more solutions in a value stream (Scaled Agile Inc, 2022a). ARTs align with a common mission, are cross-functional, and are typically made up of 50 to 125 people. The purpose is to deliver solutions that bring value to the customer and to support in doing that are some important roles, including *Release Train Engineers* (RTE), *Product Managers*, and *System Architects*. While RTEs serve as coaches facilitating the execution of the ART (similar to a Scrum Master in the teams), Product Managers are responsible for the product, meaning they need to collaborate closely with customers and POs, while System Architects are responsible for defining the technical architecture for the ART. At a solution level, multiple ARTs and value streams can be coordinated into solution trains, aligning ARTs and suppliers to a shared mission (Scaled Agile Inc, 2023f).

Additionally, SAFe organizes work into four levels: team, ART, solution, and portfolio. At the team level, SAFe promotes the use of *Scrum*, *Kanban* (such as implementing Kanban boards to visualize the workflow), or other agile methodologies to deliver value incrementally through user and enabler stories, with the customer in focus (Scaled Agile Inc, 2022b). The ART level emphasizes the coordination of work in multiple teams within a larger value stream or ART, focusing on regular synchronization, planning, and alignment (Scaled Agile Inc, 2022b). The solution level supports businesses in developing and running large-scale solutions that require extensive collaboration that goes beyond the scope of a single ART by adding additional roles, artifacts, and events (Scaled Agile Inc, 2022c). The portfolio level, the highest level of SAFe, includes governance, investment decisions, and strategic alignment of initiatives. This level ensures that the work being done at lower levels in the organization is in line with the organization's overall business objectives (Knaster and Leffingwell, 2018).

SAFe also introduces several ceremonies, where two of the most significant ones are *PI Planning* and the *Inspect and Adapt* event. PI Planning is a recurring event at the start of each Planning Interval (PI), where a PI typically lasts for 8 to 12 weeks and consists of four development iterations (called Sprints in Scrum) and one *Innovation and Planning* (IP) iteration (Scaled Agile Inc, 2023b). The purpose of PI Planning is to, ideally through face-to-face conversations, align all the teams within the ART with stakeholders. This event, which often occurs for two days, helps with identifying dependencies, nurturing cross-team and cross-ART collaboration, and increasing the speed of decision-making (Scaled Agile Inc, 2023b). Conversely, the Inspect and Adapt is held at the end of each PI to demonstrate and evaluate the current state of the solution, emphasizing the importance of continuous improvement mentioned in the twelfth agile principle.

The core values of SAFe are built around alignment, transparency, respect for people, and relentless improvement (Scaled Agile Inc, 2023a). Furthermore, SAFe emphasizes the importance of continuous integration and continuous delivery to ensure that teams can deliver value quickly and with high quality (Knaster and Leffingwell, 2018). By embracing these values and practices, SAFe enables organizations to achieve faster time-to-market, improved customer satisfaction, and increased business agility.

2.2.4. Challenges and Success Factors for Large-scale Agile Organizations

As seen by the small number of successful examples, implementing large-scale agile frameworks such as SAFe involves numerous obstacles (Ebert and Paasivaara, 2017; Edison et al., 2021). The focus of these challenges is typically cross-team collaboration (Edison et al., 2021; Dikert et al., 2016; Ebert and Paasivaara, 2017) because of the large number of teams involved, their unknown compositions, and processes based on complex, abstract, and less-than-ideal structured work. Factors like competing and conflicting team agendas as well as complex, unknown final deliverables also contribute to these types of challenges. Making decisions becomes more difficult when coordinating work across agile teams, particularly when the number of teams rises. Long meetings on complicated subjects could leave little time to discuss every issue in detail, which could put important feedback loops at risk (Edison et al., 2021). Limiting cross-team interactions can help organizations accelerate procedures, but doing so frequently comes at the expense of the overall value of collaborative insights. To further complicate matters, the adoption of SAFe frequently calls for the creation of new roles that add layers of complexity to the organizational structure which may impede decision-making by requiring more information handoffs (Edison et al., 2021). Especially the need for additional management roles may cause issues for agile procedures that prioritize self-management (Dikert et al., 2016). Moreover, this complexity can hide overarching goals and delay responses to changing priorities.

From an architectural perspective, autonomous teams might cause a fragmented approach that results in inconsistent architectural decisions as the interpretation of agile differs between teams, which makes it challenging to integrate and coordinate outputs across teams (Dikert et al., 2016). This misalignment might make it more difficult to manage shared resources at the same time as it impedes strategic direction (Edison et al., 2021). To accommodate the learning curve associated with new approaches, adopting SAFe also requires making adaptations to established processes, which may take attention away from organizational objectives (Edison et al., 2021). Because of the frequency and depth of necessary meetings, POs, for example, may discover that their jobs are growing into areas outside of their primary responsibilities. Lastly, by centralizing decision-making processes, SAFe may weaken team autonomy, thus risking

demotivating teams if they feel like their local knowledge and experience are being underutilized (Edison et al., 2021).

There has been an attempt to identify common features in successful large-scale agile adoption scenarios, such as strategic planning and inclusive decision-making, but there is no clear consensus on how to implement these models successfully (Dikert et al., 2016; Kalenda et al., 2018). According to Edison et al. (2021), critical success factors can be found in four main areas: management and organizations, processes, people, and technology. Firstly, adopting SAFe requires strong leadership that can provide direction and support (Edison et al., 2021; Dikert et al., 2016). To boost team morale and adherence to the process, leaders must support problem-solving and maintain a commitment to the core values of the approach. Secondly, concerning the process, specialized roles such as RTEs play a key role in directing the coordination of several teams toward shared organizational goals (Edison et al., 2021). By ensuring that strategic goals and agile methods are in line, these roles also contribute to improving the decision-making process. The efficiency of SAFe implementation and decision-making processes can also be greatly increased through physical closeness, by reducing delays and enhancing communication clarity (Edison et al., 2021). Such a configuration, where the teams are seated together, allows for better knowledge sharing and transparency, thus facilitating a more synchronized operation since the enhanced transparency could aid in decreased dependencies and improved team coordination. Thirdly, from a people perspective, building trust within and across teams enhances collaboration and empowers them to make more informed, proactive decisions (Edison et al., 2021). Having a shared vision also helps teams work toward organizational goals and promotes a cohesive approach to cross-team decision-making. Lastly, when it comes to technology, a robust infrastructure supports effective communication and collaboration, both of which are necessary for the decentralized decision-making that characterizes SAFe environments (Edison et al., 2021). For workflow continuity and decision correctness to be maintained, tools that facilitate automated testing, continuous integration, and real-time data sharing are essential.

2.3. Decision-making in Large-scale Agile Organizations

This final section of this chapter aims to connect the decision-making models and structures to the context of large-scale agile organizations. Firstly, decision-making in the agile iteration process is covered. Thereafter, each of the models described as rational, bounded rationality, or naturalistic decision-making, as well as decentralized and collaborative decision-making (of which the two latter are often found in agile organizations), are explained in an agile context. This is followed by a section addressing challenges and improvements in agile organizations by identifying specific challenges and improvements in aligning strategic, tactical, and operational decision-making within agile frameworks. Finally, practical approaches to improving decision-making in large-scale agile organizations are presented.

2.3.1. Decision-making in the Agile Iteration Process

In the agile iteration process, decision-making is mostly decentralized and occurs across four distinct phases: *Iteration Planning*, *Iteration Execution*, *Iteration Review*, and *Iteration Retrospective* (Drury et al., 2012), each aligning with strategic, tactical, and operational decision levels (Moe et al., 2012).

Since Iteration Planning entails establishing goals and objectives for the next iterations, frequently through cooperative team agreements, this stage largely concentrates on strategic and tactical decisions (Drury et al., 2012). While the tactical choices in this phase match short-

term iteration objectives with long-term project ideas, the strategic character of the phase permits a thorough assessment and prioritization of the project's direction. This is essential for guaranteeing that every cycle makes a meaningful contribution to overall product and release plans, which are frequently overseen by the PO and founded on a deep comprehension of the complexity of the product and business environment (Moe et al., 2012).

As agile teams plan and modify their work in response to real-time insights and emerging information, the emphasis increasingly moves to tactical and operational decisions as the process enters the Iteration Execution phase (Drury et al., 2012). Making decisions in response to urgent operational difficulties and coordinating daily operations with the defined strategic framework both depend on this dynamic adjustment process. Because of its tactical and operational character, decisions made during this phase usually incorporate project management perspectives, such as resource allocation and quick fixes for development obstacles, to keep the team moving forward and producing results (Moe et al., 2012).

The Iteration Review aims to make strategic decisions about client feedback and the present state of the product (Drury et al., 2012). To determine whether and how to modify the product features in subsequent iterations, choices are made in this phase to evaluate the alignment between the product supplied during the iteration and the customer's expectations (Drury et al., 2012). This stage, which examines the efficiency of the team's output, is essential for preserving the product's relevance and quality.

Lastly, an evaluation of the procedures followed, and results attained in finished iterations is provided by the Iteration Retrospective (Drury et al., 2012). This stage, which affects subsequent process iterations, involves both tactical and strategic decision-making intending to promote continuous improvement (Drury et al., 2012). However, putting practical solutions into practice rather than just having discussions about them can frequently be difficult (Kwak and Stoddard, 2004). These are crucial strategic decisions because they allow the team to fine-tune their methods and approach, ensure more alignment with long-term objectives, and address any systemic problems that may affect productivity in the future (Moe et al., 2012).

Throughout these phases, it is evident that while the agile teams primarily handle tactical decisions due to the short-term nature of iteration cycles, there is a significant, recurrent need for integrating these decisions with both the strategic fit provided by the PO and the operational conditions encountered during execution phases (Moe et al., 2012). Effective integration and alignment of these decision levels are predominant for mitigating issues such as software quality and code disorganization, thereby ensuring that the agility of the process does not compromise the integrity and effectiveness of the product developed (Moe et al., 2012).

2.3.2. Rational, Bounded Rationality, and Naturalistic Decision-making in Large-scale Agile Organizations

Briefly relating to the various decision-making models, it can be inferred that, given its definition as a methodical, systematic approach to the analysis of known information, rational decision-making is less consistent with agile principles. However, because agile teams make decisions based on feedback loops and iterative cycles, bounded rationality is more in line with agile since this model acknowledges the practical limitations of limited time and information. Moreover, agile approaches and naturalistic decision-making are closely related because they both place a strong emphasis on making decisions quickly and intuitively while taking the current situation and future changes into account.

In agile settings, rational decision-making adheres to a methodical, well-structured process that is best described by the three phases of Mintzberg et al.'s (1976) model: problem identification,

solution development, and best option selection. Whereas these stages are typically thought of as a linear process, they frequently happen non-sequentially and iteratively (Mintzberg et al., 1976), particularly in agile situations where teams must constantly review and improve problems and solutions. While rational decision-making is less in line with agile principles, Drury-Grogan and O'Dwyer (2013) instead note that the rational model's application to agile is especially successful for clearly defined problems with known parameters and logically defensible solutions.

Though rational decision-making models may be used at some point by some agile teams (Drury-Grogan and O'Dwyer, 2013), traditional decision-making models place more emphasis on efforts to generate and choose between options (Beach and Lipshitz, 1993) rather than using feedback and experience to understand situations (Zsambok, 1997). Furthermore, research has demonstrated that traditional software development teams use rational decision-making processes (Alenljung and Persson, 2008; Mintzberg et al., 1976), particularly concerning Daily Scrum Meetings and Sprint Planning (Drury-Grogan and O'Dwyer, 2013). On the other hand, the theory of bounded rationality, which supposes that decision-making is restricted by the available information, the cognitive limitations of individuals, and the limited time available for decision-making (Simon, 1955), is especially helpful in clearing up the structured yet adaptable character of cross-team decision-making in agile methodologies. This is especially true given that the decision-making process is influenced by the cohesiveness and empowerment of the agile team to deliver functionality (McAvoy and Butler, 2009). However, as agile teams move between the three decision stages (Mintzberg et al., 1976), it has been demonstrated that difficult or new jobs presented difficulties resulting in expertise being used as a guide (Drury-Grogan and O'Dwyer, 2013).

Therefore, according to Zannier and Maurer (2007), naturalistic decision-making (NDM) comes into play mainly with complex or ambiguous problems that lack clear-cut answers and are dependent on situational factors. With this move from rational to naturalistic decision-making, it can be viewed as moving from a plan-driven approach to an increasingly agile development (Moe et al., 2012). By using RPD (Klein, 1993), agile teams can quickly assess situations and decide on a course of action without extensive reflection (Moe et al., 2012), crucial in maintaining momentum during development cycles. Furthermore, because continuous learning and feedback loops provide the contextual foundation needed to make informed decisions, the project environment has a big influence on agile decision-making (Lipshitz et al., 2001). It is also critical to keep in mind that decisions made in a cross-team agile setting are constantly reviewed on an ongoing basis. Thus, regular retrospectives aid in improving the process of making decisions (Highsmith, 2009).

Cross-team agile decision-making combines naturalistic and rational decision-making methods to potentially create a flexible and adaptive procedure that can withstand the uncertainties of software development projects. Agile teams can therefore adjust to the comprehensive framework provided by the theoretical foundations of naturalistic decision-making (Klein, 1993; Lipshitz et al., 2001) and rational decision-making (Mintzberg et al., 1976; March, 1996) based on the particular demands and situational complexities of the projects.

2.3.3. Decentralized Decision-making in Large-scale Agile Organizations

The use of decentralized decision-making in agile organizations is essential for enhancing responsiveness and agility (Scaled Agile Inc, 2023d). This is because communication is improved at the same time as a culture of problem-solving is fostered (Highsmith, 2009). In contrast to traditional centralized decision-making, which is frequently hampered by bureaucratic delays and decreased efficiency as a result of top-down control, this approach

distributes the decision-making authority among all team members which makes it quicker to reach insights (Scaled Agile Inc, 2023d).

Those members directly involved in cross-team decisions are empowered, as agile emphasizes individuals and interactions over processes and tools (Fowler and Highsmith, 2001). This empowerment supports decentralized decision-making, enabling quick responses and adaptation to new information or emerging challenges, thus aligning with the iterative nature of agile. Furthermore, decentralization of decision-making enables teams to act quickly, which is a critical advantage in complex development environments where the speed of decision-making directly influences the pace at which the organization can deliver value (Scaled Agile Inc, 2023d). Moreover, decisions stemming from decentralized decision-making processes are often more effective as they are made by those with the best understanding of the issues (Lindstrom and Jeffries, 2004), as well as free from delays typically found due to hierarchical approval processes (Takeuchi and Nonaka, 1986). This closeness to the problem enhances the accuracy and relevance of the decisions. Additionally, innovation is fostered as team members are encouraged to find creative solutions within their autonomy (Scaled Agile Inc, 2023d). The idea of autonomy in the workplace has been strongly connected to improved productivity and personal satisfaction (Pink, 2009), contributing positively to project outcomes. Therefore, when team members have a voice in cross-team decision-making, it can be assumed to enhance their job satisfaction and motivation. Complementary, decentralized decision-making helps align team members and teams to common goals while enhancing collaboration (Scaled Agile Inc, 2023d). As a result, balanced and robust solutions emerge, as diverse viewpoints are considered by involving various stakeholders in decision-making processes.

However, for decentralized decision-making to work, there must be explicit rules on who may make decisions and what kinds of decisions can be made (Schwaber and Beedle, 2001). This framework assists in upholding order and guarantees that every decision is in line with the overall goals of the project. Moreover, a risk-taking culture is necessary because psychological safety promotes creativity and active engagement in decision-making processes (Edmondson, 1999). Furthermore, training in critical thinking and problem-solving should be included, as team members should possess the ability to make well-informed decisions (Lindstrom and Jeffries, 2004).

2.3.4. Collaborative Decision-making in Large-scale Agile Organizations

Agile collaborative decision-making, which is closely related to decentralized decision-making, can improve decision-making processes (Drury et al., 2012). All team members participate in agile collaborative decision-making, ensuring that decisions are strengthened by unique ideas and knowledge. With conventional procedures, on the other hand, decisions are frequently made by top management. The agile principles of group responsibility and self-organization, which are essential for effective and adaptable software development processes, are in line with this technique. When team members engage in the process, collaborative decision-making, which is closely related to agile principles, promotes a sense of accountability and ownership (Fowler and Highsmith, 2001).

Agile teams perform better when decision-making is collaborative and incorporates a variety of stakeholders (Drury et al., 2012). Due to the abundance of data and perspectives presented, decisions are made both faster and more accurately as a result (Drury et al., 2012). Because agile teams must be able to respond quickly to changing needs, collaborative decision-making, when used effectively, may lead to quicker reaction times in dynamic project environments (Highsmith, 2009). Similar to decentralized decision-making, the utilization of different points of view in a collaborative approach results in creative ideas and innovative potential that would

not arise in a hierarchical setting (McAvoy and Butler, 2009). Furthermore, because decisions resulting from good collaboration are influenced by a full understanding of issues and diverse viewpoints, they tend to be better aligned with project goals and user demands (Moe et al., 2012).

Agile collaborative decision-making methods must, however, be carried out well to be as successful as intended. Because of this, it is critical to define each actor's precise duties and responsibilities while making decisions (Rigby et al., 2016). Making decisions more clearly and involving all relevant participants in the process could be achieved by using decision frameworks (Leffingwell, 2010). To promote collaborative decision-making in agile contexts with a diversity of inputs, organizations should employ both advanced technology tools and skilled facilitation tactics (Kerth, 2013). Additionally, by using agile project management platforms like JIRA, Confluence, or Trello, which promote transparency and easy access to information, cross-team decisions may be made more quickly and effectively. Moreover, collaborative decision-making requires the development of a supporting culture (Rigby et al., 2016). This promotes effective cross-team decision-making as well as more devoted and engaged teams. Another part of this culture is fostering a psychologically secure space where team members may openly voice divergent viewpoints, question assumptions, and express creative ideas (Edmondson, 1999). Overall effectiveness and adaptability are further enhanced using continuous feedback mechanisms through frequent feedback sessions and retrospectives, which help to improve the decision-making process and bring it closer to the team's and the organization's strategic goals (Derby et al., 2006).

2.3.5. Decision-making Challenges and Improvements in Large-scale Agile Organizations

While shared decision-making in agile organizations can be inclusive and beneficial, the collaborative nature can slow down processes due to the need for consensus, which might not always be timely (Highsmith, 2009). Furthermore, Moe et al. (2012) found several challenges within strategic, tactical, and operational decision-making levels. The challenges were grouped into three areas of decision-making: *alignment of strategic product plans with iteration plans* (strategic decision-making), *allocation of development resources* (tactical decision-making), and *performing development and maintenance tasks in teams* (operational decision-making) (Moe et al., 2012). Each challenge category, or level, has a set of underlying challenges. For aligning strategic and iteration plans, Moe et al. (2012) found these to be: *lack of shared understanding*, *not understanding the complexity*, *no arena for solving conflict*, and *not involving the team*. For allocating resources, the sub-challenges were deemed to be: *important decisions are not aligned*, *missing a clear prioritization*, *missing a definition of done*, *conflicting priorities within the company*, and *low committing to the plan*. Lastly, for the challenge of performing tasks, the underlying challenges were: *not confronting each other*, *lack of team orientation*, *unrealistic plans*, *decision-hijacking*, *lack of knowledge*, and *technocracy*.

Strategic Level of Decision-making

The coherence between long-term project goals and short-term iteration cycles is significantly impacted by strategic misalignment in agile contexts (Moe et al., 2012). An overemphasis on short-term operations might be a risk factor for losing sight of the more important long-term goals that are essential to the overall direction of projects and organizations (Drury et al., 2012). Thus, decision-makers must provide timely and consistent feedback to align strategic, tactical, and operational choices (Moe et al., 2012). Furthermore, it has been demonstrated that keeping lines of communication open promotes alignment (Kotter, 1995). Complementary, forming teams with representatives from different levels of decision-making encourages greater

participation and improves coherence and efficacy (Highsmith, 2009; Paasivaara and Lassenius, 2014). Frequent planning sessions and tight contact with POs by both teams and other POs, which emphasize the importance of input across levels, help to achieve this alignment (Aurum and Wohlin, 2007). Although agile processes have a supporting framework, there are various obstacles to aligning strategic product plans with iteration plans (Moe et al., 2012). These issues arise from the fact that organizational strategy goals and Sprint operational tasks frequently diverge. This highlights the difficulties in accomplishing the established strategic objectives by introducing inefficiencies and slowing down the decision-making processes (Reinertsen, 2009; Nerur et al., 2005). As additional hierarchical levels are introduced for control in large and expanding agile setups, basic agile values like customer cooperation, iterative development, and responsiveness to change may become diluted (Boehm and Turner, 2004).

There is frequently a lack of mutual understanding across teams and levels on what has to be delivered, which results in irrational iteration plans and frequent plan modifications (Ktata and Lévesque, 2009). While sometimes forgotten, it is important to establish common mental models through early workshops and ongoing discussions (Moe et al., 2012). However, POs and development teams can underestimate how complicated the needs might be (Moe et al., 2012). This could result in frequent and essential plan modifications in the middle of an iteration, which would ideally call for a new iteration plan (Marks et al., 2001). Teams that include individuals with varying degrees of decision-making are better able to use various perspectives and engage more people, which improves the quality and execution of decision-making (Highsmith, 2009; Paasivaara and Lassenius, 2014). Moreover, agile teams frequently lack dedicated platforms for resolving disputes between the demands of short-term success and long-term quality, which encourages the prioritizing of quick progress over long-term quality (Moe et al., 2012). Misalignment at the strategic, tactical, and operational levels leads to subpar software and productivity (Moe et al., 2010), neglected non-functional requirements, and insufficient testing procedures (Ramesh et al., 2010; Zazworka et al., 2010). This misalignment is frequently caused by the dynamic relationship between software processes and cost, schedule, and quality (Krasner, 1998). Furthermore, it is not always the case for teams who will be impacted by strategic decisions to be included in the decision-making process, which can result in major implementation problems and disconnects (Moe et al., 2012). To properly utilize agile approaches, it is necessary to overcome this cultural legacy from earlier, more hierarchical, plan-driven development methods (Vinekar et al., 2006).

Implementing balanced scorecards might aid in improving the alignment between various levels by coordinating strategic plans with operational performance and ensuring that daily operations efficiently contribute to long-term objectives (Kaplan and Norton, 1996). Moreover, regular feedback meetings and ongoing planning between the technical and business teams can support the alignment of the iteration and strategic vision (Moe et al., 2012). Agile project management technologies that improve openness and communication are used in support of this strategy (Leffingwell, 2007; Ambler, 2002). Furthermore, structured feedback loops can help in addressing misalignments and adapting plans based on real-time operational insights to strategic management (Derby et al., 2006). It can also be helpful to integrate team awareness of agile approaches with strategic goals by implementing regular training sessions. In that way, teams can minimize miscommunications and align operations with strategic goals by creating common mental models (Moe et al., 2012). Additionally, integrating cross-team setups with members from different decision-making levels can facilitate comprehensive project understanding, enhancing decision quality and alignment with organizational objectives (Paasivaara and Lassenius, 2014).

Tactical Level of Decision-making

Resource allocation in agile environments, especially in large-scale settings, involves complex coordination. This can often lead to bottlenecks and inefficiencies (Moe et al., 2012). A challenge when scaling agile is to manage and optimize the distribution of limited resources across teams, both when it comes to employees and critical infrastructure (Larman and Vodde, 2010). Managing this is crucial to prevent delays and ensure efficient resource use (Reinertsen, 2009).

Project priorities become misaligned and Sprint Backlogs are overcrowded when decisions that have a big influence on the project's direction are put off (Moe et al., 2012; Takeuchi and Nonaka, 1986). Planning sessions can become drawn out and unfocused in the absence of a clear, well-prioritized Product Backlog from the PO, which lessens their strategic meaning and complicates resource allocation (Moe et al., 2012). A lack of direction and coherence within the team (Hackman, 1986) is another way that an unrealistic Sprint Backlog deters developers from completely committing to the project plans (Moe et al., 2012), which provokes resource allocation challenges (Salas et al., 2005). Furthermore, cross-team coordination becomes crucial in large-scale agile organizations. The project deadlines and resource usage can be greatly impacted by misalignments between many teams, which can cause cascading delays and integration problems (Leffingwell, 2010). Agile teams' autonomy and capacity for self-management, however, may be negatively impacted by resource loss brought on by competing business objectives at a higher organizational level (Hackman, 1986; Moe et al., 2012).

Frameworks that ensure fair and strategic distribution of resources while aligning them with project demands can be used to facilitate better resource allocation (Schwaber, 2007). Additionally, to manage the fluid nature of agile projects while reducing bottlenecks and improving responsiveness, dynamic resource allocation models that adjust allocations based on project demands and progress rather than fixed long-term planning could be implemented (Reinertsen, 2009). Furthermore, to speed up the resource allocation process, local teams could be empowered to make these decisions. By leveraging teams' direct knowledge of project needs and obstacles, resources could be allocated in alignment with immediate project requirements (Hackman, 1986; Moe et al., 2012). To address issues of potential siloed team resources, cross-functional resource pools could be established that promote a collaborative approach to resource management, reducing competition for resources among teams (Larman and Vodde, 2010). Lastly, collaboration tools that provide enhanced visibility and planning accuracy can help maintain clear communication channels, thus supporting effective resource allocation (Ambler, 2002).

Operational Level of Decision-making

Working across agile teams, development and maintenance duties require constant problem-solving and adaptability, which are frequently impeded by several obstacles (Moe et al., 2012). Conflict avoidance is a common trait among teams, which can negatively impact the dynamics of the cross-team decision-making processes (Moe et al, 2012; McAvoy and Butler, 2009). Moreover, unrealistic planning might heighten teams' lack of a strong collective direction (Moe et al., 2012). Reduced focus and participation in meetings are two ways that this disorientation might impact the team's everyday operating efficiency (Moe et al., 2012). As a result, low team orientation can result in decision-hijacking (Moe et al., 2012), wherein individual team members undermine collaborative decision-making efforts by making unilateral conclusions without seeking input from others (Aurum et al., 2006). Furthermore, decision-making managers have the potential to further restrict the independence of self-organizing teams (Schwaber and Beedle, 2001). This is because waiting for judgments from managers instead of coming to their conclusions might result in delays and a lack of initiative on the part of team

members (Drury et al., 2012). Moreover, the dominance of technical expertise may inhibit group decision-making by giving individual technical ideas more weight than group input and leading to conclusions that ignore relevant opposing views (McAvoy and Butler, 2009). Specialization and division of labor can also result in knowledge silos within teams, which hinders effective involvement in cross-team decision-making processes because of a lack of awareness of the larger project context (Moe et al., 2012). Significant information gaps can result from inadequate documentation and communication tactics, which are especially troublesome in complicated projects when jobs need in-depth knowledge and accurate execution (Lindstrom and Jeffries, 2004). According to Moe et al. (2008), there is a direct positive correlation between the number of teams and the probability of communication errors and misunderstandings.

It is crucial to put into practice customized documentation strategies that meet agile requirements, to help with preserving the required paperwork and enhance team communication (Ambler, 2002). Continuous communication can also be facilitated by the efficient use of synchronization meetings, retrospectives, and daily standups. To preserve task alignment and operational efficiency, these guidelines make sure that everyone on the team is informed (Schwaber, 2004). However, particularly in large-scale agile contexts, managing a multi-layered Product Backlog across multiple teams presents considerable issues. Decentralizing decision-making and empowering local leaders and teams to take ownership can help manage backlogs more efficiently and maintain agility at scale (Takeuchi and Nonaka, 1986; Schwaber, 2007). To ensure uniformity and predictability across the entire organization, consistent agile practices, such as the length of Sprint's and the *Definition of Done*, should be developed and enforced as much as possible (Kersten, 2018). As projects often suffer from not having a clear Definition of Done, this results in carry-over tasks that falsely inflate progress reports and complicate new Sprints (Moe et al., 2012).

2.3.6. Practical Approaches to Improving Decision-making in Large-scale Agile Organizations

While academic literature helps in understanding decision-making and its underlying factors, literature stemming from practitioners can assist greatly in implementing beneficial decision-making routines. For example, Blenko et al. (2010) propose six steps for decision-driven reorganizations, aimed at improving organizational decision-making processes. First and foremost, the organization's key decisions need to be identified, and second, it should be determined where those decisions should happen in the organization. Third, the organizational macrostructure should be organized around sources of value-creating activities. Fourth, it should be understood what level of authority decision-makers need. The penultimate step should be to align other elements of the organizational system with those related to decision-making. These elements could for example be related to incentives, information flow, and processes in general. As a last step for the reorganization, managers should get help and training in developing the necessary skills and behaviors for making and executing decisions in quick and effective ways.

Furthermore, several global consulting firms have proposed practices for effective organizational decision-making. For instance, there are a few foundational best practices that are adopted to support good decision-making across the three previously mentioned decision levels (Aminov et al., 2019). First, decisions should be made at the right level, which often means delegating decisions down to lower organizational levels. This practice coming from decentralized decision-making structures is often related to findings suggesting that high-quality and quick decisions are more common in organizations with fewer reporting layers.

Second, for tactical decisions, there should be a focus on optimizing processes and running meetings as effectively as possible. This could also relate to only having necessary meetings and eliminating lengthy reports, with unnecessary meetings instead being transformed into emails (De Smet et al., 2023). The key success factor is to emphasize effective coordination across teams, and to create effective processes for how decisions are made, who is involved when, and how dialogues and discussions occur. This could be done by using *RAPID* (Recommend, Agree, Perform, Input, Decide), which is a decision-making tool that clarifies decision accountability with multiple stakeholders by defining the what, who, how, and when of decision-making (Bain and Company, 2023), or with *RASCI*, which is a project management tool that can streamline decision-making processes by helping with breaking down tasks and assigning roles and responsibilities directly to team members through five areas of responsibility: Responsible, Accountable, Support, Consulted, and Informed (Interfacing, 2024). Interestingly, it has been shown that only defining roles, accountabilities, or decision rights is not sufficient for optimal decision-making. Third, aiming at improving operational decisions, successful organizations enable teams through coaching and empowerment to make decisions (Aminov et al., 2019). A key ingredient to this is believed to be a strong sense of ownership and accountability for the involved decision-makers. For instance, replacing passive phrases with active phrases such as '*I intend to…', 'I plan on…',* and *'I will…'* implies initiative and ownership, which changes conversation dynamics (Minnaar, 2019).

Furthermore, decisions should be segmented (Aminov et al., 2019). As each decision is built on fundamentally different types and factors, decision-makers need to approach each decision differently. Looking at the provided examples above, it is important for operational decisions to be built on effective empowerment, while these types of decisions are simultaneously slowed down by defined processes. For tactical decisions, on the other hand, well-defined processes and decision meetings are key for effective decision-making. Additionally, segmenting decisions can help to understand the balance between quality and speed needed for each decision (Aminov et al., 2019). For instance, operational decisions often emphasize speed by enabling decision-making at the right organizational level, while quality is more important for strategic and tactical decision-making. It is also believed that smaller teams in an agile organizational structure that have the empowerment to make quick and iterative decisions can be used to achieve both quality and speed (Aminov et al., 2019). However, there can be several factors that lower the quality and speed of decision-making processes, and identifying them through employee surveys or diagnostics is critical to addressing them effectively (Aminov et al., 2019).

Decision-making in agile organizations is most often collaborative and consensus-driven (Martins, 2022). To reach a consensus and make unanimous decisions, the *decider protocol* can be used (Martins, 2022). This method incorporates a proposer who proposes a short, clear, and actionable proposal to the forum or teams, which goes into an iterative voting process until consensus is reached. While it can be time-consuming, the method is useful for reaching consensus and having entire teams agree in a structured way. The voting is done on a count of three, after which each member holds up a thumbs-up (which means they are fully behind the proposal), a thumbs-down (cannot support the proposal), or a flat hand (support the proposal with reservations). The voting members not holding a thumb-up get an opportunity to share doubts, which are then addressed, and modify the original proposal before repeating the voting process until full consensus.

Another popular decision-making model in agile that can be used for reaching a consensus is called *fist of five* (Martins, 2022). To assess the extent to which a team has reached a consensus on any given topic, this approach utilizes hand gestures (Rogers, 2019). Similarly to the decider

protocol, the fist of five approach utilizes a facilitator who asks the entire deciding group to show their level of support for a decision by showing a fist or several fingers corresponding to their level of support. For full support, all five fingers should be showcased. This process is iterated with improved propositions until they all achieve consensus, which is assumed to be when everyone holds up at least three fingers each, or when they determine the need for moving to another topic. Next, the idea of the *advice process* is the most radical approach to distributed decision-making and an alternative to consensus-driven decision-making (Minnaar, 2019). By using this process, not everyone has to agree on a decision, therefore moving away from the need to reach a consensus. As a result, while the decision-makers need to have enough advice to make informed decisions (Minnaar, 2019), the decision-making process has the potential to become quicker and more efficient.

Lastly, similarly to academic literature, practitioner literature emphasizes the use of heuristics for guiding decision-making (Rogers, 2019; Hone, 2016). By explicitly defining heuristics, decision-making in agile teams can be accelerated as teams can make decisions rapidly while ensuring alignment between outcomes and objectives, and leaving room for individual judgment and creativity (Hone, 2016). For example, a common heuristic that builds on agile principles is connected to face-to-face conversations (Hone, 2016). This implies that whenever there is a question, it should be asked face-to-face, or when not possible, via video conference tools or phone.

Furthermore, looking at documentation in agile organizations, there are some useful approaches (Lucidspark, 2024). First and foremost, documentation should be done continuously during work sessions. For instance, coupling and producing documentation immediately after a bug fix, instead of after a larger project's end, can release some stress from the otherwise intensive documentation process (Rosenbaum and Campbell, 2021). Moreover, automating documentation whenever possible as well as creating collaborative documentation practices that ensure awareness and accountability can be beneficial (Lucidspark, 2024). However, it is important to note that documentation should not replace conversations and other real-time communication.

3. Research Methodology

In this chapter, the study's methodology is presented. First, the research strategy and design are explained in Section 3.1. Second, in Section 3.2, the case company used in this study, Zenseact, is outlined. Third, the data collection methods, including a survey, interviews, a literature review, and contextual data, are presented in Section 3.3. Fourth, in Section 3.4, the conducted data analysis methods are explained, including statistical analysis and thematic analysis. Fifth, the quality criteria for the study are outlined in Section 3.5. Finally, Section 3.6 includes information about societal, ethical, and ecological aspects considered in this study.

3.1. Research Strategy and Design

To achieve an extensive understanding of the cross-team decision-making challenges that are faced in large-scale agile organizations, and to improve decision-making processes, a single organization case study has been carried out (Bell et al., 2019). This research design allowed for an in-depth exploration of decision-making within a specific context, providing rich and detailed insights that might not be achievable through broader studies. By focusing on one organization, the researchers could dive more deeply into various aspects of decision-making processes and establish a closer relationship with the organization and the research participants, gaining access to more in-depth information and building trust, valuable aspects when studying complex organizational dynamics (Yin, 2009). The studied company is presented in Section 3.2, *Empirical Context*.

The study combined quantitative and qualitative research methods in a mixed-method strategy (Bell et al., 2019). Furthermore, as the research process has incorporated several different data collection methods, the understanding and validity have been increased through methodological triangulation as the strengths of one method can offset the limitations of another (Turner et al., 2017). Additionally, due to the comparisons, relations, and integrations looked for between both quantitative and qualitative data collected, a convergent parallel mixed method design has been employed (Bell et al., 2019). The following order has been used for the research process during the study:

First, literature from the field of research was reviewed and used to collect theoretical data and insights. The primary objective of the literature review was to instill a fundamental understanding of the subject and context, which was used as preparation for the upcoming empirical study (Bell et al., 2019). The literature review was also performed in parallel during the entire research process and used as a tool to learn about and compare theoretical and methodological approaches to the research area. For example, the literature reviewed helped categorize decision-making challenges into three levels in RQ1 (strategic, tactical, and operational) and was used to assist in formulating improvements for RQ2.

Second, as a first step in the empirical study, a self-completion online survey was sent out and used to collect both quantitative and qualitative data, answering both research questions. However, this survey focused mainly on decision-making challenges (RQ1).

Third, qualitative interviews were conducted in two rounds to answer both research questions. The first round included shorter, more informal conversations with individuals who represented diverse teams, functions, and roles within the organization. These interviews were used to gain a comprehensive understanding of the decision-making processes within an agile organization. The second round of interviews was designed as longer, more formal multi-person interviews,

with team members as one group, and the EM and PO of a team as the other group interviewed. This round of interviews was used to compare, contextualize, and dig deeper into the survey results. A semi-structured interview approach has been implemented since qualitative interview procedures tend to be flexible while providing rich and detailed answers (Bell et al., 2019).

Lastly, contextual data has been collected through various observations to contextualize previously collected data, to further increase the researcher's knowledge about the organization. A visualization of the research design can be seen in Figure 3.1 and a detailed explanation of the methods used for data collection can be found in Section 3.3, *Data Collection*.

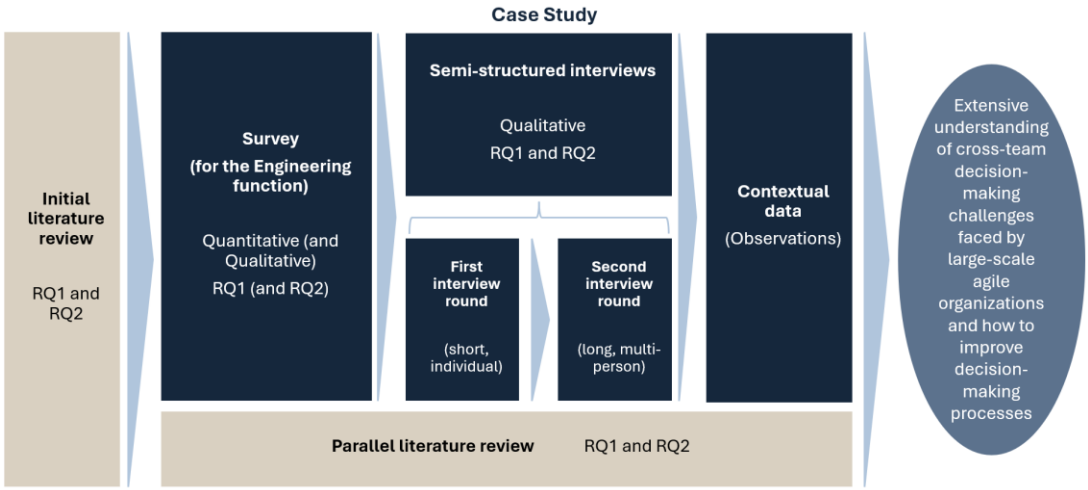

***Figure 3.1**: Illustration of the employed research design.*

3.2. Empirical Context

Zenseact is a large-scale software development firm operating in the automotive industry, designing and developing AI-powered software for autonomous driving (AD) and advanced driver assistance systems (ADAS). With the vision of "Towards zero. Faster.", Zenseact holds the belief that automation will play a crucial role in accelerating the journey toward eliminating fatalities, injuries, and accidents on the roads.

Zenseact has its roots in the development department of Volvo Cars, its current parent company. Initially started in the 1990s as an initiative to enhance car safety, this department was spun off from Volvo Cars in April 2017 and merged with car safety supplier Autoliv to form a joint venture known as Zenuity. In July 2020, Zenuity was split between the owners where one half was absorbed into Veoneer, and the other became Zenseact, a wholly owned subsidiary of Volvo Cars (Zenseact, 2024). After several years of focusing on the development of its AD software, Zenseact only recently has been close to product deliveries. During the time that the research was performed, the company had started to ship product releases to Volvo Cars for integration in vehicles.

Zenseact employs over 600 people spread across its offices in Sweden and China, with the majority being located at the Swedish office situated in Gothenburg. Due to the advanced technology developed at the company, a majority of employees are highly educated and even experts in their fields, for instance in deep learning, sensor fusion, and computer vision. The company describes itself as people-driven, nurturing a culture that promotes trust, autonomy, and value-based leadership in line with the Agile Manifesto (Zenseact, 2024). From day one, Zenseact was conceived as an agile organization across all dimensions of work, taking inspiration from the Scaled Agile Framework (SAFe) to inform its organization design. The

company is structured into the following functions: People and Communication, Product, Engineering, Finance and Digital, Strategy, and China Operations. The largest function is the Engineering function, in which self-managing and autonomous delivery teams are tied together into teams of teams, or Agile Release Trains (ARTs). There are five ARTs, collaborating to achieve a common objective. In Figure 3.2 an illustration of Zenseact's organization can be seen. The combination of self-managing teams and driving ARTs toward organizational goals therefore puts some pressure on the decision-making processes within the company, particularly related to cross-team decision-making.

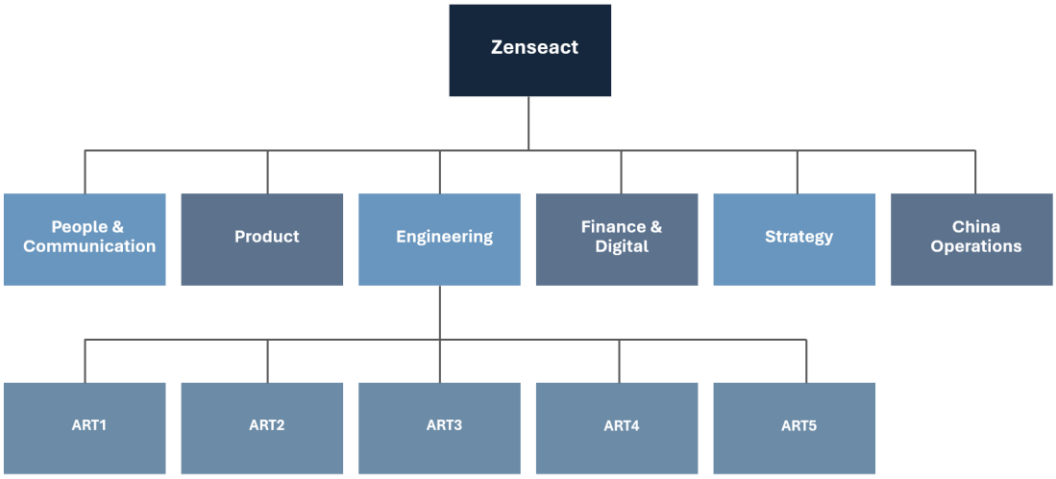

***Figure 3.2**: Organizational layout of Zenseact.*

Each ART has an ART Leadership team, which includes an ART Engineering Manager (ART EM), an ART Product Manager (ART PM), a Release Train Engineer (RTE), and a System Architect. The ART EM is responsible for competence and long-term ways of working, while the ART PM is responsible for the development and follow-up of the vision, roadmap, and objectives, as well as product performance and quality over time. The RTE is responsible for the flow of value through the ART, while the System Architect is responsible for aligning the technical solution within an ART and collaborating to build consistency in architecture and design. The teams within the ART are referred to as Delivery Teams. They are similar to Scrum Teams but also include an Engineering Manager (EM). The Delivery Team thus consists of a Product Owner (PO) who is responsible for maximizing delivered value, an Engineering Manager (EM) with responsibilities for building teams and their environment, a Scrum Master (ScM) who helps everyone understand Scrum theory and practice, and a Development Team consisting of developers working directly on product development.

The combination of this organizational structure, coupled with the defining attributes of Zenseact, established it as a highly suitable company for researching cross-team decision-making in large-scale agile organizations. As suggested in the literature, large-scale agile organization often comes with increased decision-making challenges, especially while growing, particularly regarding cross-team alignment. Given the size of Zenseact, it became interesting to dive deeper into the agile teams and roles of the company, specifically focusing on the challenges and improvements related to cross-team alignment in decision-making processes.

3.3. Data Collection

To understand the challenges and find potential improvements for cross-team decision-making in large-scale agile organizations, the following data collection methods have been used in the research: survey, interviews, literature review, and contextual data collection. Therefore, each section further describes the methods in more detail.

3.3.1. Survey

Owing to its scalability and participatory convenience (Bell et al., 2019), a self-completion survey was conducted. While addressing both RQ1 and RQ2, the survey was deemed as a suitable data collection method to primarily target RQ1, since it provided a comprehensive representation of major challenges that are faced in cross-team decision-making.

Sampling

Since the focus of the study was to understand the cross-team decision-making process, the appropriate population for the survey was deemed to be the Engineering function of Zenseact, which consisted of 424 employees at the time the survey was sent out. The purpose of the survey, which was generally to gather information and opinions from different ARTs and roles, was explained at the beginning. Furthermore, the context was also explained throughout the survey to ensure that participants understood the purpose and to connect them to the correct context while answering the questions.

Distribution

The survey was distributed through the software Microsoft Forms. To try and ensure a reasonable and sufficient response rate, the researchers promoted the survey to employees in the Engineering department with the use of email and Slack. Additionally, the industrial supervisor at Zenseact assisted with promotion and encouragement towards employees. The survey was open for two weeks and managed to collect a total of 88 answers, giving it a response rate of 21%, and being deemed sufficient to conclude the collected data. This is supported by studies showing that surveys with sample sizes smaller than 500 need at least 20% response rates to provide confident estimates (Wu et al., 2022). No role or ART was significantly under- or overrepresented, with response rates of 14-27%, as seen in Table 3.1 and Table 3.2 below. However, EMs were somewhat underrepresented. The number of answers to the survey was slightly lower than anticipated by the researchers, and non-responses were probably due to a combination of a rather intensive period for the employees, unfamiliar software, as well as a company-wide survey being sent out closely in parallel. However, as explained above, the responses gathered were still sufficient to produce accurate estimates.

***Table 3.1**: Overview of survey recipients and response rates, by role.*

Role	Sent to	Response rate	# of answers
Developer & ScM	339	21%	70
PO	36	22%	8
EM	21	14%	3
ART Leadership	17	24%	4
Other	11	27%	3
Total	**424**	**21%**	**88**

***Table 3.2**: Overview of survey recipients and response rates, by ART.*

ART	Sent to	Response rate	# of answers
ART1	91	18%	16
ART2	69	19%	13
ART3	103	23%	23
ART4	89	20%	17
ART5	72	27%	19
Total	**424**	**21%**	**88**

Survey Design and Process

The purpose of the survey at the time was mainly to collect opinions and thoughts on challenges in decision-making that impacted cross-team alignment, that is RQ1, which was used as groundwork in the later stages of the study. To reflect this purpose, the survey was threefold. The first part contained questions about the participants' background and demographics (Q1-Q4), while also investigating the respondent's role and influence in decision-making, mostly through quantitative questions about decision-making involvement, frequency, and decision forums (Q5-Q13). The second part of the survey aimed to identify challenges in decision-making with both quantitative and qualitative questions (Q14-17), while the last part of the survey examined general characteristics of the decision-making process, also with both quantitative and qualitative questions, including the respondent's satisfaction and perceived effectiveness of the process (Q18-21). Additionally, to address RQ2, a qualitative question about potential improvement ideas and solutions was asked at the end of the survey (Q22). A complete version of the survey questions (including numbers) can be found in Appendix A.

The few qualitative open-ended questions, encouraging elaboration and more detailed responses, were not compulsory. Therefore, only 12-17 respondents answered these questions, which corresponded to 14-19% of all respondents. One such exploratory question asked the respondents to describe any challenges they face related to decisions that impact cross-team alignment (Q17). Another question, yielding similar answers, asked respondents if they had any additional comments or insights (Q21). The last open-ended question asked respondents for potential improvements to challenges in the cross-team decision-making processes (Q22).

The survey was built on an early understanding of the research context and literature. For instance, questions about decision frequency and challenges (Q7-Q9 and Q14-Q16) were based on a framework by Moe et al. (2012), illustrated in Table 3.3, and previously presented in Section 2.3.5. These challenges were then applied to a cross-team context in the survey, building on future work proposed by Moe et al. (2012). Other questions were developed under the impression of decision-making literature and refined in discussion with the industrial and academic supervisors, ensuring the relevance of questions within the context of cross-team decision-making at Zenseact. Moreover, a pilot survey was conducted with a development team at Zenseact, which was part of the target population. This was done to ensure clarity and remove uncertainty for the participants. In addition, the pilot had the purpose of testing and assessing the use of Microsoft Forms, ensuring that both design and analysis were feasible.

***Table 3.3**: Framework for categorizing decision-making challenges (Moe et al., 2012).*

Aligning strategic and iteration plans	Allocating resources	Performing development tasks
Lack of shared understanding Not understanding the complexity No arena for solving conflict Not involving the team	Important decisions are not aligned Missing a clear prioritization Missing a definition of done Conflicting priorities within the company Low committing to the plan	Not confronting each other Lack team orientation Unrealistic plans Decision-hijacking Lack of knowledge Technocracy

3.3.2. Interviews

Cross-team decision-making challenges and possible improvement ideas depend on local contexts, in this case, Zenseact as a large-scale agile organization. Furthermore, there are subjective interpretations of the people who work within this context. As argued by Bell et al. (2019), qualitative interviewing is used when there is a greater interest in the point of view of the interviewees, and the semi-structured variant provides a flexible interview process for gaining answers describing these subjective interpretations. Therefore, semi-structured interviews were used in this study to collect qualitative data regarding opinions, interpretations, and perspectives from employees at Zenseact. The interview data was used to both understand the context, expand and delve deeper into the survey and theoretical data, and to find potential improvement areas. The interviews were conducted in two different rounds, with the first round having the purpose of building an understanding of the context and issues early on with shorter, informal individual conversations, while the second round, conducted with longer, multi-person interviews, was used to triangulate and contrast the survey data while understanding challenges and improvements on a deeper level. The interviews were mainly conducted on-site but with the flexibility of using Microsoft Teams for facilitating online participation, recording, and transcription of the interviews.

Sampling Strategy and Interview Process

For the set of interviews in the first round, the aim was to get a holistic and broad understanding of how the cross-team decision-making processes are built up and implemented, together with potential challenge areas that could be analyzed further. Therefore, individuals with various roles and from different ARTs were interviewed, as well as consultants at Zenseact with specific and relevant knowledge. The sampling was performed with the help of the industrial supervisor who recommended people to contact, as well as contacting people who had expressed an interest in the survey to contribute to the study. At this phase, it was mainly employees with management responsibilities, such as EMs, POs, and RTEs, that were interviewed, as it was believed that these kinds of roles had a greater experience of the researched area. In total, ten interviews were conducted at this stage: two interviews with developers, two interviews with POs, three interviews with EMs, one interview with an ART EM, one interview with an RTE, and finally one interview with a consultant. The first round of interviews was simpler, ranging from 15 to 30 minutes in length. The length of these interviews was chosen to find a balance between being short enough for participation and collecting sufficient data.

For the second round, the researchers had a desire to interview teams from several ARTs to be able to get a more comprehensive understanding. However, only two distinct teams from the same ART could be interviewed and included in the research due to time constraints. The teams were selected in cooperation with the industrial supervisor, with a focus on the POs and EMs leading the teams. However, while being in the same ART, each respective team had unique forms and levels of cross-team decision-making within the organization. In each team, there were two interviews: one with the development team, and the other with the PO and EM of the team. The idea behind this split of the team was to be able to find potential differences in the opinions between the roles while creating a more open and transparent discussion. In total, there were therefore four interviews conducted at this stage, with each interview having a length of approximately one hour. These interviews were recorded and transcribed. An overview of the conducted interviews in each round can be found in Table 3.4.

***Table 3.4**: Overview of conducted interviews.*

Round	Role	ART	Time	Date
First round	Developer 1	ART5	15 min	2024-02-28
	PO 1	ART2	15 min	2024-02-28
	Developer 2	ART1	15 min	2024-02-29
	Consultant 1	---	20 min	2024-02-29
	ART Leadership 1	ART2	15 min	2024-03-04
	ART Leadership 2	ART5	15 min	2024-03-05
	PO 2	ART1	15 min	2024-03-08
	EM 1	ART1	15 min	2024-03-08
	EM 2	ART1	15 min	2024-03-08
	EM 3	ART3	15 min	2024-03-12
Second round	Developer 3-7 + ScM 1	ART1	60 min	2024-03-18
	Developer 8-12 + ScM 2	ART1	60 min	2024-03-18
	PO 2 + EM 1	ART1	60 min	2024-03-25
	PO 3 + EM 2	ART1	60 min	2024-03-26

Semi-structured Interviews

To give participants greater freedom to share opinions and experiences, semi-structured interviews were chosen as the interview structure (Longhurst, 2003). Furthermore, semi-structured interviews were considered appropriate to minimize the extent of changes in the interview guide due to which of the two researchers had the main responsibility for conducting the interview (Bell et al., 2019). Additionally, the use of semi-structured interviews allowed for follow-up questions to better understand participants' answers.

The researchers strived to create and maintain a relaxed interview atmosphere, to be able to gain comprehensive and trustful insights. At the beginning of the interviews, the researchers emphasized that the interview would be treated with confidentiality. Furthermore, the researchers introduced themselves while explaining both the study and interview purposes. To ensure interview quality and accurate data collection, both researchers were present at all interviews. The researchers had different responsibilities, with one having the leading role of interviewing while the other had the responsibility of taking notes and contributing to follow-up questions. By utilizing this approach, pressure was relieved, and confidence was increased as the researchers could support each other if required.

Interview Guide

While the interviews in the first round were informal, they all followed the same logic of questioning to increase understanding of both the company context and relevant challenges and

improvements to decision-making processes. Before initiating the interviews, the research aim was explained and anonymity was guaranteed. Thereafter, introductory questions about the participants were asked first, followed by questions asking for the context in which the participants both worked and had decision-making experience. Next, the discussions were led by questions regarding the major challenges that each interviewee faced with cross-team decision-making, before finishing with some brainstorming questions about potential improvements to be found for cross-team decision-making processes.

The interview questions used in the second-round interviews were formulated with the specific focus of understanding, comparing, and exploring the survey results while starting to define improvement areas. The complete interview guide for the second round can be found in Appendix B. The interview guide started with introductory questions about the participants' backgrounds. This was both to create a relaxing and personal interview environment and to understand each participant's amount of experience in the field. Furthermore, the introduction contributed to the understanding of the characteristics of each participant's work tasks, being useful when comparing and discussing the results from the study.

After the introductory questions, the participants were asked about the current cross-team decision-making processes. In particular, they were asked to provide and expand on previous experiences of making decisions that required cross-team alignment, and if it was perceived to be effective. For developers, it was also specifically asked if they felt that they were involved enough in these types of decisions. It was also asked about their perceptions of communication and responsibilities in the decision-making processes. The next part of the interviews surrounded challenges and solutions, specifically focusing on the most frequently encountered challenges identified in the survey, where the participants were asked to give their opinions and thoughts on each challenge. Lastly, if time allowed, potential improvements were discussed. To avoid the risk of asking leading questions, the questions were designed to have the respondent tell a story. The questions were covered from top to bottom, and in some interviews, it was decided not to ask all the questions in the guide. This was due to the respondent already answering the question previously in another answer or changing the course of the interview. Due to the semi-structured characteristics of the interviews, other follow-up questions were at times asked that were considered relevant. All interviews ended with a question regarding if the respondent had something to add that was not covered, giving opportunities for additional perspectives. These types of concluding questions are also in line with recommendations for how to finish an interview (Bell et al., 2019).

Recording and Transcription

In qualitative research, it is important to have a detailed recording of interviews, enabling a thorough data analysis (Bell et al., 2019). In this study, the shorter informal conversations during the first round were noted and partly quoted, while the longer, multi-person interviews during the second round were recorded and transcribed. Before the interview, the researchers asked for permission to record the interview. Permission was granted for all of the conducted interviews. The recordings were made with the aid of the recording function in Microsoft Teams. The transcription was performed by the researchers, using the automatic transcription function in Microsoft Word. The transcriptions were manually looked through and corrected afterward by the researchers. However, this step was less time-consuming with the help of the automatic transcription feature instead of being made entirely manually. The recordings were listened to during the manual transcription corrections, providing another interpretation and possibilities for more detailed analysis (Bell et al., 2019).

3.3.3. Literature Review

To determine previously applied concepts and theories related to the studied topic, a literature review was conducted (Bell et al., 2019). Due to the suitability for interpretative research and the possibility of assessing broad and abstract questions, a narrative approach was used (Baumeister and Leary, 1997). As the narrative approach is built on flexible and inductive characteristics, the literature was first used as an initial review to gather enough information and understanding of the researched subject, helping with concretizing the research questions. Furthermore, the literature review was used to assist in answering both RQ1 and RQ2. For RQ1, the literature review gave a comprehensive understanding of the challenges in decision-making processes in large-scale agile organizations and was therefore used as guidance for further data collection methods. Moreover, to gain complementary benefits, the literature review ran in parallel with other means of data collection during the study, to provide further information, contrast, and understanding of collected data. Regarding RQ2, the reviewed literature supported in finding and assessed different improvement ideas that could complement the improvements that emerged from the empirical findings.

The reviewed literature specifically focused on keywords that aligned and expanded on the purpose of the thesis, namely “Agile”, “Large-scale agile organizations”, “Decentralized decision-making”, “Collaborative decision-making”, “Cross-team decision-making”, “Autonomy”, “Communication”, and “Decision alignment”. The conducted literature review relied on the accessibility of academic journals, retrieved through databases such as Chalmers Library, Google Scholar, and Scopus. Furthermore, through Chalmers Open Digital Repository, previous master’s theses corresponding to the subject were retrieved to gain insights into previous work as well as to find additional literature that was deemed relevant and interesting. The literature review also covered practitioners’ literature relevant to answering RQ2. Such articles were identified by using search engines and search phrases similar to RQ2, such as “How to improve decision-making in agile organizations?”.

3.3.4. Contextual Data

Interviews and surveys can sometimes run the risk of generating incorrect information that does not correspond entirely to reality (Bell et al., 2019). This could be due to several factors, such as respondents being put in an unknown position or answering questions that they believe the researchers want to hear instead of what they believe. Therefore, to get a clearer understanding of Zenseact and the context of decision-making, sporadic and continuous contextual data collection was performed during the study with the help of observations. This contextual data served as a complement to the other data collection methods. Among other things, these data points have been collected at various decision-making forums and meetings, company events, and in various communication channels in Slack and Confluence. Some examples include Product Info Meetings, Sprint Planning, Backlog Refinement, ART Refinement, and Product Refinement and Design Review. For instance, when attending the different decision-making forums, the meetings have been noted. Thereafter, the significance and impression of the meeting structure and content have been discussed and contrasted with the data collected from the other data collection methods.

3.4. Data Analysis

The collected data was continuously analyzed by using two methods. For the quantitative data, collected from the survey, a statistical analysis was performed. For the qualitative data,

primarily collected from the interviews and the literature review, but also from the open-ended survey questions, a thematic analysis was applied.

3.4.1. Statistical Analysis

The survey data, which was mostly quantitative, was statistically analyzed using Microsoft Excel and Jamovi to detect patterns, relationships, and trends within the responses. Before starting the analysis, the data was prepared through data cleaning to remove or modify incomplete, duplicated, or improperly formatted data. Excel was used initially to get a better overview of the answers and to perform a more basic analysis of frequencies, means, and medians. At this time, the answers were also coded to transform the data from words to corresponding numbers, allowing the answers to be analyzed quantitatively. As an example, the question about how frequently decision-making challenges were encountered had five answer alternatives that were assigned the following numbers: never (1), almost never (2), sometimes (3), most of the time (4), and every time (5).

The data was then exported to Jamovi to allow for deeper statistical analysis. However, Jamovi was also used considerably for generating descriptive statistics, including means and standard deviations, and different visualizations, such as histograms, density plots, and box plots, to allow for the identification of interesting patterns. Both univariate, such as frequency tables, as well as multivariate analysis, where several variables are analyzed together (López et al., 2015), were performed to maximize insights from the survey data. As an example, the data from different questions were often split by role, or sometimes ART, to get a better understanding of variations within the organization. For this analysis, contingency tables and chi-squared tests were performed to examine whether there was a statistically significant difference between the expected and observed frequencies of the roles and ARTs. Jamovi was also used for regression analysis to find correlations in the data and for exploratory factor analysis (EFA) to reveal any hidden latent factors that can be inferred from the observed data.

This quantitative analysis was done immediately after the survey was closed, allowing the researchers to guide the rest of the data collection, mainly interviews, based on conclusions from the survey. It also gave the researchers an overview of the organization's view and enabled certain thoughts and ideas to be explored further. The qualitative survey data was instead analyzed thematically, described further in the following section.

3.4.2. Thematic Analysis

A consequence of research is usually difficulties in systematically and analytically finding patterns due to the large amounts of data generated (Bell et al., 2019). Thus, to find repeating categories and patterns in data of a qualitative nature, a thematic analysis was applied. Both the literature and the empirical data were analyzed thematically, however, the analysis followed slightly different processes and are thus described separately below.

Thematic Analysis of Literature

The literature review was analyzed thematically using NVivo, both for RQ1 and RQ2. This was done by first importing the literature into NVivo before identifying key themes and concepts within the literature to create corresponding nodes. Thereafter, relevant sections of the literature were coded to these nodes. The codes were organized in a hierarchy, making it easier to manage the data. For example, one node was named organizational decision-making, including sub-nodes such as historical view, challenges, and improvements. The codes in NVivo were then used when writing the theoretical background, which is described with the empirical findings in Chapter 5., *Discussion*. For RQ2, practitioners' literature was also analyzed similarly.

However, points from that literature got their own nodes in NVivo to allow for better separation of the sources.

Thematic Analysis of Empirical Data

The thematic analysis of the empirical data covers both the three qualitative survey questions, the interviews, and in a few instances the contextual data, providing the researchers with a rich dataset for answering both research questions. The qualitative survey answers, together with the transcripts and notes from the interviews, were reviewed, and if they seemed to be of potential significance to answer the research questions or give context to them, they were brought into Microsoft OneNote to be labeled through color-coding and then grouped based on common themes. As recommended by Bernard et al. (2016), repetitions, analogies, similarities, and differences were emphasized when searching for themes. Repetitions were in this case referred to as recurrence within data sources (Bell et al., 2019). This served as a first step to structure and sort the data before a more thorough analysis and coding were performed. It helped the researchers reflect on various ways of categorizing the data and sparked a thought process of how to best relate it to existing concepts.

Following this, all the data that was relevant to the research questions, in other words, data that included information that explained a challenge or an improvement idea, or something that could be connected to a challenge or improvement idea, was moved into Microsoft Excel where each row represented a data point, mostly in the form of a few words or a sentence. To not lose the context of each data point, columns were added for the data collection method and role. Thereafter each data point was coded.

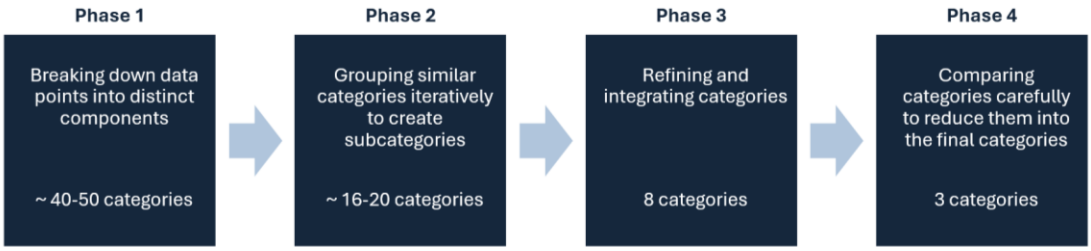

Figure 3.3*: Coding phases performed in the thematic analysis.*

The coding was done in four phases, visualized in Figure 3.3. Appendix C provides coding examples, showing how the four phases of coding were performed for some data points. In the first phase, data was broken down into distinct components in the form of full sentences based on whether they were deemed to provide any value for answering the research questions. They were then carefully assessed and contrasted to find similarities and differences. Components that had conceptual similarities were grouped into categories. This first phase was very comprehensive and resulted in around fifty categories which were slightly reduced to a bit more than forty by integrating similar categories. The second phase was carried out by making connections between categories and was accomplished iteratively, grouping the around forty categories into a more manageable set of categories, reducing the number of categories to a bit over twenty. These were later refined into sixteen, to provide better clarity and minimize overlap. This meant that each category now had a set of subcategories. In the third phase, the codes were once again refined by integrating the previously identified categories into eight ones. Lastly, in the fourth phase, the eight categories were compared carefully one last time and reduced into three categories, with the goal of making them as mutually exclusive and collectively exhaustive as possible. For example, two categories previously called *Communication and information management* and *Suboptimal and varying decision documentation* were merged to create the category *Challenges with information flow*. After

several iterations, the researchers settled on a categorization that they believed mirrored the distinct challenges in the best possible way.

Throughout the coding process for RQ1, as the researchers reflected on the emerging codes and categories against their understanding of the literature, each data point was also connected to the three decision-making levels by Moe et al. (2012); strategic, tactical, and operational. This meant that each data point now had two dimensions, both a challenge category and a decision-making level. These two dimensions are visualized in Table 3.5, including how many of the data points were included in each cell. The decision-making levels were applied to systematically connect one of the most widely used categorizations of decisions with the specific focus of this study, cross-team decision-making in large-scale agile organizations.

The above explanation of the coding procedure only applies to RQ1. RQ2 was instead coded as explained in the first phase, and then connected to a challenge category. The data points relating to RQ2 then followed its related challenge(s) throughout the rest of the coding process, as those were refined and condensed into fewer categories.

***Table 3.5**: Decision-making categories and levels used in the thematic analysis.*

Categories / Levels	Strategic	Tactical	Operational
Challenges with information flow	8	6	10
Challenges in collaboration and understanding	6	10	2
Complexities and coordination in decision-making processes	6	3	3

3.5. Research Quality

It is important to follow specific quality criteria when designing a research project (Bell et al., 2019). The importance of validating the research and focusing on what to validate is also emphasized. Therefore, measures were taken to ensure research quality for this study. The set of quality criteria known as trustworthiness was used to ensure a comprehensive and focused approach (Bell et al., 2019). This particular framework is built on four considered evaluation criteria: credibility, transferability, dependability, and confirmability (Bell et al., 2019).

Credibility is related to how believable the study findings are (Bell et al., 2019). Therefore, it is dependent on the abilities of the researchers to understand and interpret the studied reality. To increase credibility, the researchers chose to employ triangulation, achieved by comparing and confirming survey data with interviews, as well as using literature to validate the empirical findings with previous work. Moreover, there are some related risks when conducting semi-structured interviews (Alvesson, 2003). One of these risks could be that respondents give answers that are influenced by the researchers, company norms, or culture. The granted anonymity communicated during the interviews and the relaxed environment were efforts taken to increase the possibility of collecting unbiased opinions.

Transferability is explained as the degree to which the study results can be generalized to other contexts (Bell et al., 2019). The researchers have tried to describe the research process in as much detail as possible to increase the ability to generalize the study findings. To the extent permitted by Zenseact, the empirical context has been further described. However, it should be noted that the autonomous driving industry in which Zenseact operates is relatively novel, which might hinder the generalizability of this study. Despite this, Zenseact is still a software engineering company, which might increase the generalizability of the study results to these kinds of companies. However, caution when generalizing the findings should be used, as

studies of a qualitative nature, such as this one, have a limited possibility to generalize the findings (Bell et al., 2019).

Dependability is concerned with the transparency exhibited by the researchers regarding the methodology and process (Bell et al., 2019). Efforts to increase the robustness of these criteria were made by implementing key measures, such as clearly stated problem formulation, thorough documentation of the data analysis, and preservation of fieldwork notes and transcripts.

Confirmability refers to the researchers' objectivity, implying the minimization of subjectiveness during the study (Bell et al., 2019). There are difficulties in fully avoiding subjectivity when conducting qualitative research (Bell et al., 2019), and thus some efforts were made to increase the confirmability. As explained, a thematic analysis was performed in the analysis of qualitative data, following comprehensive guides for the correct implementation of the method. Moreover, the confirmability has increased since this study went through the opposition of colleagues (Bell et al., 2019).

3.6. Societal, Ethical, and Ecological Aspects

This section of the report explains the societal, ethical, and ecological aspects considered during the study.

3.6.1. Societal Aspects

The societal aspects of this study included ensuring accessibility, responsibility, and transparency. Accessibility concerns making certain that the research findings are accessible and comprehensible to a broader audience, including individuals lacking specialized technical expertise. It is also highly important that the research results are used responsibly and for the benefit of greater society. Lastly, transparency about the research process and methodology is salient to build trust and commitment.

3.6.2. Ethical Aspects

Diener and Crandall (1978) mention four prominent ethical considerations that need to be considered: harm to participants, lack of informed consent, invasion of privacy, and involvement of deception. Avoiding harm was ensured by respecting the time of research participants, for example by offering flexibility in terms of interview time slots and guaranteeing anonymity. Informed consent seeks to ensure that research participants are given as much information about the study as possible, allowing them to make informed decisions about whether to participate in it (Bell et al., 2019). This was achieved by informing the participants about their independence during the data collection, allowing them to opt-out or decline to answer questions that they felt uncomfortable answering. Invasion of privacy was avoided by restricting who had access to the research data and by ensuring anonymity and protecting personal and sensitive information from unauthorized access and use. Deception was prevented by being transparent and honest towards the research participants regarding the scope and purpose of the study, disclosing that they are involved in a master's thesis. Additionally, treating the research participants fairly and equally, and minimizing biases in sampling, data collection, and data analysis were paramount ethical aspects.

3.6.3. Ecological Aspects

The ecological aspects of this study included ensuring that the research was conducted sustainably and minimized environmental impact. This included using sustainable research practices, for example by utilizing digital platforms for literature review and data sharing, reducing the need for printing and physical storage of research materials, and by using technology for virtual meetings to avoid extensive travel, lowering emissions and resource consumption. However, it is important to point out that in organizational studies such as this master's thesis, there was a need for nuanced understanding and insights that often necessitate direct engagement with research participants. Travel mostly occurred within an urban environment, in the majority by public transport and bike, thus limiting carbon footprint. Therefore, in-person meetings and interviews were prioritized, as the positive impact this had on the quality of the study outweighed any potential negative ecological impacts.

4. Empirical Findings

This chapter presents the results of the data collection, including the survey, interviews, and contextual data. It displays the empirical data produced for this thesis, aiming to answer the research questions and explore additional findings from the study. The chapter is structured around the research questions and is divided into a statistical analysis of RQ1, a thematic analysis of RQ1, and a thematic analysis of RQ2.

4.1. Statistical Analysis Answering RQ1

This section presents the quantitative results from the survey. The chapter is structured around the following five groups in which questions were asked: frequency of decisions, decision forums, frequency of decision challenges, effort spent on decision-making-related activities, and decision-making satisfaction and perceived effectiveness. Thereafter, correlations are displayed. Lastly, relationships between variables are explored more deeply through an exploratory factor analysis (EFA).

4.1.1. Frequency of Decisions

The first section of the survey focused on decision frequency, in other words, how often the respondents were involved in, or affected by decisions, first on a general level and then across various types of decisions. The respondents were asked to rate each question on a scale from never to daily. To allow for statistical analysis, the answers were assigned the following corresponding values during the data analysis: never (0), once a month or more seldom (1), a few times a month (2), once a week (3), a few times a week (4), and daily (5).

One question asked how frequently the respondents were involved in cross-team decisions, followed by a question about how frequently the respondents were affected by such decisions. The frequency means and standard deviations are shown in Table 4.1, split by role.

Table 4.1*: Frequency of decision involvement and affectedness, split by role.*

Metric	Role	N	Mean	SD
Involved	ART Leadership	4	4.50	0.58
	Developer	59	2.03	1.40
	EM	3	3.67	1.53
	Other	3	2.67	1.16
	PO	8	4.00	0.93
	ScM	11	2.36	1.29
Affected	ART Leadership	4	3.50	1.29
	Developer	59	2.78	1.42
	EM	3	3.33	1.53
	Other	3	2.33	0.58
	PO	8	3.63	1.30
	ScM	11	2.45	1.37

The results show that ART Leadership has the highest involvement in decision-making, with 100% of respondents with this role answering that they are involved once a week or more often

(>=3), giving a mean of 4.50. Developers and Scrum Masters on the other hand have the lowest involvement, with only 31% and 45% of respondents with this role answering that they are involved once a week or more often (>=3), giving a mean of 2.03 and 2.36 respectively. Furthermore, it shows that POs and ART Leadership are most affected by cross-team decisions, with 75% of respondents with this role answering that they are involved once a week or more often (>=3), giving a mean of 3.63 and 3.50, while Scrum Masters are least affected, with only 45% of respondents with this role answering that they are involved once a week or more often (>=3), giving a mean of 2.45. It is also worth mentioning that Developers and Scrum Masters are affected by decisions more frequently than they are involved in them, while the opposite goes for the other roles. It is also important to note that the standard deviation is fairly high here, indicating that there is considerable variability within the dataset.

Tables D.1 and D.3 in Appendix D show contingency tables for decision involvement and affectedness, displaying the multivariate frequency distribution of the variables. A Chi-squared test of association was also conducted, both for decision involvement and affectedness. The results for decision involvement, seen in Table D.2 in Appendix D, show that $p = 0.068$. Since this is larger than the conventional significance level of 0.05, the null hypothesis is not rejected. However, the result may be considered as marginally statistically significant. However, for decision affectedness, seen in Table D.4 in Appendix D, $p = 0.566$. This large number clearly shows that there is a statistically insignificant difference in affectedness across different roles.

Furthermore, the survey asked about how frequently different types of decisions were made, departing from the three categories presented by Moe et al. (2012). The frequency means and standard deviations are shown in Table 4.2, split by role.

***Table 4.2**: Frequency of decisions by category, split by role.*

Category	Role	N	Mean	SD
Aligning plans	ART Leadership	4	3.50	1.73
	Developer	59	1.07	1.11
	EM	3	2.33	2.31
	Other	3	1.67	1.16
	PO	8	2.63	1.51
	ScM	11	0.82	0.60
	Mean	**88**	**1.35**	**1.34**
Allocating resources	ART Leadership	4	2.50	1.29
	Developer	59	0.86	0.92
	EM	3	2.33	2.31
	Other	3	1.00	1.00
	PO	8	2.13	2.03
	ScM	11	0.55	0.93
	Mean	**88**	**1.07**	**1.23**
Development tasks	ART Leadership	4	3.00	2.16
	Developer	59	1.92	1.29
	EM	3	1.67	2.08
	Other	3	2.00	1.00
	PO	8	2.88	1.36
	ScM	11	1.73	1.35
	Mean	**88**	**2.02**	**1.37**

The results demonstrate that the decisions that are made most frequently are regarding the process of *Performing development tasks*, with 31% of respondents answering that they make such decisions once a week or more often (>=3), giving a mean of 2.02. Conversely, the least frequent decisions are regarding the process of *Allocating resources*, with only 11% of respondents answering that they make such decisions once a week or more often (>=3), with a mean of 1.07. Looking at specific roles, it becomes clear that ART Leadership are the ones making decisions most frequently, which is in line with them being the ones most involved in decisions. This goes for all three decision categories. The results also show that Scrum Masters are generally the ones making these types of decisions the least frequently.

***Table 4.3**: Contingency table for aligning plans, split by role.*

Aligning plans		**Role**						
		ART Leader-ship	**Deve-loper**	**EM**	**Other**	**PO**	**ScM**	**Total**
0	Observed	0	20	0	0	0	3	23
	% within column	0.0 %	33.9 %	0.0 %	0.0 %	0.0 %	27.3 %	26.1 %
1	Observed	1	25	2	2	2	7	39
	% within column	25.0 %	42.4 %	66.7 %	66.7 %	25.0 %	63.6 %	44.3 %
2	Observed	0	7	0	0	3	1	11
	% within column	0.0 %	11.9 %	0.0 %	0.0 %	37.5 %	9.1 %	12.5 %
3	Observed	0	5	0	1	0	0	6
	% within column	0.0 %	8.5 %	0.0 %	33.3 %	0.0 %	0.0 %	6.8 %
4	Observed	2	1	0	0	2	0	5
	% within column	50.0 %	1.7 %	0.0 %	0.0 %	25.0 %	0.0 %	5.7 %
5	Observed	1	1	1	0	1	0	4
	% within column	25.0 %	1.7 %	33.3 %	0.0 %	12.5 %	0.0 %	4.5 %
Total	Observed	4	59	3	3	8	11	88
	% within column	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %

***Table 4.4**: Contingency table for allocating resources, split by role.*

Allocating resources		Role						
		ART Leader-ship	Deve-loper	EM	Other	PO	ScM	Total
0	Observed	0	24	0	1	2	7	34
	% within column	0.0 %	40.7 %	0.0 %	33.3 %	25.0 %	63.6 %	38.6 %
1	Observed	1	23	2	1	2	3	32
	% within column	25.0 %	39.0 %	66.7 %	33.3 %	25.0 %	27.3 %	36.4 %
2	Observed	1	9	0	1	1	0	12
	% within column	25.0 %	15.3 %	0.0 %	33.3 %	12.5 %	0.0 %	13.6 %
3	Observed	1	2	0	0	1	1	5
	% within column	25.0 %	3.4 %	0.0 %	0.0 %	12.5 %	9.1 %	5.7 %
4	Observed	1	1	0	0	0	0	2
	% within column	25.0 %	1.7 %	0.0 %	0.0 %	0.0 %	0.0 %	2.3 %
5	Observed	0	0	1	0	2	0	3
	% within column	0.0 %	0.0 %	33.3 %	0.0 %	25.0 %	0.0 %	3.4 %
Total	Observed	4	59	3	3	8	11	88
	% within column	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %

***Table 4.5**: Contingency table for development tasks, split by role.*

Development tasks		Role						
		ART Leader-ship	Deve-loper	EM	Other	PO	ScM	Total
0	Observed	1	6	1	0	0	1	9
	% within column	25.0 %	10.2 %	33.3 %	0.0 %	0.0 %	9.1 %	10.2 %
1	Observed	0	20	1	1	1	5	28
	% within column	0.0 %	33.9 %	33.3 %	33.3 %	12.5 %	45.5 %	31.8 %
2	Observed	0	17	0	1	3	3	24
	% within column	0.0 %	28.8 %	0.0 %	33.3 %	37.5 %	27.3 %	27.3 %
3	Observed	1	7	0	1	1	1	11
	% within column	25.0 %	11.9 %	0.0 %	33.3 %	12.5 %	9.1 %	12.5 %
4	Observed	1	7	1	0	2	0	11
	% within column	25.0 %	11.9 %	33.3 %	0.0 %	25.0 %	0.0 %	12.5 %
5	Observed	1	2	0	0	1	1	5
	% within column	25.0 %	3.4 %	0.0 %	0.0 %	12.5 %	9.1 %	5.7 %
Total	Observed	4	59	3	3	8	11	88
	% within column	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %

***Table 4.6**: Chi-squared test for aligning plans, allocating resources and development tasks, split by role.*

χ^2 Tests (N = 88, df = 25)		
	Value	p
Aligning plans	52.9	< .001
Allocating resources	45.4	0.008
Development tasks	19.5	0.770

Tables 4.3, 4.4, and 4.5 show contingency tables for aligning plans, allocating resources, and development tasks, split by role. A Chi-squared test of association was also conducted. The results for aligning plans, seen in Table 4.6, show that $p < 0.001$. This p-value suggests a statistically significant difference in this variable across different roles. Also allocating resources, with $p = 0.008$ as seen in Table 4.6, shows a statistically significant difference at a 0.05 significance level. However, for development tasks, $p = 0.770$ as seen in Table 4.6. Since the p-value is larger than the significance level of 0.05, the null hypothesis is not rejected. In other words, the results from the Chi-squared test show a statistically insignificant difference in the frequency of decisions regarding development tasks across different roles.

4.1.2. Decision Forums

One question in the survey addressed in what forums cross-team decisions were typically made. The respondents were given numerous options to choose from and were able to select multiple options.

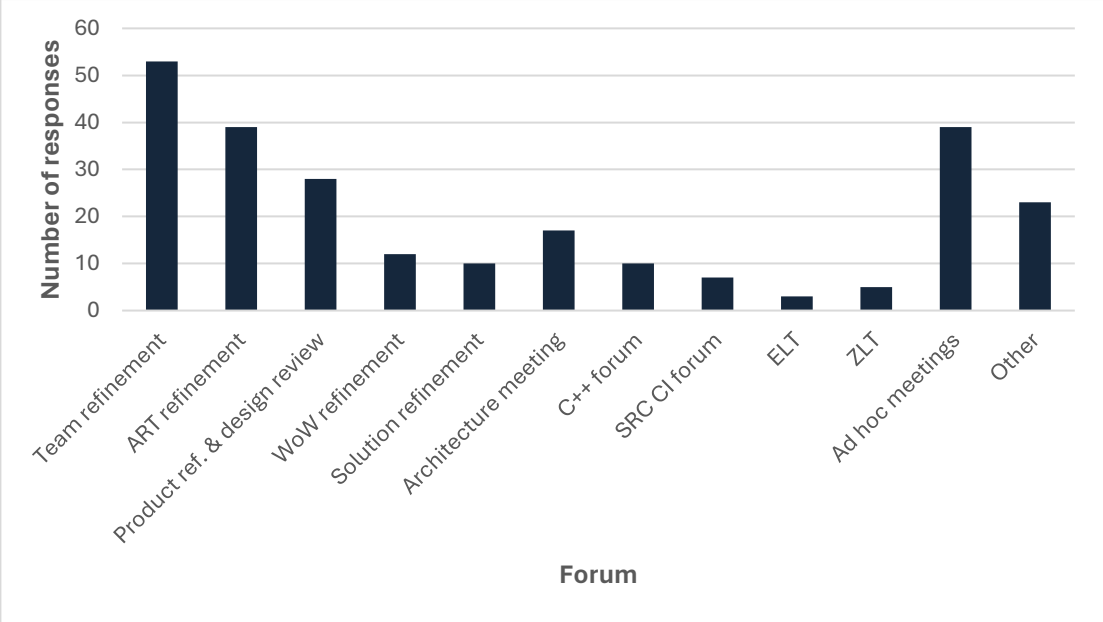

***Figure 4.1**: Forums used for cross-team decision-making.*

The results indicate that the forums most frequently used for these types of decisions were the *Team refinement*, *ART refinement*, *Ad hoc meetings*, and *Product refinement & design review meetings*. An overview of the answers can be seen in Figure 4.1.

4.1.3. Frequency of Decision-making Challenges

This part of the survey aimed to better understand which decision-making challenges were encountered most frequently. Just like the question investigating the frequency of decisions, this question followed the framework by Moe et al. (2012) and their three categories; *Aligning strategic product plans with iteration plans*, *Allocating development resources*, and *Performing development and maintenance tasks*. However, here they were also further decomposed into their underlying factors to provide a more nuanced picture of the challenges. The respondents were asked to rate how frequently they encountered each challenge on a five-point scale from never to every time. These alternatives were then coded to the following numbers during the data analysis: never (1), almost never (2), sometimes (3), most of the time (4), and every time (5).

***Table 4.7**: Frequency of encountering various decision-making challenges.*

Decision-making challenge	Mean	SD
Lack of shared understanding	3.20	1.16
Not understanding the complexity	3.48	0.93
No arena for solving conflicts	2.86	1.19
Not involving the team	2.69	1.21
Mean aligning plans	**3.06**	**0.83**
Important decisions are not aligned	3.07	1.10
Missing a clear prioritization	3.03	1.15
Missing a definition of done	2.75	1.08
Conflicting priorities within the company	3.20	1.15
Low committing to the plan	2.39	0.98
Mean allocating resources	**2.89**	**0.83**
Not confronting each other	2.23	1.06
Lacking team orientation	2.43	1.10
Unrealistic plans	2.98	1.08
Decision-hijacking	2.09	0.97
Lack of knowledge	2.72	0.98
Technocracy	2.34	1.04
Mean development tasks	**2.46**	**0.69**
Mean all challenges	**2.76**	**0.67**

The results show that the six most frequently encountered challenges are *Lack of shared understanding*, *Not understanding the complexity*, *Important decisions are not aligned*, *Missing a clear prioritization*, *Conflicting priorities within the company*, and *Unrealistic plans*. The first two are within the category of *Aligning strategic product plans with iteration plans*, the next three in *Allocating development resources*, and the last one in *Performing development tasks*. From Table 4.7 it becomes apparent that *Aligning strategic product plans with iteration plans* is the category where challenges are encountered the most, followed by *Allocating development resources*. These have a mean score of 3.06 and 2.89 respectively.

When diving deeper into the most challenging aspects of each category, the following percentages in Table 4.8 can be extracted from the data:

***Table 4.8**: Most frequently encountered decision-making challenges, sorted.*

Category	Challenge	Mean score (1-5)	# of respondents answering that they encounter the challenge 'Every time' or 'Most of the time' (>=4)	# of respondents answering that they encounter the challenge 'Every time' (=5)
Aligning plans	Not understanding the complexity	3.48	55.7%	10.2%
	Lack of shared understanding	3.20	44.3%	12.5%
Allocating resources	Conflicting priorities within the company	3.20	39.8%	15.9%
	Important decisions are not aligned	3.07	35.3%	11.4%
	Missing a clear prioritization	3.03	39.7%	10.2%
Development tasks	Unrealistic plans	2.98	36.3%	6.8%

***Table 4.9**: Frequency of encountering various decision-making challenges, grouped by category, split by role.*

Category	Role	N	Mean	SD
Mean aligning plans	ART Leadership	4	2.63	0.72
	Developer	59	3.12	0.85
	EM	3	3.08	0.63
	Other	3	3.00	0.50
	PO	8	3.09	0.64
	ScM	11	2.86	1.05
Mean allocating resources	ART Leadership	4	2.60	0.83
	Developer	59	2.96	0.87
	EM	3	2.67	0.81
	Other	3	3.07	0.31
	PO	8	3.13	0.64
	ScM	11	2.47	0.82
Mean development tasks	ART Leadership	4	2.21	0.71
	Developer	59	2.53	0.69
	EM	3	2.39	0.69
	Other	3	2.61	1.11
	PO	8	2.77	0.59
	ScM	11	1.98	0.54
Mean overall	ART Leadership	4	2.45	0.70
	Developer	59	2.83	0.69
	EM	3	2.67	0.71
	Other	3	2.87	0.57
	PO	8	2.98	0.54
	ScM	11	2.38	0.64

When splitting the data by role, it becomes clear that different roles encounter decision-making challenges to various degrees, see Table 4.9. Overall, POs and Developers encounter challenges most frequently (with mean values of 2.98 and 2.83), while Scrum Masters and ART Leadership encounter challenges least frequently (with mean values of 2.38 and 2.45).

***Table 4.10**: Frequency of encountering various decision-making challenges, grouped by category, split by ART.*

Challenge	ART	N	Mean	SD
Mean aligning plans	ART1	16	2.59	0.88
	ART2	13	3.17	0.71
	ART3	23	3.32	0.97
	ART4	17	2.94	0.72
	ART5	19	3.17	0.64
Mean allocating resources	ART1	16	2.58	0.82
	ART2	13	2.95	0.56
	ART3	23	3.05	1.05
	ART4	17	2.62	0.73
	ART5	19	3.15	0.70
Mean development tasks	ART1	16	2.22	0.67
	ART2	13	2.56	0.68
	ART3	23	2.68	0.81
	ART4	17	2.17	0.57
	ART5	19	2.61	0.55
Mean overall	ART1	16	2.44	0.70
	ART2	13	2.86	0.54
	ART3	23	2.97	0.83
	ART4	17	2.53	0.51
	ART5	19	2.94	0.54

The data can also be split by ART, revealing significant differences between the ARTs when it comes to how often individuals encounter challenges. As depicted in Table 4.10, ART3 and ART5 encounter the most challenges (with mean values of 2.97 and 2.94), while ART1 and ART4 encounter the least (with mean values of 2.44 and 2.53).

When comparing the challenge frequency means with the decision frequency means for each of the three decision-making categories, an interesting pattern can be seen. The numbers show that the most frequent decisions (*Development tasks*) are the least challenging ones, while the less frequent decisions (*Aligning plans* and *Allocating resources*) are the most challenging ones. Therefore, one can reasonably speculate that aligning plans and allocating resources are inherently more complex decisions to be made.

4.1.4. Effort Spent on Decision-making Related Activities

The survey also included a question aimed at identifying inefficiencies in the decision-making process by letting the respondents rank the effort spent on a set of activities related to decision-making on a scale from too little to too much: too little, a bit too little, just right, a bit too much, and too much. The scale was purposefully set this way so that the middle alternative

corresponded to the most desirable answer and the answers the furthest away indicating areas which can be improved.

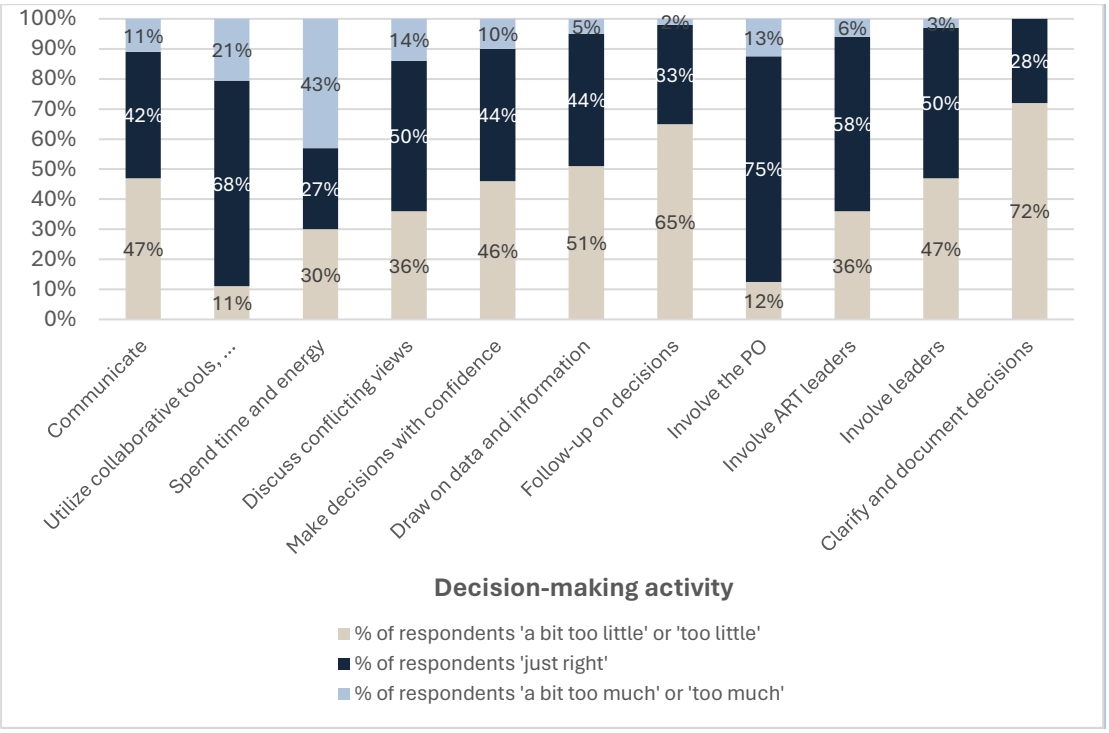

***Figure 4.2**: % of respondents expressing spending too little, just right, or too much effort on different decision-making activities.*

As illustrated in Figure 4.2, whether the effort spent on each activity was just right, too little, or too much varied substantially between the activities. The two closest to just right were *Involve the PO* and *Utilize collaborative tools, platforms, and resources*, while *Spend time and energy* and *Clarify and document decisions* were furthest away, where the former was shifted towards too much and the latter towards too little.

***Table 4.11**: Mean effort spent on decision-making activities, split by role.*

Metric	Role	N	Mean	SD
Mean effort spent	ART Leadership	4	3.50	0.73
	Developer	59	3.68	0.68
	EM	3	4.03	0.28
	Other	3	3.48	0.76
	PO	8	3.84	0.52
	ScM	11	3.86	0.60

By splitting the data by role and looking at the mean value of all activities, ranging from one to five where five corresponds to just right and one to too little and too much, Table 4.11 unveils that there are differences, with Engineering Managers being the ones closest to spending just the right amount of effort and ART Leadership being furthest away.

***Table 4.12**: Mean effort spent on decision-making activities, split by ART.*

Metric	ART	N	Mean	SD
Mean effort spent	ART1	16	4.07	0.49
	ART2	13	3.73	0.58
	ART3	23	3.51	0.72
	ART4	17	3.76	0.75
	ART5	19	3.61	0.56

Splitting the answers by ART, the mean value of all activities shows that ART1 is closest to spending just the right amount of effort, while ART3 is furthest away. These results, shown in Table 4.12, are consistent with the previous question, indicating that the ARTs that encounter challenges more often also tend to have an imbalance in the effort spent on various decision-making-related activities.

4.1.5. Decision-making Satisfaction and Perceived Effectiveness

The survey was concluded with a question about how satisfied the respondents were with the current decision-making processes, as well as a question about how effective they perceived these processes to be. The respondents could choose between the following alternatives on a five-point Likert scale (which were assigned corresponding numbers during the data analysis): very dissatisfied/ineffective (1), somewhat dissatisfied/ineffective (2), neither satisfied/effective nor dissatisfied/ineffective (3), somewhat satisfied/effective (4), and very satisfied/effective (5).

***Table 4.13**: Satisfaction and perceived effectiveness, split by role.*

Metric	Role	N	Mean	SD
Satisfaction	ART Leadership	4	3.25	0.96
	Developer	59	2.98	1.08
	EM	3	3.00	1.00
	Other	3	3.00	1.00
	PO	8	3.00	0.76
	ScM	11	3.36	1.12
Effectiveness	ART Leadership	4	3.00	0.82
	Developer	59	2.93	1.03
	EM	3	3.67	0.58
	Other	3	3.33	1.16
	PO	8	2.63	0.92
	ScM	11	3.09	1.38

The results, which can be seen in Table 4.13, illustrate that Scrum Masters (3.36) are the most satisfied with the decision-making process, followed by ART leadership (3.25). The rest of the roles are at similar satisfaction levels. When it comes to perceived effectiveness, Engineering Managers (EMs) scored the highest (3.67) while POs scored the lowest (2.63).

Tables D.5 and D.7 in Appendix D show contingency tables for satisfaction and perceived effectiveness, split by role. A Chi-squared test of association was also conducted. The results for satisfaction, seen in Table D.6 in Appendix D, show that $p = 0.804$. This suggests that there

is a statistically insignificant difference in satisfaction across different roles. The same goes for perceived effectiveness, having a p-value of 0.511 as seen in Table D.8 in Appendix D.

***Table 4.14**: Satisfaction and perceived effectiveness, split by ART.*

Metric	ART	N	Mean	SD
Satisfaction	ART1	16	3.69	0.79
	ART2	13	3.23	0.93
	ART3	23	2.78	1.20
	ART4	17	3.18	0.95
	ART5	19	2.58	0.84
Effectiveness	ART1	16	3.56	0.89
	ART2	13	3.08	0.95
	ART3	23	2.70	1.22
	ART4	17	3.18	0.88
	ART5	19	2.53	0.91

Table 4.14 shows that ART1 is both the ART that is the most satisfied with their decision-making process and the one that ranks highest in perceived effectiveness. Contrary, ART3 and ART5 are the ARTs that are the least satisfied with their decision-making process and the ones that rank lowest in perceived effectiveness.

***Table 4.15**: Contingency table for satisfaction, split by ART.*

Satisfaction		ART					
		ART1	ART2	ART3	ART4	ART5	Total
1	Observed	0	0	4	1	1	6
	% within column	0.0 %	0.0 %	17.4 %	5.9 %	5.3 %	6.8 %
2	Observed	1	4	6	3	9	23
	% within column	6.3 %	30.8 %	26.1 %	17.6 %	47.4 %	26.1 %
3	Observed	5	2	5	5	6	23
	% within column	31.3 %	15.4 %	21.7 %	29.4 %	31.6 %	26.1 %
4	Observed	8	7	7	8	3	33
	% within column	50.0 %	53.8 %	30.4 %	47.1 %	15.8 %	37.5 %
5	Observed	2	0	1	0	0	3
	% within column	12.5 %	0.0 %	4.3 %	0.0 %	0.0 %	3.4 %
Total	Observed	16	13	23	17	19	88
	% within column	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %

***Table 4.16**: Contingency table for perceived effectiveness, split by ART.*

Effectiveness		ART					
		ART1	ART2	ART3	ART4	ART5	Total
1	Observed	0	0	5	0	1	6
	% within column	0.0 %	0.0 %	21.7 %	0.0 %	5.3 %	6.8 %
2	Observed	2	5	5	5	11	28
	% within column	12.5 %	38.5 %	21.7 %	29.4 %	57.9 %	31.8 %
3	Observed	5	2	6	4	3	20
	% within column	31.3 %	15.4 %	26.1 %	23.5 %	15.8 %	22.7 %
4	Observed	7	6	6	8	4	31
	% within column	43.8 %	46.2 %	26.1 %	47.1 %	21.1 %	35.2 %
5	Observed	2	0	1	0	0	3
	% within column	12.5 %	0.0 %	4.3 %	0.0 %	0.0 %	3.4 %
Total	Observed	16	13	23	17	19	88
	% within column	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %

***Table 4.17**: Chi-squared test for satisfaction and perceived effectiveness, split by ART.*

χ^2 Tests (N = 88, df = 16)		
	Value	p
Satisfaction	23.6	0.098
Effectiveness	27.6	0.035

Tables 4.15 and 4.16 show contingency tables for satisfaction and perceived effectiveness, split by ART. A Chi-squared test of association was also conducted. The results for satisfaction, seen in Table 4.17, show that p = 0.098, so the result is statistically insignificant at a 0.05 level. However, at a 0.10 significance level, the results show a significant difference in satisfaction across different ARTs. For perceived effectiveness, however, p = 0.035 as seen in Table 4.17, showing a clearer statistically significant difference across ARTs.

These results are once again in line with previous results, showing that the ARTs that encounter challenges more often and that tend to have an imbalance in the effort spent on various decision-making-related activities, also seem to be less satisfied with the current decision-making processes and perceive them to be less effective. Another interesting insight is that, when looking at satisfaction and perceived effectiveness, ARTs seem to be more predictive than roles. Both satisfaction and perceived effectiveness vary considerably across ARTs (with Chi-squared values of 23.6 and 27.6 respectively), while they vary less across roles (with Chi-squared values of 14.5 and 19.2 respectively). This indicates that some ARTs may be "better" than others at decision-making, potentially due to factors such as structures, processes, leadership, or culture.

4.1.6. Correlations

As depicted fully in Appendix E, showing a correlation matrix, many of the correlated variables were between sub-questions, between questions in the same category, or between two questions that were related in nature, thus not providing many interesting insights. However, a few more insightful correlations could be identified, being highlighted below.

Satisfaction with current decision-making processes was positively correlated with how effective the person perceives the process to be ($r = 0.719$, $p < .001$). Furthermore, *Follow-up on decisions* was positively correlated with *Clarify and document decisions* when considering if it is done too little, too much, or just right ($r = 0.476$, $p < .001$), and *Involve ART leaders* was positively correlated with *Involve Zenseact leaders* ($r = 0.717$, $p < .001$). The correlation matrix also shows which challenges were most correlated with decision-making satisfaction and perceived effectiveness. When it comes to satisfaction, the following challenges were the most strongly negatively correlated (all with $r < -0.463$ and $p < .001$): *Lack of shared understanding*, *No arena for solving conflicts*, *Not involving the team*, *Missing a clear prioritization*, *Low committing to the plan*, *Lacking team orientation*, and *Decision-hijacking*. For effectiveness, only some of the same challenges were as strongly negatively correlated (with $r < -0.459$ and $p < .001$): *Lack of shared understanding*, *No arena for solving conflicts*, *Missing a clear prioritization*, and *Low committing to the plan*. Conversely, the challenge that correlated the least with satisfaction and perceived effectiveness was *Not confronting each other*, with $r = -0.168$ for satisfaction (however with $p = 0.117$) and $r = -0.242$ for perceived effectiveness (with $p = 0.023$).

4.1.7. Exploratory Factor Analysis

To identify the underlying structure of the survey data and determine the number of latent factors, an exploratory factor analysis (EFA) was performed. When looking at the 33 variables of the dataset covered in Section 4.1.1, *Frequency of decisions*, Section 4.1.3, *Frequency of decision-making challenges*, Section 4.1.4, *Effort spent on decision-making related activities*, and Section 4.1.5, *Decision-making satisfaction and perceived effectiveness*, the analysis revealed three distinct factors, each representing a cluster of related items.

As a first step of conducting the EFA, assumption checks were performed. These can be found in Appendix F. Bartlett's test for sphericity was used to verify whether there is a significant divergence between the observed and null correlation matrices (Navarro and Foxcroft, 2023). The result, with $p < 0.001$, shows that the test is significantly divergent and thus appropriate for EFA. Further, sampling adequacy was checked using the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy, a measure indicating the proportion of variance among the observed variance that may be common variance (Navarro and Foxcroft, 2023). All variables but two (*Make decisions with confidence* and *Involve the PO*) have KMO values above 0.5, which are considered adequate. The overall KMO measure was 0.750, suggesting a good sampling adequacy which makes EFA suitable (Navarro and Foxcroft, 2023).

Next, the number of factors to extract from the data was decided. This was done through a combined judgment of looking at the eigenvalues and a parallel analysis technique. A scree plot was used to choose all components with eigenvalues greater than one, resulting in four factors with more variance than a single observed variable (Navarro and Foxcroft, 2023). However, the fourth factor was just above one. For the parallel analysis, the eigenvalues were contrasted with those that would have been derived from random data. This technique resulted in three factors when using a minimum residual extraction method. Based on this, three factors were chosen for the analysis. Additionally, an oblique rotation, namely Oblimin, was selected as this is preferred for correlated factors (Navarro and Foxcroft, 2023). Of the extracted factors, factors 1 and 3 were slightly negatively correlated, thus making an oblique rotation preferred. A table with inter-factor correlations and a summary of the factor statistics can be found in Appendix F.

Table 4.18 shows the factor loadings for the 33 variables. Loadings of less than 0.3 have been hidden as only the high loadings are useful indicators of the latent factor. The results show that

Factor 1 includes many of the variables in Section 4.1.3, *Frequency of decision-making challenges*, with high loadings (above 0.5) for 11 variables. The variables *Satisfaction* and *Effectiveness* were also included in this factor, although with strongly negative factor loadings. This seems reasonable since the satisfaction and perceived effectiveness with decision-making processes are likely affected by how frequently challenges are encountered. Factor 2 is more clearly separated from the other factors and matches well with the variables in Section 4.1.1, *Frequency of decisions*. This is reasonable as they all measure the frequency of decisions. It also makes sense that *Affected* has a lower loading since all the other variables in Factor 2 are related to or involved in making decisions, while *Affected* instead measures how often a respondent was affected by a decision. However, several variables under Section 4.1.4, *Effort spent on decision-making-related activities* were also present in this factor, although with low negative factor loadings. Lastly, Factor 3 indicated that *Involve ART leaders* and *Involve Zenseact leaders* are related to a common factor, with *Involve the PO* and *Discuss conflicting views* being related, but not as strongly, to the same factor.

The EFA presents interesting insights into which variables impacted decision-making satisfaction and perceived effectiveness the most and the least. As shown in Table 4.18, five decision-making challenges had factor loadings above 0.60: *No arena for solving conflicts*, *Important decisions are not aligned*, *Missing a clear prioritization*, *Conflicting priorities within the company*, and *Low committing to the plan*.

***Table 4.18**: Exploratory factor analysis.*

Factor Loadings				
Variable	**Factor**			**Uniqueness**
	1	**2**	**3**	
Involved		0.615		0.573
Affected	0.316	0.404		0.673
Aligning plans		0.844		0.285
Allocating resources		0.634		0.547
Development tasks		0.678		0.554
Lack of shared understanding	0.567			0.686
Not understanding the complexity	0.557			0.696
No arena for solving conflicts	0.600			0.458
Not involving the team	0.534			0.585
Important decisions are not aligned	0.688			0.553
Missing a clear prioritization	0.847			0.335
Missing a definition of done	0.591			0.560
Conflicting priorities within the company	0.698		0.311	0.555
Low committing to the plan	0.665			0.510
Not confronting each other		0.345		0.764
Lacking team orientation	0.497			0.528
Unrealistic plans	0.494			0.721
Decision-hijacking	0.557			0.633
Lack of knowledge	0.515			0.675
Technocracy	0.486			0.776
Communicate		-0.339		0.802
Utilize collaborative tools				0.862
Spend time and energy		-0.327		0.838
Discuss conflicting views		-0.304	0.327	0.700
Make decisions with confidence				0.867
Draw on data and information				0.816
Follow-up on decisions	-0.365			0.742
Involve the PO			0.370	0.857
Involve ART leaders			0.722	0.431
Involve Zenseact leaders			0.617	0.546
Clarify and document decisions		-0.311		0.735
Satisfaction	-0.643		0.347	0.348
Effectiveness	-0.629			0.526

Note. 'Minimum residual' extraction method was used in combination with an 'oblimin' rotation.

4.2. Thematic Analysis Answering RQ1

The following section presents the empirical findings from qualitative data aiming to answer RQ1, mainly collected from interviews, with support from answers to the open-ended survey questions and the contextual data. To provide clarity around which data comes from which survey respondent or interviewee, each research participant has been numbered, see Table 4.19. As explained in detail in Section 3.4.2, *Thematic Analysis*, the empirical findings have been categorized into the three following categories: Challenges with information flow, Challenges in collaboration and understanding, and Complexities and coordination in decision-making processes. Further, when presenting the findings, each challenge has been connected to the three decision-making levels presented by Moe et al. (2012): strategic, tactical, and operational.

***Table 4.19**: Overview of survey respondents and interviewees.*

Role	Data collection method
Developer 1	Interview 1
Developer 2	Interview 3
Developer 3-7	Interview 12
Developer 8-12	Interview 14
Developer 13-27	Survey
PO 1	Interview 2
PO 2	Interview 7 and 11
PO 3	Interview 13
PO 4-6	Survey
EM 1	Interview 8 and 11
EM 2	Interview 9 and 13
EM 3	Interview 10
ScM 1	Interview 12
ScM 2	Interview 14
ScM 3 and 4	Survey
Consultant 1	Interview 4
ART Leadership 1	Interview 5
ART Leadership 2	Interview 6

4.2.1. Challenges with Information Flow

Effective information flow is crucial for decision-making processes to be effective, yet numerous challenges exist in the areas of communication and documentation. One challenge illustrating a lack of communication on a strategic level was brought up by Developer 27, expressing a belief that the long-term plan of the company is not communicated very clearly. Developer 16 believed that long-term planning was entirely lacking.

Another challenge in this area is that people do not always interpret the same problem in the same way. Such misinterpretations can happen both on a strategic, tactical, and operational level. PO 5 put it the following way:

"It is not uncommon that people believe they are discussing the same thing without realizing that they are in fact discussing completely different topics. For example, a question is fundamentally misinterpreted, and an answer is provided to a completely different question."

Yet another decision-making challenge, also related to communication, this time on a tactical level, was identified in the interviews. PO 2 reflected on how dependent the teams are on the PO and EM when it comes to how well decisions are communicated to them. Some POs or EMs may be extremely good at communicating with their teams, while others are not, meaning that it can vary significantly between teams how well-informed they are. This communication

becomes especially important considering that it is often tricky for developers to get insight into what is discussed in the many forums in which the POs and EMs participate, because of a lack of transparency in the information flows. Consultant 1 emphasized this too, explaining that because of the lack of communication channels between teams, the teams rely heavily on the PO for information:

"How well informed the teams are depends heavily on how good the PO is at communicating. It often relies on one specific person!"

When asked about what decision-making challenges they were facing, Developer 24 answered the following:

"Being promised deliveries that do not arrive on time without any communication about the delay."

This challenge on an operational level is also brought up by Developer 2 who phrased it as an uncertainty and lack of communication from people and teams that they depend on.

According to Developers 9 and 10, decision-making processes can sometimes become slow when too much information is going through the PO. However, as the team said, it is not that often that this is needed. Another team of developers described how the process is usually slower if operational decisions are taken the official way. For example, requesting to add a new item to the backlog is often slower than asking someone directly for help since it reduces overhead.

A challenge on a strategic level is a lack of a communication channel strategy. In other words, it is not clearly mapped or defined what is to be communicated where. Consultant 1 explained this challenge, highlighting several underlying factors, including that there are too many information channels and that the way of communicating varies significantly within the organization. Decisions, for example, can be communicated on Slack, but also in a Teams channel, somewhere else in SharePoint, on Confluence, or sometimes even in Jira. In certain cases, the same information can be found in several places, while in others it may not be found anywhere. It may at least not be accessible for the person needing it. Also, Developers 15 and 25 expressed concerns about there being too many parallel information flows, making it difficult and time-consuming to find the right information. Developer 15 explained it this way:

"Except for the product info meeting, there is no good digest of information to my team. Decisions that are taken are communicated on Slack, but to get all the information that is important to me, I have to read through a lot of information that is at best tangential. That takes a lot of time. If I invest less time and listen to fewer information channels, I will miss relevant information."

This concern, mostly about the difficulties of finding relevant information, is explained further by Consultant 1, separating the challenges into Slack and Confluence, the two main communication and information management tools used in the organization. In Slack, finding information is challenging because of the high number of channels and the fact that the information is stored in a flow. Developer 4 added that it is not clear in which channel strategic questions and decisions linked to those are communicated, while Developer 10 raised a concern that decisions may sometimes be documented in private Slack channels. When it comes to Confluence, however, the challenge is more about its inferior search functionality and information not being well structured or updated. PO 2 explained it as a case of information overflow.

Another documentation-related decision-making challenge had to do with clarifying and documenting decisions. Several factors contributed to this, one of which was mentioned is the

dependence on note-takers for documentation. PO 2 explained how the quantity and quality of documentation is highly dependent on the note-taker, leading to high variation in what and how much is being documented in different teams and situations. For instance, if the person responsible for taking notes is also very involved in the discussion it might be challenging for that same person to simultaneously take comprehensive notes. When asked if they believed they spent too much or too little time on clarifying and documenting decisions, EM 2 responded that it depends on the background the person has and varies remarkably between generations. EM 2 had the impression that there is a difference in mentality between generations regarding how much documentation is believed to be sufficient. Whereas older generations tend to document more extensively, younger generations tend to not appreciate such work as much, more often questioning its value.

4.2.2. Challenges in Collaboration and Understanding

Collaboration and understanding are central to maintaining alignment and managing backlogs effectively, both impacting cross-team decision-making processes. A challenge mentioned related to this category is a lack of understanding of what other ARTs do, and relatedly a lack of knowledge about dependencies, both resulting in challenges with alignment. Developer 26 described it in the following way in the survey:

> *"Very low collaboration between ARTs for a common issue, hard to make focus groups across ARTs which leads to lack of knowledge."*

Lack of understanding was also mentioned as a challenge in the interviews, not only between the ARTs but sometimes also between teams within the same ART. Stakeholder review meetings were given as an example by ScM 1 of a scenario where it could be difficult for the different parties to understand each other's situation and how much effort and risk a decision comes with, making it challenging to make prioritizations. Another situation is when one team contacts another team for help without understanding that their work is of a lower priority for the contacted team. In such a situation the contacted team may feel that it is awkward to bring it up to their EM as that would feel like "going to their parent", but at the same time, it is unfeasible for them to help the team directly as that will likely affect the backlog items already committed to for the Sprint.

Developer 20 explained how there may also be a lack of understanding at a higher organizational level, showcasing a challenge on a strategic and tactical level:

> *""Higher" organizational level might lack understanding or insight while "lower" organizational level can lack capability to make or enforce a decision. Especially for areas where there is no clear owner on "higher" organizational level, resulting in that it can be very difficult to acquire mandate to make a decision with broad impact."*

It may also mean that higher organizational levels decide that something has to be done, for example, compliance work, without being fully aware of what exactly has to be done and the complexities of it, including how long it would take. Developer 22 believed that this was due to a lack of technical knowledge in middle management. ScM 1 also brought up how a lack of awareness of complexities from higher organizational levels could create alignment challenges. Some developers, both in the survey and in the interviews, describe this lack of awareness to be related to a lack of collaboration between developers and the product organization. Developer 13 put it this way:

> *"I think it is negative that developer and managers/product-organization are not collaborating more closely with each other – it is like two separate organizations."*

On a tactical level, complexities and a lack of understanding of them can be manifested as issues with alignment. EM 2 described a situation in which important decisions were not aligned, saying that one of her teams oftentimes lacked the alignment and priority from the ART PM as this person in turn needed to align with another ART PM, something that was not done often enough. A consequence of this was that the PO for that team had a very challenging time aligning priorities with other POs within the same ART, often realizing that the priorities were indeed different.

As many of the decision-making challenges in large-scale agile organizations are related to coordination and managing dependencies, Developer 22 believed that more attention should be given to reducing team dependencies through architectural decisions and planning:

"There is too much focus on aligning between teams rather than focusing on reducing cross-team dependencies by architecture and planning."

However, this is probably easier said than done as PO 2 explained how difficult it is to change the scope and capacity of teams due to managerial aspects, knowledge, and cost. For example, as PO 2 described it, the team size cannot easily be reduced or increased to support other teams in urgent deliveries because of factors such as the management of people and teams, and cost calculations making it complex.

Several decision-making challenges with backlog management were mentioned in the interviews, oftentimes impacting prioritization decisions, or put differently, tactical decisions related to resource allocation. One such challenge is situations when backlog items are not refined ahead of the Sprint Planning meeting. According to PO 2, this may lead to the Sprint Planning meeting becoming lengthy and inefficient:

"If the backlog has not been refined enough before the Sprint Planning meeting, time needs to be taken to discuss and clarify requirements. This risks making the Sprint Planning meeting unnecessarily long."

Conversely, if the backlog were to remain unrefined it may result in inaccurate capacity planning, where too much or too little effort is estimated for each item. Unrefined backlog items may not only cause challenges on a tactical level but also on an operational level. For example, as Developer 4 explained, if the backlog items remain unrefined when the Sprint starts, developers may struggle to understand the scope of work, causing inefficient coding, overcommitment, or underutilization of resources, ultimately affecting what is being delivered.

Developer 2 also expressed difficulties in keeping the team's backlog prioritization in cases when new decisions are coming from "above", adding new backlog items with higher priority. Since the team only can finish the work items committed to at the start of the Sprint, this means some of the items will remain unfinished at the end of the Sprint. Frustration about changing prioritization during the Sprint is mentioned in one of the other developer interviews too, particularly if someone comes with tasks that are not properly prioritized by the PO or if the new prioritization means that the developers have spent a lot of time on something that suddenly becomes irrelevant.

4.2.3. Complexities and Coordination in Decision-making Processes

Navigating the complexities of cross-team decision-making processes requires effective coordination, presenting various challenges. One of the overarching strategic level challenges affecting the effectiveness of the decision-making process is project complexity, in this case specifically AD-ADAS integration. Therefore, at its core, this is also very much a product complexity with challenges related to sensor fusion and perception, safety assurance, data privacy, and regulatory compliance. This challenge was specifically brought up by PO 4 in the survey, but also broadly mentioned in the interviews. EM 2 said that "the nature of both the

problem and the solution is making it complex". PO 2 added the following when product complexity was talked about during the interview:

"I believe working in an agile way makes it easier, because the product is so complex."

Complex decision-making processes, with high variability and uncertainty, bring challenges in coordinating the entire process, a challenge that is more of a strategic character. Ideally, everyone should be involved to get as many perspectives as possible. However, in reality, this is seldom feasible and instead risks extending the processes far beyond what is desirable. One such complexity on a strategic and tactical level is the tricky decision paths that come with many involved parties. During an interview, EM 1 expressed the following about starting to work with deep learning in a new way (referred to as DL2.0):

"It has been really difficult to incorporate DL2.0 in our way of working, including who is responsible for deciding how. I think this is because the decision affects so many and so much. There are too many people on the same level that are involved."

Too many people ultimately means that more coordination is needed, but also that it is not always clear who is responsible. This lack of responsibility, often to make the final decision, leads to further decision iterations, sometimes resulting in an unnecessarily lengthy process.

Furthermore, during one of the interviews, EM 1 raised a challenge about making decisions where tradeoffs or pros and cons need to be considered. According to this EM, it is often more challenging and time-consuming with decisions that require the decision-maker(s) to choose between different alternatives because they need to evaluate each option carefully. Making such decisions can take unnecessarily long, also since the alternative cost of doing something affects people on a psychological level.

Additionally, PO 3 explained in the interview how the teams do not always have a good process for work related to teams other than their immediate stakeholders:

"There is room for improvement, especially that we can have more structured synchronization when we have work relating to many teams other than immediate stakeholders' input and output. In those cases, we take too many iterations on decisions. We have some autonomy in some areas, but these cases don't fall under one of these areas, so we don't have a good process around it."

Another challenge is connected to striking the right balance between responding to change and following a plan. More specifically, about the planning horizon, including the length of the Planning Interval (PI). Developer 17 stated the following, expressing dissatisfaction with the PI length and its compatibility with agile:

"One major issue with planning for three months is that it leans towards waterfall rather than an agile way of working."

This is related to difficulties in backlog management and keeping prioritizations because with lengthy PIs comes an increasing risk that priorities may shift, new requirements emerge, and the backlog becomes outdated.

Several of the interviewees described challenges in ways of working type of decisions, in other words, decisions that involve determining an organization's methods and processes, such as establishing a new process for task allocation or documentation, whereas making product decisions is often easier. PO 3 said that this is because product-related decisions mostly have a good structure and flow, with Jira and specific forums, while ways of working type of decision seldom have such a clearly defined process. Further, EM 2 believed that this is due to interpersonal aspects such as communication styles, team dynamics, and trust. When asked whether the company's agile practices affected this, EM 1 answered the following:

”I believe it has more to do with the culture that comes with the agile practices, rather than the practices itself. I think it suits us very well in Sweden at least, since the Swedish way of working aligns very well with the agile values.”

Consequently, EM 2 sees room for improvement by having a more structured synchronization with the other involved teams that can help reduce the number of iterations needed to reach a decision. EM 1 and PO 2 also mentioned that decisions regarding ways of working questions often are more challenging because the process is more ambiguous compared to product decisions. Additionally, PO 3 described how the information flow for ways of working type of decisions is more ad-hoc, with less comprehensive documentation, making it more challenging to track the origin of such decisions and discussions.

4.3. Thematic Analysis Answering RQ2

This section introduces the empirical findings connected to improvement ideas to address the challenges described in 4.2. Therefore, while naturally interconnected, they are structured to address challenges with unclear information flow, collaboration and understanding, and complexities and coordination in decision-making processes.

For improvements addressing challenges with unclear information flow, they try to improve cross-team communication and decision rationale, increase accountability and responsibility, and centralize and update information systems. For challenges addressing collaboration and understanding, the improvements aim to enhance cross-team collaboration, increase organizational clarity, improve alignment, and boost backlog management and process refinement. Lastly, for the improvements that address complexities and coordination in decision-making processes, the goal is to streamline the decision-making process and address technical complexities.

4.3.1. Addressing Challenges with Information Flow

Several interviewed developers felt that more communication is generally better than less, especially when working cross-team and talking about quality expectations. Furthermore, several different roles mentioned the need to inform people about why a decision is being taken. It is important to keep the team informed and updated on decisions being taken outside the team to make them feel involved. Developer 14 put it this way:

“The PO and higher management should preferably spend more time with the team and be in the office more since this would align better with the decision-making and help with having more effective communication. Otherwise, we sometimes feel that the decision is taken outside of the team’s control, or without being discussed with the team.”

The idea of increased communication was further explained by an EM, who also believed that it strengthens the involvement that teams feel. These efforts to enhance communication have also been emphasized by Developer 10, who feels that more communication is, in most cases, better than less communication. This could be especially true to increase transparency, particularly connected to other teams that are not in direct contact daily.

“Generally, the more we talk is usually the better – especially with teams we don’t meet often.”

As these targeted challenges are broad, naturally, so are the improvement ideas. Developer 1 mentioned that it should be ensured that there is clear communication about status updates and specified who should be contacted for various questions. Several other developers also

addressed that it is important to maintain frequent communication with other teams and set expectations regarding quality. Therefore, the consensus is that more communication is generally better than less in these contexts.

Furthermore, to provide clear communication of the strategic direction, the previously mentioned proposal of having managers spend more time at the office could help. This way, people would have an easier way of communicating continuously, and help discuss why decisions are being made. Furthermore, there are improvements to be found in terms of architecture, as mentioned by Developer 23 in a question asking for ideas:

"Transparent architecture with some kind of plan of direction, steps to take, and goals."

On the other hand, interviewed developers felt that there are improvements to be made in documenting decisions, including decision goals and motivation. This is also supported by EM 2:

"We need to become better at informing and documenting why we need to make a decision."

Improvements identified for suboptimal and varying decision documentation were operational, as it was mentioned by developers that there is a need to become better at documenting some decisions, including the goals and motivations for a decision. For instance, Developer 11 explained it like this:

"[…] like the goal of this meeting is to decide something. Or in your meeting notes, to be more explicit when it comes to decisions could probably be more helpful. […] to write it down basically. I think that gives a good feeling."

For alignment issues stemming from not fully comprehending the complexities, several mentioned ideas could be relevant for improvements. The consensus that communication is vital, and the explained need for informing about why decisions are made, can help with addressing complexities between roles and be considered in future decisions or work.

Furthermore, the following improvement ideas connect to the challenges stemming from unclear communication, which is first and foremost targeted at increasing accountability and responsibility. Or as EM 3 put it:

"With responsibility comes empowerment."

However, while several interviewees believe in team responsibility, EM 3 also brought up the following thought:

"Shared responsibility is no responsibility."

Therefore, it is believed that it should always be written down who is responsible for a decision and connecting it to a deadline. It has been observed that several product-oriented forums use a structured approach including these mentioned steps, however, non-product-oriented forums could become more structured. In this context, non-product-oriented forums are often run by EMs and involve interpersonal questions, while product-oriented forums are run by POs and entail technical and product questions.

The idea of responsibility is something that has been expanded by other participants as well. For example, when writing down responsibilities, it was proposed that responsibility assignment frameworks could be used, such as RASCI or RAPID. As mentioned by PO 6, there is a need for clearer responsibilities:

"Make responsibilities clearer. Give clear mandate."

Furthermore, delegation is another improvement area connected to responsibilities, which was proposed to increase the speed and thus try and make decision-making processes more optimized for a broader range of topics. This was covered by Developer 1:

"We should delegate responsibility for areas more than just features to make sure someone does it."

The common view on improving the challenges related to finding information about decisions has been that it is an overwhelmingly comprehensive task. As information today is scattered and difficult to find, improvement ideas have been focused on gathering all information in one central *Content Management System* (CMS) or *Customer Relationship Management system* (CRM), which is not Confluence or Slack, as these lack tools to properly direct information. Additionally, while interviews have shown that decision forums work suitably, Developer 18 feels differently:

"It's hard finding the right forums and people to talk to. You need to summarize all that on a page somewhere."

Another idea to make information easier to find was connected to updating Confluence, where it was emphasized that old information is removed from Confluence and that a tool used to approve that the information is up to date is introduced. Once again, Developer 18 further emphasized this solution:

"[…] it's really obnoxiously hard to find accurate information on Confluence. How to solve this? Auto delete all pages older than X months that haven't been cleared by the people that worked on them."

Furthermore, Consultant 1 had some technical ideas that should be introduced, where SSO-logins should be used for intranet platforms. This way, it was believed that all employees could access information systems more regularly and easily. Lastly, one common decision log should be used, with automated send-outs to relevant people. Worth noting is that efforts to improve this area have already been made, particularly to showcase what meetings are taking place and the implementation of smaller decision logs.

Additionally, it became known that previous efforts to focus entire PI planning on documentation have been done to create a more unified view and understanding of the need for documentation.

4.3.2. Addressing Challenges in Collaboration and Understanding

Several ideas regarding improvements to collaboration and team dynamics were mentioned, such as facilitating collaboration by making teams sit closer to each other or arranging after-work, which was seen as the responsibility of the EM. Additionally, interviewees also mentioned how they believe in team responsibility, and as put by ScM 4, all relevant roles and teams should be represented:

"Make sure there are representatives of all parts when doing refinement and making decisions."

Other improvement ideas were mentioned during the survey and interviews that address the issue coming from limited collaboration and understanding between the different actors within the organization. Some of these surrounded the need to enhance communication at a strategic level, especially between POs and Architects, as presented by ScM 3:

"Better communication between POs and Architects which is then communicated down to teams instead of developers interrupting development time to find correct teams, POs, etc. to communicate to."

Additionally, there were also ideas on improving organizational clarity to be able to increase the collaboration and understanding between different roles. For example, team principles should be clearly defined, while dependency graphs could also be used to increase the knowledge about dependencies between teams. One idea that was tested at one ART was to have an open day that showcases all teams in a particular ART. Another idea, using provided tools to facilitate understanding, was introduced in the following way by Developer 18:

"[…] the main problem with decision-making is that not everyone, at all times, has a clear picture of what product we are actually making and how it fits together. Please just put a good summary of how everything fits together somewhere, how things are tested, what features go where, etc., not too deep but not too light on the technical stuff."

However, as noted by EM 2, there needs to be an agreement between the actors involved and impacted by a decision for collaboration to work. This way, all participants have an opportunity to address and understand the issue at hand.

"There needs to be a handshake on it for the responsibility, so that everyone understands, due to the workload."

The difficulties surrounding collaboration in setting team scopes and dependencies impacting cross-team alignment were particularly expressed by EM 2. In their reflection on the solution for an issue regarding the borrowing of other team members to help with understaffed teams, they put it like this:

"It was good that I was the manager, as I could be aligned for myself. It would be a much bigger challenge if I needed to borrow members outside of my area."

However, while working, being dependent on only individual work areas is not desired. Therefore, it is safe to assume that there are improvements to be found in the use of forums by implementing more focus on alignment issues and communication surrounding those.

For backlog management and prioritization, it has been found that collaboration through communication in general can help to improve this. Teams need to be able to communicate with each other, both about the status and quality of work between them, to properly align it with the backlogs. ScM 1 described it like this:

"[…] we have someone requesting us to do something but the requester doesn't understand, then it's necessary with some refinement or like to slow down in that decision-making process to leave some gap, some chance for us, to estimate how big it is."

Furthermore, some process improvements could also be applied to decrease these challenges. For example, improvements incorporating feedback loops could naturally create opportunities for POs to properly align and prioritize the backlogs.

Additionally, the idea of introducing a common backlog was mentioned. Coming from having important tasks being left unattended due to process weaknesses, the idea was envisioned by Developer 19 as this:

"I believe we would be way more effective as an organization if we had a company-wide backlog where anyone can add a task and we first prioritize them, then we decide what tasks teams should be working on based on what is most important. It would help us decide what to work on and how to align our efforts."

Additionally, systematic planning seems to also be a key to improving these types of issues. Previously mentioned company-wide backlogs could be used for clear communication for all teams, as well as previously mentioned upfront architectural work connected to final deliverables. This could also help in both showing and addressing various complexities.

4.3.3. Addressing Complexities and Coordination in Decision-making Processes

While the complexities surrounding Zenseact are a natural factor due to the field of work, there were some improvement ideas to make sense of it. One such idea was on the theme of architecture, as put by PO 1:

"More upfront architectural work connected to final deliverables, for example, code on target, would help to reduce the number of late and painful decisions."

Furthermore, a more structured approach in meetings for each agenda item is another improvement that could address complexities and optimize decision-making processes, particularly in non-product-oriented forums. To increase decision transparency, non-product-oriented forums could establish similarly structured meetings as product-oriented forums, as these already use a structured approach for each agenda item including responsibilities, expected outcomes, and decisions.

While these challenges can be hard to improve with pin-pointed efforts, the ambiguity and complexity often come from new experiences that impact the way decisions are made. Therefore, PM 3 explained how it could be improved:

"We need to reflect on how we can take that decision in a more structured way the next time."

Additionally, to increase the speed of the decision-making processes in complex situations, Developer 21 had a rather straightforward proposal:

"Dare to take decisions. Don't let time take the decisions for you."

Furthermore, to decrease the difficulty in making decisions that require some kind of analysis of different alternatives, interviewees believe that the decisions need to be iterated and go through feedback loops. However, as EM 1 noted, in this case, there are clear deadlines and high safety requirements that may limit the possibilities for iterations:

"Our deadlines and safety requirements don't fully give us proper time for iterations and feedback, so we need to find a workaround in some way."

To increase the technical knowledge in middle management and thus improve complexity understanding, it is believed that a thorough explanation and visualization of the product, components, and dependencies is needed. For example, the idea of summaries showing product information and dependencies between parts, explained by Developer 18 in Section 4.3.1, could be helpful. By including a more technical perspective, PO, EMs, and ART leadership could increase their knowledge about the technical perspectives, helping in the collaboration with developers.

However, the complexity connected to the technical nature of product development is hard to improve. Therefore, no relevant ideas were provided as the complex nature of this field is not easily changed and has certain requirements. Furthermore, challenges in the lengthy iteration cycles were not directly addressed, due to the setup being linked to the organizational dependency between Zenseact and its owners.

5. Analysis and Discussion

This chapter aims to analyze and discuss the empirical findings considering existing knowledge presented in the theoretical background. This master's thesis aimed to explore challenges in cross-team decision-making processes in large-scale agile organizations, and to provide insights into how these processes could be improved. This is achieved through two research questions which are analyzed and discussed consecutively in this chapter. Section 5.1, *Challenges impacting cross-team decision-making processes*, seeks to answer RQ1 while Section 5.2, *Improving cross-team decision-making processes*, seeks to answer RQ2.

5.1. RQ1: Challenges Impacting Cross-team Decision-making Processes

The first research question in this study aimed to explore challenges impacting cross-team decision-making processes. This section discusses the empirical findings related to this research question, including both the statistical analysis of the survey and the thematic analysis of the interviews, while also connecting and comparing it to theory from the literature review. The section starts with a discussion about the most common challenges identified in the survey together with other interesting insights from the statistical analysis, such as differences between roles and ARTs, and how the challenges correlate with satisfaction and perceived effectiveness. Thereafter, challenges in different areas are discussed further, including communication, documentation, collaboration and understanding, alignment and dependencies, and complexities and coordination.

Common Challenges and Their Statistical Connections to Measured Variables

Of the six most common challenges identified in the survey, two were within the category of aligning plans, three were within the category of allocating resources and one was within the category of development tasks. Within these categories, lack of understanding of complexities, lack of alignment, and difficulties with prioritizations emerged as the most common decision-making challenges in large-scale agile organizations. These findings are consistent with the interview data as *Challenges with information flow* were one of the identified categories in the thematic analysis of RQ1.

Interestingly, as can be seen in the findings from the survey, POs and developers encounter challenges more frequently while Scrum Masters and ART Leadership encounter challenges less frequently. This may be explained by the fact that POs and developers mostly deal with decisions about product features and priorities, which may involve complex trade-offs. Scrum Masters, on the other hand, mainly focus on facilitating the agile process, which may be less challenging. More surprising is that ART Leadership does not encounter that many challenges. However, it is important to keep in mind that the number of respondents with this role was quite low, making it hard to draw any major conclusions based on this.

Large differences were also seen between the ARTs, where ART3 and ART5 encountered the most challenges and ART1 and ART4 the least. This can be due to ART3 and ART5 having more dependencies between the teams within the ART as well as with other ARTs, making the

work more complex. Other possible reasons for this could be differences in employee background and mindset, maturity of the teams, and differences in leadership style.

When analyzing which variables impacted decision-making satisfaction and perceived effectiveness the most and the least, it was clear from the correlation matrix and the EFA that the variables connected to the different decision-making challenges negatively impacted satisfaction and perceived effectiveness the most. More specifically, *Lack of shared understanding*, *No arena for solving conflicts*, and *Missing a clear prioritization* had the largest impact on satisfaction and perceived effectiveness. Interestingly, these were also some of the challenges that were most frequently encountered, indicating that there is a relationship between how frequently a challenge is encountered and the satisfaction and perceived effectiveness of the decision-making process.

The analysis further shows that how frequently a person is involved or affected by a decision has no significant impact on decision-making satisfaction and perceived effectiveness. The same goes for the effort spent on the majority of the decision-making activities. However, *Involve ART leaders* and *Involve Zenseact leaders* were slightly positively correlated with satisfaction. This is an interesting insight since it goes against decentralizing decision-making. On the other hand, a wish for closer collaboration between developers and managers was mentioned in the interviews, matching this correlation. To further support this, Dikert et al. (2016) highlight management support as a key success factor for large-scale agile organizations, a factor that likely improves the decision-making processes as well by assisting with collaboration. Additionally, *Follow-up on decisions* was slightly positively correlated with perceived effectiveness, suggesting that this could be an important aspect to spend more effort on to increase the effectiveness of decision-making processes.

Furthermore, the EFA classified *No arena for solving conflicts*, *Important decisions are not aligned*, *Missing a clear prioritization*, *Conflicting priorities within the company*, and *Low committing to the plan* in the same factor, with high factor loadings for all four variables. This is the same factor where satisfaction and perceived effectiveness have strong negative loadings. Looking more closely at these variables it can be observed that all but one (*No arena for solving conflicts*) is related to allocating resources, according to the framework by Moe et al. (2012). Therefore, these findings reveal that challenges within allocating resources, which are decision challenges mostly on a tactical level, may affect satisfaction and perceived effectiveness more than other challenge categories. A possible reason behind this may be that decisions about resource allocation involve complex coordination that often leads to bottlenecks and inefficiencies (Moe et al., 2012), therefore impacting the satisfaction and perceived effectiveness more negatively than other decision-making categories when challenges are encountered.

Unclear Communication

Misunderstandings, where people do not interpret the same problem in the same way, are often the result of a lack of communication. This variability in interpretation can lead to significant challenges, especially when the product is complex and requires deep knowledge. By connecting to Cohn (2009), it could be argued that inadequate communication and documentation strategies could explain these information gaps that make it difficult to create cross-team alignment and clarity. Additionally, Moe et al. (2012) point out that the probability of misunderstandings and communication errors rises with the number of teams and team members, highlighting that the need for communication is even more important in large-scale

agile organizations. With this in mind, while relating to the empirical findings, the role of the PO and EM is crucial for clear communication, as they play a vital role in how well-informed the development teams are.

Inconsistent Documentation

The survey results show that 72% of respondents believe that they spend too little time and effort on clarifying and documenting decisions. However, as the second agile value highlights (Fowler and Highsmith, 2001), the primary focus should be on delivering working software rather than comprehensive documentation. Nevertheless, documentation is still important, and as argued by Dikert et al. (2016), it is even more so in large-scale agile organizations. This is because of the complicated dependencies emerging in such organizations making the agile process more difficult and often requiring more formal documentation. As a consequence, this often goes against the vital agile principle of limiting documentation and harnessing flexibility. At the same time, it is important to remember that the Agile Manifesto (Fowler and Highsmith, 2001) still sees value in documentation even if working software is valued more.

One interesting point mentioned in the interviews is the differences in documentation between generations. A possible reason why older generations often document more could be that they have been working for longer with traditional software development principles, such as waterfall, where detailed documentation is deemed more important. With most of their experience being different than agile, they may find comfort in extensive documentation as they are used to it. Older generations may also prioritize documentation more in their work since they have seen the effects of insufficient documentation in the past. Additionally, they may view documentation as a way to share expertise among various team members and generations. Younger generations on the other hand may only have worked in an agile context, where documentation is given less prominence (Fowler and Highsmith, 2001). They also often prioritize direct communication, and some may perceive documentation as tedious and unnecessary, especially if they have had negative experiences with outdated documentation in the past. However, as shown in the empirical data, the quantity and quality of documentation varies a lot between different individuals in general, no matter how many years they have spent in the company or in an agile context. As variations and inconsistencies in documentation across generations have not been specifically discussed in the literature, this may call for a larger emphasis on reliable methods that remove uncertainties and inconsistencies in the decision-making processes (March, 1996).

Documentation also seems to vary significantly across different types of decisions. As can be seen in the empirical data, documentation is often less comprehensive for ways of working type of decisions compared to product decisions. This is likely due to the nature of the decisions themselves. Product decisions more often involve clear outcomes, requiring detailed documentation to ensure alignment and accountability. There may even be legal requirements regarding documentation, for example, to allow for tracking when a certain decision was made and by whom. Ways of working decisions on the other hand may involve more nuanced considerations which can be harder to document. It is also reasonable to believe that ways of working decisions may be perceived as less important, leading to less emphasis on documentation.

Lack of Collaboration and Understanding

The empirical data shows that one of the biggest categories of decision-making challenges is connected to collaboration and understanding. This is not just a challenge in the context of decision-making, but on a more general level in large-scale agile organizations, as demonstrated by Edison et al. (2021) who mention that cross-team collaboration is one of the greatest obstacles in such organizations. Moreover, the most common decision-making challenge identified in the survey was not understanding the complexity. There are likely two reasons behind this, firstly, that the lack of understanding is related to the complexity of the product being developed, and secondly, that it is a consequence of limited collaboration. However, as mentioned in the findings, it is not obvious that simply communicating more will improve the challenge. Communication must also be done in an organized way without harming the agile way of working.

The empirical data also brings up a lack of understanding between different levels in the organization. This disparity is more noticeable in situations where there is no clear owner at a higher organizational level, which makes it challenging to get the authority to make decisions that will have a large impact. These results are consistent with arguments put out by Ktata and Lévesque (2009), who suggest that there is frequently a lack of mutual understanding between the development teams and the POs, often leading to irrational iteration plans which are changed frequently. Even if this lack of understanding between developers and POs is not very pronounced, as seen in the survey where most respondents believe that the level of PO involvement is good, there may sometimes still be a disconnect between developers and middle management. The empirical data suggests that this may be because of large discrepancies in technical knowledge. It is also reasonable to believe that this gap in technical knowledge can lead to misunderstandings, hindering effective collaboration.

Both a lack of understanding at a higher organizational level and a lack of awareness of complexities from a higher organizational level are expressed in the findings. Although related, a distinction can be made between the two. A lack of understanding implies that decisions may be made by higher organizational levels without them fully grasping the situation, leading to misalignment. On the other hand, a lack of awareness has more to do with the fact that the person does not recognize the full scope of complexities. While the literature has no explicit point of view, the former situation is likely more challenging to improve as it might be outside of control due to, for example, the inherent product complexity, while the latter is more connected to missing the bigger picture and could thus likely be solved easier by improving communication and collaboration.

Suboptimal Alignment and Dependencies

Zenseact, just like other agile organizations, relies heavily on decentralization, but these characteristics also make it more difficult to keep teams' alignment and consistency. Even though decentralization empowers lower levels of the organization, if it is not handled well, it can result in inconsistent decision-making and information sharing (Cyert and March, 1963). This supports the empirical challenges that arise when decentralized decision-making occasionally leads to barriers and misalignment of decisions. The theory emphasizes how important it is to have efficient tools and processes for collaboration that ensure everyone in the team is on the same page.

An interesting idea from one developer was to reduce team dependencies through architectural decisions and planning to allow for better coordination and dependency management. As described by Edison et al. (2021), limiting cross-team dependencies can help organizations speed up processes. However, doing so often reduces the overall value of the insights gained when teams must coordinate dependencies between each other. It is also important to note that this goes directly against the Agile Manifesto and its values and principles (Fowler and Highsmith, 2001), specifically the fourth agile value which prioritizes responding to change over following a plan. Limiting dependencies in itself may not be negative, but it may still be challenging due to several factors. First, it assumes that the work content and distribution across teams can be planned enough, despite the complexities involved in developing autonomous driving software. Second, it also assumes that it is possible to create an architecture of relatively independent features, allowing it to separate the workstreams in a good way. And third, it assumes that such planning would be desirable. There could for example be a risk that a reduction of dependencies creates a belief that alignment becomes less important. However, as the empirical data suggests, coordination and alignment will likely remain a fundamental challenge when making decisions in large-scale agile organizations. Based on the discussion above, there may be more value in focusing on improving processes and activities to help identify dependencies and nurture cross-team and cross-ART collaboration. One SAFe event that focuses specifically on this alignment is PI Planning (Scaled Agile Inc, 2023b), underscoring its importance if conducted appropriately.

Another interesting empirical finding that was not discussed in the agile literature regards the difficulties in changing the scope and capacity of teams due to aspects such as knowledge and cost. Even if the idea of forming and dissolving teams frequently based on emerging needs may be beneficial, it is likely very tricky in practice as when teams evolve and become more stable and mature, they presumably also become more difficult to change. This not only goes for managerial aspects but also political and cultural. Since restructuring teams often involves reallocating resources and redefining roles it risks disrupting established decision-making processes.

Unsolved Complexities and Coordination

As previously mentioned, having established processes and tools in place is crucial to allow for effective decisions to be made. While this is especially important in larger organizations where the level of uncertainty is higher due to more complex interactions between individuals and strategic considerations (Coleman, 1986), it is even more so in large-scale agile settings where decisions must align across various teams and layers of the organization, and where the environment is characterized by rapid changes and flexibility. However, as the Agile Manifesto highlights (Fowler and Highsmith, 2001), individuals and interactions are valued even more than processes and tools, pointing to a tricky balance. As promoted by frameworks like SAFe, more structure and established processes can be beneficial for large-scale agile organizations (Scaled Agile Inc, 2023a). For example, SAFe events and artifacts assist in aligning the organization. Such processes and tools exist at Zenseact, mainly for product decisions. The empirical data clearly shows that product-related decisions mostly have a good structure and flow, which is likely to be attributed to the well-defined processes including forums and documentation processes. However, the process is often less clearly defined for ways of working decisions. This is likely due to a larger variation in types of decisions and that the decisions could depend more on contextual factors based on interpersonal aspects such as personal relationships. As an EM stated, this probably has less to do with the agile work

procedures per se, and more to do with people, culture, and values. These thoughts are not discussed in large-scale agile literature directly, even if they can impact an organization's success drastically. Edison et al. (2021) also bring attention to the fact that large-scale agile methodologies, such as SAFe, may slow down decision-making by adding layers of complexity to the organizational structure through new roles. These added layers mean more information handoffs, complicating and slowing down the decision-making process. The survey findings also show that 43% of respondents believe that they spend too much time and energy on making decisions, suggesting a potential to improve the process.

What can also slow down or in other ways negatively impact decision-making are too long Planning Intervals (PI). The three months used at Zenseact are believed by some to be too long, arguing that it limits the organization's agility. Long PIs mean long feedback loops, making it more difficult to quickly adapt to changes, which can delay decision-making or result in decisions being made based on outdated information. Additionally, in fast-paced environments with high complexity, too long PIs may make it more challenging for decision-makers to determine whether a chosen course of action is still appropriate. With this background, Zenseact has introduced a mid-increment planning every six weeks as an addition to the PI planning occurring every twelve weeks, allowing them to plan and coordinate more often. This strategy aligns with SAFe's recommendation of targeting eight to twelve weeks (Scaled Agile Inc, 2023c) and demonstrates a proactive approach to maintaining agility and responsiveness.

Making decisions where tradeoffs, or pros and cons, need to be evaluated is also mentioned to be especially challenging. Tierney (2011) argues that this can be the effect of decision fatigue, where a person becomes reluctant to make such decisions as they are very advanced and energy-consuming. Decision fatigue can result in avoidance of decisions or that important factors are overlooked, ultimately affecting the quality of the decision-making process. This challenging evaluation of alternatives can also be connected to the rational decision-making model where individuals weigh the benefits and drawbacks of each option to make the best choice. However, in real-world situations like the example here, emotions, biases, and incomplete information complicate the process, suggesting that the bounded rationality model may be better suited, saving the decision makers both time and mental effort.

A challenge where backlog items were not refined before Sprint Planning meetings was also observed in the study. The empirical data indicates that this may result in long and ineffective planning sessions since the meeting's discussion and clarification of requirements take up important time. This is consistent with the findings of Moe et al. (2012), who argue that planning sessions can become lengthy and unfocused when a clear, well-prioritized Product Backlog is missing. Such a backlog lessens the strategic value of planning sessions and makes resource allocation more difficult. Moreover, the findings resonate with Moe et al.'s (2012) claims that POs and development teams may underestimate the complexity of needs, which may result in frequent plan adjustments in the middle of iterations. As noted by Marks et al. (2001), these adjustments should ideally require a new iteration plan. It is therefore worth highlighting the significance of keeping a well-refined backlog to speed up planning sessions and improve the overall decision-making process. Additionally, maintaining shared knowledge of the backlog between the PO and the development team is vital for effective collaboration (Maximini et al., 2018), stressing the importance of collaboration and coordination between these roles.

5.2. RQ2: Improving Cross-team Decision-making Processes

The second research question for this thesis was aimed at finding improvements for the cross-team decision-making process in large-scale agile organizations. Therefore, this section of the chapter discusses the empirical findings while connecting and contrasting them to the theoretical background. In general, while the improvement ideas are interconnected and can address several challenges simultaneously, they revolve around improving cross-team communication, assigning responsibilities, enhancing collaboration, clarifying documentation, and maintaining a balance between adaptability and predictability.

Improving Cross-team Communication

The empirical study demonstrates the importance of enhancing cross-team communication for improved decision-making, as both developers and managers have expressed a desire for increased transparency in decision-making procedures and reasoning. The main goal of this desire seems to be to ensure that everyone is informed about the decisions made and feels included in the work. Furthermore, this is especially important in complex, flexible situations where the decision-makers need to make informed decisions to proceed and respond quickly to changing requirements or conditions, as well as in large-scale environments due to the increased variability and interconnections among teams.

To ensure that everyone is informed of decisions and the reasoning behind them, more strategic and operational communication is required according to the empirical findings. Organizing frequent, structured communication sessions, such as weekly cross-team briefings on decision statuses and rationales that ensure transparency, could be one method to do this (Schwaber, 2004). Regular feedback channels could be established for teams to express their perspectives regarding decisions and how they are being implemented across teams (Derby et al., 2006), supporting the understanding between iteration and strategic vision by creating common mental models (Moe et al., 2012). Agile methodologies already incorporate retrospective meetings and daily stand-ups, which involve all stakeholders that are affected or relevant, to discuss challenges and suggest improvements (Sutherland and Schwaber, 2007). This practice, when further applied to a cross-team context, therefore supports the importance of empirical suggestions for establishing regular feedback communication. However, there should be an emphasis on not adding unnecessary meetings and instead utilizing emails for communication (De Smet et al., 2023).

Moreover, theories supporting decentralized decision-making, where decision power is closer to the information source and action, are in line with this call for more frequent and transparent communication (Takeuchi and Nonaka, 1986; Simon, 1991). These theories suggest that improved information flow can empower people by putting decision-making in the hands of those who have contextual knowledge. As a result, the findings pointing to increased decision understanding can thus be assumed to be supported by decentralized decision-making, which could help in reaching high-quality and quick decisions (Aminov et al., 2019). Nevertheless, this is not particularly surprising, as agile methodologies are built around the concept of emphasizing individuals (Fowler and Highsmith, 2001). Instead, the findings show that decentralized decision-making also holds value in agile organizations that have grown to larger scales, as teams' direct knowledge could be leveraged to address immediate project requirements (Moe et al., 2012). Moreover, decentralized decision-making could also enable speedier and more responsive decision-making due to the encouragement of transferring decision-making authority to lower organizational levels (Takeuchi and Nonaka, 1986;

Mintzberg, 1989). To keep everyone in the company coordinated and coherent, however, it also requires effective communication channels and prevention of siloed team resources. This insight reinforces the need for enhanced communication frameworks, such as those used in Scrum or RAPID (Bain and Company, 2023), that provide consistent knowledge and involvement among teams and organizational levels for enhanced visibility (Ambler, 2002). Additionally, dashboards such as Kanban boards can be implemented to visualize workflows and enhance the transparency of information flows.

The difficulties with information flow brought to light by the findings are also consistent with the idea of bounded rationality, suggesting that limitations in information processing affect decision-making quality (Simon, 1955). As this model assumes an individual's ability to make decisions is constrained by the information at their disposal and their cognitive capacities, the empirical findings endorsing organized communication tactics and centralized information systems offer ways to decrease these information constraints inside the organization. Therefore, it is underlined by both theory and empirical evidence that there is a need to create conditions where decision-makers have access to all relevant information necessary to make informed decisions. As a result, to counteract effects arising from bounded rationality, efforts should focus on enhancing information symmetry across teams. For instance, this could be achieved through a robust infrastructure (Edison et al., 2021), which could include systemic documentation practices, regular update meetings, and digital tools that provide real-time updates and comprehensive visibility into project statutes and decisions, or through organizing the organizational macrostructure (Blenko et al., 2010). Nevertheless, this should be done with care, as there is a risk of information overflow being present if not performed correctly, which would do more harm than good for the decision-making processes.

However, information asymmetries could arise due to decision-making often occurring in forums that not all relevant parties can attend or get insights into. Due to this, decisions are being made without comprehensive stakeholder input. As the empirical findings highlight, the challenges in capturing the full scope of input may lead to decisions not being fully informed or accepted across teams. Therefore, there is a need for agreements among all actors impacted by a decision. By including people from different levels in the decision-making, participation is encouraged while coherence is improved (Highsmith, 2009; Paasivaara and Lassenius, 2014). To improve the clarity and traceability of decisions, there needs to be consistent documentation and decision-making forums that both include and can reach out to all necessary stakeholders. In this way, both decision quality and buy-in across teams and the organization have the potential to be improved. However, as shown by the lack of communication channel strategies and difficulties in finding information, it may be beneficial for information clarity to restructure and rethink the balance of attending forums and clarifying through documentation.

Assigning Clear Responsibilities

The data collected also suggests that there is confusion around the roles involved in decision-making, which often leads to inefficiencies in the decision-making process. Therefore, as indicated by the empirical findings, roles and responsibilities connected to decision-making processes need to be clearly defined and communicated. This is particularly important across teams, as it seems that these do not have the same level of communication and understanding, increasing the ambiguity and complexity among them. One way, which is already applied and adjusted to fit Zenseact, is to use the clearly defined roles within the decision-making process outlined in the SAFe methodology (Knaster and Leffingwell, 2018). For example, the decision-

making process and team alignment to shared objectives are improved by clearly defining and effectively implementing essential roles such as the PO or RTE (Dikert et al., 2016; Edison et al., 2021). However, it should be ensured to a greater extent that everyone involved knows their part, thus reducing confusion and overlapping efforts. Another way could be to utilize accountability frameworks such as RAPID (Bain and Company, 2023), to increase buy-in and set clear accountabilities. The use of these frameworks was also proposed by a survey respondent, showing that there may be a need for further implementation of their use for increased clarification of responsibilities. Furthermore, the importance of well-defined roles and responsibilities for improving organizational performance is well-established in organizational behavior theories (March, 1996). As the empirical data showed the lack of role clarity often leads to priority issues and ineffective decision-making, it could be useful to apply these theoretical insights to structure roles more effectively and align goals across teams. The use of active phrases instead of passive phrases, as described by Minnaar (2019), could assist in clarifying responsibilities as they imply increased initiatives and ownership.

Furthermore, theories related to decentralization (Mintzberg, 1989), also emphasize the importance of clear role definitions. This way, effective governance and decision-making efficiency are ensured, as the approach supports the necessary clear responsibilities to manage potential complexities coming from distributed decision-making. At the same time, empirical findings indicate that there are challenges with varying levels of involvement and impact across roles and teams in decision-making processes. This variability can lead to confusion and inefficiencies, further underscoring the need for clearly defined roles ensuring that everyone understands their decision-making authority. Additionally, recurring sessions should thus be used to review and realign roles and responsibilities as projects evolve and organizational or cross-team priorities shift. Given the dynamic nature of agile environments, as noted by both literature and empirical findings, these sessions can help manage the changes effectively and ensure that all team members across the teams are aligned with current needs and objectives.

Enhancing Cross-team Collaboration

The objective should be to create a trustworthy atmosphere where each team member feels valued for their contributions to the cross-team decision-making process. Building trust within and across teams enhances collaboration and empowers them to make more informed, proactive decisions (Edison et al., 2021). Therefore, large-scale agile organizations need to have a shared vision, where teams work toward organizational goals and promote a cohesive and aligned approach to decision-making. As a step towards this, managers should spend more time directly with the teams at the office, creating opportunities for more effective communication and improving the alignment of cross-team decision-making. This is in line with and utilizes heuristics such as face-to-face communication, which is a good fit for agile organizations (Hone, 2016). Additionally, teams should also be seated together to reduce delays and enhance communication clarity, helping to create an efficient SAFe configuration (Edison et al., 2021). In this way, developers would not feel the need to interrupt development time to find the correct teams, POs, or other managers, to communicate with. Furthermore, the use of consensus-driven decision models, such as the fist of five or decider protocol (Martins, 2022) could enhance collaboration as it drives decision-making in an iterative way to common understanding and agreement.

One recurring theme from the empirical findings was the introduction of some variation of a company-wide backlog. However, interestingly, there were also some smaller indications of

already existing backlogs with similar scopes. In this case, there seem to be challenges in the communication of these, which could be improved with previously explained communication ideas. However, by utilizing these company-wide backlogs, there may be improvements in the collaboration and coordination among several teams, or even ARTs depending on the scope, as they would together be able to decide on the proper priorities. To manage these backlogs efficiently at larger scales, empowering teams to take ownership could help (Schwaber, 2007). Furthermore, for effective use of common backlogs, there should be uniformity and predictability across the decision-making process by leveraging consistent agile practices across teams, such as similar Sprint lengths and Definition of Done. (Kersten, 2018).

Furthermore, the empirical findings also touch on the necessity of collaborative decision-making structures, which are fundamental to complex situations (Vroom and Yetton, 1973), often found in agile environments. As these structures emphasize the value of shared accountability and collective participation in decision processes, collaborative decision-making is recommended by theories on organizational behavior and decision-making for improved handling of complex situations (March, 1996; Simon, 1991). The idea that well-coordinated diverse groups make better judgments because they have access to a wider range of information and perspectives aligns with the improvements aimed at open communication and delegated responsibilities. Thus, the empirical results support this, as they highlight the necessity for decision-making procedures to incorporate a wider range of viewpoints to increase the understanding between organizational levels, while also assisting in resolving challenges related to cross-team collaboration.

Clarifying Documentation

Another, rather comprehensive but connected, challenge with decision-making regards inconsistencies in documenting decisions, which affects the clarity and traceability of decisions. Therefore, the empirical data points to the need for decision documentation practices to be improved and standardized across teams to include clear, concise, and accessible decision logs. These logs should furthermore include the context, rationale, expected impact, and follow-up action for each decision. By implementing a centralized digital platform that updates in real-time, for example, a central CMS system or auto-updated Confluence setup, transparency across teams could be increased. Consequently, all team members regardless of their team or level, would have access to the latest information and understand the context and rationale behind decisions. This is also in line with the emphasis of decentralized decision-making theories on the importance of placing decision-making authority closer to the information source (Simon, 1991; Mintzberg, 1989). However, it needs to be emphasized that such a tool must be implemented and used correctly to decrease scatteredness and confusion, rather than increasing it. Therefore, instead of just adding another tool, there could be a reasonable logic to first explore the possibilities for improvements of the present communication tools in terms of automation, structure, and accessibility. Furthermore, while the first agile value emphasizes individuals and interactions over processes and tools (Fowler and Highsmith, 2001), these tools should, in a large-scale environment, instead be seen as a means to enhance team interactions in especially cross-team decision-making processes.

Additionally, theories argue for the necessity of good documentation practices to ensure that all decision-making activities are recorded, transparent, and traceable (Cohn, 2009). One way could be to document continuously during decision sessions or create collaborative documentation practices that ensure awareness (Lucidspark, 2024). Therefore, proper

documentation supports organizational memory and accountability, which are essential in complex and dynamic environments often found in contexts where several teams need to work together. As the empirical data revealed inconsistencies and gaps in decision documentation, creating confusion and hindering effective decision-making, there is also an empirical need to implement documentation practices that provide clear and accessible decision records. This could be done, for example, by developing and implementing a standardized documentation protocol that includes templates and guidelines for recording decisions, rationale, and expectations, while being accessible to relevant parties. These protocols would also make it easier to note during sessions, as the structure would already be provided. However, while these types of protocols are used by specific instances or forums, they need to be used consistently throughout the organization for optimal impact. Furthermore, real-time documentation and tracking of decisions, such as tools enabling auto-deletion of certain irrelevant and old pages or auto-updated information, could be facilitated by utilizing digital tools to improve the decision-making process. Digital tools and technologies, such as using AI in Microsoft Teams, will only become better and thus help greatly in notetaking and auto-transcriptions used in documentation. This way, these empirical challenges are addressed by ensuring that updated information is always accessible for decision-makers, reducing delays in communication across teams.

Maintaining a Balance

In complex organizations, however, striking a balance between decision-making flexibility and organized communication is essential (March, 1996; Shapira, 1996). While agile approaches frequently place a strong emphasis on flexibility, organized communication is still necessary to make sure that every action taken by a large-scale organization is in line with its aims and objectives. Again, regular and brief coordination meetings among teams can give the right amount of structure while still enabling the flexibility required in organizations of agile character (Moe et al., 2012). On the other hand, as exemplified by the empirical study, dependencies could also be reduced. Moreover, the need for clear and transparent architecture connected to final deliverables could also help in finding this balance. As indicated by the empirical findings, upfront architectural work would reduce the number of late changes, thus increasing organized communication, while still enabling enough flexibility for decisions connected to the development. By leveraging architecture, predictability is enforced which could increase alignment across large-scale organizations, assisting teams that experience delays and redundant processes that hinder agile responsiveness.

However, the empirical findings indicate that there are struggles with maintaining the balance between adaptability and predictability. To combat the issue of maintaining this balance, scorecards could be implemented to ensure efficient daily operations that contribute to long-term objectives by coordinating strategic plans with operational performance (Kaplan and Norton, 1996). Additionally, there may be a benefit from developing decision-making frameworks that can shift between adaptive and predictive modes depending on the context. In this way, there are opportunities to maintain some level of predictability while navigating uncertainty typical for agile settings. These hybrid decision-making models could, for instance, incorporate agile methods for project and product development decisions often found in decisions made on an operational level while traditional methods are used for resource allocation and long-term planning, that is in tactical and strategic decision-making. However, it is worth noting that resource allocation could be greatly improved if managed to adjust to project demand and progress rather than long-term planning (Reinertsen, 2009). This approach

could address the findings where there is a need for consistency in strategic direction and resource management while having the flexibility to make quick adjustments. However, the models should ideally be robust yet flexible enough to withstand and adapt to external and internal changes. By implementing guidelines clearly stating when it is acceptable to deviate from the norm and under what circumstance, adjustments to new information could be made.

6. Conclusions

Decision-making in large-scale agile organizations is characterized by complexity and dynamic interactions, presenting a unique environment where organizational decision-making is becoming more and more defined by the requirement of cross-team integration and collaboration. Agile methodologies place a high value on responsiveness and adaptability, yet distributing decision-making among multiple agile teams can be difficult and result in strategic misalignments. Existing research does not clearly cover why agile organizations have these alignment issues, pointing at a need to better understand this.

This master's thesis aimed to explore challenges in cross-team decision-making processes in large-scale agile organizations. Further, it sought to understand and provide insights into how these cross-team decision-making processes could be improved in large-scale agile organizations. To answer these research questions, a single organization case study was carried out, combining quantitative and qualitative research methods. Data was collected through a literature review, a quantitative and qualitative survey, qualitative interviews with employees of different roles, and observations.

This chapter presents the conclusions of the study. The following section revolves around answering the two research questions. Thereafter, academic and practical implications are provided. Lastly, limitations and concluding suggestions regarding future research are presented.

6.1. Answering the Research Questions

The first research question set out to answer *"What challenges are impacting the cross-team decision-making processes in large-scale agile organizations?"*. To answer this question, data was collected primarily through a survey and interviews, but also through a literature review. It can be concluded that the challenges impacting cross-team decision-making processes in large-scale agile organizations can be grouped into three main categories: challenges with information flow, including communication and documentation, challenges in collaboration and understanding, impacting alignment and backlogs, and complexities and coordination in decision-making processes. Notably, POs and developers encounter challenges related to cross-team decision-making more frequently while Scrum Masters and ART Leadership encounter such challenges less frequently. Interestingly, in the decision-making categories where decisions are made more frequently, challenges are encountered less frequently. Additionally, the study concludes that how frequently challenges are encountered varies across the organization. ARTs encountering more challenges also tend to have a greater imbalance in the effort spent on various decision-making-related activities.

The second research question for this thesis was *"How can the cross-team decision-making processes in large-scale agile organizations be improved?"*. The collection of qualitative data from the survey and interviews, as well as from theory, shows that improving the decision-making processes is a multifaceted and complex journey. However, by focusing on selected areas, the decision-making processes can be improved step-by-step. First, communication is important for effective decision-making and can be improved with regular, structured communication sessions and transparent information sharing that creates a common understanding across teams. Thereafter, roles and responsibilities should be clarified by explicitly defining and communicating them. With this, organizations can minimize confusion and streamline decision-making processes. Furthermore, collaboration is another important

area in decision-making, especially in large-scale agile organizations. This could be improved by enhancing alignment across teams by encouraging engagement from more organizational levels and teams in the decision-making processes. The decision-making processes are also impacted by the level of documentation, and by standardizing these practices, decisions become more traceable, transparent, and accessible. This way, rationales become clearer while organizational memory and accountability are supported, which is essential in large-scale agile environments. However, while there seems to be a need for more structure and quantity of information, there is a need to find and keep the balance between adaptability in decision-making processes and predictability in the planning process. This could be done by using scorecards that help organizations navigate the uncertainty of large-scale setups and align cross-team agile operations with long-term goals.

6.2. Academic Implications

This thesis identifies and categorizes challenges in cross-team decision-making within large-scale agile organizations, shedding light on an area that has been underexplored by contributing to the understanding of practical challenges in such settings. Specifically, it answers Moe et al.'s (2012) call for future research to better understand difficulties in aligning decisions on all levels in agile organizations. The categorization into three main categories provides a structured taxonomy that can be used as a basis for future research, where researchers could refine, expand, and validate the taxonomy through empirical studies.

Further, while the improvement ideas identified in this study are interesting for large-scale agile organizations, they may also be that for the research area of decision-making in complex and dynamic organizational environments more broadly. This is because such environments are likely to share a lot of the same challenges, such as communication, collaboration, and coordination challenges. It may also be the case that organizations adopt practices that are part of agile without explicitly saying that they are working according to agile principles, making the findings in this study relevant also for them. Additionally, the theory about decentralized and collaborative decision-making presented in Sections 2.3.3 and 2.3.4 indicates that many decision-making challenges common in agile organizations also appear in non-agile organizations that follow such decision-making models, for example, difficulties with organizational alignment (Cyert and March, 1963) and groupthink (Janis, 1972).

Another academic implication this thesis provides is that it highlights the importance of communication for successful cross-team decision-making. While Dikert et al. (2016) present communication as a success factor for large-scale agile transformations, the connection to decision-making is missing. In general, there are limited studies diving deeper into communication and decision-making as more deeply interrelated concepts. Therefore, this could be further investigated by, for example, seeing communication through the lens of systems theory by building on Niklas Luhmann's communication theory (Seidl and Becker, 2006), defining communication as a synthesis of information, utterance, and understanding.

6.3. Practical Implications

This study offers practical insights for large-scale agile organizations aiming to improve their decision-making processes. Firstly, there should be prioritizations on establishing regular communication sessions and ensuring transparent information sharing across teams. POs and EMs should focus on having regular updates with stakeholders across teams to ensure alignment and transparency, while also implementing mechanisms for continuous feedback between development teams and stakeholders. ART Leadership should also facilitate regular

ART-level meeting points to enable transparent information flow and ensure alignment across all teams within the ART. The use of, for example, Kanban boards or other dashboards could be a useful tool in large-scale agile organizations to provide transparent, comprehensive, and automated progress updates used in the decision-making processes.

Secondly, POs should clearly prioritize and manage the backlog while setting expectations on development teams regarding deadlines, as this helps with understanding the situation and planning for decision-making processes. On the other hand, EMs should clarify roles and responsibilities by clearly defining responsibilities and expectations for each team member, while ensuring that resources are allocated based on understanding of roles and project needs. Additionally, on an ART Leadership level, the roadmap should be clearly communicated together with the importance of each team's contribution to reaching the goals. This way, dependencies in large-scale environments would be clearer, making the decision-making processes across teams more efficient. To further increase decision-making efficiencies, there should be defined and communicated engineering practices and standards to be followed by teams. While this would hurt the autonomy stemming from an agile way of working, it would improve decision-making processes.

Thirdly, to foster collaboration, POs should be open to organizing workshops to bring together developers and other stakeholders to discuss product requirements and be able to make decisions based on information from several teams. Additionally, EMs should try and foster collaboration and knowledge sharing by encouraging and enabling ways of working suitable for cross-team projects. Furthermore, ART Leadership should utilize PI planning sessions to align cross-team efforts and objectives. However, it may be wise to use mid-PI sessions as well to iteratively improve and realign efforts. A collaborative culture should also be encouraged by increasing engagement and participation across teams in larger decision-making processes, such as those during ART-level events. This collaboration could also be improved by creating and supporting smaller communities or forums, which could utilize highly focused discussions to improve decision-making processes.

6.4. Limitations

While the study provided valuable insights in answering the research questions, it is important to acknowledge certain limitations that may affect the generalizability and interpretation of the findings. As this master's thesis is a case study conducted solely in collaboration with Zenseact, there may be limitations in terms of generalizability. Zenseact is characterized by its own culture and processes and may therefore face challenges that other actors do not share in their industry. Additionally, there may be specific challenges more prevalent in their industry that do not hold in other large-scale agile organizations in other industries, further impacting the generalizability. Zenseact is also in a special situation as they need to align with their owner Volvo Cars on many decisions. In other words, it may be challenging to identify whether the challenges and improvement ideas observed in the case study are unique to the organization being studied or if they are common across large-scale agile organizations. However, the literature review helped address this concern, showing that the findings largely match with large-scale agile organizations in general.

Another limitation is related to the sampling strategy of the interviews, where the interviews were mostly conducted in one ART due to time constraints in the other ARTs. This may present a limitation in the depth of the qualitative insights gathered. Additionally, it becomes challenging to quantify to which extent the challenges identified in one ART or team apply to other ARTs, or if they are even prevalent at all. However, the survey compensates for this by

covering all ARTs to an equal extent, providing quantitative data that allowed the researchers to compare and contrast challenges between the ARTs. Interesting to note here is that the ARTs encountering decision-making challenges more frequently had the least time available to participate in the study.

In the context of limitations, it is also crucial to reflect on to which extent the survey respondents answered the survey questions with the specific scope in mind. Even if the respondents were continuously reminded that the survey focused specifically on decisions impacting cross-team alignment, there is a risk that some respondents may have answered the questions thinking about decision-making on a more general level, for example also including decisions that are made only within one team.

Additionally, for RQ2, it is important to acknowledge that without analytically testing the identified improvement ideas, it is difficult to determine for certain whether and to what degree they would improve cross-team decision-making processes. Therefore, future studies should focus on running such experiments, as explained further below.

6.5. Suggestions for Future Research

The identified challenges and proposed improvements provide opportunities for further empirical research. For example, researchers could investigate specific communication strategies, initiatives to improve role clarity, or collaboration techniques in real-world large-scale agile organizations. One way of doing this is through action research, where experiments are designed to assist in finding solutions. By testing different improvement ideas by for example following specific agile teams, researchers can co-create an environment where change is actively induced into the teams to see how they adapt. For example, one team can be given very concrete guidelines and another team more abstract ones. Concrete guidelines could entail, for example, implementing specific collaborative decision-making sessions, clarifying roles and responsibilities, or implementing frameworks for decision documentation, such as RASCI. Abstract guidelines, on the other hand, could include promoting information sharing and transparency, nurturing a culture based on values expressed in the Agile Manifesto, or expectations on monitoring and evaluating decision outcomes. Teams could then be asked to rate to which extent they encounter decision-making challenges before and after the action research has been conducted. However, as organizational change often takes time, such studies will likely need to be conducted over an extended period to be able to observe the long-term effects of implementing the proposed improvements.

Relatedly, future research should focus on evaluating improvement ideas commonly mentioned in practitioners' literature, such as consensus-driven decision-making models like the fist of five and decider protocol. This way the gap between what is used in practice and what is suggested in literature can be narrowed. Consequently, fostering such an evidence-based culture could lead to improved decision-making practices across large-scale agile organizations across various industries.

Another interesting area for future research could be to look closer into the cross-team decision-making processes in large-scale agile organizations from the perspective of the leadership level. This can provide valuable insights into how leaders influence aspects such as collaboration and alignment. Research in this area could for example explore the impact of different leadership styles on the efficiency and effectiveness of the decision-making process.

The interdisciplinary nature of the research also presents opportunities for collaboration between scholars from various fields, such as organizational psychology, information systems,

and management. For example, future research can dive deeper into the psychological factors behind the decision-making challenges to better understand the root causes. This would allow for the generation of improvement ideas that are even more connected to the psychological aspects of decision-making, aspects that are very prominent in the field.

Many aspects of the findings in this study can be related to agile values, almost to the degree that agile values may provide useful guidance for improving cross-team decision-making processes. Thus, it would be of interest to further investigate the connection between decision-making challenges and agile values and principles. Perhaps a deeper exploration could reveal specific agile principles that effectively address common decision-making challenges. This could lead to improved frameworks or guidelines, integrating agile values more into decision-making processes.

Bibliography

Alenljung, B., & Persson, A. (2008). Portraying the practice of decision-making in requirements engineering: A case of large scale bespoke development. *Requirements Engineering*, *13*, 257–279. https://doi.org/10.1007/s00766-008-0068-2

Alvesson, M. (2003). Beyond Neopositivists, Romantics, and Localists: A Reflexive Approach to Interviews in Organizational Research. *Academy of Management Review*, *28*(1), 13–33. https://doi.org/10.5465/amr.2003.8925191

Ambler, S. W. (2002). *Agile modeling: Effective practices for eXtreme programming and the unified process*. J. Wiley.

Aminov, I., De Smet, A., Jost, G., & Mendelsohn, D. (2019). *Decision making in the age of urgency*. McKinsey and Company. https://www.mckinsey.com/capabilities/people-and-organizational-performance/our-insights/decision-making-in-the-age-of-urgency, Accessed: 2024-02-21.

Aurum, A., & Wohlin, C. (2007). A Value-Based Approach in Requirements Engineering: Explaining Some of the Fundamental Concepts. In P. Sawyer, B. Paech, & P. Heymans (Eds.), *Requirements Engineering: Foundation for Software Quality*, *4542*, 109–115. Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-540-73031-6_8

Aurum, A., Wohlin, C., & Porter, A. (2006). Aligning software project decisions: A case study. *International Journal of Software Engineering and Knowledge Engineering*, *16*(06), 795–818. https://doi.org/10.1142/S0218194006003002

Austin, R., & Devin, L. (2009). Research Commentary - Weighing the Benefits and Costs of Flexibility in Making Software: Toward a Contingency Theory of the Determinants of Development Process Design. *Information Systems Research - ISR*, *20*, 462–477. https://doi.org/10.1287/isre.1090.0242

Bain and Company. (2023). *RAPID® Decision Making*. Bain and Company. https://www.bain.com/insights/rapid-decision-making/, Accessed: 2024-05-19.

Balthazard, P. A., & Cooke, R. A. (2004). Organizational culture and knowledge management success: Assessing the behavior-performance continuum. *37th Annual Hawaii International Conference on System Sciences 2004*, *9*, pp. 80239a. https://doi.org/10.1109/HICSS.2004.1265577

Basadur, M. (1997). Organizational Development Interventions for Enhancing Creativity in the Workplace. *The Journal of Creative Behavior*, *31*(1), 59–72. https://doi.org/10.1002/j.2162-6057.1997.tb00781.x

Baumeister, R. F., & Leary, M. R. (1997). Writing Narrative Literature Reviews. *Review of General Psychology*, *1*(3), 311–320. https://doi.org/10.1037/1089-2680.1.3.311

Beach, L. R., & Lipshitz, R. (1993). Why classical decision theory is an inappropriate standard for evaluating and aiding most human decision making. In *Decision making in action: Models and methods* (pp. 21–35). Ablex Publishing.

Bell, E., Bryman A., & Harley, B. (2019). *Business Research Methods*. Oxford University Press.

Bernard, H. R., Wutich, A., & Ryan, G. W. (2016). *Analyzing Qualitative Data: Systematic Approaches*. SAGE Publications.

Blenko, M. W., Mankins, M., & Rogers, P. (2010). The Decision-Driven Organization. *Harvard Business Review*. https://hbr.org/2010/06/the-decision-driven-organization, Accessed: 2024-03-06.

Boehm, B. W., & Turner, R. (2004). *Balancing agility and discipline: A guide for the perplexed*. Addison-Wesley Professional. https://books.google.com/books?hl=sv&lr=&id=MWhXwkHsS0gC&oi=fnd&pg=PR13&dq=Boehm,+B.,+%26+Turner,+R.+(2005)+-+%22Balancing+Agility+and+Discipline:+A+Guide+for+the+Perplexed.%22&ots=T_jETPpvSe&sig=_y49sedjA1JYVBuqE3-NH_Cy_2s

Brynjolfsson, E., & McAfee, A. (2014). *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies*. W. W. Norton & Company.

Cohn, M. L., Sim, S. E., & Lee, C. P. (2009). What Counts as Software Process? Negotiating the Boundary of Software Work Through Artifacts and Conversation. *Computer Supported Cooperative Work (CSCW)*, *18*(5), 401. https://doi.org/10.1007/s10606-009-9100-4

Coleman, J. S. (1986). Social Theory, Social Research, and a Theory of Action. *American Journal of Sociology*. https://doi.org/10.1086/228423

Conboy, K. (2009). Agility from First Principles: Reconstructing the Concept of Agility in Information Systems Development. *Information Systems Research*, *20*(3), 329–354. https://doi.org/10.1287/isre.1090.0236

Cui, Z. (2016). Decision Making in Cross-Functional Teams: The Role of Decision Power*. *Decision Sciences*, *47*(3), 492–523. https://doi.org/10.1111/deci.12188

Cyert, R. M., & March, J. G. (1963). *A behavioral theory of the firm*. Prentice Hall/Pearson Education.

De Smet, A., Lackey, G., & Weiss, L. M. (2017). *Untangling your organization's decision making*. McKinsey and Company. https://www.mckinsey.com/capabilities/people-and-organizational-performance/our-insights/untangling-your-organizations-decision-making, Accessed: 2024-02-21.

De Smet, A., Rinaudo, E. K., Lund, F., & Weiss, L. M. (2023). *What is decision making? | McKinsey*. McKinsey and Company. https://www.mckinsey.com/featured-insights/mckinsey-explainers/what-is-decision-making#/, Accessed: 2024-02-21.

Derby, E., Larsen, D., & Schwaber, K. (2006). *Agile retrospectives: Making good teams great*. Pragmatic Bookshelf. https://books.google.com/books?hl=sv&lr=&id=zA5QDwAAQBAJ&oi=fnd&pg=PT8&dq=%E2%80%A2%09Derby+et+al.,+2006&ots=wwN3_Zvko2&sig=LTP1LUZ8lC8xB7MX99sJe9M8a1I

Diener, E., & Crandall, R. (1978). *Ethics in social and behavioral research*. University of Chicago Press.

Dikert, K., Paasivaara, M., & Lassenius, C. (2016). Challenges and success factors for large-scale agile transformations: A systematic literature review. *Journal of Systems and Software*, *119*, 87–108. https://doi.org/10.1016/j.jss.2016.06.013

Drury, M., Conboy, K., & Power, K. (2012). Obstacles to decision making in Agile software development teams. *Journal of Systems and Software*, *85*(6), 1239–1254. https://doi.org/10.1016/j.jss.2012.01.058

Drury-Grogan, M. L., Conboy, K., & Acton, T. (2017). Examining decision characteristics & challenges for agile software development. *Journal of Systems and Software*, *131*, 248–265. https://doi.org/10.1016/j.jss.2017.06.003

Drury-Grogan, M., & O'Dwyer (formerly McHugh), O. (2013). An investigation of the decision-making process in agile teams. *International Journal of Information Technology and Decision Making*, *12*, 1097–1120. https://doi.org/10.1142/S0219622013400105

Dybå, T., & Dingsøyr, T. (2008). Empirical studies of agile software development: A systematic review. *Information and Software Technology*, *50*(9), 833–859. https://doi.org/10.1016/j.infsof.2008.01.006

Dyba, T., & Dingsoyr, T. (2009). What Do We Know about Agile Software Development? *IEEE Software*, *26*(5), 6–9. https://doi.org/10.1109/MS.2009.145

Ebert, C., & Paasivaara, M. (2017). Scaling Agile. *IEEE Software*, *34*(6), 98–103. https://doi.org/10.1109/MS.2017.4121226

Edison, H., Wang, X., & Conboy, K. (2021). Comparing methods for large-scale agile software development: A systematic literature review. *IEEE Transactions on Software Engineering*, *48*(8), 2709–2731. http://dx.doi.org/10.1109/TSE.2021.3069039

Edmondson, A. (1999). Psychological Safety and Learning Behavior in Work Teams. *Administrative Science Quarterly*, *44*(2), 350–383. https://doi.org/10.2307/2666999

Feldman, M. (1989). *Order Without Design: Information Production and Policy Making (Vol*. 231). Stanford University Press. ISBN: 9780804717267.

Follett, M. P. (1924). *Creative Experience*. Longmans, Green and Co. *https://books.google.se/books/about/Creative_Experience.html?id=XwkPAAAAQAAJ&redir_esc=y*

Fowler, M., & Highsmith, J. (2001). The Agile Manifesto. *https://edisciplinas.usp.br/pluginfile.php/3184441/mod_resource/content/1/The_Agile_Manifesto_SDMagazine.pdf*

Gale, S. F. (2012). The Evolution of Agile. *Project Management Institute*, *26*(1), 28–33. *https://www.pmi.org/learning/library/adaptability-new-agile-hybrids-pm-4262*

Gigerenzer, G., & Goldstein, D. G. (1996). Reasoning the fast and frugal way: Models of bounded rationality. *Psychological Review*, *103*(4), 650–669. https://doi.org/10.1037/0033-295X.103.4.650

Gigerenzer, G., & Selten, R. (2002). *Bounded rationality: The adaptive toolbox*. MIT Press. https://books.google.com/books?hl=sv&lr=&id=dVMq5UoYS3YC&oi=fnd&pg=PR9&dq=Gigerenzer,+G.,+%26+Selten,+R.+(2001)+-+%22Bounded+Rationality:+The+Adaptive+Toolbox.%22&ots=p20pVHGO-1&sig=PWCB834H2beqc8j7miObQHQ7Zuc

Gustavsson, T. (2017). Assigned roles for inter-team coordination in large-scale agile development: A literature review. *Proceedings of the XP2017 Scientific Workshops*, 1–5. https://doi.org/10.1145/3120459.3120475

Hackman, J. R. (1986). The psychology of self-management in organizations. In *Psychology and work: Productivity, change, and employment* (pp. 89–136). American Psychological Association. https://doi.org/10.1037/10055-003

Hackman, J. R., & Morris, C. G. (1975). Group Tasks, Group Interaction Process, and Group Performance Effectiveness: A Review and Proposed Integration. In L. Berkowitz (Ed.), *Advances in Experimental Social Psychology* (Vol. 8, pp. 45–99). Academic Press. https://doi.org/10.1016/S0065-2601(08)60248-8

Harvey, J. B. (1974). The Abilene paradox: The management of agreement. *Organizational Dynamics*, *3*(1), 63–80. https://doi.org/10.1016/0090-2616(74)90005-9

Herzberg, F. (2003). One More Time: How do You Motivate Employees? *Harvard Business Review*, *81*, 87–96. https://doi.org/10.1007/978-1-349-02701-9_2

Highsmith, J. (2009). *Agile project management: Creating innovative products*. Pearson education. https://books.google.com/books?hl=sv&lr=&id=VuFpkztwPaUC&oi=fnd&pg=PT49&dq=%E2%80%A2%09Highsmith,+2009&ots=CwAIXd-h7B&sig=cEdnLzCpeSFlx5_l_fLHnfiXoFQ

Holmstrom, B. R., & Tirole, J. (1989). Chapter 2 The theory of the firm. In *Handbook of Industrial Organization* (Vol. 1, pp. 61–133). Elsevier. https://doi.org/10.1016/S1573-448X(89)01005-8

Hone, T. (2016). *What are Heuristics and How Can They Accelerate Decision-Making?* Excella. https://www.excella.com/insights/what-are-heuristics-and-how-can-they-accelerate-decision-making, Accessed: 2024-02-23.

Interfacing. (2024). *What is RASCI / RACI: A comprehensive guide and how to use them*. Interfacing. https://www.interfacing.com/what-is-rasci-raci, Accessed: 2024-06-06.

Janis, I. L. (1972). *Victims of groupthink: A psychological study of foreign-policy decisions and fiascoes*. Houghton Mifflin. https://books.google.se/books/about/Victims_of_Groupthink.html?id=FB13AAAAMAAJ&redir_esc=y

Kahneman, D., & Klein, G. (2009). Conditions for intuitive expertise: A failure to disagree. *American Psychologist*, *64*(6), 515–526. https://doi.org/10.1037/a0016755

Kahneman, D., Slovic, P., & Tversky, A. (Eds.). (1982). *Judgment under Uncertainty: Heuristics and Biases*. Cambridge University Press. https://doi.org/10.1017/CBO9780511809477

Kalenda, M., Hyna, P., & Rossi, B. (2018). Scaling agile in large organizations: Practices, challenges, and success factors. *Journal of Software: Evolution and Process*, *30*(10), e1954. https://doi.org/10.1002/smr.1954

Kanter, R. M. (2001). *Evolve!: Succeeding in the Digital Culture of Tomorrow*. Harvard Business School Press. https://www.hbs.edu/faculty/Pages/item.aspx?num=4860

Kaplan, R. S., & Norton, D. P. (1996). Using the balanced scorecard as a strategic management system. In *The Economic Impact of Knowledge* (pp. 315–324). Elsevier. https://doi.org/10.1016/B978-0-7506-7009-8.50023-9

Kersten, M. (2018). *Project to Product: How to Survive and Thrive in the Age of Digital Disruption with the Flow Framework*. IT Revolution.

https://books.google.se/books/about/Project_to_Product.html?id=G1aQtAEACAAJ&redir_esc=y

Kerth, N. L. (2013). *Project retrospectives: A handbook for team reviews*. Addison-Wesley. https://books.google.com/books?hl=sv&lr=&id=3VUUAAAAQBAJ&oi=fnd&pg=PT17&dq=%E2%80%A2+Kerth,+2001+project&ots=nAdfGmJRWy&sig=d1d0VrYvSKN4e5fLqhZDXhgqhDA

Klein, G. (1993). A Recognition Primed Decision (RPD) Model of Rapid Decision Making. In *Decision making in action: Models and methods*. https://api.semanticscholar.org/CorpusID:60839705

Klein, G. (1998). *Sources of Power: How People Make Decisions* (20th ed.). The MIT Press. https://doi.org/10.2307/j.ctt1v2xt08

Knaster, R., & Leffingwell, D. (2018). *SAFe 4.5 Distilled: Applying the Scaled Agile Framework for Lean Software and Systems Engineering*. Addison-Wesley Professional. https://books.google.com/books?hl=sv&lr=&id=HsZlDwAAQBAJ&oi=fnd&pg=PT12&dq=leffingwell+2018+agile&ots=KowUtcrQjh&sig=PlXLpOeubKlnNEN8ehKnMSf8gow

Kotter, J. P. (1995). Why transformation efforts fail. *Harvard Business Review*, *73*(2), 59–67. https://hbr.org/1995/05/leading-change-why-transformation-efforts-fail-2

Kozlowski, S. W. J., & Bell, B. S. (2003). Work Groups and Teams in Organizations. *Handbook of Psychology: Industrial and Organizational Psychology*, *12*, 333–375. https://doi.org/10.1002/0471264385.wei1214

Krajewski, L. J., Ritzman, L. P., & Malhotra, M. K. (2007). *Operations management. Processes and value chains* (8th ed). Pearson Prentice Hall. https://books.google.se/books/about/Operations_Management.html?id=9HtfPgAACAAJ&redir_esc=y

Krasner, H. (1998). Using the Cost of Quality Approach for Software. *The Journal of Defense Software Engineering*, *11*, 6-11. https://www.semanticscholar.org/paper/Using-the-Cost-of-Quality-Approach-for-Software-Krasner/7346d2930e6c619fe70abda901af563c8674ac9d

Kreps, D. M. (1990). Corporate culture and economic theory. In J. E. Alt & K. A. Shepsle (Eds.), *Perspectives on Positive Political Economy* (pp. 90–143). Cambridge University Press. https://doi.org/10.1017/CBO9780511571657.006

Ktata, O., & Lévesque, G. (2009). Agile development: Issues and avenues requiring a substantial enhancement of the business perspective in large projects. *Proceedings of the 2nd Canadian Conference on Computer Science and Software Engineering*, 59–66. https://doi.org/10.1145/1557626.1557636

Kwak, Y. H., & Stoddard, J. (2004). Project risk management: Lessons learned from software development environment. *Technovation*, *24*(11), 915–920. https://doi.org/10.1016/S0166-4972(03)00033-6

Langley, A. (1995). Between "Paralysis by Analysis" and "Extinction by Instinct." *MIT Sloan Management Review*. https://sloanreview.mit.edu/article/between-paralysis-by-analysis-and-extinction-by-instinct/

Larman, C., & Vodde, B. (2010). *Practices for Scaling Lean & Agile Development: Large, Multisite, and Offshore Product Development with Large-Scale Scrum* (1st ed.). Addison-Wesley Professional. https://api.semanticscholar.org/CorpusID:114410497

Lee, M. Y., & Edmondson, A. C. (2017). Self-managing organizations: Exploring the limits of less-hierarchical organizing. *Research in Organizational Behavior*, *37*, 35–58. https://doi.org/10.1016/j.riob.2017.10.002

Leffingwell, D. (2007). *Scaling Software Agility: Best Practices for Large Enterprises*. Pearson Education. ISBN:978-0-321-45819-3.

Leffingwell, D. (2010). *Agile software requirements: Lean requirements practices for teams, programs, and the enterprise*. Addison-Wesley Professional. https://books.google.com/books?hl=sv&lr=&id=pTExbNmZwZUC&oi=fnd&pg=PT41&dq=leffingwell+2011&ots=bcGPjwLI9A&sig=SqDq4FjYB3Dgespbv-yxWOe7I2Y

Lindstrom, L., & Jeffries, R. (2004). Extreme Programming and Agile Software Development Methodologies. *Information Systems Management*, *21*(3), 41–52. https://doi.org/10.1201/1078/44432.21.3.20040601/82476.7

Lipshitz, R., Klein, G., Orasanu, J., & Salas, E. (2001). Taking stock of naturalistic decision making. *Journal of Behavioral Decision Making*, *14*(5), 331–352. https://doi.org/10.1002/bdm.381

Longhurst, R. (2003). Semi-structured Interviews and Focus Groups. In *Key Methods in Geography* (pp. 117–132). Sage Publications Ltd.

López, M. I., Callao, M. P., & Ruisánchez, I. (2015). A tutorial on the validation of qualitative methods: From the univariate to the multivariate approach. *Analytica Chimica Acta*, *891*, 62–72. https://doi.org/10.1016/j.aca.2015.06.032

Lucidspark. (2024). *The Do's and Don'ts of Agile Documentation*. Lucidspark. https://lucidspark.com/blog/agile-documentation-dos-and-donts, Accessed: 2024-05-19.

March, J. G. (1987). Ambiguity and accounting: The elusive link between information and decision making. *Accounting, Organizations and Society*, *12*(2), 153–168. https://doi.org/10.1016/0361-3682(87)90004-3

March, J. G. (1996). Understanding how decisions happen in organizations. In Z. Shapira (Ed.), *Organizational Decision Making* (pp. 9–32). Cambridge University Press. https://doi.org/10.1017/CBO9780511584169.004

Marks, M. A., Mathieu, J. E., & Zaccaro, S. J. (2001). A Temporally Based Framework and Taxonomy of Team Processes. *Academy of Management Review*, *26*(3), 356–376. https://doi.org/10.5465/amr.2001.4845785

Martins, R. (2022). *6 Agile Decision-Making Models to Foster Collaboration*. Agile42. https://www.agile42.com/en/blog/decision-making-models, Accessed: 2024-05-19.

Maximini, D. (2018). Scrum Culture Definition. In D. Maximini (Ed.), *The Scrum Culture: Introducing Agile Methods in Organizations* (pp. 3–16). Springer International Publishing. https://doi.org/10.1007/978-3-319-73842-0_1

McAvoy, J., & Butler, T. (2009). The role of project management in ineffective decision making within Agile software development projects. *European Journal of Information Systems*, *18*(4), 372–383. https://doi.org/10.1057/ejis.2009.22

Minnaar, J. (2019). *5 Best Practices To Distribute Decision-Making*. Corporate Rebels. https://www.corporate-rebels.com/blog/distribute-decision-making, Accessed: 2024-02-21.

Mintzberg, H. (1989). The Structuring of Organizations. In D. Asch & C. Bowman (Eds.), *Readings in Strategic Management* (pp. 322–352). Macmillan Education UK. https://doi.org/10.1007/978-1-349-20317-8_23

Mintzberg, H., Raisinghani, D., & Theoret, A. (1976). The structure of" unstructured" decision processes. *Administrative Science Quarterly*, *21*(2), 246–275. https://www.jstor.org/stable/2392045

Moe, N. B., & Aurum, A. (2008). Understanding Decision-Making in Agile Software Development: A Case-study. *2008 34th Euromicro Conference Software Engineering and Advanced Applications*, 216–223. https://doi.org/10.1109/SEAA.2008.55

Moe, N. B., Aurum, A., & Dybå, T. (2012). Challenges of shared decision-making: A multiple case study of agile software development. *Information and Software Technology*, *54*(8), 853–865. https://doi.org/10.1016/j.infsof.2011.11.006

Moe, N. B., Dingsøyr, T., & Dybå, T. (2008). Understanding Self-Organizing Teams in Agile Software Development. *19th Australian Conference on Software Engineering (Aswec 2008)*, 76–85. https://doi.org/10.1109/ASWEC.2008.4483195

Moe, N. B., Dingsøyr, T., & Dybå, T. (2010). A teamwork model for understanding an agile team: A case study of a Scrum project. *Information and Software Technology*, *52*(5), 480–491. https://doi.org/10.1016/j.infsof.2009.11.004

Navarro, D. J., & Foxcroft, D. R. (2023). *Exploratory Factor Analysis — Learning statistics with jamovi*. Jamovi Documentation. https://lsj.readthedocs.io/fr/latest/Ch15/Ch15_FactorAnalysis_1.html#fig-efa5, Accessed: 2024-05-22.

Nerur, S., Mahapatra, R., & Mangalaraj, G. (2005). Challenges of migrating to agile methodologies. *Communications of the ACM*, *48*(5), 72–78. https://doi.org/10.1145/1060710.1060712

Olson, M. (1971). *The Logic of Collective Action: Public Goods and the Theory of Groups, With a New Preface and Appendix*. Harvard University Press. https://www.hup.harvard.edu/books/9780674537514

Organizational Behavior. (2017). *Organizational Behavior*. University of Minnesota Libraries Publishing edition. This edition is adapted from a work originally produced in 2010 by a publisher who has requested that it not receive attribution. https://doi.org/10.24926/8668.1501

Paasivaara, M., & Lassenius, C. (2014). Communities of practice in a large distributed agile software development organization–Case Ericsson. *Information and Software Technology*, *56*(12), 1556–1577. https://doi.org/10.1016/j.infsof.2014.06.008

Papadakis, V. M., Lioukas, S., & Chambers, D. (1998). Strategic decision-making processes: The role of management and context. *Strategic Management Journal*, *19*(2), 115–147. http://www.jstor.org/stable/3094060?origin=JSTOR-pdf

Pink, D. (2009). *The puzzle of motivation* [Video]. *TEDGlobal 2009*. https://www.ted.com/talks/dan_pink_the_puzzle_of_motivation

Putta, A., Paasivaara, M., & Lassenius, C. (2018). Benefits and Challenges of Adopting the Scaled Agile Framework (SAFe): Preliminary Results from a Multivocal Literature Review. *Product-Focused Software Process Improvement: 19th International Conference, PROFES 2018, Wolfsburg, Germany, Nov 28–30*. (Vol. 11271, pp. 334–351). Springer International Publishing. https://doi.org/10.1007/978-3-030-03673-7_24

Ramesh, B., Cao, L., & Baskerville, R. (2010). Agile requirements engineering practices and challenges: An empirical study. *Information Systems Journal*, *20*(5), 449–480. https://doi.org/10.1111/j.1365-2575.2007.00259.x

Reifer, D. J., Maurer, F., & Erdogmus, H. (2003). Scaling agile methods. *IEEE Software*, *20*(4), 12–14. https://doi.org/10.1109/MS.2003.1207448

Reinertsen, D. G. (2009). *The principles of product development flow: Second generation lean product development*. Celeritas. https://cir.nii.ac.jp/crid/1130000797260740096

Rigby, D., Sutherland, J., & Takeuchi, H. (2016). Embracing Agile. *Harvard Business Review*. https://hbr.org/2016/05/embracing-agile

Rogers, P. (2019). *Team Decision Making Techniques*. Medium. https://medium.com/agile-outside-the-box/team-decision-making-techniques-80f2138ae31e, Accessed: 2024-04-15.

Rosenbaum, O., & Campbell, M. (2021). *Shifting to Continuous Documentation as a New Approach for Code Knowledge*. InfoQ. https://www.infoq.com/articles/continuous-documentation/, Accessed: 2024-05-19.

Rubin, K. S. (2012). *Essential Scrum: A practical guide to the most popular Agile process*. Addison-Wesley. https://libdoc.dpu.ac.th/eBook/113642.pdf

Salas, E., Sims, D. E., & Burke, C. S. (2005). Is there a "Big Five" in Teamwork? *Small Group Research*, *36*(5), 555–599. https://doi.org/10.1177/1046496405277134

Scaled Agile Inc. (2022a). *Agile Release Train*. Scaled Agile Framework. https://scaledagileframework.com/agile-release-train/, Accessed: 2024-04-16.

Scaled Agile Inc. (2022b). *Essential SAFe*. Scaled Agile Framework. https://scaledagileframework.com/essential-safe/, Accessed: 2024-04-16.

Scaled Agile Inc. (2022c). *Large Solution*. Scaled Agile Framework. https://scaledagileframework.com/large-solution/, Accessed: 2024-04-16.

Scaled Agile Inc. (2023a). *Core Values*. Scaled Agile Framework. https://scaledagileframework.com/safe-core-values/, Accessed: 2024-04-16.

Scaled Agile Inc. (2023b). *PI Planning*. Scaled Agile Framework. https://scaledagileframework.com/pi-planning/, Accessed: 2024-04-16.

Scaled Agile Inc. (2023c). *Planning Interval (PI)*. Scaled Agile Framework. https://scaledagileframework.com/planning-interval/, Accessed: 2024-04-16.

Scaled Agile Inc. (2023d). *Principle #9—Decentralize Decision-Making*. Scaled Agile Framework. https://scaledagileframework.com/decentralize-decision-making/, Accessed: 2024-02-22.

Scaled Agile Inc. (2023e). *Scrum Master/Team Coach*. Scaled Agile Framework. https://scaledagileframework.com/scrum-master-team-coach/, Accessed: 2024-04-16.

Scaled Agile Inc. (2023f). *Solution Train*. Scaled Agile Framework. https://scaledagileframework.com/solution-train/, Accessed: 2024-04-16.

Scaled Agile Inc. (2024). *SAFe 6.0 Framework.* Scaled Agile Framework. https://scaledagileframework.com/, Accessed: 2024-05-20.

Schoemaker, P. J. H. (1982). The Expected Utility Model: Its Variants, Purposes, Evidence and Limitations. *Journal of Economic Literature*, *20*(2), 529–563. http://www.jstor.org/stable/2724488?origin=JSTOR-pdf

Schwaber, K. (2004). *Agile Project Management with Scrum*. Microsoft Press. https://books.google.se/books/about/Agile_Project_Management_with_Scrum.html?id=dJlqJfm8FM4C&redir_esc=y

Schwaber, K. (2007). *The Enterprise and Scrum*. Microsoft Press. https://books.google.se/books/about/The_Enterprise_and_Scrum.html?id=NA-WHQO7QDMC&redir_esc=y

Schwaber, K., & Beedle, M. (2001). *Agile software development with Scrum*. Prentice Hall PTR. https://dl.acm.org/doi/abs/10.5555/559553

Seidl, D., & Becker, K. H. (2006). Organizations as Distinction Generating and Processing Systems: Niklas Luhmann's Contribution to Organization Studies. *Organization*, *13*(1), 9–35. https://doi.org/10.1177/1350508406059635

Shapira, Z. (1995). *Risk Taking: A Managerial Perspective*. Russell Sage Foundation. https://www.jstor.org/stable/10.7758/9781610444927

Shapira, Z. (Ed.). (1996). *Organizational Decision Making*. Cambridge University Press. https://doi.org/10.1017/CBO9780511584169

Simon, H. A. (1955). A Behavioral Model of Rational Choice. *The Quarterly Journal of Economics*, *69*(1), 99–118. https://doi.org/10.2307/1884852

Simon, H. A. (1956). Rational choice and the structure of the environment. *Psychological Review*, *63*(2), 129–138. https://doi.org/10.1037/h0042769

Simon, H. A. (1977). The Logic of Heuristic Decision Making. In R. S. Cohen & M. W. Wartofsky (Eds.), *Models of Discovery* (Vol. 54, pp. 154–175). Springer Netherlands. https://doi.org/10.1007/978-94-010-9521-1_10

Simon, H. A. (1991). Bounded Rationality and Organizational Learning. *Organization Science*, *2*(1), 125–134. https://doi.org/10.1287/orsc.2.1.125

Smith, A. (1776). The Wealth of Nations. *W. Strahan and T. Cadell, London*.

Surowiecki, J. (2004). *The wisdom of crowds: Why the many are smarter than the few and how collective wisdom shapes business, economies, societies, and nations*. Doubleday & Co. https://books.google.se/books/about/The_Wisdom_of_Crowds.html?id=hHUsHOHqVzEC&redir_esc=y

Sutherland, J., & Schwaber, K. (2007). The Scrum Papers. *Nuts, Bolts and Origins of an Agile Process*. https://www.academia.edu/download/64196137/scrumpapers.pdf

Takeuchi, H., & Nonaka, I. (1986). The new new product development game. *Harvard Business Review*. https://hbr.org/1986/01/the-new-new-product-development-game

Talby, D., Hazzan, O., Dubinsky, Y., & Keren, A. (2006). Reflections on reflection in agile software development. *AGILE 2006 Conference, 23-28 July 2006, Minneapolis, Minnesota, USA*. https://doi.org/10.1109/AGILE.2006.45

Thaler, R. H. (2000). From Homo Economicus to Homo Sapiens. *Journal of Economic Perspectives*, *14*(1), 133–141. https://doi.org/10.1257/jep.14.1.133

Tierney, J. (2011). Do You Suffer From Decision Fatigue? *The New York Times*. https://www.nytimes.com/2011/08/21/magazine/do-you-suffer-from-decision-fatigue.html

Turner, S. F., Cardinal, L. B., & Burton, R. M. (2017). Research Design for Mixed Methods: A Triangulation-based Framework and Roadmap. *Organizational Research Methods*, *20*(2), 243–267. https://doi.org/10.1177/1094428115610808

Vinekar, V., Slinkman, C. W., & Nerur, S. (2006). Can Agile and Traditional Systems Development Approaches Coexist? An Ambidextrous View. *Information Systems Management*, *23*(3), 31–42. https://doi.org/10.1201/1078.10580530/46108.23.3.20060601/93705.4

Von Neumann, J., & Morgenstern, O. (1944). *Theory of games and economic behavior*. Princeton University Press. https://www.jstor.org/stable/j.ctt1r2gkx

Vroom, V., & Yetton, P. (1973). Leadership and Decision-Making. *University of Pittsburg Press*, *18*(4). https://doi.org/10.2307/2392210

Williamson, O. E. (1975). Markets and Hierarchies: Analysis and Antitrust Implications: A Study in the Economics of Internal Organization. *University of Illinois at Urbana-Champaign's Academy for Entrepreneurial Leadership Historical Research Reference in Entrepreneurship*. https://papers.ssrn.com/abstract=1496220

Wu, M.-J., Zhao, K., & Fils-Aime, F. (2022). Response rates of online surveys in published research: A meta-analysis. *Computers in Human Behavior Reports*, *7*(2), 100206. https://doi.org/10.1016/j.chbr.2022.100206

Yin, R. K. (2009). *Case Study Research: Design and Methods*. Thousand Oaks, CA: SAGE. https://doi.org/10.33524/cjar.v14i1.73

Zannier, C., & Maurer, F. (2007). Comparing Decision Making in Agile and Non-agile Software Organizations. *Agile Processes in Software Engineering and Extreme Programming* (Vol. 4536, pp. 1–8). Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-540-73101-6_1

Zazworka, N., Stapel, K., Knauss, E., Shull, F., Basili, V. R., & Schneider, K. (2010). Are developers complying with the process: An XP study. *Proceedings of the 2010 ACM-IEEE International Symposium on Empirical Software Engineering and Measurement*, 1–10. https://doi.org/10.1145/1852786.1852805

Zenseact. (2024). *People at heart*. Zenseact. https://zenseact.com/people-at-heart/, Accessed: 2024-01-30.

Zsambok, C. E. (1997). Naturalistic decision making research and improving team decision making. In C. E. Zsambok & G. Klein (Eds.), *Naturalistic Decision Making*, (pp. 111–120). Lawrence Erlbaum Associates, Inc. https://psycnet.apa.org/record/1997-97363-010

Appendix A: Survey Questions

Master's Thesis Survey: Decision-making in self-managing, agile organizations

Hello!

We are happy that you have found this survey related to our master's thesis project here at Zenseact, supervised by ART Engineering Manager Elisabet Eriksson.

The thesis aims to explore how effective decision-making can be facilitated in self-managing, agile organizations (such as Zenseact), specifically focusing on decisions that impact cross team alignment.

We would really appreciate you taking the time to complete this survey. It only takes about 5-7 minutes, and the survey data will be treated with confidentiality. If you have any questions, don't hesitate to reach out to us in Slack!

Thank you,
Simon Schuster and Tomislav Lastro

* Required

Roles and experience

This set of questions is for us to understand your role and experience at Zenseact.

1. What is your role within Zenseact? *

- ◯ Developer
- ◯ Scrum Master
- ◯ Engineering Manager
- ◯ Product Owner
- ◯ ART Leadership (RTE, ART EM, ART PM)
- ◯ Other

2. Which ART do you belong to? *

- ◯ ART1
- ◯ ART2
- ◯ ART3
- ◯ ART4
- ◯ ART5

3. How long have you been working at Zenseact/Zenuity? *

- ◯ <1 year
- ◯ 1-2 years
- ◯ 2-4 years
- ◯ 4-5 years
- ◯ 5+ years

4. How long have you been working in or with agile teams? (Including jobs before Zenseact) *

- ◯ <1 year
- ◯ 1-2 years
- ◯ 2-4 years
- ◯ 4-5 years
- ◯ 5+ years

Understanding your role and influence in decision-making

This set of questions is for us to understand your role and influence in the decision-making processes. The following questions only concern decisions that impact your team's alignment with other teams (cross team alignment), in other words, decisions that must be coordinated between teams.

5. How frequently are you as an individual **involved in** decisions that impact cross team alignment? I.e. you are actively taking part in making the decision. *

- ◯ Never
- ◯ Once a month or more seldom
- ◯ A few times a month
- ◯ Once a week
- ◯ A few times a week
- ◯ Daily

6. How frequently are you as an individual **affected by** decisions that impact cross team alignment? I.e. you are affected by decisions made by someone else. *

- ◯ Never
- ◯ Once a month or more seldom
- ◯ A few times a month
- ◯ Once a week
- ◯ A few times a week
- ◯ Daily

7. For decisions that impact cross team alignment, how frequently do you make decisions regarding the process of **aligning ART-/company level plans with team-level plans**? *

- ◯ Never
- ◯ Once a month or more seldom
- ◯ A few times a month
- ◯ Once a week
- ◯ A few times a week
- ◯ Daily

8. For decisions that impact cross team alignment, how frequently do you make decisions regarding the process of **allocating resources**? *

- ◯ Never
- ◯ Once a month or more seldom
- ◯ A few times a month
- ◯ Once a week
- ◯ A few times a week
- ◯ Daily

9. For decisions that impact cross team alignment, how frequently do you make decisions regarding the process of **performing development tasks**? *

- ◯ Never
- ◯ Once a month or more seldom
- ◯ A few times a month
- ◯ Once a week
- ◯ A few times a week
- ◯ Daily

10. Are there any other types of decisions that you make that impact cross team alignment?

11. Who typically makes decisions that impact cross team alignment in your team? *

- ◯ The development team
- ◯ The delivery team
- ◯ Delegated to ART Leadership
- ◯ Delegated to decision forum
- ◯ Individual
- ◯ Other

12. Please specify which individual in Q11 (role-based or knowledge-based, e.g. PO or the person with the most knowledge in the subject) *

13. In what forum are decisions that impact cross team alignment typically made? (Multiple choices available) *

- [ ] Team refinement
- [ ] ART refinement
- [ ] Product refinement & design review meeting
- [ ] WoW refinement
- [ ] Solution refinement
- [ ] Architecture meeting
- [ ] C++ forum
- [ ] SRC CI forum
- [ ] ELT
- [ ] ZLT
- [ ] Ad hoc meetings
- [ ] Other

Identifying challenges in decision-making

This set of questions is for us to understand the challenges that you may face in the decision-making processes. As before, the focus is on decisions that impact your team's alignment with other teams (cross team alignment).

14. For decisions that impact cross team alignment, how frequently do you encounter challenges regarding the process of **aligning ART-/company-level plans with team-level plans** in the following areas? *

	Never				Every time
Lack of shared understanding (e.g. what is supposed to be delivered in the upcoming release)	◯	◯	◯	◯	◯
Not understanding the complexity (e.g. requirements not being specified and explained)	◯	◯	◯	◯	◯
No arena for solving conflicts (e.g. meetings to discuss conflicts between long-term quality and short-term progress)	◯	◯	◯	◯	◯
Not involving the team (e.g. involving all team members in important decisions)	◯	◯	◯	◯	◯

15. For decisions that impact cross team alignment, how frequently do you encounter challenges regarding the process of **allocating resources** in the following areas? *

	Never				Every time
Important decisions not aligned (e.g. postponing important decisions and therefore adding too many features to the sprint backlog)	○	○	○	○	○
Missing a clear prioritization (e.g. product backlog not being well-prioritized and aligned to all decisions)	○	○	○	○	○
Missing a definition of done (e.g. no clear definition of done that prolongs work, therefore using up resources that could be used on other tasks instead)	○	○	○	○	○
Conflicting priorities within the company (e.g. lost resources during iterations due to conflicting priorities and lacking support from the organization)	○	○	○	○	○
Low commitment to the plan (e.g. creating individual plans instead of following the team's plan due to an unrealistic sprint backlog)	○	○	○	○	○

16. For decisions that impact cross team alignment, how frequently do you encounter challenges regarding the process of **performing development tasks** in the following areas? *

	Never				Every time
Not confronting each other (e.g. unwillingness to argue with other)	○	○	○	○	○
Lacking team orientation (e.g. missing a clear team direction when performing tasks together)	○	○	○	○	○
Unrealistic plans (e.g. due to over-ambitious product backlogs)	○	○	○	○	○
Decision-hijacking (e.g. team members making decisions without informing the others)	○	○	○	○	○
Lack of knowledge (e.g. not being able to give feedback or discuss during the decision-making process due to lack of knowledge)	○	○	○	○	○
Technocracy (e.g. high expert power attained by certain individuals creating roadblocks for shared and aligned decision-making)	○	○	○	○	○

17. For decisions that impact cross team alignment, are there any particular challenges that you are facing? If so, please describe them.

Overall thoughts on the decision-making processes

This set of questions is for us to understand and assess your overall thoughts and satisfaction levels, as well as to gather potential improvement ideas you may have. As before, the focus is on decisions that impact your team's alignment with other teams (cross team alignment).

18. For decisions that require alignment with other teams, we... *

	Too little		Just right		Too much
Communicate	◯	◯	◯	◯	◯
Utilize collaborative tools, platforms, and resources (e.g. Confluence, Slack)	◯	◯	◯	◯	◯
Spend time and energy	◯	◯	◯	◯	◯
Discuss conflicting views	◯	◯	◯	◯	◯
Make decisions with confidence	◯	◯	◯	◯	◯
Draw on data and information	◯	◯	◯	◯	◯
Follow-up on decisions	◯	◯	◯	◯	◯
Involve the PO	◯	◯	◯	◯	◯
Involve ART leaders	◯	◯	◯	◯	◯
Involve Zenseact leaders	◯	◯	◯	◯	◯
Clarify and document decisions	◯	◯	◯	◯	◯

19. For decisions that impact cross team alignment, how **satisfied** are you with the current decision-making processes in general? *

- ◯ Very satisfied
- ◯ Somewhat satisfied
- ◯ Neither satisfied nor dissatisfied
- ◯ Somewhat dissatisfied
- ◯ Very dissatisfied

20. For decisions that impact cross team alignment, how **effective** do you perceive the decision-making processes in general to be? *

- ◯ Very effective
- ◯ Somewhat effective
- ◯ Neither effective nor ineffective
- ◯ Somewhat ineffective
- ◯ Very ineffective

21. Are there any additional comments or insights you would like to share regarding decisions that impact cross team alignment?

22. Do you have any ideas or thoughts on how the effectiveness of decision-making processes can be improved regarding decisions that impact cross team alignment?

23. Are you interested in providing us with your additional thoughts and ideas or by participating in future steps of the research? If so, please provide your name and we will reach out to you.

Appendix B: Interview Guide

Introduction

- Introduce the researchers and topic
- Aim and format of the interview
    - Aim: Learn more about the team, dive deeper and confirm results from survey (RQ1), start digging into solution ideas (RQ2)
    - Format: 1 hour, in-person
- Conventions (confidentiality, recordings, transcribing, everybody's view, open debate)
- Personal introduction of participants
    - What is your role?
    - How long have you been in your role?
    - Do you have any previous experience in your current role?

Discussion

Current Decision-making Process

1. Tell me about the last time you made a decision that required cross-team alignment?
    1.1. Why did you need to align with another team?
    1.2. Describe the process?
    1.3. Who made the decision?
    1.4. Was it documented? How?
    1.5. Did you find the process effective?
    1.6. Developers: Are you involved enough in cross-team decisions?
2. Describe a situation when you effectively made a decision that required cross-team alignment?
    2.1. Why was it effective?
    2.2. What prevents you from always having this effective process?

3. How do you perceive cross-team alignment decisions are communicated? Are the right people informed?
    3.1. Do you believe that you have the right communication channels to effectively make decisions across teams?
        3.1.1. Why? Why not?
        3.1.2. How can this be improved?
    3.2. (Does this vary between developers and PO/PM/EM?)
4. Do you have someone responsible/accountable for each decision?
    4.1. Is this stated somewhere? (Both specifically for each decision, but also more generally in terms of the responsibilities of the role)
    4.2. How do you make sure that other teams know who is responsible for a decision?

Challenges and Solutions

5. Are there any challenges that you as a team face when aligning decisions across teams?
    5.1. If yes, please describe them.
    5.2. If not, what works? Why?
    5.3. What effect does your agile WoW have on this? Would this challenge be solved if your organization was more traditional/top-down? Or do you need to be more agile?
    5.4. Is there a specific type of cross-team alignment decisions that are especially challenging to make?
        5.4.1. E.g. product or WoW type of questions?

6. Our survey suggests that the following are the most common challenges: 'Not understanding the complexity', 'Lack of shared understanding', 'Conflicting priorities within the company', 'Important decisions are not aligned', and 'Missing a clear prioritization'
    6.1. Describe why this is challenging.
    6.2. How do you think this can be solved?
7. Our survey indicates that a lot of you believe that you spend too much time and energy on cross-team decision-making. Do you agree?
    7.1. Why is that?
    7.2. How do you think this can be solved?
8. Our survey indicates that a lot of you believe that you spend too little time/effort on clarifying and documenting decisions. Do you agree?
    8.1. Why is that?
    8.2. How do you think this can be solved?

9. Do you believe that it is clearly defined which cross-team decisions should be addressed in which forum? Explain more.
10. Do you believe that it is clearly defined who to reach out to regarding different types of cross-team decisions? Explain more.

11. Is there anything else related to cross-team decision-making challenges that we haven't captured yet?
12. Any ideas of how the decision-making process can be improved?

Summing Up

13. Is there anything that we haven't covered that you want to mention?
(alt. What do you think I should have asked you about that I haven't?)

- Thanking the interviewee(s)
- Informing about next steps for thesis, including presentations in June.

Appendix C: Interview Coding Examples

***Table C.1**: Example of the coding process in the thematic analysis for the category Challenges with information flow.*

<table>
<tr><th>Phase 1</th><th>Phase 2</th><th>Phase 3</th><th>Phase 4</th></tr>
<tr><td>Challenges in finding information about decisions on Slack and Confluence</td><td rowspan="2">Systemic difficulties in finding relevant information about decisions</td><td rowspan="3">Communication and information management</td><td rowspan="8">Challenges with information flow</td></tr>
<tr><td>Information overflow</td></tr>
<tr><td>Too many information channels, making it difficult to find the right information</td><td rowspan="2">Lack of communication channel strategy</td></tr>
<tr><td></td></tr>
<tr><td>Dependence on note-takers for documentation</td><td rowspan="2">Differing views on documentation necessities</td><td rowspan="4">Suboptimal and varying decision documentation</td></tr>
<tr><td>Difference in mentality between generations regarding how much documentation is useful</td></tr>
<tr><td>Issue with clarifying and documenting decisions</td><td rowspan="2">Suboptimal decision documentation</td></tr>
<tr><td></td></tr>
</table>

Appendix D: Contingency Tables and Chi-squared Tests

Table D.1: *Contingency table for decision involvement, split by role.*

Contingency Tables

		Role						
Involved		ART Leadership	Developer	Other	EM	PO	ScM	Total
0	Observed	0	6	0	0	0	0	6
	% within column	0.0 %	10.2 %	0.0 %	0.0 %	0.0 %	0.0 %	6.8 %
1	Observed	0	19	0	0	0	3	22
	% within column	0.0 %	32.2 %	0.0 %	0.0 %	0.0 %	27.3 %	25.0 %
2	Observed	0	16	2	1	0	4	23
	% within column	0.0 %	27.1 %	66.7 %	33.3 %	0.0 %	36.4 %	26.1 %
3	Observed	0	7	0	0	3	2	12
	% within column	0.0 %	11.9 %	0.0 %	0.0 %	37.5 %	18.2 %	13.6 %
4	Observed	2	7	1	1	2	1	14
	% within column	50.0 %	11.9 %	33.3 %	33.3 %	25.0 %	9.1 %	15.9 %
5	Observed	2	4	0	1	3	1	11
	% within column	50.0 %	6.8 %	0.0 %	33.3 %	37.5 %	9.1 %	12.5 %
Total	Observed	4	59	3	3	8	11	88
	% within column	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %

Table D.2: *Chi-squared test for decision involvement, split by role.*

χ^2 Tests

	Value	df	p
χ^2	36.2	25	0.068
N	88		

Table D.3: *Contingency table for decision affectedness, split by role.*

Contingency Tables

		Role						
Affected		ART Leadership	Developer	Other	EM	PO	ScM	Total
1	Observed	0	12	0	0	0	4	16
	% within column	0.0 %	20.3 %	0.0 %	0.0 %	0.0 %	36.4 %	18.2 %
2	Observed	1	19	2	1	2	2	27
	% within column	25.0 %	32.2 %	66.7 %	33.3 %	25.0 %	18.2 %	30.7 %
3	Observed	1	9	1	1	2	1	15
	% within column	25.0 %	15.3 %	33.3 %	33.3 %	25.0 %	9.1 %	17.0 %
4	Observed	1	8	0	0	1	4	14
	% within column	25.0 %	13.6 %	0.0 %	0.0 %	12.5 %	36.4 %	15.9 %
5	Observed	1	11	0	1	3	0	16
	% within column	25.0 %	18.6 %	0.0 %	33.3 %	37.5 %	0.0 %	18.2 %
Total	Observed	4	59	3	3	8	11	88
	% within column	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %

Table D.4: *Chi-squared test for decision affectedness, split by role.*

χ^2 Tests

	Value	df	p
χ^2	18.3	20	0.566
N	88		

Table D.5: *Contingency table for satisfaction, split by role.*

Contingency Tables

		Role						
Satisfaction		ART Leadership	Developer	Other	EM	PO	ScM	Total
1	Observed	0	6	0	0	0	0	6
	% within column	0.0 %	10.2 %	0.0 %	0.0 %	0.0 %	0.0 %	6.8 %
2	Observed	1	15	1	1	2	3	23
	% within column	25.0 %	25.4 %	33.3 %	33.3 %	25.0 %	27.3 %	26.1 %
3	Observed	1	13	1	1	4	3	23
	% within column	25.0 %	22.0 %	33.3 %	33.3 %	50.0 %	27.3 %	26.1 %
4	Observed	2	24	1	1	2	3	33
	% within column	50.0 %	40.7 %	33.3 %	33.3 %	25.0 %	27.3 %	37.5 %
5	Observed	0	1	0	0	0	2	3
	% within column	0.0 %	1.7 %	0.0 %	0.0 %	0.0 %	18.2 %	3.4 %
Total	Observed	4	59	3	3	8	11	88
	% within column	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %

Table D.6: *Chi-squared test for satisfaction, split by role.*

χ^2 Tests

	Value	df	p
χ^2	14.5	20	0.804
N	88		

Table D.7: *Contingency table for perceived effectiveness, split by role.*

Contingency Tables

		Role						
Effectiveness		ART Leadership	Developer	Other	EM	PO	ScM	Total
1	Observed	0	5	0	0	0	1	6
	% within column	0.0 %	8.5 %	0.0 %	0.0 %	0.0 %	9.1 %	6.8 %
2	Observed	1	17	1	0	5	4	28
	% within column	25.0 %	28.8 %	33.3 %	0.0 %	62.5 %	36.4 %	31.8 %
3	Observed	2	15	0	1	1	1	20
	% within column	50.0 %	25.4 %	0.0 %	33.3 %	12.5 %	9.1 %	22.7 %
4	Observed	1	21	2	2	2	3	31
	% within column	25.0 %	35.6 %	66.7 %	66.7 %	25.0 %	27.3 %	35.2 %
5	Observed	0	1	0	0	0	2	3
	% within column	0.0 %	1.7 %	0.0 %	0.0 %	0.0 %	18.2 %	3.4 %
Total	Observed	4	59	3	3	8	11	88
	% within column	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %

Table D.8: *Chi-squared test for perceived effectiveness, split by role.*

χ^2 Tests

	Value	df	p
χ^2	19.2	20	0.511
N	88		

Appendix E: Correlation Matrix

Correlation Matrix (dark orange: r > |0.6|, orange: |0.4| < r < |0.6|, light orange: |0.2| < r < |0.4|)

		Involved	Affected	Aligning plans	Allocating resources	Development tasks	Lack of shared understanding	Not understanding the complexity	No arena for solving conflicts	Not involving the team	Important decisions not aligned	Missing a clear prioritization	Missing a definition of done	Conflicting priorities within the company	Low commitment to the plan	Not confronting each other	Lacking team orientation	Unrealistic plans	Decision-hijacking	Lack of knowledge	Technocracy	Communicate	Utilize collaborative tools	Spend time and energy	Discuss conflicting views	Make decisions with confidence	Draw on data and information	Follow-up on decisions	Involve the PO	Involve ART leaders	Involve Zenseact leaders	Clarify and document decisions	Satisfaction	Effectiveness
Involved	Pearson's r	—																																
	p-value	—																																
Affected	Pearson's r	0.469	—																															
	p-value	< .001	—																															
Aligning plans	Pearson's r	0.597	0.388	—																														
	p-value	< .001	< .001	—																														
Allocating resources	Pearson's r	0.413	0.303	0.669	—																													
	p-value	< .001	0.004	< .001	—																													
Development tasks	Pearson's r	0.503	0.34	0.521	0.414	—																												
	p-value	< .001	0.001	< .001	< .001	—																												
Lack of shared understanding	Pearson's r	0.1	0.284	0.049	-0.002	0.156	—																											
	p-value	0.356	0.007	0.647	0.986	0.146	—																											
Not understanding	Pearson's r	0.028	0.224	0.085	0.031	0.108	0.387	—																										
	p-value	0.797	0.036	0.434	0.772	0.317	< .001	—																										
No arena for solving	Pearson's r	0.138	0.169	0.074	-0.151	0.178	0.322	0.371	—																									
	p-value	0.201	0.115	0.493	0.16	0.096	0.002	< .001	—																									
Not involving the team	Pearson's r	-0.095	0.096	-0.067	-0.218	-0.017	0.367	0.366	0.517	—																								
	p-value	0.376	0.372	0.532	0.041	0.878	< .001	< .001	< .001	—																								
Important decisions not	Pearson's r	0.148	0.24	0.077	-0.029	0.166	0.467	0.359	0.447	0.414	—																							
	p-value	0.167	0.024	0.476	0.789	0.122	< .001	< .001	< .001	< .001	—																							
Missing a clear	Pearson's r	0.018	0.176	-0.015	-0.034	-0.037	0.401	0.456	0.543	0.372	0.57	—																						
	p-value	0.869	0.1	0.887	0.752	0.733	< .001	< .001	< .001	< .001	< .001	—																						
Missing a definition of	Pearson's r	0.205	0.253	0.23	0.143	0.238	0.199	0.406	0.442	0.339	0.422	0.491	—																					
	p-value	0.055	0.018	0.031	0.182	0.026	0.063	< .001	< .001	0.001	< .001	< .001	—																					
Conflicting priorities	Pearson's r	0.087	0.215	0.05	-0.018	-0.003	0.436	0.466	0.334	0.27	0.553	0.562	0.294	—																				
	p-value	0.42	0.045	0.645	0.867	0.978	< .001	< .001	0.001	0.011	< .001	< .001	0.005	—																				
Low commitment	Pearson's r	0.062	0.145	0.035	0.035	0.028	0.286	0.287	0.523	0.414	0.424	0.583	0.564	0.319	—																			
	p-value	0.564	0.179	0.744	0.744	0.798	0.007	0.007	< .001	< .001	< .001	< .001	< .001	0.002	—																			
Not confronting	Pearson's r	0.117	0.149	0.316	0.244	0.163	0.037	0.029	0.281	0.244	0.154	0.353	0.344	0.037	0.359	—																		
	p-value	0.278	0.167	0.003	0.022	0.13	0.734	0.792	0.008	0.022	0.152	< .001	0.001	0.732	< .001	—																		
Lacking team orientation	Pearson's r	0.092	0.215	0.184	0.088	0.153	0.327	0.266	0.521	0.421	0.307	0.497	0.461	0.102	0.506	0.427	—																	
	p-value	0.396	0.044	0.086	0.413	0.155	0.002	0.012	< .001	< .001	0.004	< .001	< .001	0.343	< .001	< .001	—																	
Unrealistic plans	Pearson's r	-0.065	0.128	0.093	0.001	0.132	0.288	0.215	0.266	0.267	0.329	0.481	0.262	0.384	0.302	0.275	0.403	—																
	p-value	0.55	0.235	0.39	0.991	0.221	0.006	0.044	0.012	0.012	0.002	< .001	0.014	< .001	0.004	0.009	< .001	—																
Decision-hijacking	Pearson's r	0.004	0.242	0.064	0.072	0.033	0.374	0.295	0.382	0.408	0.34	0.473	0.277	0.263	0.425	0.249	0.427	0.408	—															
	p-value	0.973	0.023	0.555	0.505	0.76	< .001	0.005	< .001	< .001	0.001	< .001	0.009	0.013	< .001	0.019	< .001	< .001	—															
Lack of knowledge	Pearson's r	-0.132	0.155	-0.168	-0.079	0.005	0.386	0.337	0.272	0.314	0.252	0.406	0.193	0.226	0.416	0.107	0.263	0.34	0.451	—														
	p-value	0.22	0.15	0.118	0.465	0.964	< .001	0.001	0.01	0.003	0.018	< .001	0.071	0.034	< .001	0.321	0.013	0.001	< .001	—														
Technocracy	Pearson's r	0.049	0.195	0.037	0.018	-0.102	0.114	0.198	0.253	0.305	0.19	0.424	0.366	0.134	0.334	0.263	0.352	0.212	0.427	0.367	—													
	p-value	0.647	0.068	0.735	0.871	0.343	0.292	0.065	0.017	0.004	0.075	< .001	< .001	0.214	0.001	0.013	< .001	0.048	< .001	< .001	—													
Communicate	Pearson's r	-0.151	-0.221	-0.242	-0.076	-0.291	-0.098	-0.243	-0.263	-0.165	-0.269	-0.097	-0.283	-0.002	-0.162	-0.206	-0.317	-0.022	-0.205	-0.14	-0.253	—												
	p-value	0.16	0.039	0.023	0.483	0.006	0.364	0.022	0.013	0.124	0.011	0.37	0.007	0.984	0.131	0.054	0.003	0.835	0.056	0.192	0.017	—												
Utilize collaborative	Pearson's r	-0.082	-0.181	-0.109	-0.093	-0.053	-0.131	-0.241	-0.221	-0.321	-0.168	-0.149	-0.196	-0.178	-0.2	-0.13	-0.214	-0.127	-0.159	-0.147	-0.012	0.233	—											
	p-value	0.445	0.091	0.312	0.386	0.621	0.223	0.024	0.039	0.002	0.117	0.165	0.067	0.097	0.062	0.228	0.045	0.239	0.14	0.171	0.909	0.029	—											
Spend time and energy	Pearson's r	-0.099	0.006	-0.244	-0.11	-0.26	-0.092	0.08	-0.277	-0.145	-0.267	-0.051	-0.074	-0.047	-0.088	-0.171	-0.262	-0.143	-0.09	-0.057	0.044	0.272	0.11	—										
	p-value	0.357	0.955	0.022	0.306	0.014	0.392	0.459	0.009	0.177	0.012	0.635	0.494	0.664	0.415	0.11	0.014	0.184	0.406	0.599	0.684	0.01	0.306	—										
Discuss conflicting	Pearson's r	-0.077	-0.176	-0.121	-0.008	-0.221	-0.087	-0.148	-0.303	-0.338	-0.139	-0.27	-0.364	0.038	-0.319	-0.347	-0.457	-0.236	-0.23	-0.174	-0.34	0.271	0.141	0.243	—									
	p-value	0.477	0.101	0.26	0.944	0.039	0.422	0.17	0.004	0.001	0.195	0.011	< .001	0.724	0.002	< .001	< .001	0.027	0.031	0.105	0.001	0.011	0.189	0.022	—									
Make decisions with	Pearson's r	0.083	0.02	-0.056	0.126	-0.027	-0.095	-0.136	-0.33	-0.084	-0.027	-0.29	-0.019	-0.132	-0.166	-0.139	-0.122	-0.079	-0.112	-0.267	-0.025	-0.075	0.054	0.123	0.189	—								
	p-value	0.443	0.857	0.602	0.242	0.801	0.377	0.207	0.002	0.435	0.802	0.006	0.86	0.221	0.121	0.196	0.258	0.463	0.299	0.012	0.816	0.488	0.616	0.252	0.078	—								
Draw on data and	Pearson's r	-0.085	-0.146	-0.177	-0.043	-0.021	-0.108	-0.099	-0.205	-0.214	-0.08	-0.258	-0.203	-0.124	-0.404	-0.261	-0.3	-0.215	-0.248	-0.239	-0.222	0.078	0.114	0.043	0.257	0.272	—							
	p-value	0.432	0.176	0.1	0.689	0.843	0.318	0.357	0.056	0.045	0.459	0.015	0.058	0.25	< .001	0.014	0.004	0.045	0.02	0.025	0.037	0.472	0.291	0.693	0.016	0.01	—							
Follow-up on decisions	Pearson's r	-0.059	-0.21	-0.19	-0.09	-0.29	-0.287	-0.259	-0.398	-0.154	-0.246	-0.273	-0.24	-0.274	-0.327	-0.203	-0.239	-0.338	-0.196	-0.342	-0.139	0.196	0.173	0.19	0.235	0.147	0.266	—						
	p-value	0.585	0.05	0.075	0.404	0.006	0.007	0.015	< .001	0.151	0.021	0.01	0.024	0.01	0.002	0.058	0.025	0.001	0.068	0.001	0.195	0.067	0.107	0.076	0.028	0.171	0.012	—						
Involve the PO	Pearson's r	0.025	0.158	0.112	0.125	0.009	-0.102	-0.236	-0.025	-0.314	-0.05	-0.044	0.065	0.059	0.006	0.076	-0.076	-0.033	-0.02	-0.137	0.049	0.155	0.183	0.061	0.112	0.075	0.042	0.068	—					
	p-value	0.815	0.142	0.301	0.246	0.932	0.345	0.027	0.818	0.003	0.646	0.684	0.55	0.587	0.952	0.484	0.479	0.76	0.856	0.203	0.653	0.148	0.087	0.57	0.298	0.486	0.701	0.527	—					
Involve ART leaders	Pearson's r	0.178	0.108	0.181	0.195	-0.01	-0.172	-0.202	-0.273	-0.262	-0.022	-0.207	0.022	-0.024	-0.234	0.005	-0.175	-0.203	-0.248	-0.272	0.09	0.051	0.155	0.16	0.171	0.179	0.166	0.126	0.356	—				
	p-value	0.097	0.317	0.091	0.069	0.928	0.11	0.059	0.01	0.014	0.836	0.053	0.841	0.824	0.028	0.961	0.103	0.058	0.02	0.01	0.402	0.637	0.148	0.138	0.111	0.095	0.122	0.243	< .001	—				
Involve Zenseact	Pearson's r	0.215	0.188	0.209	0.206	0.104	-0.18	-0.102	-0.197	-0.187	0.069	-0.127	0.105	-0.004	-0.099	-0.061	-0.112	-0.132	-0.238	-0.153	-0.002	-0.003	0.2	0.034	0.068	0.18	0.1	-0.048	0.212	0.717	—			
	p-value	0.044	0.08	0.05	0.055	0.333	0.093	0.343	0.066	0.081	0.524	0.238	0.332	0.974	0.358	0.57	0.298	0.219	0.025	0.155	0.985	0.974	0.062	0.755	0.531	0.093	0.354	0.654	0.047	< .001	—			
Clarify and document	Pearson's r	-0.169	-0.118	-0.23	-0.091	-0.188	-0.129	-0.205	-0.439	-0.256	-0.163	-0.196	-0.232	-0.175	-0.217	-0.161	-0.275	-0.278	-0.225	-0.215	-0.099	0.161	0.225	0.182	0.351	0.282	0.358	0.476	0.016	0.163	-0.063	—		
	p-value	0.115	0.273	0.031	0.399	0.08	0.229	0.056	< .001	0.016	0.129	0.067	0.029	0.103	0.043	0.135	0.01	0.009	0.035	0.045	0.359	0.133	0.035	0.091	< .001	0.008	< .001	< .001	0.886	0.129	0.559	—		
Satisfaction	Pearson's r	-0.021	-0.205	0.022	0.261	0.081	-0.463	-0.346	-0.646	-0.517	-0.338	-0.498	-0.354	-0.33	-0.476	-0.168	-0.485	-0.361	-0.467	-0.386	-0.316	0.263	0.319	0.044	0.304	0.327	0.282	0.28	0.182	0.382	0.385	0.306	—	
	p-value	0.848	0.055	0.841	0.014	0.454	< .001	< .001	< .001	< .001	0.001	< .001	< .001	0.002	< .001	0.117	< .001	< .001	< .001	< .001	0.003	0.013	0.002	0.686	0.004	0.002	0.008	0.008	0.089	< .001	< .001	0.004	—	
Effectiveness	Pearson's r	-0.108	-0.194	-0.106	0.1	-0.024	-0.48	-0.36	-0.514	-0.328	-0.308	-0.459	-0.335	-0.407	-0.528	-0.242	-0.427	-0.357	-0.304	-0.346	-0.307	0.248	0.232	0.056	0.263	0.319	0.318	0.351	0.026	0.198	0.192	0.281	0.719	—
	p-value	0.318	0.07	0.324	0.353	0.828	< .001	< .001	< .001	0.002	0.004	< .001	0.001	< .001	< .001	0.023	< .001	< .001	0.004	< .001	0.004	0.02	0.03	0.601	0.013	0.002	0.003	< .001	0.809	0.065	0.073	0.008	< .001	—

Appendix F: Exploratory Factor Analysis

Table F.1: *Factor statistics, summary.*

Factor	SS Loadings	% of Variance	Cumulative %
1	6.78	20.54	20.5
2	3.13	9.49	30.0
3	2.35	7.13	37.2

Table F.2: *Factor statistics, inter-factor correlations.*

	Factor		
	1	2	3
1	—	0.152	-0.274
2		—	0.103
3			—

Table F.3: *Assumption check, Bartlett's Test of Sphericity.*

χ^2	df	p
1328	528	< .001

Table F.4: *Assumption check, KMO Measure of Sampling Adequacy.*

	MSA		MSA
Overall	**0.750**	Unrealistic plans	0.735
Involved	0.540	Decision-hijacking	0.906
Affected	0.717	Lack of knowledge	0.801
Aligning plans	0.672	Technocracy	0.709
Allocating resources	0.623	Communicate	0.611
Development tasks	0.593	Utilize collaborative tools	0.718
Lack of shared understanding	0.790	Spend time and energy	0.526
Not understanding the complexity	0.782	Discuss conflicting views	0.814
No arena for solving conflicts	0.817	Make decisions with confidence	0.473
Not involving the team	0.749	Draw on data and information	0.831
Important decisions are not aligned	0.866	Follow-up on decisions	0.742
Missing a clear prioritization	0.823	Involve the PO	0.386
Missing a definition of done	0.868	Involve ART leaders	0.602
Conflicting priorities within the company	0.806	Involve Zenseact leaders	0.548
Low committing to the plan	0.827	Clarify and document decisions	0.653
Not confronting each other	0.772	Satisfaction	0.831
Lacking team orientation	0.899	Effectiveness	0.838

DEPARTMENT OF TECHNOLOGY MANAGEMENT AND ECONOMICS
DIVISION OF INNOVATION AND R&D MANAGEMENT
CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden
www.chalmers.se

CHALMERS
UNIVERSITY OF TECHNOLOGY