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# Challenges and Opportunities in Agile Projects in Big Corporations

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## **Abstract**

Big corporations are shifting towards Agile in response to rapid technological developments and changing market demands. In this context, Agile methodologies have become a pivotal framework for increasing organizations' adaptability, resilience, and efficiency. Originally, Agile's origins of success were in small, co-located teams. However, large corporations started implementing Agile practices at scale. This thesis researches the adoption and implementation of Agile methodologies within large corporations and the complex challenges and opportunities they face. The research employs a mixed-methods approach, combining quantitative data from a questionnaire with qualitative insights from an extensive literature review.

One key result of the thesis is that Agile often faces resistance to change from existing organizational culture and insufficient understanding from management. The thesis demonstrates that adaptability, inter-team communication, and opportunities for improvement and innovation are critical building blocks for any successful large-scale corporate Agile transformation. Moreover, the thesis discusses the design of organizations as scale-free networks with communication hubs as possible optimization for inter-team collaboration.

The thesis adds valuable knowledge to the ongoing debate on Agile methodologies, providing a practical guide for organizations planning to leverage the advantages of Agile and emphasizing the potential of Agile for innovation and competitive advantage in the modern business world.

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## **List of abbreviations**

|       |                                     |
|-------|-------------------------------------|
| ASD   | Agile Software Development          |
| APM   | Agile Project Management            |
| CI/CD | Continuous Integration and Delivery |
| DAD   | Disciplined Agile Delivery          |
| GSD   | Global Software Development         |
| LeSS  | Large-Scale Scrum                   |
| PM    | Product Manager                     |
| PO    | Product Owner                       |
| RAGE  | Recipes for Agile                   |
| SAFe  | Scaled Agile Framework              |
| SM    | Scrum Master                        |
| SoS   | Scrum of Scrums                     |
| XP    | Extreme Programming                 |

# **1 Introduction**

## **1.1 Background**

Since it was introduced, Agile Methodology has made a great impact in software development and project management. The introduction of the Agile Manifesto in 2001 (Beck et al., 2001) led to changes in software projects by focusing on adaptability, flexibility, customer satisfaction, continuous improvement, and responsiveness to change. Over time, these methodologies have been used in organizations other than the software development industry, thus indicating their usefulness in multiple organizational contexts.

However, implementing agile projects is not smooth sailing for big corporations, as they face unique challenges. Attempting to transform large organizations into Agile enterprises can be complicated due to factors such as established traditional management structures, complexity of large-scale organizations and managing multiple teams operating from diverse locations and cultures. Nevertheless, the possible advantages of enhanced teamwork efficiency, increased product quality and increased collaboration between team members make Agile an interesting concept for organizational transformations.

The evolution of Agile methodologies reflects the ongoing efforts to address those challenges in a structured way. In response to these challenges, standard scaling frameworks like SAgile and LeSS were developed. However, the diversity and uniqueness of each organization highlight a critical need: the tailored customization of these frameworks to meet specific corporate landscapes.

## **1.2 Statement of the Problem**

While Agile methodologies have demonstrated significant benefits for software development teams and small organizations, their use in large corporations is accompanied by many

challenges. These include difficulties maintaining Agile principles across multiple teams, integrating new practices with existing corporate cultures, and effectively managing projects spanning different regions and departments. Moreover, there is no universally applicable one-size-fits-all scaling framework; hence, organizations must experiment and customize Agile methodologies to their specific operational contexts. This experimentation leads to inconsistent implementation and varying degrees of success.

### **1.3 Significance of the Study**

Acknowledging these difficulties of implementing Agile, this thesis aims to fill the research gap, which exists in academic literature, by researching real-life case studies on Agile transformation efforts and its success or failure factors in relation to large organizations. The thesis will combine a practical questionnaire, that will be given to team members of four different agile projects within big corporations and a comprehensive review of relevant literature available. The findings of this mixed-method analysis can guide organizations seeking to navigate the path towards an Agile transformation with recommendations about how they can create an environment that values Agile principles.

### **1.4 Objectives and Scope of the Thesis**

The significance of addressing these challenges leads to the primary objective of this thesis - to research the challenges and opportunities associated with implementing Agile methodologies in large corporations. Specifically, the thesis research following questions:

1. What are the challenges that large corporations face during the adoption of Agile practices?
2. What specific opportunities arise for large organizations when implementing Agile methodologies?



To analyze the implementation of Agile practices in a large-scale setting, a mixed-methods research approach will be used. The method will combine quantitative data from questionnaire surveys with qualitative findings obtained through a comprehensive literature review.

## **2 Literature Review**

### **2.1 Overview of Agile Methodology**

The roots of the Agile methodology can be traced back to a paper titled "The New Product Development Game" published in 1986 by Hirotaka Takeuchi and Ikujiro Nonaka in the Harvard Business Review (Takeuchi & Nonaka, 1986). In the 1980s, Takeuchi and Nonaka observed several successful companies that could create products different from their competitors. Instead of the classic approach, where one project phase was completed by one team and passed on to the next, these organizations adopted what the authors defined as the "rugby approach." In this approach, a team moves back and forth over the development field, passing one product just like a ball, pushing forward the whole project rather than in isolated phases. This approach leads to overlapping development stages, where testing and refinement were done simultaneously to designing and production, resulting in a more iterative and incremental process.

#### Agile Manifesto

The "rugby approach" outlined by Takeuchi and Nonaka inspired the Agile development methodology by promoting several fundamental principles that would later be found in the Agile Manifesto. In 2001, seventeen software developers met at a resort in Snowbird, Utah, to discuss lightweight development methods and published the "Manifesto for Agile Software Development" (Beck et al., 2001). The Agile Manifesto consists of four foundational values and twelve supporting principles. These values and principles serve as the cornerstone of the Agile

methodology, guiding the practices and decision-making processes in Agile project management. The Agile Manifesto values are defined as follows (Beck et al., 2001):

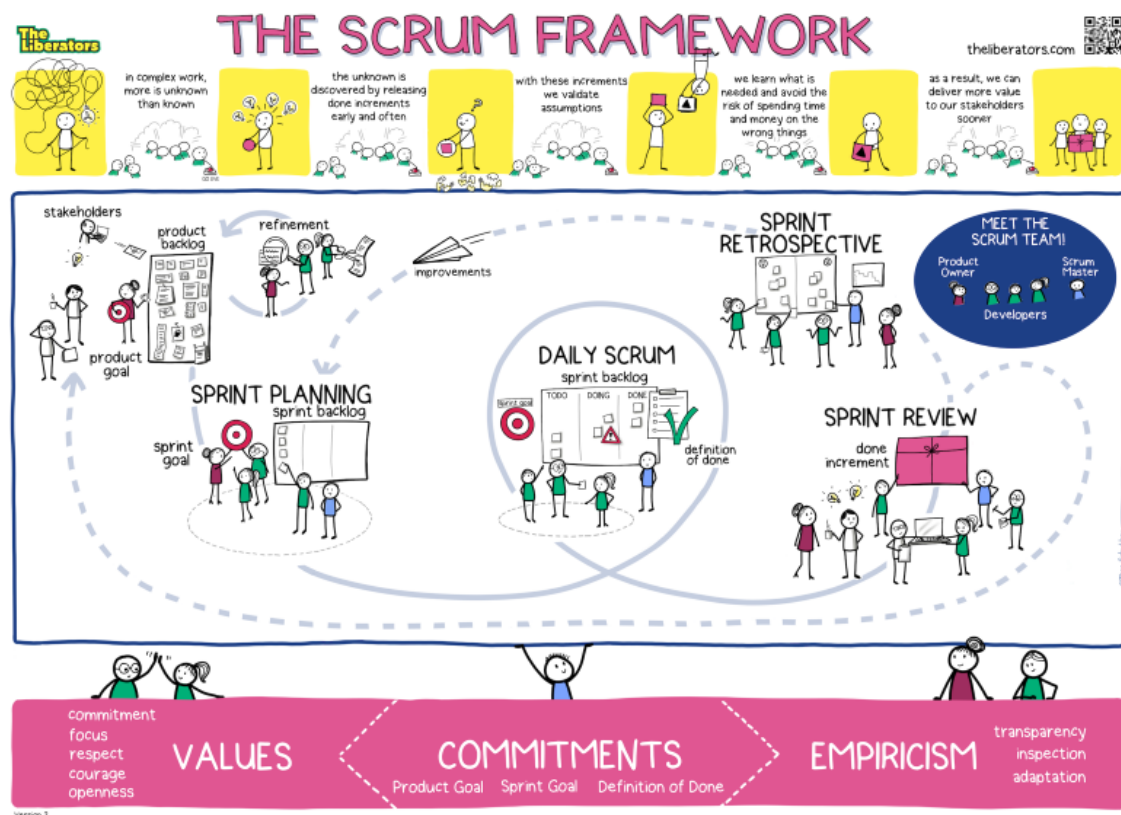
- Individuals and interactions over processes and tools - Highlighting the importance of human communication and collaboration over-reliance on rigid processes and specific tools.
- Working software over comprehensive documentation - Prioritizing the delivery of functional software over the production of extensive documentation.
- Customer collaboration over contract negotiation - Emphasizing direct collaboration with customers to ensure the product meets their needs and expectations.
- Responding to change over following a plan - Valuing flexibility and the capacity to adapt to changes over strict adherence to a predefined project plan.

These values are further expounded by twelve principles, which include customer satisfaction through early and continuous software delivery, welcoming changing requirements, delivering working software frequently, and maintaining a sustainable pace of work (Beck et al., 2001).

### Scrum

One of the most widely implemented Agile frameworks is Scrum, designed to facilitate project management in small, cross-functional teams. Scrum was used by 66% of the Agile Teams in 2023 (*17th State of Agile Report*, 2023). Scrum was designed by Ken Schwaber in collaboration with Jeff Sutherland in the early 1990s (Sutherland, 2014) The term "Scrum" was first introduced in a 1995 paper presented by Sutherland and Schwaber at the OOPSLA conference in Austin, Texas. The paper, titled "Scrum Software Development Process" (Schwaber, 1997) was inspired by the article published by Takeuchi and Nonaka (1986), which Schwaber and Sutherland saw as a model for adaptive, team-based project management. Schwaber continued

to refine and promote Scrum and was a key figure in the creation of the Agile Manifesto in 2001.



**Figure 1: The Scrum Framework (Overeem, 2020)**

Scrum introduces specific roles, events, and artifacts to structure the development process, ensuring alignment with Agile values and principles (Figure 1). The Scrum Values are defined in the Scrum guide (Schwaber & Sutherland, 2020):

- **Courage** – Scrum Team members have the courage to do the right thing and work on tough problems.
- **Focus** – Everyone focuses on the work of the Sprint and the goals of the Scrum Team.
- **Commitment** – People personally commit to achieving the goals of the Scrum Team.
- **Respect** – Scrum Team members respect each other to be capable, independent people.
- **Openness** – The Scrum Team and its stakeholders agree to be open about all the work and the challenges with performing it.

The Scrum framework defines three primary roles in the Scrum Guide (Schwaber & Sutherland, 2020):

- **Product Owner:** The Product Owner has the task of maximizing the value of the product resulting from the work of the Scrum Team. They are responsible for managing the Product Backlog, which includes clearly expressing Product Backlog items, ordering them to best achieve goals, and ensuring the backlog is transparent, visible, and understood.
- **Scrum Master:** Serving as a coach for the Scrum Team, the Scrum Master is responsible for ensuring Scrum is understood and enacted. They do this by helping everyone understand Scrum theory, practices, rules, and values and removing impediments to the team's progress to ensure effective workflow and productivity.
- **Development Team:** Development Teams are structured and empowered by the organization to organize and manage their work. The fundamental unit of Scrum is a small team of professionals who produce a usable, potentially releasable increment of "Done" product at the end of each Sprint. Development Teams are cross-functional, with all the skills as a team necessary to create a product Increment.

Scrum employs five specific events (ceremonies) to create regularity and to minimize the need for meetings not defined in Scrum (Schwaber & Sutherland, 2020):

- **Sprints:** The heart of Scrum is a Sprint, a time-boxed period where a usable, and potentially releasable product Increment is created, which also completes the definition of "Done". Sprints have consistent durations throughout a development effort.
- **Sprint Planning:** The work to be performed in the Sprint is planned during the Sprint Planning. The collaborative work of the entire Scrum Team creates this plan.

- **Daily Scrum:** The Development Team uses the Daily Scrum to inspect progress toward the Sprint Goal and how progress is trending toward completing the work in the Sprint Backlog.
- **Sprint Review:** At the end of the Sprint, the Scrum Team and stakeholders convene for the Sprint Review to inspect the Increment and adapt the Product Backlog if needed.
- **Sprint Retrospective:** The Sprint Retrospective occurs after the Sprint Review and before the next Sprint Planning. This is a time for the Scrum Team to inspect itself and create a plan for improvements to be enacted during the next Sprint.

Scrum artifacts represent a piece of work or value to provide transparency and opportunities for retrospection and adaptation:

- **Product Backlog:** This is a list with an order and contains everything that is required for the product. It provides the sole requirements for changes that may be performed on the product.
- **Sprint Backlog:** The set of Product Backlog items selected for the Sprint and intended to be delivered as a Product Increment, plus a Sprint Goal.
- **Increment:** It includes all Product Backlog Items completed during a sprint plus those of all previous sprints.

These roles, events, and artifacts define how Scrum works in solving difficult problems by delivering valuable products collaboratively and adaptively.

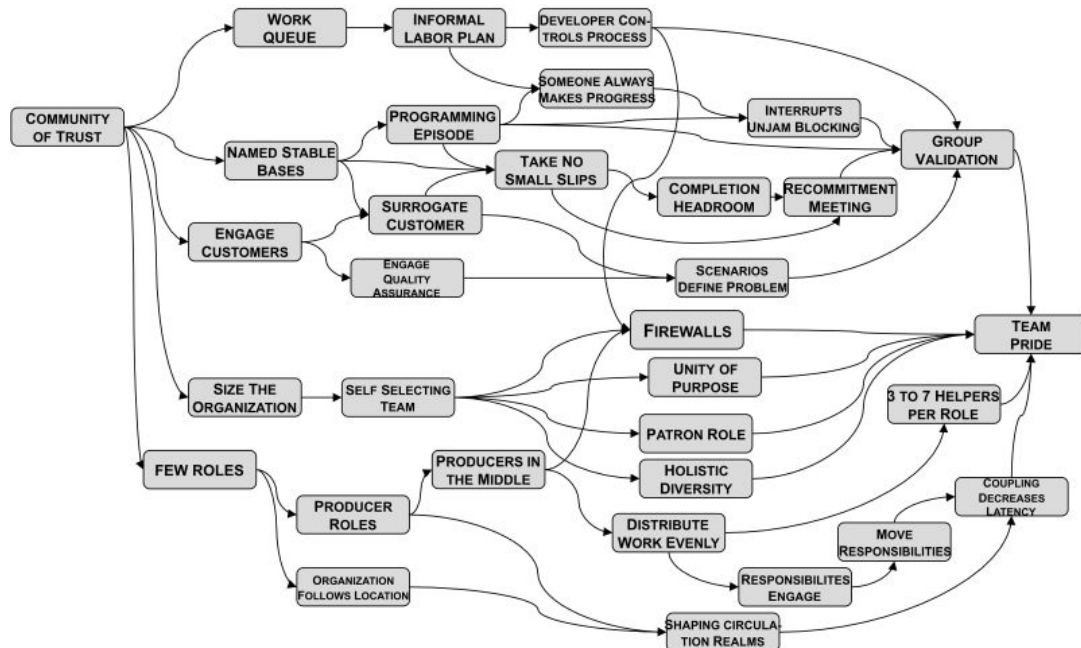
## **2.2 Evolution of Agile Methodologies**

Having established the baseline of understanding Agile, this chapter presents the further evolution of Agile. Since the introduction of the Agile Manifesto in 2001, the Agile movement has come a long way extending its reach beyond small co-located teams to large-scale, multinational companies. This evolution is clearly supported through the development of different

agile frameworks and practices that have been designed to address the complexities of scaling Agile methodologies across large and diverse teams and projects.

### Scrum Pattern Language

A significant step in the development of Agile methods is the Scrum Pattern Language which marks a way into a more structured but adaptable approach to implementing Agile principles within organizations. "Organizational Patterns of Agile Software Development" (J. O. Coplien, 2005) introduces a pattern-based framework for understanding and applying Scrum practices, which were later refined in 2008 to the "Scrum Organizational Patterns", Figure 2. "A Scrum Book: The Spirit of the Game" (Sutherland et al., 2019) is a further development and encompasses a comprehensive framework for implementing Scrum in organizational settings, defining a series of interrelated patterns divided into two main categories: the Product Organization and the Value Stream.



**Figure 2: Scrum Organizational Patterns (Sutherland et al., 2019)**

The main focus of the Product Organization category is to establish teams, roles and responsibilities around the product being developed (Sutherland et al., 2019). This approach

advocates for a product-centered mindset that allows the delivery of valuable products with high quality to customers as its main objective. The 38 patterns within this category provide directions on the establishment of cross-functional teams, a description of the roles of Scrum Master and Product Owner, as well as putting in place effective communication channels between teams or across an organization. Some key patterns within the Product Organization category are Cross-Functional Teams, Product Backlog, and Sprint Planning. These design patterns aim to create a structured yet adaptable environment for product development supported by clear roles, responsibilities, and processes that align with Agile principles.

The Category of the Value Stream addresses the flow of value from the initial concept to the product delivery to the end customer (Sutherland et al., 2019). It focuses on optimizing procedures, eliminating bottlenecks, prioritization, and management that maximizes value delivery. Within this category, 94 patterns guide how to manage the lifecycle process of a product and how to integrate customer feedback. They can also be used to improve processes continuously. Some patterns within the Value Stream include Continuous Integration and Delivery (CI/CD), Feedback Loops, and Retrospectives. By focusing on the Value Stream, organizations can refine their product development practices, ensuring a consistent and efficient delivery of value to their customers.

The integration between the Product Organization and the Value Stream patterns provides an all-inclusive framework for implementing Scrum in a structured yet adaptive manner that is tailored to each organization's unique needs and challenges.

### Agile Scaling Frameworks

As organizations must apply Agile methodologies in larger projects with multiple teams, the need for scalable frameworks emerged. These frameworks are designed to retain Agile

principles while providing structures that facilitate coordination and communication across multiple teams. Kalenda et al. (2018) present all major frameworks (Table 1).

| Aspect            | SAFe<br>(Scaled Agile Framework) | SoS<br>(Scrum of Scrums)          | LeSS<br>(Large-Scale Scrum)         | DAD<br>(Disciplined Agile Delivery)  | Nexus                             | RAGE<br>(Recipes for Agile)       |
|-------------------|----------------------------------|-----------------------------------|-------------------------------------|--------------------------------------|-----------------------------------|-----------------------------------|
| Team size         | 50-120 people in release trains  | 5-10 teams                        | 10 Scrum teams,<br>7 members x team | 200 people or more                   | 3-9 Scrum teams                   | No specific size                  |
| Diffusion         | High                             | High                              | Medium                              | Low                                  | Low                               | Low                               |
| Maturity level    | High                             | High                              | High                                | Medium                               | Low                               | Low                               |
| Complexity        | High/Medium                      | Medium/low                        | Medium/low for Scrum-aware          | High (many practices)                | Medium/low for Scrum-aware        | Medium/low for Scrum-aware        |
| Organization Type | Traditional Enterprises          | Traditional and Agile Enterprises | Large Enterprises                   | Multiple organizations & Enterprises | Traditional and Agile Enterprises | Traditional and Agile Enterprises |

**Table 1: Major frameworks for scaling agile (Kalenda et al., 2018)**

The most common agile scaling frameworks:

- **SAFe (Scaled Agile Framework):** Developed by Dean Leffingwell, SAFe combines Agile and Lean principles to provide a guide for scaling Agile across the enterprise. It features a layered structure, including Team, Program, and Portfolio levels, allowing for an organization-wide implementation of Agile methodologies. SAFe has been widely adopted due to its comprehensive approach to scaling and its emphasis on alignment, built-in quality, and program execution (Leffingwell, 2011)
- **SoS (Scrum of Scrums):** As one of the earliest methods for scaling Scrum, the Scrum of Scrums approach involves the coordination of multiple Scrum teams through the formation of a "meta Scrum" team. This team consists of representatives from each Scrum team and focuses on addressing dependencies and integration issues across



teams, facilitating scaled Agile implementation in larger projects (Schwaber & Beedle, 2002).

- **LeSS (Large-Scale Scrum):** Craig Larman and Bas Vodde introduced LeSS as a framework for scaling Scrum to multiple teams working on the same product. LeSS maintains the core principles of Scrum while introducing additional roles and practices to manage the complexities of larger projects. It emphasizes simplicity, customer-centricity, and whole-product focus (Larman & Vodde, 2009).
- **DAD (Disciplined Agile Delivery):** Scott Ambler and Mark Lines developed DAD as a process decision framework that extends Scrum with elements from other Agile methodologies, such as Lean and Kanban. DAD provides a more disciplined approach to Agile delivery, incorporating architecture and design practices and offering guidance for the entire delivery lifecycle (Ambler & Lines, 2012).
- **Nexus:** Introduced by Ken Schwaber, Nexus is a framework that builds on Scrum to support the integration of work produced by multiple Scrum teams. It introduces new roles and events focusing on managing dependencies and ensuring that the integrated work meets quality standards (Bittner et al., 2018).
- **RAGE (Recipes for Agile Governance in the Enterprise):** RAGE offers a collection of best practices and guidelines for implementing Agile in large enterprises. It focuses on governance, providing strategies for managing risks, optimizing resources, and ensuring alignment between Agile teams and organizational objectives (Thompson, 2013).
- **Spotify Model:** Although not a formal framework, the Spotify model describes the organizational structure and culture of Spotify's engineering teams. It emphasizes autonomy, communication, and collaboration using squads, tribes, chapters, and guilds. This model has inspired many organizations seeking to scale Agile by creating a culture of innovation and continuous improvement (Kniberg & Ivarsson, 2012).

## 2.3 Agile Project Management in Big Corporations

The evolution of Agile methodologies naturally is confronted with the challenges of its implementation in big corporations. The transition into Agile practices in large companies is driven by enhanced adaptability and responsiveness to rapidly changing market demands and customer requirements. Several studies (Dingsøy et al., 2018; Rodríguez et al., 2012) point out the rising interest towards Agile and Lean methods in software engineering for productivity, better product quality, and time-to-market reduction. The transition from plan-driven methodologies to agile methods involves a much organizational transformation focusing on core values such as collaboration, customer needs, and continuous learning. In Agile projects undertaken by big corporations, there are unique challenges which result from project size and distinct coordination strategies for each category. Dingsøy et al. (2018) define the taxonomy of software agile projects and group them into small-scale, large-scale, and very large-scale, presented in Table 2.

| Level            | Number of teams | Coordination approaches                                                                                                              |
|------------------|-----------------|--------------------------------------------------------------------------------------------------------------------------------------|
| Small-scale      | 1               | Coordinating the team can be done using agile practices such as daily meetings, common planning, review, and retrospective meetings. |
| Large-scale      | 2-9             | Coordination of teams can be achieved in a new forum such as a Scrum of Scrums forum.                                                |
| Very large scale | 10+             | Several forums are needed for coordination, such as multiple Scrum of Scrums.                                                        |

**Table 2: A taxonomy of scale of agile software development projects (Dingsøy et al., 2018)**

Strategically integrating agile methodologies requires tailoring agile practices to effectively address scaling and coordination challenges. Industry case studies (Ciric et al., 2019; Petersen & Wohlin, 2010) emphasize the need to develop an organizational culture that supports agile practices, investment in training and resources for adopting agile practices and developing mechanisms to scale agile practices across distributed teams. These efforts allow

organizations to leverage the benefits of agility, align development processes with business objectives, and enhance their competitiveness.

## **2.4 Agile Implementation Challenges for Big Corporations**

### **2.4.1 Agile Adoption: Cultural and Organizational Barriers**

#### Cultural Barriers

Traditional hierarchical culture is a significant barrier to adopting Agile methodologies in large corporations and can impede their successful integration. In the study “When Agile Meets the Enterprise” van Waardenburg and van Vliet (2013) illustrate the challenge of integrating agile methodologies in an environment that historically prioritizes stability and predictability. The authors note the conflict between long-established corporate traditions and Agile values, thus highlighting the problem of introducing Agile methodologies into organizations characterized by command-and-control mentality. Their research points out the insufficient business involvement and the complex IT landscape. Similarly, Laanti et al. (2011) analyze Nokia’s transition to Agile with a survey collecting data from over 1000 respondents across seven countries to evaluate the impact of agile transformation within the company. The survey revealed a strong positive attitude towards agile methods, with 60% of respondents favoring agile over traditional methods. However, despite these positive perceptions, the study also revealed challenges related to cultural resistance and organizational inertia.

Similarly, the study by Dingsøyr et al. (2012) reveals that initial doubts and skepticism to Agile adoption were experienced during the early project management stages and are mainly brought on by cultural inertia. The author states that organizations need a cultural shift to inculcate agile methodologies into their strategies. In general it is common for the traditional corporate cultures which have rigid hierarchies and risk-averse attitudes to resist agile adoptions due to concerns about destabilization and loss of control (Dingsøyr et al., 2012). On the

other hand, this study discloses an absence of any consistent framework for adopting Agile even after various efforts for integration with traditional organizational structures. The transition to Agile requires a coordinated effort to change the corporate culture, improve the team dynamics, and realign performance metrics to support Agile flexibility.

### Organizational Structure Barriers

Organizational structure rigidity and siloed departments are another significant impediment to Agile adoption. Boehm and Turner (2005) describe the traditional organization's reliance on hierarchical, plan-driven processes. This dependency creates resistance against agile methodologies, which are perceived as too unstructured and informal for large-scale implementation. The paper discusses the challenge of integrating agile methods with existing organizational processes that are not designed to accommodate Agile's flexibility. For instance, traditional milestone reviews and performance metrics do not easily apply to Agile's iterative and incremental development approach. Furthermore established hierarchies and bureaucratic structures conflict with Agile's preference for flexible, cross-functional teams and collaborative work environments (Nerur et al., 2005). The author points out that traditional corporations often have cultures that value predictability, extensive planning, and a hierarchical management style. Moreover, organizational structures in large corporations often reflect their siloed nature, which can hinder the cross-functional teamwork essential for Agile. Agile adoption may require restructuring to create more fluid and adaptable organizational forms that support collaboration and rapid decision-making (Nerur et al., 2005). The challenge of reorganizing existing companies' structures to support Agile methodologies is non-trivial. It requires committed leadership to rethink and realign organizational norms and processes to facilitate Agile.

## Business Process Conflicts

Resistance to adopting Agile methodologies in traditional settings arises from business process conflicts and people conflicts. In their study, Boehm and Turner (2005) examine the issues faced during a transition from the top-down traditional management approach to a more agile, flexible style. They find out that at the heart of this integration process are people conflicts. Agile methodologies recommend for more collaborative, team-based ways of working which challenge the hierarchical and role-based structures common in traditional organizations. This requires a change in the business processes and a shift in the organizational mindset, valuing individual and team contributions differently and creating an environment dedicated to agile practices. The suggested approaches toward integrating agile practices into organizations include comprehensive preparation, education of stakeholders, and reward system adjustment.

### **2.4.2 Team-level Implementation Difficulties**

#### Cultural and Organizational Resistance

A significant challenge in implementing agile methodologies at the team level in large organizations is the resistance to change and the required cultural adaptation. According to (Kalenda et al., 2018) the fear of adopting Agile practices is the fear of increased transparency and redistribution of responsibilities. The authors state that this resistance was not just in the development teams but across all levels of the organization, notably within the middle and upper management. The shift towards agile development must be supported by a change management approach to address the team members' concerns for increased visibility and the reshaping of their traditional roles. The study (Kalenda et al., 2018) is highlighting the importance of managing transitions sensitively to support agile adoption.

Likewise, the summary of the workshop at XP2014 (Dingsøyr & Moe, 2014) highlights the fundamental tension between Agile's preference for self-managing teams and the traditional

hierarchical top-down management prevalent in large corporations. The need of the teams to self-manage is in conflicts with the established structures, which prioritize control and predictability over flexibility and responsiveness. Dingsøyr and Moe (2014) state that in large-scale development work is coordinated on two levels - the team's level and between the team and the rest of the organization. Effective communication requires teams to work closely with internal members and external experts, such as designers, infrastructure personnel and other stakeholders. To address these challenges, the authors recommend the adoption of shared norms and values and the establishment of effective knowledge networks. These strategies highlight the necessity of a robust network for knowledge sharing and collaboration in large-scale agile organizations.

Petersen and Wohlin (2009) discuss in a case study at Ericsson the challenge of implementing an Agile mindset in an environment characterized by hierarchy, silos, and risk aversion, which contrasts starkly with Agile's emphasis on flat structures, cross-functional collaboration, and embracing change. One primary hurdle in the Agile transformation is the resistance to the necessary cultural shift. Petersen and Wohlin (2009) highlight the challenge of creating an Agile mindset. The effort to change the corporate culture requires training and sustained effort beginning with the leadership and every team member. The authors observe that agile team members communicate intensively face-to-face in frequent meetings but also because they are located together. They are learning to understand the other benefits of collaboration and know-how sharing. Knowledge is transferred through frequent feedback for each iteration. The study concludes that using small teams increases control over the project but increases the management issues in the coordination of the teams, stressing the need for tailored approaches to scaling Agile. An essential point in the study is that the empowerment of engineers initially makes managers afraid and thus requires sufficient training. For the successful implementation

of Agile methodologies at the team level in large corporations, addressing resistance to change and cultural challenges is critical.

### Communication Challenges

Effective communication plays a significant role in Agile but is demanding for groups in large organizations, which are distributed across different countries. Kalenda et al. (2018) identified that difficulties in maintaining effective communication and collaboration among distributed teams are a major barrier to the adoption of Agile within organizations. Moreover, Petersen and Wohlin (2009) point out that globalization has added further complexities in Agile development processes such as time zone differences, cultural differences, reliance on virtual communication tools, thus hindering close cooperation. This often means that large organizations have geographically distributed Agile teams. As a result, it becomes more complicated to manage and communicate within the team structure. Finally, Petersen and Wohlin (2009) explain how effective communication can be achieved in projects via a combination of tools, technologies, processes that facilitate good understanding of work progress and goals thereby building trust among the involved participants.

### Leadership and Team Dynamics

The shift towards Agile determines changes in leadership styles and team dynamics, moving away from the command-and-control pattern to more collaborative, dynamic models.

(Imam et al., 2021) insist on the critical and significant role of collective leadership in Agile projects. The research showed that shared leadership has a positive effect on project success, through improvement of knowledge sharing, team interaction and trust. The research emphasizes that the shared leadership model is pivotal in agile environments requiring flexibility and rapid decision-making. Through embracing dynamic leadership approach, large corporations

can reduce implementation challenges at team level where traditional hierarchical structures are dominant.

### Cross-Functionality and Specialization

A cross-functional team capable of handling multiple aspects of a project is a core aspect of Agile. In large organizations known for specialization, this is a challenge. The study by Hoda and Murugesan (2016) highlights that achieving a cross-functional team capable of working across various technologies and functional areas is a challenge. Large corporations, characterized by their distinct departments and specialized roles, struggle to create an environment where team members willingly step out of their expertise zones to learn new skills, as employees are often siloed into specific functions. A team is cross-functional if its members have varying specializations, and the interaction within themselves through processes and behavior patterns leads to a better understanding of each other's perspective (Takeuchi & Nonaka, 1986). Cross-functionality is vital to reduce dependencies on specialists so that the team would be functional despite the absence of individuals. In conclusion, overcoming team-level implementation difficulties in large corporations requires a multifaceted approach addressing cultural, structural, and operational challenges.

### **2.4.3 Communication and Coordination in Scaling Agile**

#### Need for Adapting Coordination Mechanisms

As an Agile project scales up, traditional communication methods used in agile lose effectiveness. Dingsøyr et al. (2018) stresses that large corporations scaling Agile must use a coordination framework like Scrum of Scrums (Table 1) for bigger projects. The author categorizes agile projects depending on their size into small-scale, large-scale, and very large-scale projects as presented in Table 2.



### Key Barriers to Scaling Agile

Shameem et al. (2020) investigate the critical barriers to scaling agile development and develop a systematic approach for identifying, categorizing, and prioritizing these challenges in the global software development (GSD) environment. The results were validated using a questionnaire survey. Shameem et al. (2020) conclude that agile principles are applied differently on a GSD. Distributed teams require communication, coordination, and cultural alignment. According to the author, distribution of teams across geographical locations creates barriers to effective communication and coordination because synchronous interactions and face-to-face communication, which are vital for agile practices, are limited due to cultural differences and temporal distances. Additionally, inadequate client involvement as well as poor technological infrastructure makes it difficult to implement agile practices in a GSD environment. The suggests that established agile frameworks like SAFe can be used for efficient management of large-scale firms' agile practices. Nevertheless, the study notes that agile development has low success rates when implemented in distributed settings.

### Coordination in Globally Distributed Projects

Similarly, Herbsleb (2007) evaluates how Agile methodologies are influenced by geographical and temporal separation. Many mechanisms that coordinate the work in a co-located setting are absent or disrupted in GSD project. The author concludes that even short distances between offices, such as 30 meters, can reduce communication frequency and spontaneity dramatically. Radical co-location – putting the whole team together rather than in individual offices can have a surprising effect on development efficiency. According to Herbsleb (2007), without context sharing, it becomes difficult for distributed team members to start communicating spontaneously, as people communicate with less colleagues from a distant site as from their site. The distance leads to teams failing to achieve a common understanding of their project. It becomes hard to manage dependencies between distributed teams. There are many reasons for this.

Differences in socio-cultural backgrounds, lack of close physical contact, and different time zones are some of the barriers that hinder effective communication (Herbsleb, 2007). This often leads to misunderstandings and challenges in tracking the effects of changes across project sites, such as lack of information, who is an expert in what, and who is responsible for what. Because people at different sites share little context, they tend to have little knowledge of what their colleagues are doing and their concerns and impediments. Agile practices rely on close, daily cooperation among team members, which is important for rapid iterations.

### Technological Solutions for Enhanced Communication

The distributed communication in scaled Agile Teams can be enhanced with technological solutions. The study (Paasivaara, 2017) focuses on Comptel's adoption of SAFe across two business lines globally distributed in UK and Malaysia, and analyzes the experienced implementation challenges and success factors in introducing the Agile methodology. Despite the challenges in scaling Agile across multiple teams and locations, Comptel managed to leverage electronic communication solutions and organize successful Spring Planning meetings. Synchronous participation of the team members was facilitated by the adoption of real-time Skype for Business connections between the sites, as the events started early in the morning in Europe and in the afternoon in Asia. This approach helped to solve and overcome the logistical challenges of globally distributed teams and the coordination between multiple locations (Paasivaara, 2017). Besides the planning events, collaboration between the development teams and the Product Managers and Product Owners (PO) was possible. The most significant improvement due to ad-hoc communication for solving problems in the adoption was the change in the Product Manager's (PM) minds from long-term plans to shorter plans, as well as finding priorities at the business line level instead of thinking in the old, siloed ways. Similarly, Herbsleb (2007) suggests virtual co-location and virtual proximity so that the coordination and

communication can be natural in the environment, as if the coworkers are in the same office, leveraging technology for real-time communication.

### Structural and Organizational Adaptations

In the case study (Bjarnason et al., 2011) the "One Continuous Scope Flow" was introduced as tools to improve the communication and coordination in the agile projects of a large software development company. Overscoping is common in software development, as projects include unrealistically large amounts of weakly prioritized features. The One Continuous Scope Flow solves this problem by unifying all requirements in one list enabling transparency between the business and the development team. This list is constantly changed, refined, and prioritized, and the most prioritized features are worked on first. According to Bjarnason et al. (2011) this approach has made the planning more efficient and coordinated.

### Communication Challenges at Scale

Bick et al. (2016) investigate a case study in a software company involving 13 teams, where the combination of traditional planning on an inter-team level and agile development on a team level leads to ineffective coordination in large-scale software development. The development teams struggled with unidentified dependencies, leading to blockages, delays, and increased frustration among team members. This misalignment was mainly attributed to conflicting planning activities, specifically in the specification, prioritization, estimation, and allocation of requirements, and were identified as critical barriers to achieving dependency awareness. According to (Bick et al., 2016), there were times when the high-level planning of the central team conflicted with the immediate planning carried out by the agile teams. This obscured critical inter-team dependencies and prevented effective coordination. Correspondingly Paasivaara et al. (2012) come to a similar conclusion, stressing that introducing of Scrum-of-

Scrums (SoS) meetings in large-scale, globally distributed projects faces major obstacles mainly because too many people participate, and they all have different interests.

## **2.5 Opportunities for Agile Transformation in Big Corporations**

### **2.5.1 Adaptability and Responsiveness to Change**

#### Critical Success Factors

While the implementation of Agile in big corporations is challenging, there are many opportunities in the transformative potential of an Agile transition. The ability to adapt and respond to change efficiently sets Agile software development methods apart from traditional software development methodologies. Chow et al. (2008) examined critical success factors of Agile software development using survey data. The factors were identified based on existing literature, and a survey was conducted among Agile professionals. The authors collected data from 109 Agile projects across 25 countries. The study concluded that despite many factors in the literature, only a few were genuinely critical. Of the 48 research hypotheses, only 10 were supported in practice. The critical success factors identified in the study are:

- correct delivery strategy
- proper practice of Agile software engineering techniques
- high-caliber team.

Three other factors that could be critical to specific success dimensions were identified in the study: good Agile project management process, Agile-friendly team environment, and strong customer involvement. This research's contribution simplifies an agile processes' potential anecdotal success factors to three key areas based on empirical evidence. Interestingly, no evidence was found to support the hypothesis that strong executive support and Agile-specific facilities are important for a project's success. Chow et al. (2008) conclude that the flexibility

and the adaptivity of an Agile project when faced with changing circumstances can be improved if management has focused on the identified factors.

### Agile Techniques - the Silver Bullet?

Murphy et al. (2013) showcased Agile practices at Microsoft for their effectiveness in enhancing adaptability and responsiveness within the context of large-scale software development. The adoption of Agile was driven by changing customer requirements, market pressures and technological advancements. This study presents findings from a comprehensive longitudinal study conducted between 2006 and 2012, which gathered insights from 1,969 Agile and non-Agile practitioners. According to Murphy et al. (2013) although expected to offer flexibility and speed, the Agile practices were adopted less slower at Microsoft than expected.

Despite sluggish adoption, the consensus on the benefits and problems of Agile across different roles indicates a shared understanding of its value and challenges. These findings indicate that both the non-Agile and Agile practitioners working for Microsoft agreed that Agile methodologies had advantages and have been associated with high satisfaction among practitioners at Microsoft.

### Stakeholder Engagement and Business Alignment

Ktata and Lévesque (2009) study analyzes the strategic benefits of agile frameworks in large corporations. Agile is prioritized as a potential solution for fast-changing organizational needs in a turbulent business environment. The authors discuss some problems that product owners face by trying to balance the stakeholders' expectations and the business value added. Ktata and Lévesque (2009) conclude that product owners cannot effectively manage these responsibilities due to scalability problems and a lack of tools for prioritizing the real business value of every feature. The study discusses a goal-value-oriented approach so that stakeholders can express their expectations regarding goals. Conflicting goals can then be identified and handled

in a holistic view. Furthermore, the study suggests linking low-level requirements such as user stories and features (technical perspective) to medium-level or tactic goals and strategic goals (business perspective). In this way organizations can achieve robust stakeholder involvement and a value-driven development approach to leverage Agile's potential for adaptivity fully.

### Adaptability and Responsiveness in Practice

In a case study at Nokia, Paasivaara and Lassenius (2016) provide another example, where scaling Scrum across 20 teams in four countries demonstrates that the applied Agile practices were important to the success of a business project. The case study highlights the importance of Agile's core principles, such as iterative development, customer collaboration, and embracing change. It is important to note that implementing Agile contributed significantly to improving organizational flexibility and responsiveness towards customer requirements. The case project has been highly successful from a business point of view, indicating that Agile methodologies can enable fast responses to customer requirements, even in large, distributed organizations. Nokia's management promoted Agile specifically for the developed product, which was considered perfect for trying out Scrum as a pilot project: a new product with unclear requirements and potentially close collaboration with the first few customers. In the study Paasivaara and Lassenius (2016) identified the following four pain points in implementing agile:

- partial absence of the agile mindset,
- the product was difficult to divide into reasonable requirement parts,
- the Scrum implementation did not have a common view, and
- time pressure caused by the constant market demands.

Traditionally, in the telecom industry, new software versions of systems products were released approximately every two or three years. By applying Agile methodologies, Nokia reacted faster and more flexibly to changing customer requirements and new technology developments.

## Hybrid Agile and Traditional Methodologies

Sithambaram et al. (2021) systematize the issues and challenges impacting agile Projects. The study captured 38 unique issues and challenges faced by 42 participating industry practitioners in several rounds of interviews. The study identified “Process Flexibility” as a significant factor impacting the successful management of agile-hybrid projects. This shows the essential need for processes to be adaptable in a dynamic and changing environment, where some slackness in schedules can promote fluidity, leading to responsiveness as opposed to rigidity of project management. Sithambaram et al. (2021) also examine the problem of “Change Management and Control” in effectively managing and controlling changes within agile-hybrid projects. The author concludes that systematic change management processes can boost adaptability of projects without being chaotic (Sithambaram et al., 2021). In attempt to improve their ability to adapt and respond to change, large corporations are exploring agile methodologies for their flexibility. Thus, by integrating flexible processes and effective change management practices, these companies can overcome the problems caused by their businesses’ size and complexity, hence becoming more profitable in today’s volatile business environment.

### **2.5.2 Creating Collaborative Agile Environment**

#### Open Communication and Collaboration

The most critical factor for success in a large-scale Agile environment is creating a collaborative environment, as it enables teams to manage project complexity and interdependencies more effectively. Effective communication and coordination are essential when multiple interdependent teams work together towards a common goal. The "Modular Case" at SAP SE by Bick et al. (2016) presents a scenario in which minimal coordination between teams was necessary because of the largely independent nature of their tasks. The case was implemented with around 40 employees in four teams at three locations. The solution had four independent

modules but shared a common foundation layer. The underlying foundation layer required selective but effective communication to implement the necessary functionalities collaboratively. The setup is an example of simplified large-scale coordination in an Agile environment, where emphasis is placed on flexible, spontaneous ad-hoc communication approach. This method involved regular meetings of team representatives in joint release planning workshops, where coordination issues were resolved, so that inter-team dependencies were proactively managed. Bick et al. (2016) stress one critical practical implication of this case: Proactive dependency management between development teams is productive and equally possible in top-down and bottom-up coordination settings.

#### Adaptability and Continuous Improvement

In a study in a government institution on a project that lasted several years and involved over 40 professionals Russo (2021) analyzed the relations between the main stakeholders involved in an Agile project. The study identified the role of developers and the top management commitment as the most important aspects to lead to a software project's success. However, the Scrum Master and Product Owner's roles were identified as less relevant. The project's focus of the Agile transformation was centered on developing an informational system emphasizing stakeholder buy-in and team collaboration as key pillars. Improved autonomy among teams was made possible through the implementation of agile techniques that prioritize communication and collaboration which are key on addressing complex issues efficiently. In this environment, not only were communication silos broken down, but also diverse perspectives and expertise were leveraged. This evidence shows the importance of building an environment where teams can self-organize, openly communicate, and effectively collaborate. Russo (2021) discusses better problem-solving and innovation result from effective collaboration in an Agile environment. Their study revealed that agile contributed to the rapid development of new features.



### Role of Tools and Physical Spaces

In a case study, Berntzen et al. (2022) analyses the inter-team communication mechanisms and how they support inter-team coordination in a large-scale software development firm over 1.5 years. The research identified several coordination mechanisms important for enhancing cooperation across teams, including inter-team stand-ups, coordination meetings, communities of practice, and tools and artifacts such as JIRA, Slack and Confluence. The authors analyzed, how these mechanisms enable agile principles using thematic analysis of interviews, observations, and supplemental materials. The tools support open communication, knowledge sharing, and mutual support among teams. For example, within the organization, this enabled the sharing of specialized knowledge across team boundaries through communities of practice, thereby enriching the collective expertise (Berntzen et al., 2022). Similarly, Slack and JIRA were integral in enabling efficient information sharing and task coordination between multiple teams.

### Coordination Meetings and Mechanisms

In a case study of a large-scale agile development with 16 teams, Berntzen et al. (2021) highlights several coordination strategies that were implemented to encourage a spirit of collaboration. These include shared routines and tools like Confluence and Slack for documentation and communication, inter-team stand-ups, and tech lead forums. These strategies addressed different challenges aligning autonomous teams and maintaining an overview across teams. An example is provided using Confluence where it ensured uniformity despite different groups in terms of processes as well as understanding. Also, a Slack channel enhanced seamless communication among groups leading to open dialogue while removing silos. Inter-team stand-ups and the tech lead forum created a platform for knowledge sharing and collectively addressing problems which are vital in achieving technical consistency while managing dependencies. For effective collaboration in large-scale agile environments, there must be structured yet flexible coordination mechanisms that align with agile principles. This is discussed in the study

(Berntzen et al., 2021), which shows how having temporary team arrangements and using both physical and digital spaces for meetings and workshops enhanced effectively collaboration. These arrangements improved flexibility and enabled adaptability in addressing new challenges and priorities.

### Knowledge Sharing and Community Practices

Dingsøyr et al. (2017) examine two large-scale development projects using Scrum in a case study. The study supports the finding that group mode coordination is central to achieving inter-team coordination in large-scale projects. For the improvement of cooperation within the program, the so-called “open space technology” was introduced. This system encouraged discussion and ensured that there were no restrictions for the whole project to identify problems or discover better ways of solving them. Furthermore, chatting tools like Jabber facilitated spontaneous informal coordination between team members. This provided room for unscheduled conversations by promoting quick responses to spontaneous questions and supported the creation of a community spirit among the team members (Dingsøyr et al., 2017).

## **2.5.3 Developing Continuous Improvement and Innovation**

### Agile Methodology Customization

Agile methodologies focus on continuous improvement and innovation to quickly respond to changes and to improve product quality. The “Synchronized Agile” paper by Sithole and Solms (2016) examines how Scrum can be customized for synchronized cross-platform releases, giving interesting insights into how large corporations can employ agile practices to continuously improve and innovate. Continuous improvement and innovation are essential for maintaining competitiveness and to meet customer expectations in the software development industry. Sithole and Solms (2016) analyze the Scrum at Scale framework and how the Scrum practices can be customized for building cross-platform client applications. In their study, they used

sprint retrospective meetings, feedback mechanisms, and agile metrics like velocity. The teams identified inefficiencies and areas for improvement in real time by integrating agile metrics and applying sprint retrospective meetings. The retrospectives were used to analyze impediments after each sprint to introduce corrective actions for continuous improvement. Team-level resolutions and daily Scrum meetings were used for resolving technical impediments, systematic impediments were resolved at the agile center of excellence, and corporate impediments were resolved at the executive level. Scrum at Scale provided extensive customization practices for this project (Sithole & Solms, 2016). The case study identified several challenges due to changing team dynamics and skills profiles, which might be obstacles for synchronization, requiring an adaptive approach to the Agile customization, stressing the need for continuous evaluation and refinement of the practices. Applying the Agile methodology Scrum at Scale allowed the team to overcome these hurdles. The project teams could navigate these challenges effectively, so that the development efforts remained aligned with project goals and customer needs.

#### Satisfaction and Collaborative Practices

The iterative and feedback-driven approach not only improves the quality of the product and productivity of the team, but it also improves the satisfaction of team members from their work. The adaptability and flexibility of Agile frameworks allow teams to quickly apply new ideas and seamlessly integrate new technologies for innovation, thereby driving innovation. The research conducted by Kropp et al. (2020) provides empirical evidence that Agile development methodologies contribute to higher satisfaction levels among software development team members compared to traditional plan-driven approaches. A nationwide survey among IT professionals in Switzerland examined the relationship between the usage of agile practices, team satisfaction, and their influence on business, team, and software aspects. Notably, the study identified that Agile practices such as self-organizing teams, collective code ownership, and collaborative processes are highly related to satisfaction. In addition, the study pointed out the

importance of continuous reflection and improvement brought by agility's iterative nature, which is necessary for an innovative development environment. Kropp et al. (2020) concluded that technical practices and team impacts are important but at lesser levels. However, on a personal basis, the ability to focus more on technical quality is seen as critical. Furthermore management-related issues are still problematic.

### Inter-team Coordination in Agile

Similarly, in a study in a Norwegian pension bank and insurance company, Nyrud and Stray (2017) highlight how agile practices such as sprint planning, retrospectives, and demos drive the process of continuous improvement and innovation, important for sustaining competitiveness in large corporations. The study outlines retrospective meetings as a valuable tool for teams to reflect on their work in the last sprint and to identify what worked well and areas for improvement. This practice ensures that learning from each sprint is incorporated. Regular retrospectives are fundamental to the agile philosophy of continuous improvement. Planning sprints enables teams to carefully select future tasks for the upcoming sprint, allowing them to make changes based on learnings from previous sprints. Demos are platforms for showcasing developed products to stakeholders and getting immediate feedback. This enabled very fast cycles of iteration where feedback from stakeholders could assist in making better products. Such work environment enables faster coordination between employees who can easily overcome obstacles caused by iterative improvements or resolve problems quickly as they embrace. Agile methodologies with an open working area which provide access for physical communication pathways among team members hence promote productivity and creativity within the firm in line with open-office layout concepts. In the same vein, Nyrud and Stray (2017) established that informal ad hoc conversations are the most commonly used form of coordination and are highly prized. This implies that such conversations allow for rapid decision making and problem solving, and this in turn supports a culture of always getting better while

encouraging sharing of understandings and answers across teams leading to an enhanced capacity of the project to innovate. Similarly, the study by Kamei et al. (2017) identifies knowledge sharing among the team members as a pivotal benefit of Agile, facilitated by practices such as Pair Programming, Sprint Planning, Daily Meetings, Co-located teams, Sprint Review, and Task board usage.

### Psychological Empowerment through Agile Practices

A study by Malik et al. (2021) explores how psychological empowerment can mediate the link between agile practices and project performance. The researchers stress that agile practices greatly impact on psychological empowerment, mainly in terms of team autonomy and agile communication. It is worth noting that this empowerment leads to more innovation among team members and thus better projects' outcomes. The study also notes that an empowered person tends to be very innovative making a project successful. Hence, the authors highlight the importance of psychological empowerment as a mediator.

## **2.6 Comparative Analysis of Agile Methodologies in Big vs Small Corporations**

The Agile movement, which began with the Agile Manifesto in 2001, emphasizes customer satisfaction, early and continuous delivery of valuable software, as well as the ability to accommodate and adapt to changing requirements. (Beck et al., 2001), started initially with small teams in mind. A survey of 1002 projects (Serrador & Pinto, 2015), demonstrates the positive impact of Agile methodologies on project efficiency and stakeholder satisfaction, particularly in medium to large projects. Furthermore, Jørgensen (2018) also studied the scalability of Agile in large software projects. He showed that Agile projects are much better and outperform than non-Agile ones, highlighting the latter's scalability.

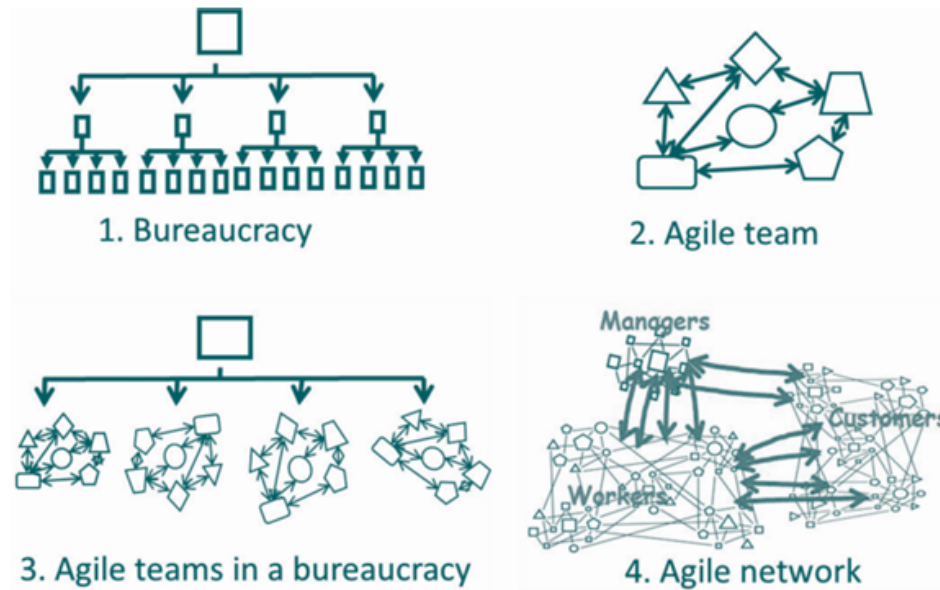
The efficiency and the success of the Agile methodology is dependent on how good a project's vision is. Jørgensen (2018) pointed out that Agile practices help projects with a well-articulated and high-quality vision to benefit more, stressing the significance of strategic alignment in managing agile projects. In all the studies that were analyzed, Jørgensen (2018) argued that agile methodologies have proved to be effective and applicable in diverse sectors such as IT, healthcare, and professional services, thereby illustrating Agile's versatility beyond its software development project roots. This adaptability is key for wider adoption of Agile methodologies thus promoting better performance on projects across organizations and industries.

The research paper by Hutter et al. (2023) offers a case study of an agile transformation in a multinational corporation. Authors stress out, that pressure from digital disruptions, big tech giants' rivalry and shifting consumer desires and expectations are significant factors for companies to implement Agile. The study discloses that big enterprises, having complicated organizational structures along with legacy systems, must undergo through an Agile transformation to improve their flexibility, customer-orientation as well as their ability to innovate. Unlike small firms that are inherently agile because of size differences, large corporations should deal with extra challenges before they can embed agility into their complex and hierarchical organizational structures. Thus, it is not only a strategic choice but also the only way out of existence for them under the conditions of digital disruption together with intense competition (Hutter et al., 2023).

### Agile vs Bureaucracy

Denning (2018) discusses that Agile transformation is not merely about adopting new tools or processes but requires a profound shift in organizational mindset towards customer-centricity, flexible team structures, and a continuous improvement and innovation culture. Denning (2018) concludes that to be fully entrepreneurial, organizations need to embrace the Agile mindset and function as an interactive network. A top-down bureaucracy with just a few teams

implementing Agile processes is not a coherent approach running the whole organization, as shown in Figure 3.



**Figure 3: Agile teams integrated into an Agile network vs Agile teams administered by a Bureaucracy (Denning, 2018)**

The formation of the SD Learning Consortium (“The SD Learning Consortium”) by large firms committed to implementing Agile management shows the role of leadership in navigating the Agile transformation. These firms recognized the necessity of moving beyond traditional management models to create innovative, customer-focused, and responsive organizations (Denning, 2018).

### 3 Case Study Analysis

#### 3.1 Methodology

This thesis uses a mixed-method research method integrating quantitative primary data from a carefully developed questionnaire and secondary qualitative data from a comprehensive literature review. This approach allows for a detailed analysis of the challenges and opportunities

of Agile projects in large corporations. This way, the breadth of the analysis is combined with the specific survey for depth to highlight the research problem in the best way possible. Broad patterns and trends in the literature can be analyzed quantitatively, while individual experiences and perceptions can be explored qualitatively with the survey to facilitate more profound interpretations of the data.

The primary data collection involved distributing a structured questionnaire with 24 questions on a Likert scale to participants from four Agile projects within large corporations. The decision to use this method for data collection aims to get firsthand information from people who have been through an Agile transformation process. Integration of theoretical perspectives from the literature review with the empirical data from the questionnaire makes it possible to accurately analyze the application of Agile methodologies in big corporations. The selection of a mixed-methods approach is predicated on its ability to offer a complete view compared to either quantitative or qualitative research alone. Combining data from multiple sources, enhances the validity of the research findings and provides a comprehensive understanding of Agile practices within large organizational contexts. This approach of combining the academic and the practical perspective not only facilitates the identification of common themes as well as any inconsistencies but also leads to the development of valuable recommendations for both practitioners and academic researchers of Agile practices in large corporations.

## **3.2 Research Design**

The methodological foundation sets the stage for a detailed research design. For primary data, the research is focused on a comparative case study of four Agile projects in four different large corporations. These cases are chosen in such a way that they encompass team sizes and agile implementations across a range of contexts. All projects were carried out in big corporations between 2010 and 2023 ranging from 3-4 years each. The thesis writer has also worked as a



software developer or scrum master for the projects, observing all agile and team dynamics firsthand. All the participants in the questionnaire study were team members in these projects with different roles: software developers, testers, Scrum Masters, Product Owners. Most of them were working freelance or in consulting companies, so the teams were a mix of experts with different backgrounds, but all were external consultants to the customers – the big corporations facilitating the projects. The study's phased approach includes the developing and distributing of the questionnaire, data collection, and subsequent analysis. The questionnaire was designed by analyzing the literature and the questions were asked using a Likert Scale. This will allow more participants to participate in the study, compared to individual interviews with open questions.

The literature review was conducted by searching with keywords (agile, scrum, opportunities, benefits, success factors, challenges, difficulties, large-scale) in different Information Systems journals: ACM Digital Library, IEEEExplore, Science Direct, Springer Link, Wiley, Sage Publications, Scopus, Emerald Insight. Over 500 papers were downloaded and manually reviewed. The common themes were structured in categories and the most suitable studies were included in the literature review section of the thesis.

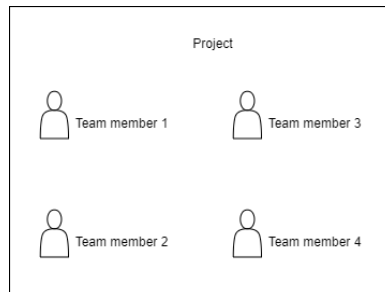
The primary and secondary data results will then be analyzed and compared. This analysis identifies unique challenges and opportunities presented by Agile practices in large-scale corporations, contributing valuable insights into the broader field of Agile project management.

### **3.3 Selection of Case Studies**

#### **3.3.1 Project A: 1 Team Small-Scale Project**

Project A is a digital banking platform relaunch and was in a banking institution with four independent banks brands. One team was set up with external consultants and software developer experts on the applied technology stack. The role of Product Owners (POs) was taken up

by internal bank employees. A dedicated Scrum Master was absent. The Agile coaching responsibilities were not assigned to one dedicated person. This created a sense of ownership but also posed challenges for maintaining Agile discipline and focus.

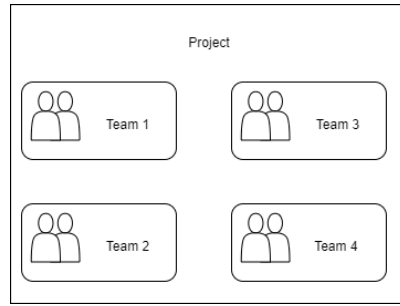


**Figure 4: Teams Structure – Project A**

As the project had only one Scrum team, there was no need for Scaling Practices. There were inter-team dependencies to the internal infrastructure teams, which were well managed by the internal POs. Most of the collaboration was done in person, and JIRA was used to manage the requirements as User Stories and Scrum Process. Stakeholder support was notably strong, with easy access to all relevant parties, which was further enhanced by the colocation in one office. Throughout the project lifecycle, the team could gather all requirements and feedback.

### **3.3.2 Project B: 4-5 Teams Large-Scale Project**

The project was in a financial banking group offering software for over 100 tenants – brand branches. The project involved 4-5 teams working collaboratively. Several teams were involved, but no scaling framework was used. The teams had common Sprint Planning and Daily Stand-up meetings. This way of proceeding brought about difficulties, especially when the lengths of meetings became too long for the whole team to cope with its tasks properly.

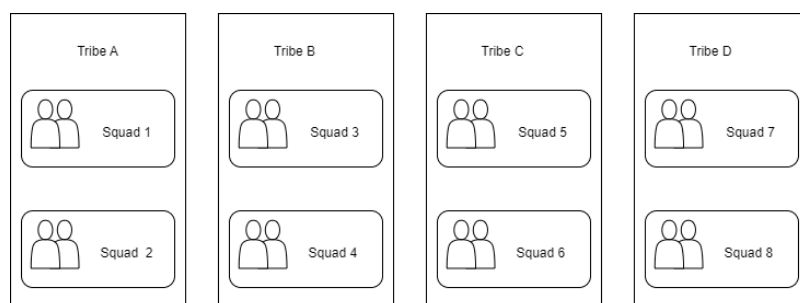


**Figure 5: Teams Structure – Project B**

Internal employees worked as Product Owners for each team, sometimes overwhelmed by the needed communication and insufficient Agile training. Each team was constructed of external developers, bringing in the needed specialized skills. However, the project employed only one Scrum Master to support all teams. Inter-team dependencies were not critical, as the software was divided into separate modules, which allowed for somehow isolated work of the teams. Collaboration Tools were direct communication and JIRA. Prioritization of requirements emerged as a significant challenge, given the stakeholders' diverse needs across the group's branches.

### 3.3.3 Project C: 5-10 Teams Large-Scale Project

Project C was initiated by a banking institution aiming to migrate its public-facing web applications to the latest front-end and back-end technologies.



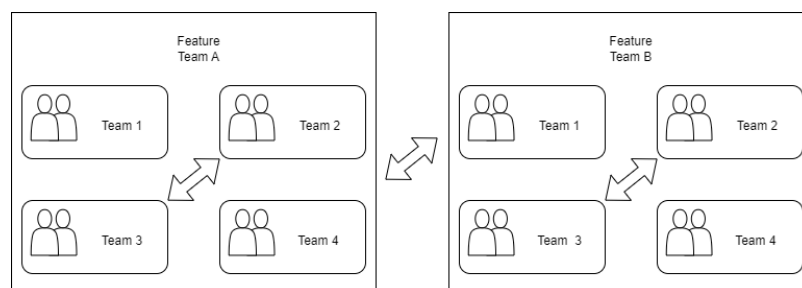
**Figure 6: Teams Structure – Project C**

To handle the complexity and the scale of the project, elements of the Spotify Agile framework were adopted. This resulted in independent squads, tribes and guilds in a matrix

organizational structure. For the Agile implementation, no Agile coaches were employed, and Scrum Masters were employed only at an early stage of the project. Product owners who were internal employees guided the development and tried to align it with changing strategic objectives of banks. All teams involved in development were made up of external developers from different companies. Managing inter-team dependencies became critical for the microservices architecture in this project, and it was not always successful. The geographically dispersed teams used JIRA for communication and MS Teams as well. Stakeholders were solidly behind the success of the project with support coming particularly from internal product owners. They played an important role in integrating all the external consultants and managing the dependencies between the teams.

### 3.3.4 Project D: 15 Teams Very Large-Scale Project

Project D was a comprehensive relaunch of a corporate multinational website of a car manufacturer, integrating multiple technologies and complex business requirements.



**Figure 7: Teams Structure – Project D**

The project was designed with multiple feature teams, which were each made up of 3-4 smaller development teams responsible for different parts of the website relaunch. These feature teams planned together in order to ensure that the development was approached in a coordinated manner. The project was not implemented within any established Agile scaling framework, the methodology resembles Scrum of Scrums. External developers from various companies supported development efforts, each bringing specialized skills essential for the project's

diverse technology requirements. Also, Scrum Masters and Product Owners were external consultants. Inter-team dependencies management was an important aspect of this project as different feature teams often had contradictory requirements. For task tracking JIRA tools and Skype communication were used. Stakeholder support was not straightforward due to conflicting visions among departments of the organization.

### **3.4 Development of a Questionnaire**

The selection of case study projects leads to the creation of a comprehensive questionnaire, designed to research in more detail the Agile implementation of each selected project. The design of the questionnaire was a significant and time-consuming phase in the research of this thesis to explore the challenges and opportunities of Agile implementation in large corporations in a systematic way. The Questionnaire was developed using two exceptionally well-organized literature reviews (Dikert et al., 2016; Uludağ et al., 2018), which helped to categorize the most common challenges and opportunities in agile projects. The authors of these literature reviews have analyzed multiple papers and categorized the academic research in a very accessible way. Furthermore, to ensure that the questions in the survey are relevant to modern Agile practices, insights from the latest The 17<sup>th</sup> State of Agile Report (*17th State of Agile Report*, 2023) and The Scrum Team Survey (Verwijns, 2021) were incorporated. These sources provided a valuable industry perspective and some common problems and opportunities in Agile projects, guiding the formulation of targeted questions that reflect real-world issues. The literature review and industry reports were incorporated to create 24 questions that were evenly distributed across six subcategories. Each question was designed to elicit specific information regarding the respondents' experiences with Agile methodologies, focusing on practical challenges and perceived benefits. Before distribution, the questionnaire was tested with two agile coaches, who provided valuable feedback on the questions. In further tables and figures in this thesis, the short version of the questions will be used. The short question does not represent a positive

or a negative statement, its purpose is to have a label for the question, instead just using the Qx numbers in the figures. For correct interpretation the full question should be considered.

| Agile Implementation Challenges for Big Corporations    |                                                                                                                         |                                           |
|---------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|
| Category                                                | Question                                                                                                                | Short Question                            |
| C1 Agile Adoption: Cultural and Organizational Barriers | Aligning agile methodologies with the traditional, non-agile culture of your company is challenging.                    | Q1 Cultural Fit of Agile                  |
|                                                         | In your organization the resistance to agile practices is high.                                                         | Q2 Organizational Resistance              |
|                                                         | Management's understanding of agile principles is insufficient.                                                         | Q3 Management Support                     |
|                                                         | Management does not micromanage; instead, the team self-organizes and works autonomously.                               | Q4 Micromanagement                        |
| C2 Team-level Implementation Difficulties               | The agile roles (such as Scrum Master, Product Owner) are well understood and present.                                  | Q5 Role Clarity and Adaptation            |
|                                                         | The team is cross-functional with no skill gaps.                                                                        | Q6 Cross-Functional Team Dynamics         |
|                                                         | The team has responsibility for the whole product, not only for a single feature.                                       | Q7 Product focus                          |
|                                                         | Efforts to create team spirit and trust among both internal team members and external contractors are highly effective. | Q8 Team Building                          |
| C3 Communication and Coordination in Scaling Agile      | Coordinating requirements and sharing of knowledge between multiple agile teams is well managed.                        | Q9 Inter-Team Coordination                |
|                                                         | My team communicates effectively with other teams to address integration issues and dependencies.                       | Q10 Managing Dependencies and Integration |
|                                                         | Communication within geographically distributed agile teams is successful.                                              | Q11 Communication in Distributed Teams    |
|                                                         | Scaling Agile practices across multiple teams is done effectively in our organization.                                  | Q12 Scalability of Agile Practices        |

**Table 3: Questionnaire challenges**

| Opportunities and Advantages of Agile in Large Organizations |                                                                                                                               |                                            |
|--------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| Category                                                     | Question                                                                                                                      | Short Question                             |
| C4 Adaptability and Responsiveness to Change                 | Our Agile approach effectively manages scope creep/change requests and adapts to changing project requirements.               | Q13 Scope Creep Management                 |
|                                                              | Our team quickly adapts project goals in response to new information and stakeholder feedback.                                | Q14 Adapting Project Plans and Goals       |
|                                                              | Our Agile process ensures rapid alignment with changing business needs allowing us to pivot rapidly.                          | Q15 Alignment with Changing Business Needs |
|                                                              | Agile adoption improves significantly our organization's responsiveness to market changes.                                    | Q16 Market Responsiveness                  |
| C5 Creating Collaborative Agile Environment                  | Agile practices have improved our engagement with stakeholders.                                                               | Q17 Stakeholder Engagement                 |
|                                                              | The level of transparency and open communication within our Agile teams is high, creating a trusting environment.             | Q18 Transparency and Open Communication    |
|                                                              | Tools like JIRA significantly improve team communication, contributing to smoother collaboration.                             | Q19 Tools and Techniques                   |
|                                                              | Our team consistently enhances direct communication practices, leading to improved collaboration across the organization.     | Q20 Continuous Improvement                 |
| C6 Developing Continuous Improvement and Innovation          | The implementation of Agile has noticeably accelerated innovation within our project.                                         | Q21 Innovation Acceleration through Agile  |
|                                                              | Agile encourages our team to engage in learning and experimentation, contributing to a dynamic and adaptive work environment. | Q22 Learning and Experimentation Culture   |
|                                                              | Agile practices contribute to continuous improvement in product quality.                                                      | Q23 Quality Enhancement                    |
|                                                              | End-user feedback is effectively integrated into the agile development process.                                               | Q24 End-User Feedback Integration          |

**Table 4: Questionnaire opportunities**

### Challenges presented in Table 3

- **Cultural and Organizational Barriers:** Questions under this subcategory focused on identifying the extent to which traditional corporate cultures and organizational structures posed challenges to Agile implementation.

- **Team-level Implementation Difficulties:** This subcategory aimed to uncover hurdles faced by teams during the adoption and practice of Agile methodologies.
- **Communication and Coordination in Scaling Agile:** Questions here were designed to explore the complexities of scaling Agile practices.

Opportunities presented in Table 4:

- **Adaptability and Responsiveness to Change:** This subcategory included questions that assessed how Agile practices enhanced the organization's ability to adapt to changing market demands and project requirements.
- **Creating a Collaborative Agile Environment:** Questions focused on the role of Agile in creating collaboration and communication within and across teams.
- **Developing Continuous Improvement and Innovation:** This section aimed to understand how Agile methodologies contributed to continuous learning, improvement, and innovation within the organization.

### **3.5 Data Collection Process**

The data collection process for the questionnaire was planned and executed, addressing the participants involved in the four Agile projects within large corporations. A multi-channel distribution strategy was employed. LinkedIn, Xing, and WhatsApp, email were used to contact the participants. This way, a high participation rate was secured so that their accessibility was granted. Each project was assigned a unique Google Forms link to ensure that responses could be accurately attributed and analyzed according to the specific project they participated in. This differentiation was important for the comparative analysis stage, as it allows analysis of the data of each project separately and a consolidation of the data is also possible. The four Google Forms were later exported to Excel, and the data was transformed to better fit the further analysis.



### 3.6 Data Analysis Methodology

The data analysis process was designed to extract meaningful insights from the surveys' responses, collected through the Google Forms associated with each of the four Agile projects. After data was collected, they are carefully exported out of the survey and then imported into Microsoft Excel for further processing and analysis. This was necessary to efficiently categorize the data and form a comprehensive analysis, that is needed for making conclusions about Agile practices in large corporations in this thesis.

Initially the data was coded, and a representation was built in Excel, allowing for multiple representations and statistical analysis. The relationships between the categories and questions were mapped in Excel, but also the answers were coded numerically. This allows the quantitative data from the Likert-scale survey to be used for the later statistical analysis.

#### Data Representation Techniques

To visualize the patterns and trends within the data, several representation techniques were employed:

- Heat Map - The average responses for each project were visualized using a heat map, providing an immediate visual understanding of the data for each project and each question. A fast comparison is possible.
- Percentage Distribution of all Question – the overall accumulated percent distribution of the responses to the questions (attached in Appendix 1 and Appendix 2).
- Diverging Bars Representation – a better graphical representation than a table with the percent distribution.
- Box Plots - utilized to depict the variability and distribution of responses, for identifying outliers and understanding the spread of the data.

## Statistical Analysis

- ANOVA Test - was conducted to assess the statistical significance of the differences between the responses related to the four projects.
- Post-hoc Test (Bonferroni Correction) with T-Test - This method adjusted for multiple comparisons, reducing the risk of Type I errors, and was applied to highlight the specific pairs of projects between which statistically significant differences existed.

## **4 Results**

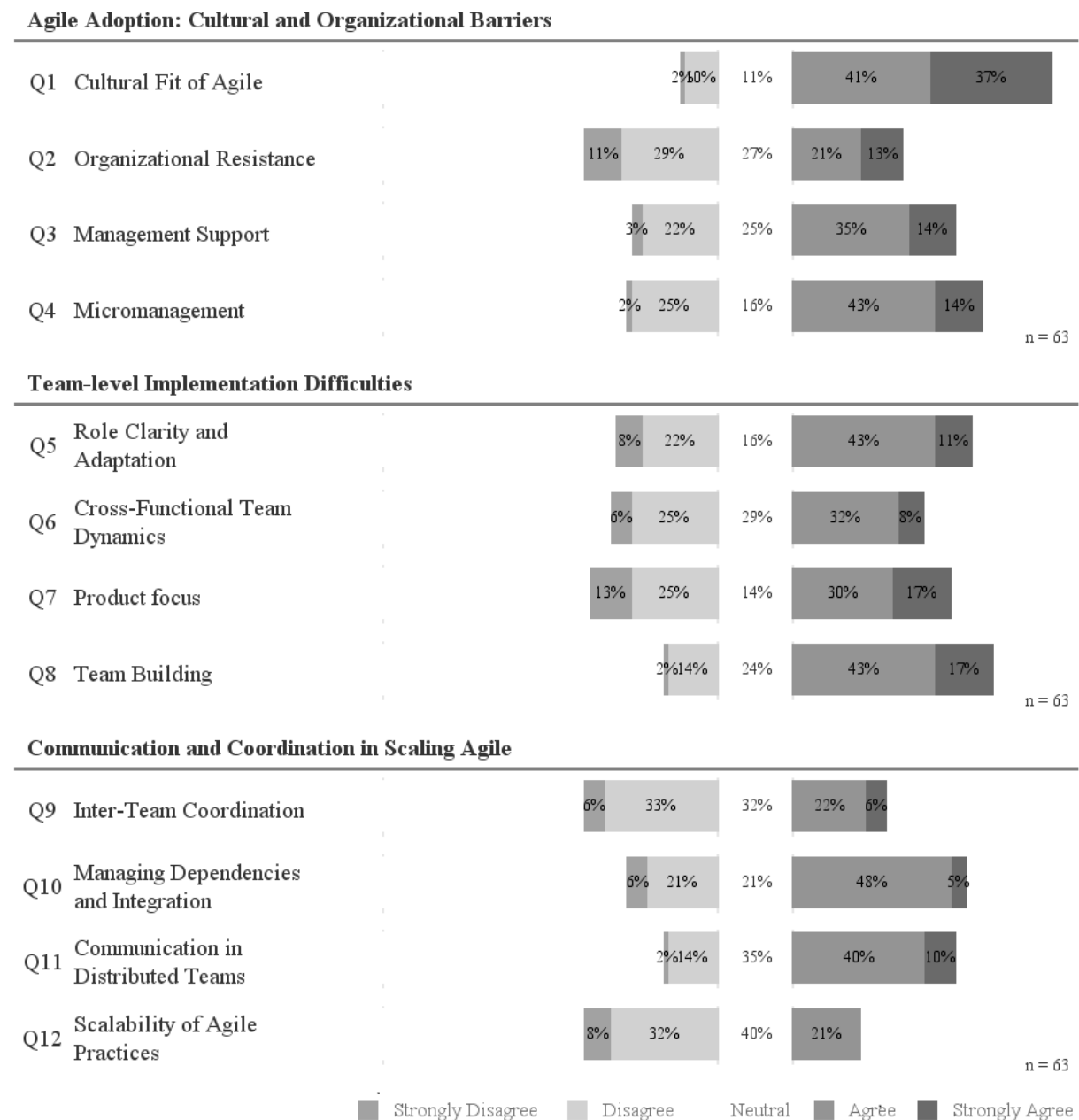
### **4.1 Summary of Key Findings**

This chapter consolidates the key findings derived from the responses of 63 participants who participated in the survey with the designed questionnaire. The findings will be analyzed to get an overview of the current Agile landscape in large organizations. The questionnaire results are presented with diverging bars in Figure 8 and Figure 9, as defined in (Heiberger & Robbins, 2014). This data is also presented as a table in Appendix 1 and Appendix 2.

### Cultural and Organizational Barriers to Agile Adoption

A significant challenge revealed by the survey is the difficulty of aligning Agile methodologies with large corporations' traditional, hierarchical culture. The survey highlights the existing cultural gap between Agile methodologies and the non-Agile traditional corporations. A considerable 78% of the responders agreed with the question on whether it is challenging to fit Agile methodologies to their company's culture (Q1), reflecting the cultural resistance to adopting Agile 34% agreeing, 40% not agreeing (Q2). There is a sufficient perception that management's understanding of Agile principles is lacking (Q3), with 49% agreeing with the insufficiency of management's grasp on Agile. This highlights an obstacle for the Agile transformation process. In contrast, micromanagement does not remain pervasive, as 57% of the

respondents agree that their teams were able to self-organize and operate autonomously (Q4). This finding indicates the integration of one of Agile's core values - empowering teams to manage their workflow and decisions independently.



**Figure 8: Questionnaire Results - All Replies Challenges**

### Agile Implementation at the Team Level

Findings on the team-level implementation of Agile indicate a definite need to improve role clarity and adaptation. Over half of the survey respondents (54%) agreed that Agile roles are

well-defined and present in their teams (Q5). This is very important, and a better understanding of the roles should be expected. The lack of clear understanding of the Agile process or absent roles can lead to inefficiencies in the Agile's objective of streamlining processes.

The dynamics within cross-functional teams emerged as an area that needs attention. Despite recognizing cross-functional teams, only 40% of the respondents reported no skill gaps and clear responsibilities (Q6), and 47% agreed on product focus (Q7). Moreover, team building was successful, which creates trust and effective collaboration. The majority (60%) see these efforts as highly effective (Q8), implying that the teams have a spirit of solidarity and confidence that Agile strongly recommends.

#### Communication, Coordination, and Scalability Challenges

Inter-team coordination and communication are important to the success of Agile, especially in organizations with multiple Agile teams. The results show that 39% of the participants found that the inter-team coordination was challenging (Q9), whereas more than half (53%) of the responders agreed with the statement that managing dependencies and integration across teams was well handled (Q10).

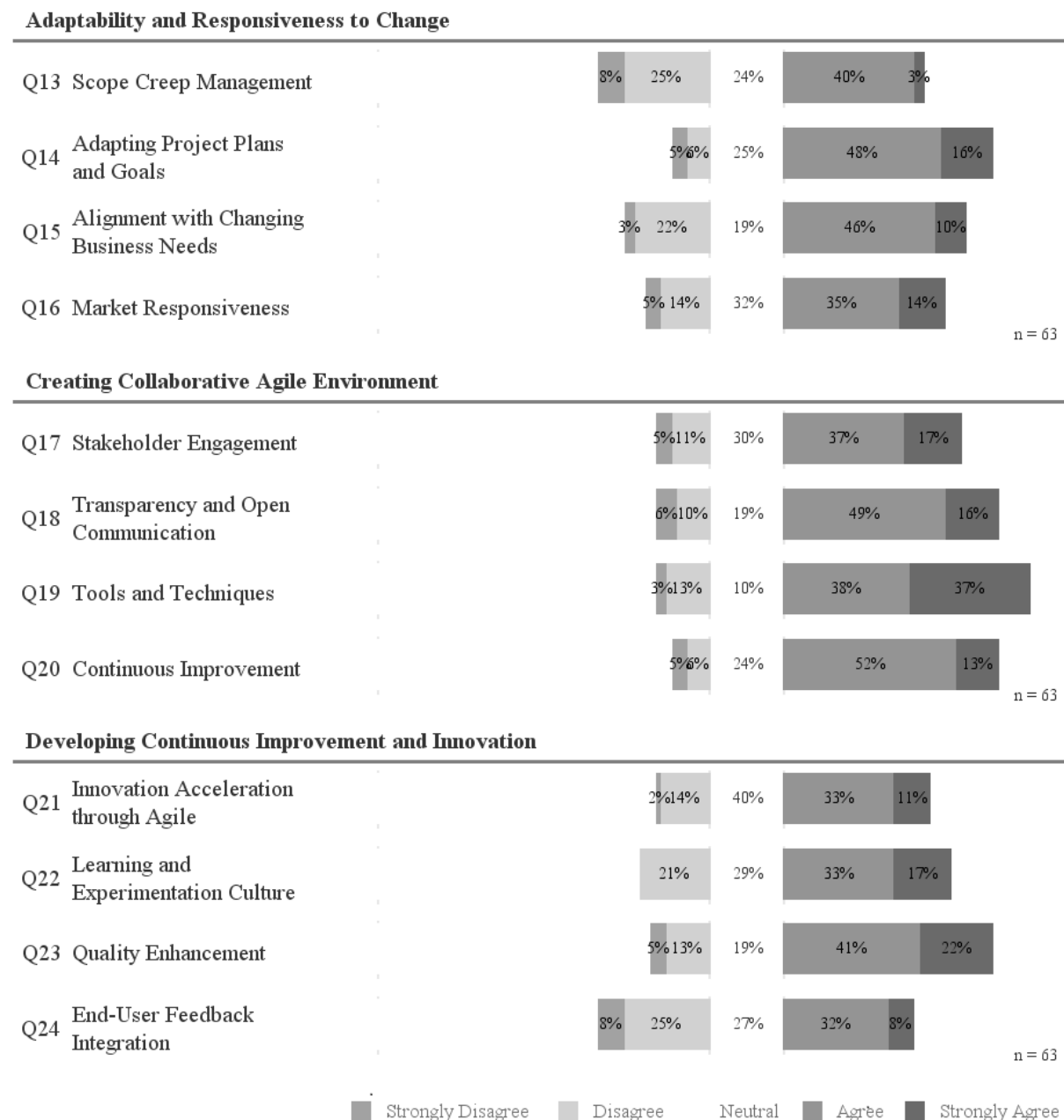
This is an indication of areas where the process could be optimized for better flow and interaction between distributed teams. In the context of geographically distributed teams, 50% of the respondents agreed with the success of the communication (Q11). However, concerning scaling Agile practices across multiple teams, 40% responded negatively on its effectiveness (Q12), implying that the scaling of Agile within large companies is done ineffectively.

#### Responsiveness to Change

The Agile approach is celebrated for its adaptability and responsiveness to change, which is proved by the results in this category. Most respondents (43%) agreed that scope creep is well-managed (Q13). A combined 64% agreed that project goals adapt quickly to new information

(Q14). Over 56% agreed that their agile process rapidly aligns with changing business needs

(Q15). 49% agreed with the statement that Agile significantly improves the organization's responsiveness to market changes.



**Figure 9: Questionnaire Results – All Replies Opportunities**

### Stakeholder Engagement and Collaborative Environments

Agile methodologies are important to stakeholder engagement, which is confirmed by 54% of respondents(Q17). Also, Agile's promise of transparency and open communication is

confirmed fulfilled, as 65% agree with the level of transparency in Agile teams (Q18). This is an essential trust enabler in effective collaboration. In addition, 75% of the participants stated that using tools like JIRA supports facilitating Agile practices (Q19). Improved collaboration (Q20) was confirmed by 65% of the respondents.

### Continuous Improvement and Innovation

Finally, innovation acceleration, a desirable outcome of Agile implementation, was significantly accelerated according to 44% of respondents (Q21). Nonetheless, Agile's learning and experimentation culture got a positive perception from 50% of the respondents (Q22). 63% of the participants confirmed that Agile leads to quality improvements. Integrating feedback from end-users into products has been approved by only 40% of the responders (Q24), showing potential optimization.

## **4.2 Insights from Scrum Team Members**

This chapter analyzes the practical insights collected from the Scrum team members of each Project A-D, presenting the distribution of the variation in the responses in box-and-whisker plots. (Figure 10, Figure 11).

### Differences in Agile Perception

The box plots reveal a variety of dispersions across the questions, which relate to the Scrum team members' perspectives on the team-specific Agile implementation:

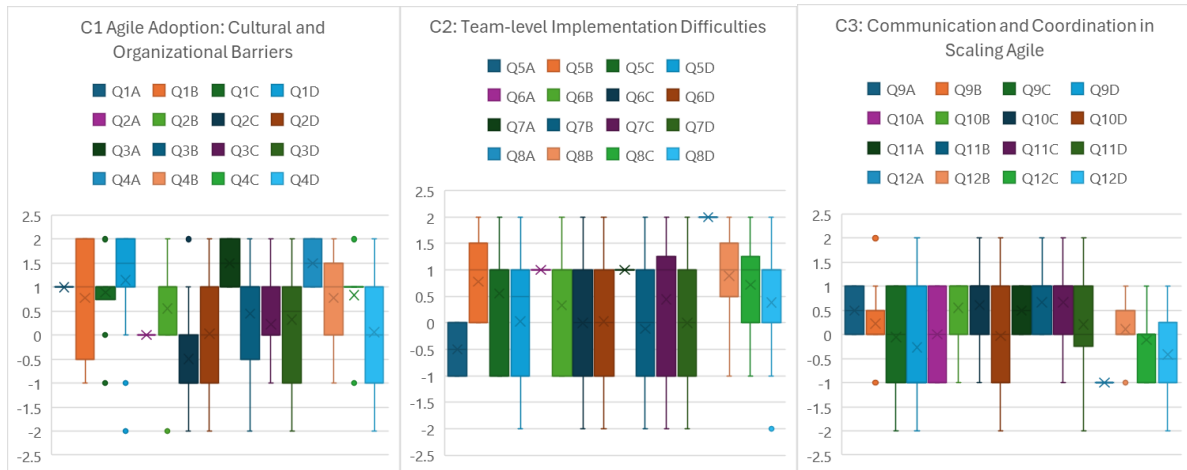
- Varied experiences with Agile roles: The variety of responses about understanding Agile roles (Q5) points out that some teams clearly understand Agile, while others may still be struggling. That could indicate variation in training quality or different stages of agile maturity across teams.

- Communication within distributed teams: The distribution of responses on the effectiveness of communication within distributed teams (Q11) highlights the complexity of collaboration for distributed teams in different geographical locations.
- Responsiveness to change: Regarding adaptability to change and responsiveness to feedback (Q14 and Q15), the range of the answers shows the different dynamics within these teams. This aspect could also indicate how flexible and quickly adaptable these organizations are at scale since the capability to pivot as soon as new information occurs, might reflect the broader organizational agility.

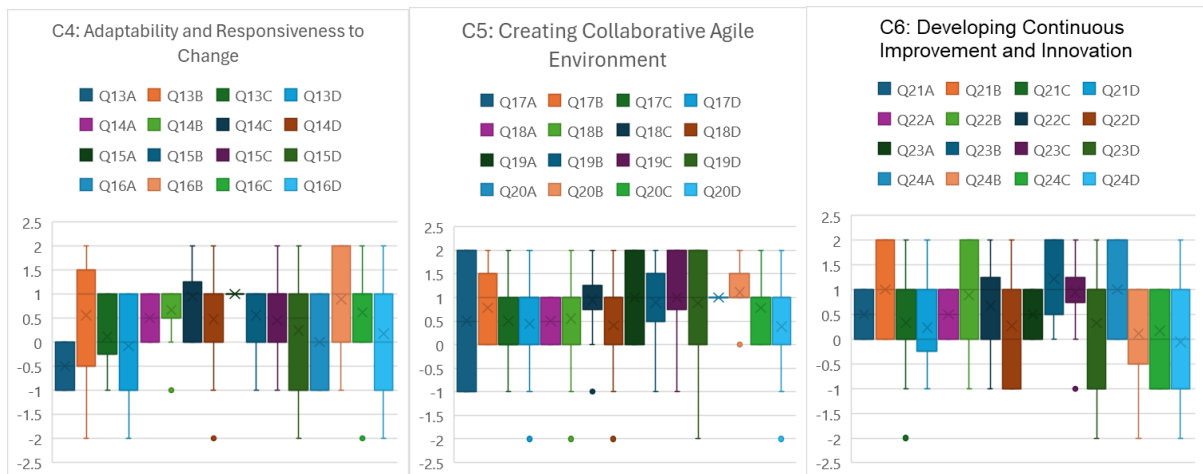
#### Outliers as Indicators of Unique Scenarios

Outliers in the box plots indicate experiences that significantly deviate from the norm for the other teams:

- Exceptional Team Autonomy: Outliers in the data concerning micromanagement (Q4) suggest the presence of teams that work highly autonomously and are not representative of other teams. Additional analysis would be necessary to determine what contributes to these unique scenarios of heightened autonomy.
- Significant Stakeholder Engagement: Outliers on stakeholder engagement (Q17) may indicate several cases where Agile's collaborative nature is well or poorly practiced. These cases offer an opportunity to learn from best practices or to identify areas needing urgent improvement.



**Figure 10: Questions Q1-Q12, for each Project A, B, C, D (A n=2, B n=9, C n=18, D n=34)**



**Figure 11: Questions Q13-Q24, for each Project A, B, C, D (A n=2, B n=9, C n=18, D n=34)**

## Complex Agile Implementation

Certain trends indicate the difficulty of implementing Agile.

- Effectiveness of supportive tools: The skewness towards higher agreement on the effectiveness of Agile tools like JIRA (Q19) is a general acceptance of these tools in facilitating Agile practices.
- Cultural Readiness for Agile: Skewness in responses related to cultural challenges (Q1) suggests that while some teams have already embraced an Agile-friendly culture, others still work in environments that are not yet committed to Agile methodologies.



### Insights Specific to Individual Projects

- **Project-Specific Communication Patterns:** The difference in effectiveness of communication between projects (Q9, Q10, Q11) suggests that the size of a project or its structure might contribute a lot to inter-team interactions.
- **Different Approaches to Team Building:** The distribution of responses related to team building (Q8) across the projects suggests that project objectives and management style might give rise to distinctive team dynamics.

## **4.3 Comparative Analysis of Results**

For a deeper statistical analysis, the study results were coded according to Table 5. Using negative and positive values makes understanding statistical data easier and is used in all following tables.

| Answer | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|--------|-------------------|----------|---------|-------|----------------|
| Coding | -2                | -1       | 0       | 1     | 2              |

**Table 5: Coding of the answers**

In Table 7 the averages per project are presented. The data suggests that there are differences between the four groups (the four projects). To prove if a statistically significant difference exists, an ANOVA compares the four Projects as four groups for each question, as suggested by (Norman, 2010). The result is presented in Table 8. For the statistical significance a factor of 0,05 is used. A p-value less than 0,05 shows a statistical significance.

| Test                                  | Alpha  |
|---------------------------------------|--------|
| ANOVA                                 | 0,05   |
| Post-hoc test (Bonferroni Correction) | 0,0125 |

**Table 6: Alpha for statistical significance**

| Question                                   | Global n | Global Average | Project A<br>n=2<br>Average | Project B<br>n=9<br>Average | Project C<br>n=18<br>Average | Project D<br>n=34<br>Average |
|--------------------------------------------|----------|----------------|-----------------------------|-----------------------------|------------------------------|------------------------------|
| Q1 Cultural Fit of Agile                   | 63       | 1.02           | 1.00                        | 0.78                        | 0.89                         | 1.15                         |
| Q2 Organizational Resistance               | 63       | -0.05          | 0.00                        | 0.56                        | -0.50                        | 0.03                         |
| Q3 Management Support                      | 63       | 0.35           | 1.50                        | 0.44                        | 0.22                         | 0.32                         |
| Q4 Micromanagement                         | 63       | 0.43           | 1.50                        | 0.78                        | 0.83                         | 0.06                         |
| Q5 Role Clarity and Adaptation             | 63       | 0.27           | -0.50                       | 0.78                        | 0.56                         | 0.03                         |
| Q6 Cross-Functional Team Dynamics          | 63       | 0.10           | 1.00                        | 0.33                        | 0.00                         | 0.03                         |
| Q7 Product focus                           | 63       | 0.14           | 1.00                        | -0.11                       | 0.44                         | 0.00                         |
| Q8 Team Building                           | 63       | 0.60           | 2.00                        | 0.89                        | 0.72                         | 0.38                         |
| Q9 Inter-Team Coordination                 | 63       | -0.11          | 0.50                        | 0.22                        | -0.06                        | -0.26                        |
| Q10 Managing Dependencies and Integration  | 63       | 0.24           | 0.00                        | 0.56                        | 0.61                         | -0.03                        |
| Q11 Communication in Distributed Teams     | 63       | 0.41           | 0.50                        | 0.67                        | 0.67                         | 0.21                         |
| Q12 Scalability of Agile Practices         | 63       | -0.27          | -1.00                       | 0.11                        | -0.11                        | -0.41                        |
| Q13 Scope Creep Management                 | 63       | 0.05           | -0.50                       | 0.56                        | 0.11                         | -0.09                        |
| Q14 Adapting Project Plans and Goals       | 63       | 0.63           | 0.50                        | 0.67                        | 0.94                         | 0.47                         |
| Q15 Alignment with Changing Business Needs | 63       | 0.37           | 1.00                        | 0.56                        | 0.44                         | 0.24                         |
| Q16 Market Responsiveness                  | 63       | 0.40           | 0.00                        | 0.89                        | 0.61                         | 0.18                         |
| Q17 Stakeholder Engagement                 | 63       | 0.51           | 0.50                        | 0.78                        | 0.50                         | 0.44                         |
| Q18 Transparency and Open Communication    | 63       | 0.59           | 0.50                        | 0.56                        | 0.94                         | 0.41                         |
| Q19 Tools and Techniques                   | 63       | 0.92           | 1.00                        | 0.89                        | 1.00                         | 0.88                         |
| Q20 Continuous Improvement                 | 63       | 0.62           | 1.00                        | 1.11                        | 0.78                         | 0.38                         |
| Q21 Innovation Acceleration through Agile  | 63       | 0.38           | 0.50                        | 1.00                        | 0.33                         | 0.24                         |
| Q22 Learning and Experimentation Culture   | 63       | 0.48           | 0.50                        | 0.89                        | 0.67                         | 0.26                         |
| Q23 Quality Enhancement                    | 63       | 0.63           | 0.50                        | 1.22                        | 0.94                         | 0.32                         |
| Q24 End-User Feedback Integration          | 63       | 0.06           | 1.00                        | 0.11                        | 0.17                         | -0.06                        |

**Table 7: Averages by project**

| Question                                 | ANOVA<br>n=63, F crit=2.76 | ANOVA<br>F-value | ANOVA<br>p-value | A vs B<br>p-value | A vs C<br>p-value | A vs D<br>p-value | B vs C<br>p-value | B vs D<br>p-value | C vs D<br>p-value |
|------------------------------------------|----------------------------|------------------|------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Q1 Cultural Fit of Agile                 |                            | 0.44             | 0.72             | 0.81              | 0.84              | 0.85              | 0.77              | 0.39              | 0.38              |
| Q2 Organizational Resistance             |                            | 1.68             | 0.18             | 0.52              | 0.54              | 0.97              | 0.03              | 0.26              | 0.14              |
| Q3 Management Support                    |                            | 0.86             | 0.46             | 0.29              | 0.05              | 0.17              | 0.58              | 0.79              | 0.75              |
| Q4 Micromanagement                       |                            | 3.58             | 0.02             | 0.40              | 0.34              | 0.06              | 0.89              | 0.08              | 0.01              |
| Q5 Role Clarity and Adaptation           |                            | 1.76             | 0.16             | 0.08              | 0.21              | 0.56              | 0.60              | 0.10              | 0.14              |
| Q6 Cross-Functional Team Dynamics        |                            | 0.70             | 0.56             | 0.44              | 0.20              | 0.23              | 0.45              | 0.47              | 0.93              |
| Q7 Product focus                         |                            | 0.82             | 0.49             | 0.27              | 0.56              | 0.32              | 0.30              | 0.83              | 0.27              |
| Q8 Team Building                         |                            | 2.36             | 0.08             | 0.14              | 0.08              | 0.03              | 0.67              | 0.17              | 0.24              |
| Q9 Inter-Team Coordination               |                            | 0.81             | 0.50             | 0.68              | 0.43              | 0.36              | 0.46              | 0.24              | 0.51              |
| Q10 Managing Dependencies                |                            | 1.91             | 0.14             | 0.41              | 0.33              | 0.97              | 0.86              | 0.16              | 0.04              |
| Q11 Communication in Distributed Teams   |                            | 1.31             | 0.28             | 0.77              | 0.81              | 0.67              | 1.00              | 0.18              | 0.10              |
| Q12 Scalability of Agile Practices       |                            | 1.54             | 0.21             | 0.03              | 0.09              | 0.43              | 0.41              | 0.15              | 0.27              |
| Q13 Scope Creep Management               |                            | 1.09             | 0.36             | 0.32              | 0.29              | 0.61              | 0.28              | 0.15              | 0.50              |
| Q14 Adapting Project Plans and Goals     |                            | 0.91             | 0.44             | 0.77              | 0.42              | 0.97              | 0.35              | 0.63              | 0.12              |
| Q15 Alignment with Changing Needs        |                            | 0.55             | 0.65             | 0.43              | 0.38              | 0.38              | 0.74              | 0.45              | 0.52              |
| Q16 Market Responsiveness                |                            | 1.53             | 0.22             | 0.33              | 0.40              | 0.83              | 0.49              | 0.09              | 0.15              |
| Q17 Stakeholder Engagement               |                            | 0.23             | 0.87             | 0.74              | 1.00              | 0.95              | 0.45              | 0.42              | 0.85              |
| Q18 Transparency and Open Communication  |                            | 0.98             | 0.41             | 0.95              | 0.46              | 0.92              | 0.33              | 0.75              | 0.09              |
| Q19 Tools and Techniques                 |                            | 0.05             | 0.99             | 0.89              | 1.00              | 0.90              | 0.78              | 0.99              | 0.73              |
| Q20 Continuous Improvement               |                            | 1.82             | 0.15             | 0.81              | 0.58              | 0.46              | 0.16              | 0.08              | 0.18              |
| Q21 Innovation Acceleration              |                            | 1.71             | 0.17             | 0.47              | 0.81              | 0.69              | 0.08              | 0.03              | 0.72              |
| Q22 Learning and Experimentation Culture |                            | 1.22             | 0.31             | 0.64              | 0.82              | 0.75              | 0.59              | 0.11              | 0.18              |
| Q23 Quality Enhancement                  |                            | 2.35             | 0.08             | 0.29              | 0.46              | 0.85              | 0.41              | 0.05              | 0.06              |
| Q24 End-User Feedback Integration        |                            | 0.66             | 0.58             | 0.33              | 0.23              | 0.25              | 0.88              | 0.71              | 0.49              |

**Table 8: ANOVA and post-hoc tests**

This is the case only for question (Q4), with a p-value of 0.02. This means that only the question (Q4) "Management does not micromanage; instead, the team self-organizes and works

autonomously.” has a statistically significant difference between the projects and indicates a difference. To prove where the difference is found a Post-hoc T-Test is executed between each pair of project permutations. The alpha for correcting Type I errors is applied using the Bonferroni correction (Armstrong, 2014):  $4 \times 0,05 = 0,0125$  presented in Table 6. This is necessary to ensure that the statistical significance is high enough given multiple comparisons.

To determine the statistical significance between responses, a p-value from the T-Tests was used in the analysis. The T-Test p-value between the projects C and D is equal to 0,01, and thus, this explains the statistical difference. The differences between all other questions between the projects are not statistically significant, as the significance level was set at 0,0125.

This indicated that there are differences in Agile practices adoption and impact across the projects in the survey. In question (Q4), the critical insight was found with an ANOVA Test p-value of 0.02. Since this is a statistical marker, pointing out that there exists variance among different teams with respect to autonomy and self-organization. Consequently, this indicates that these two projects’ participants have statistically significant differences on how they responded in regard to question Q4 thus suggesting difference in management style.

#### **4.4 Implications for Agile Practice in Big Corporations**

The questionnaire data reveals that the main challenge to a successful adoption of Agile in large corporations is the integration of Agile practices with the established corporate culture. Overcoming the adoption resistance requires a cultural shift toward flexibility and an appreciation for Agile's core principles and values. This process must be driven by management's active support and management’s understanding and buy-in in the way Agile works. In an Agile transformation, the role of management evolves from directing tasks in the command-and-control pattern to enabling team autonomy, promoting shared leadership, Agile's adaptive planning, and continuous improvement ethos. Team autonomy was the only statistically significant

difference between the projects, which shows how important is the absence of micromanagement.

A critical finding is the need for clearly defined roles within Agile teams. All roles must be occupied. Proper role definition and addressing skill gaps through continuous training can enhance cross-functionality and create an environment enabling Agile methodologies. The questionnaire confirmed that inter-team coordination, particularly in geographically distributed teams, remains a challenge. Adopting structured Agile frameworks and leveraging collaborative tools can mitigate these issues, enabling more effective scaling of Agile practices within the corporate structure.

The survey highlights Agile's capacity to improve responsiveness to market changes - a key advantage in today's hectic business environment. Maintaining competitiveness is a must. Hence, companies need to keep improving their Agile implementations to respond quickly and pivot adaptively to stakeholder and customer feedback and market shifts.

Finally, the survey reveals that the integration of end-user feedback can be better facilitated in the daily work of the Scrum teams. Product owners can provide this valuable feedback during the Spring Planning meetings, so that this knowledge about the customers' needs can be incorporated in the product development during the Sprint.

This perspective is essential due to the fact that Agile methodologies encourage involvement of stakeholders and an innovative culture. Organizations need improved understanding, that getting customer feedback and incorporating it into the products will incrementally improve the quality and the customer satisfaction over time.

In sum, the full embracement of the Agile mindset includes not only adopting its methods but also promoting agility throughout the organization – developing flexibility, empowering teams, and creating an innovation environment as well.

## 5 Discussion

### 5.1 Theoretical Implications

Bridging the gap between the conducted academic literature review and the results from the questionnaire, the theoretical implications of evidence will be discussed. The integration of Agile methodologies in large corporations reveals the potential for significant theoretical implications for the transformation of organizations specific to their organizational culture and processes. The literature review in this thesis and the questionnaire data challenges conventional theories, suggesting a paradigm shift and a new direction in understanding organizational dynamics.

**Organizational Change Theories:** Agile's iterative and incremental nature challenges traditional change management theories that often prefer linear processes. An adaptive and flexible framework is required to deal with challenging cultural alignment with Agile, as shown by the questionnaire data - 78% facing cultural alignment issues (Q1). This trend aligns with the development of theories that can consider the organic and evolving aspects related to agile transformations.

**Organizational Culture:** Agile methodologies necessitate moving from top-down command and control organizations to horizontal, cooperative ones. This highlights the importance of theoretical models that give preference to adaptability and empowerment. This can be related to the results reported by 57% (Q4) of respondents on the effectiveness of self-organizing teams which point out a preference towards organizational cultures promoting team autonomy and continuous learning.

**Leadership and Systems Theory:** The adoption of agility emphasizes leadership that advocates for openness, flexibility as well as team empowerment. Thus, this implies a shift in leadership

theories towards more participative than directive approaches that correspond with systems theory's emphasis on feedback loops and organizational interconnectivity.

Knowledge Management: Agile's focus on continuous improvement and collaboration highlights the role of knowledge sharing (e.g., with tools like JIRA, Confluence) is in resonance with learning organization theories on agile success. Therefore, integrating agile practices with knowledge management strategies is required to boost organizational learning.

Incorporation of agile practices into large corporations implies the need to rethink existing theoretical frameworks towards more dynamic and nonlinear models of organizational change, culture, leadership, and knowledge management. The findings of this thesis contribute to the understanding of organizational theory by providing a foundation for future research in Agile transformations.

## **5.2 Practical Implications**

### **5.2.1 Addressing the Challenges: Strategies and Recommendations**

Efforts to integrate the Agile methodologies in large corporations are faced with significant cultural, organizational, and communication-related challenges. Insights from the conducted literature review in Chapter 2. Literature Review and empirical data from the questionnaire from Chapter 4 Results show a path for effectively addressing these impediments. Initially, the literature review served as a map offering a view of the landscape of common hurdles and challenges captured and analyzed deeply in academic and industry research. These thematic areas were the foundation for the questions of the questionnaire used in the thesis, which was designed to assert and prove these challenges in real-world projects by practitioners in complex Agile projects.

The questionnaires' responses, which reflected real-world experiences, confirmed the literature's identified issues. As reflected by 78% (Q1) of respondents, the most pronounced

challenge is the challenging cultural alignment with the Agile methodology. This resistance against change is rooted in traditional corporate values, implying that stability is preferred to agility, predictability over adaptability. To counter this, corporations need to start a strategic top-down cultural transformation. Management should endorse agile practices and show commitment to them by becoming ambassadors of agile values and principles. This is essential in creating an organizational climate promoting agility as a core competency. Furthermore, micromanagement should be avoided, so that the teams can act autonomously. Team autonomy was revealed as a statistically significant difference between the four projects in the questionnaire, indicating that some teams were acting more autonomously and living the Agile's core principles.

At the same time, the structural rigidity of large corporations hampers the fluid, cross-functional collaboration essential for agile success. The hierarchical and siloed nature of such organizations needs to be transformed. Corporations can create ecosystems where Agile autonomy prospers by redesigning organizational structures for more effective agile workflows, cross-functional teams and flat hierarchies.

Moreover, the thesis highlighted the communication challenges, especially in the coordination of distributed teams. Regular agile ceremonies and platforms facilitating cross-team collaboration are instrumental in bridging communication gaps, ensuring that agile teams can collaborate even in geographically dispersed settings. In essence, navigating the complexities of Agile adoption in large corporations demands a concerted effort focused on cultural transformation, structural realignment, and improved inter-team coordination.

### **5.2.2 Leveraging the Opportunities: A Way Ahead for Big Corporations**

The Agile transformation journey presents many opportunities for large corporations to redefine their operational, strategic, and cultural paradigms. The literature review in Chapter 2.



Literature Review acted as a basis in designing the questionnaire structure to explore the various aspects of the opportunities by the Agile adoption in large companies. The questionnaire results in Chapter 4 Results, in turn, acted as a bridge, translating the academic insights into empirical data, which reflects the current corporate practices. From the insights of the literature review of the thesis and the detailed information obtained from the questionnaire, can be concluded that, Agile methodologies offer large corporations not only challenges but open new opportunities for growth, adaptability, and stakeholder engagement.

Notably the empirical data of the questionnaire highlighted the potential of Agile to enhance organizational adaptivity – a critical capability in a constantly changing business environment. The ability to change quickly by being responsive and adaptable is central to the agile philosophy. This was confirmed by 56% (Q15) of survey respondents as one of Agile organizations' most valuable aspects. In an environment characterized by volatility and unpredictability, adaptability becomes a critical factor in enabling organizations to respond fast and to pivot their operations, when changes in the market occur or new technologies get introduced. Hence, agile practices have to be integrated into strategic planning and execution at the heart of any organization. Consequently, this permits businesses to embrace iterative development and feedback loops that are closely attuned with customer demands as well as market dynamics.

Furthermore, the agile methodology advocates for a culture of continuous improvement and innovation, as evidenced by the positive impact on product quality reported by 63% (Q23) of the study participants. This emphasis on iterative progress and a proactive approach to incorporating stakeholder feedback, creates an environment where innovation thrives. Large corporations can benefit from a culture that not only values but actively seeks out opportunities for innovation, leveraging Agile practices, while staying ahead of the competitors.

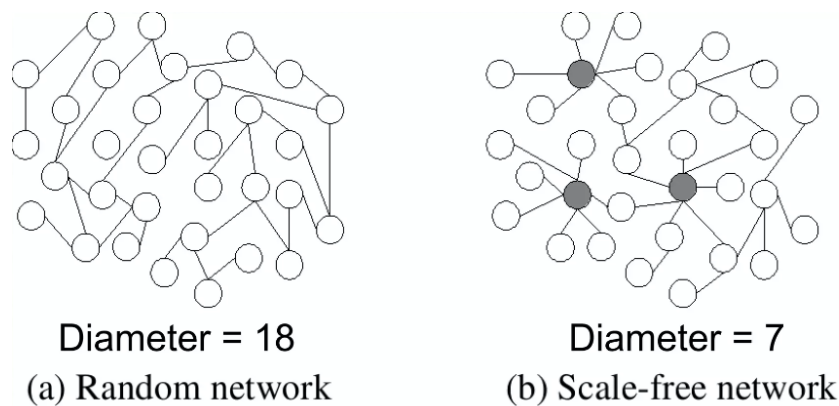
Moreover, the enhanced stakeholder engagement facilitated by agile methodologies highlights the importance of building and maintaining robust relationships with customers and

other key stakeholders. By prioritizing customer feedback and ensuring that products and services are closely aligned with their expectations, corporations can enhance customer satisfaction and loyalty, driving long-term success.

In conclusion, using Agile methodologies gives corporations strategic method to navigate complexities through a commitment to adaptability, innovation, and stakeholder engagement. Agile corporations can redefine their competitive advantage, ensuring sustained growth and resilience in a changing business environment.

### 5.2.3 Scale-Free Networks as a possible optimization.

After discussing the challenges and addressing the opportunities within large corporations, in this chapter an innovative approach to analyzing and optimizing inter-team communication in large-scale Agile organizations will be shortly presented.



**Figure 12: Scale-Free Network (Castillo, 2005)**

Scale-free networks are discussed in a presentation by J. Coplien (2019) as a possible optimization for Agile inter-team communication. Scale-free networks are found in many natural and technological systems and are known for their resilience and ability to process information efficiently. A scale-free network is a network that has a high number of hubs Figure 12. The key feature of these networks is their uneven distribution of connections among nodes, with a small number of nodes (hubs) having many connections while the majority have few. The hubs

tie together communities of leaves or maybe other hubs. Scale-free networks have a diameter that remains constant as the graph grows. In an organizational context, the diameter represents the longest communicational path. J. Coplien (2019) states that most organizations have a “natural” distribution of node degrees. In contrast, Agile organizations follow the exponential distribution of node degrees meaning having many hubs and smaller diameters. Similarly, the Agile networks were discussed in the literature review chapter 2.6 in a study by Denning (2018), presented in Figure 3.

Corporations must strategically identify and develop agile hubs, to applying scale-free networks in agile projects. These hubs, or centers of excellence, should embody deep agile experience and the capacity to influence and support surrounding nodes (other project teams). The hubs can also be practices of interest such as backend-, frontend-, design-, tester-, agile-practice-hub, etc. Scale-free networks thrive on the diversity of connections and interactions. Encouraging cross-functional collaboration exchanging ideas between agile hubs and peripheral teams can lead to innovative solutions and enhanced project outcomes. The connectivity in the organization must be enhanced. Organizational and technological measures can be undertaken to facilitate seamless communication between hubs and other nodes, ensuring that knowledge and best practices can flow freely throughout the organization.

### **5.3 Limitations of the Study**

Despite its comprehensiveness, this thesis has certain limitations. To begin with, the use of self-reported survey responses can introduce biases due to individual experiences in the corporate culture. Second, the sample size, despite being adequate, is limited to a certain type of demographic - freelance software consultants. Therefore, these findings may not be applicable to all business organizations worldwide, especially large ones. In addition, this thesis focuses on the challenges and opportunities that agile methodologies pose to big firms but does not

specifically look at differences between various Agile scaling frameworks that might have different implications for large organizations. Finally, as agile practices continue evolving and corporate environments are changing dynamically, these results might not fully anticipate future trends and long-term impact of Agile transformations.

## **5.4 Recommendations for Future Research**

The thesis has limitations, and its findings need to be put into context to guide future research. To achieve this, one option is a longitudinal approach, which may help reveal more about the long-term effect of agile practices on large corporations. In addition, the dynamic nature of Agile transformations could be addressed. Agile transformation is characterized by its reliance on an ongoing reviews and improvement cycle. Further research is needed to compare the effectiveness of various Agile scaling frameworks in large-scale environments. A nuanced and deeper understanding can be provided of how these frameworks align with corporate structures and culture. Additional areas of further research can be in qualitative studies with a focus on semi-structured interviews. Rich contextual insights can be provided into the agile transformation process regarding psychological and cultural shifts within organizations. A good starting point for this area may involve examining technology's role and digital tools in facilitating agile practices especially in remote work and distributed teams.

## Appendix

### Appendix 1: Questionnaire Results - Challenges

| Question                                  | Global n | Distribution Overall in % |          |         |       |                |
|-------------------------------------------|----------|---------------------------|----------|---------|-------|----------------|
|                                           |          | Strongly Disagree         | Disagree | Neutral | Agree | Strongly Agree |
| Q1 Cultural Fit of Agile                  | 63       | 2%                        | 10%      | 11%     | 41%   | 37%            |
| Q2 Organizational Resistance              | 63       | 11%                       | 29%      | 27%     | 21%   | 13%            |
| Q3 Management Support                     | 63       | 3%                        | 22%      | 25%     | 35%   | 14%            |
| Q4 Micromanagement                        | 63       | 2%                        | 25%      | 16%     | 43%   | 14%            |
| Q5 Role Clarity and Adaptation            | 63       | 8%                        | 22%      | 16%     | 43%   | 11%            |
| Q6 Cross-Functional Team Dynamics         | 63       | 6%                        | 25%      | 29%     | 32%   | 8%             |
| Q7 Product focus                          | 63       | 13%                       | 25%      | 14%     | 30%   | 17%            |
| Q8 Team Building                          | 63       | 2%                        | 14%      | 24%     | 43%   | 17%            |
| Q9 Inter-Team Coordination                | 63       | 6%                        | 33%      | 32%     | 22%   | 6%             |
| Q10 Managing Dependencies and Integration | 63       | 6%                        | 21%      | 21%     | 48%   | 5%             |
| Q11 Communication in Distributed Teams    | 63       | 2%                        | 14%      | 35%     | 40%   | 10%            |
| Q12 Scalability of Agile Practices        | 63       | 8%                        | 32%      | 40%     | 21%   | 0%             |

## Appendix 2: Questionnaire Results - Opportunities

| Question                                   | Global n | Distribution Overall in % |          |         |       |                |
|--------------------------------------------|----------|---------------------------|----------|---------|-------|----------------|
|                                            |          | Strongly Disagree         | Disagree | Neutral | Agree | Strongly Agree |
| Q13 Scope Creep Management                 | 63       | 8%                        | 25%      | 24%     | 40%   | 3%             |
| Q14 Adapting Project Plans and Goals       | 63       | 5%                        | 6%       | 25%     | 48%   | 16%            |
| Q15 Alignment with Changing Business Needs | 63       | 3%                        | 22%      | 19%     | 46%   | 10%            |
| Q16 Market Responsiveness                  | 63       | 5%                        | 14%      | 32%     | 35%   | 14%            |
| Q17 Stakeholder Engagement                 | 63       | 5%                        | 11%      | 30%     | 37%   | 17%            |
| Q18 Transparency and Open Communication    | 63       | 6%                        | 10%      | 19%     | 49%   | 16%            |
| Q19 Tools and Techniques                   | 63       | 3%                        | 13%      | 10%     | 38%   | 37%            |
| Q20 Continuous Improvement                 | 63       | 5%                        | 6%       | 24%     | 52%   | 13%            |
| Q21 Innovation Acceleration through Agile  | 63       | 2%                        | 14%      | 40%     | 33%   | 11%            |
| Q22 Learning and Experimentation Culture   | 63       | 0%                        | 21%      | 29%     | 33%   | 17%            |
| Q23 Quality Enhancement                    | 63       | 5%                        | 13%      | 19%     | 41%   | 22%            |
| Q24 End-User Feedback Integration          | 63       | 8%                        | 25%      | 27%     | 32%   | 8%             |

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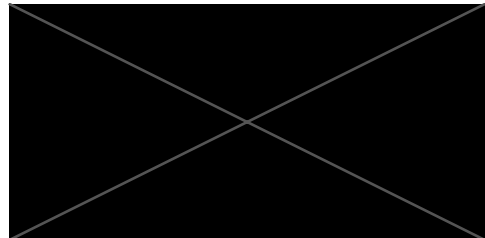
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