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Unlocking Innovation

Exploring Communication Methods in Corporate Project Teams

TU Delft

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By

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Preface

This thesis marks the culmination of my academic journey and the completion of my Master's in Management of Technology (MOT) at TU Delft. Reflecting on my years of study, I can say that this master's program has been both challenging and rewarding, particularly because my background is in Applied Science, having completed a bachelor's degree in Mechanical Engineering. Despite the initial hurdles, I am very pleased with my decision to pursue this master's.

Before starting this program, I hoped to explore new perspectives beyond the technical lens I had grown accustomed to during my bachelor's. I quickly realized that technology in a corporate environment encompasses far more than just technical challenges. By learning about these multifaceted aspects throughout the MOT program, I feel I have grown significantly, both as a professional and as an individual. This final thesis is an excellent representation of the knowledge and skills I have acquired during the master's. Not only does it dive into the realm of innovation management, a core focus of MOT, but it also requires considering various factors that influence communication methods within project teams, much like the different lenses that I have learned to use throughout my studies in MOT.

I would like to extend my gratitude to my supervisors, whose support and guidance were invaluable throughout this graduation period. My deepest thanks go to my first supervisor, Nikos Pachos-Fokialis, for the frequent meetings and his readiness to answer all my questions, always helping me focus on the right aspects of my research. I would also like to thank my second supervisor, Victor Scholten, for his assistance during the construction of the interview guide and for his insightful feedback on my report.

Finally, I am immensely grateful to all the participants who took the time to be interviewed for this research. Their insights form the core of this study, and I genuinely enjoyed conducting the interviews and learning from their experiences.

Tim Petit
Oktober, 2024
Breda

Management Summary

In today's corporate landscape, team innovation plays a critical role in maintaining competitive advantage, as organizations increasingly rely on project teams to develop creative solutions and implement new processes or products. However, the shift toward more virtual and hybrid work environments, accelerated by the COVID-19 pandemic, has introduced significant communication challenges. Effective communication, characterized by clear information exchange, timely feedback, and mutual understanding among team members, is crucial for facilitating collaboration and driving innovation. This research investigates how varying Levels of Virtuality (LoV) influence communication methods within corporate project teams and explores how these methods adapt across different stages of innovation, from idea generation to implementation. By addressing these challenges, the study aims to provide insights into optimizing communication strategies for enhanced team performance.

Using a deductive approach, the research conducted semi-structured interviews with project managers and team members across three technology-focused companies. The research draws upon contingency theory to establish a framework for the analysis, highlighting that there is no single best communication strategy for all teams. Instead, the effectiveness of communication methods is contingent on factors such as the stage of innovation and the team's Level of Virtuality (LoV). LoV refers to the extent to which team members interact through virtual means rather than face-to-face communication, ranging from fully remote to entirely in-person work environments. The research identifies that during the Idea Generation phase, informal and synchronous communication methods (e.g., brainstorming sessions, face-to-face meetings) are most effective for fostering creativity and spontaneity. Conversely, during the Implementation stage, formal and asynchronous methods (e.g., emails, reports) become more critical to ensure coordination and accountability.

The research concludes that for corporate project teams to optimize their innovation outcomes, they must adapt their communication strategies according to both the stage of innovation and their Level of Virtuality (LoV). Project managers should actively encourage informal and synchronous communication methods, such as brainstorming sessions and video calls, during the Idea Generation phase to foster creativity and spontaneity. In contrast, during the Implementation phase, they should introduce formal, structured methods like project management tools, detailed reports, and scheduled check-ins to ensure coordination and accountability. Additionally, managers must consider their team's LoV when selecting communication tools. For high virtuality environments, prioritizing synchronous tools like video conferencing and collaborative platforms can reduce misinterpretation and maintain immediacy. In low virtuality settings, project managers should leverage face-to-face interactions for discussions while integrating asynchronous tools, such as shared documents and emails, to maintain effective documentation and coordination.

The research concludes that for corporate project teams to optimize their innovation outcomes, they must adapt their communication strategies according to both the stage of innovation and their LoV. Practical implications for project managers include the need to carefully select communication methods that suit both the current phase of the project and the team's virtual work environment. Additionally, the research highlights the importance of organizational support in providing the necessary tools and training to ensure effective communication in hybrid and virtual settings.

In conclusion, the research highlights the complex interplay between LoV, stages of innovation, and communication methods, demonstrating that effective team communication is contingent on these factors. By recognizing and addressing these contingencies, corporate teams can enhance their communication strategy.

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1 Introduction

In today's dynamic corporate landscape, companies are constantly striving to improve and offer superior products or services. The degree of innovation achieved by an organization is crucial for gaining a competitive edge (Crossan & Apaydin, 2010). Within corporate project teams, effective communication plays a pivotal role in navigating the innovation process (Litchfield et al., 2018) . This study aims to explore how communication methods are adapted and utilized within these teams, particularly focusing on how these methods vary during the different stages of innovation, as well as in different levels of virtuality. By understanding these variations, the research seeks to provide insights into the communication strategies that best support project teams throughout the innovation process.

Innovation is described as the process that leads to the creation of new or improved practical and implementable solutions (Cropley, 2015; Thayer et al., 2018). To understand this better, innovation can be broken down into two stages: the idea generation stage, where new ideas are generated, and the idea implementation stage, where innovative ideas are implemented (Cropley, 2015; Hughes et al., 2018). As products and services evolve due to innovation, they become increasingly intricate to develop, requiring a diverse range of skills, knowledge, and viewpoints (Usher & Barak, 2020). This complexity necessitates the strategic formation of teams in the corporate context, where a cohesive group of individuals collaborates to achieve specific, shared goals and objectives within an organization (West & Sacramento, 2006). These teams bring together diverse skills, knowledge, and perspectives to address complex tasks and solve problems collectively. Given the current need for rapid development, project teams have become an effective way to drive innovation. Their temporary nature demands quick team formation, norming, and performing stages (Thayer et al., 2018). Project teams are often cross-functional, incorporating members from various departments and areas of expertise to work on specific projects. This diversity is crucial for addressing complex project requirements and fostering innovation (Berntsson Svensson, 2017).

As a result, this collaborative approach in the form of project teams has emerged as pivotal in driving innovation within firms in contemporary times (Hashmi & Ishak, 2017). Building further on the definition of innovation, team innovation specifically focuses on how teams create and implement new ideas, processes, products, or procedures that are novel and beneficial to the organization (West & Sacramento, 2006). The success of team innovation, however, hinges not only on the diversity and expertise within the team but also on the effectiveness of team dynamics. These dynamics, which include interactions, leadership, and particularly communication methods, play a significant role in determining the level of innovation that can be achieved (Litchfield et al., 2018). Among these elements, communication methods (CM's) are particularly critical, as found in a meta-analysis done by Hülsheger et al. (2009). Communication methods refer to the various means or tools through which information is exchanged, conveyed, or shared between individuals or groups (Den Otter & Emmitt, 2007). In this research, CM's have been categorized into 3 different categories; Formal & Informal, Synchronous & Asynchronous and Internal & External. Effective communication methods, characterized by clarity, mutual understanding, and adaptability, influence various stages of innovation by facilitating the exchange of ideas, promoting collaboration, and ensuring that information flows seamlessly within the team. For instance, during the idea generation stage, open and inclusive communication can foster a creative environment where diverse perspectives lead to innovative ideas. In the implementation stage, clear and coordinated communication ensures that these ideas are effectively executed and refined (Anderson et al., 2014).

As previously mentioned, in recent years, the way teams communicate and collaborate has been significantly influenced by the rise of hybrid and virtual work environments, a trend that has been accelerated by the global shift towards remote work due to the COVID-19 pandemic (Klonek et al., 2022). These changes have led to a greater reliance on digital communication tools

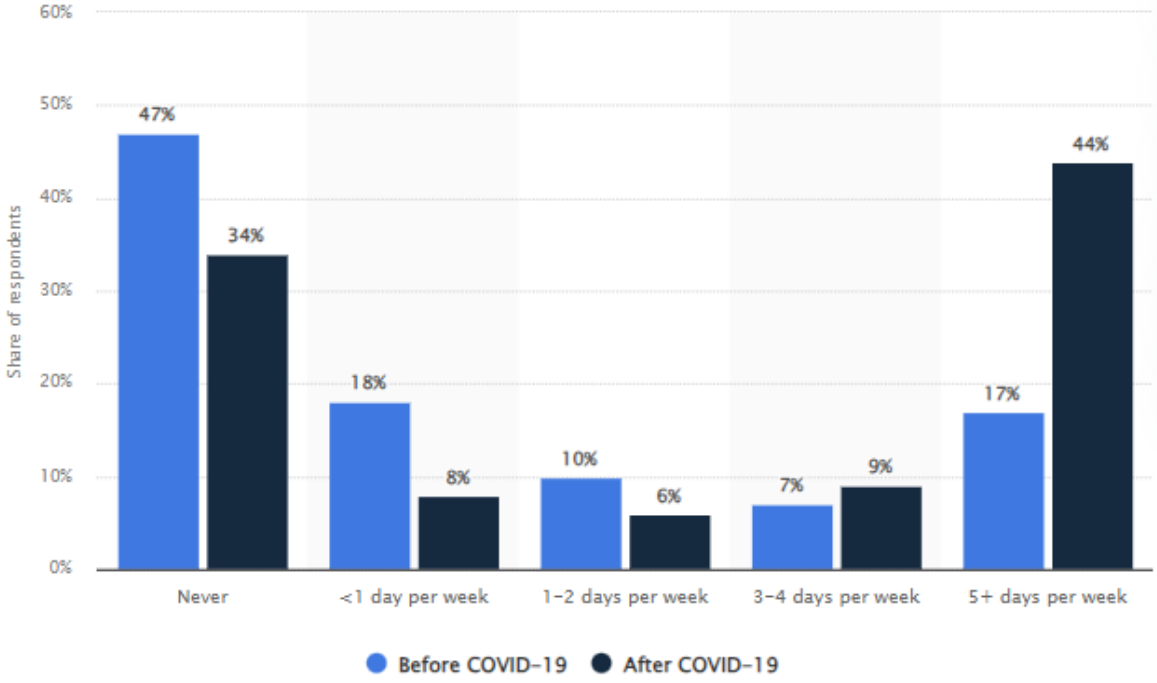

Figure 1-1; Change in remote work trends after COVID-19
(Source: (Statisca, 2023))

The impact of this shift is clearly illustrated in Figure 1-1, which shows the significant change in remote work trends before and after COVID-19 in the United States. As teams have adapted to this new reality, virtual communication, despite its many advantages, often lacks the richness and immediacy of face-to-face interactions, which are crucial for maintaining the deep engagement and spontaneous exchanges that drive innovation (Marlow et al., 2017)

To deepen our understanding on one of the most vital parts of team dynamics, this thesis aims to shift the focus to the communication methods employed within teams. Previous studies have shown that effective communication can significantly enhance team performance and team innovation (Den Otter & Emmitt, 2007; Hülsheger et al., 2009). Effective communication is crucial for team performance because it serves as the foundation for collaboration and knowledge sharing (De Jong & Dirks, 2016). When communication is clear, timely, and appropriately tailored to the team's needs, it can significantly enhance team performance, leading to better innovation outcomes. However, the specific impact of various communication methods, particularly in the context of hybrid and virtual work environments remains underexplored. The shift towards hybrid work environments has introduced new challenges in maintaining effective communication. Traditional face-to-face interactions are now often replaced with virtual meetings, and other digital communication tools. While these tools offer flexibility, they also present potential problems such as reduced social cues, miscommunication, and difficulties in maintaining team cohesion. The lack of physical presence can hinder spontaneous interactions and the rich, nuanced communication that typically occurs in person, leading to challenges in selecting effective communication methods.

To better understand these dynamics, this research uses the concept of Level of Virtuality (LoV), which refers to the degree to which a team's communication is mediated through digital tools rather than face-to-face interactions (De Jong & Dirks, 2016). LoV provides a framework for assessing how different levels of virtual interaction influence communication methods and innovation outcomes. This research seeks to explore the impact of LoV on the innovation process within corporate project teams, particularly focusing on how varying degrees of virtuality affect both the idea generation and implementation stages

of innovation. By addressing this gap, the study aims to provide insights into how organizations can better manage communication in today's increasingly prevalent hybrid and virtual settings to foster innovation.

Despite the growing use of virtual and hybrid environments, the current body of literature has not adequately addressed how different communication methods influence the distinct stages of innovation within these project teams. Specifically, there is a need to understand how communication methods affect both the creative idea generation stage and the implementation stage, where ideas are turned into actionable outcomes. This research seeks to fill this gap by exploring the impact of various communication methods on innovation in corporate project teams, with a particular focus on the challenges posed by hybrid and virtual work environments. By addressing this gap, the study extends existing theories on communication and innovation in two key ways. First, it incorporates the influence of virtual and hybrid work settings into the understanding of communication dynamics within project teams. Second, it provides insights into how communication methods can be adapted based on the stages of innovation.

1.1 Research questions

To cope with the problem statement of the influence of communication methods on teams, the following research question is formulated:

"How do communication methods influence team innovation within corporate project teams?"

Sub-questions:

1. What are the stages of innovation within corporate project teams?
2. What specific communication methods do corporate project teams employ to run their projects?
3. What are the perceived barriers and facilitators to effective communication within corporate project teams?
4. How does the level of virtuality influence the use of communication methods within corporate project teams?
5. How do corporate project teams adapt their communication methods and strategies in response to the stage of innovation?

By answering the sub-questions, the main research question can be answered and the objective of this research can be achieved, which is to understand the influence of communication methods on team innovation.

1.2 Research Approach

Building on these research questions, this study focuses on investigating the influence of communication methods on innovation outcomes within project teams in companies involved in technological innovation and product development. While not limited to a specific country or region, the research will primarily involve companies in the Netherlands, leveraging the researcher's professional network to identify suitable participants.

The study examines a range of companies across various sectors, all of which are involved in technological innovation and product development. This focus is chosen because innovation in these industries is inherently complex and dynamic, requiring diverse expertise and robust cross-functional collaboration. Moreover, the research will emphasize recent developments, particularly how corporate project teams have adapted to the increasing prevalence of hybrid work environments following the COVID-19 pandemic. The findings from this research will be analyzed against the backdrop of existing literature, with the goal of contributing to and expanding current understanding of these phenomena.

To achieve these objectives, a qualitative research approach will be employed. Semi-structured interviews will be conducted with both project leaders and team members within corporate project teams. This method is well-suited for exploring the nuanced impacts of communication methods on different stages of innovation. The primary unit of analysis in this study are project teams, which are distinct from permanent corporate teams or departments. Unlike departments, which are typically stable entities focused on routine operations, project teams are formed with the explicit goal of delivering innovative solutions within a limited timeframe. This makes them particularly ideal for studying the dynamic processes involved in innovation.

1.3 Report Structure

Chapter 2 reviews the relevant literature on communication methods, team innovation, and virtual work environments, establishing the theoretical foundation for this study. It concludes with a conceptual framework that guides the research. Chapter 3 describes the research methodology, explaining the rationale for selecting a qualitative approach and detailing the data collection process through semi-structured interviews with corporate project teams. Chapter 4 presents the study's findings, addressing the sub-questions by exploring how communication methods are adapted across different stages of innovation and varying levels of virtuality. It also identifies key barriers and facilitators influencing communication within the teams. Chapter 5 discusses the findings in relation to the existing literature, highlighting the study’s theoretical contributions, discussing limitations, and proposing recommendations for future research and practical application. Chapter 6 concludes the report, summarizing the main insights and providing final reflections on the study's contributions.

2 Theoretical Background

2.1 Team Innovation

Innovation has been an important field of study for decades, with extensive research conducted on various levels, including individual, team, and organizational (Crossan & Apaydin, 2010). At its core, innovation refers to the process that leads to the creation of new or improved practical and implementable solutions (Cropley, 2015; Thayer et al., 2018). This broad understanding of innovation is crucial because it forms the foundation for more specific contexts, such as team innovation. Team innovation, a subset of the general concept, specifically examines how teams collaboratively generate and implement new ideas, processes, products, or procedures that are novel and beneficial to the organization (West & Sacramento, 2006). Thus, understanding innovation in a broader sense provides a necessary background for exploring how innovation occurs at the team level, where the dynamics of communication become more pronounced.

Recognizing the distinct stages of innovation in general is essential for examining how various factors, such as communication methods, influence team innovation. In innovation as a whole, two key stages are typically identified: the idea generation stage, where new ideas are created, and the idea implementation stage, where these innovative ideas are put into practice (Cropley, 2015; Hughes et al., 2018). Since team innovation is closely derived from these overarching principles, these stages are also central to understanding how teams operate within an organization to innovate. The way communication methods affect each of these stages at the team level provides valuable insight into how innovation unfolds in a collaborative environment.

Idea Generation: This stage focuses on creating novel and useful ideas. An open and creative environment, where team members feel free to share their thoughts and explore new possibilities without immediate judgment or constraints, is crucial. Anderson et al. (2014) emphasize the need for a supportive environment that encourages free thinking and the sharing of diverse perspectives. In the context of communication methods, it is essential to explore how different techniques, such as brainstorming sessions or collaborative digital platforms, facilitate this open environment.

Idea Implementation: This stage involves the execution of these ideas to enhance procedures, practices, or products. It requires structured processes, project management, and addressing any challenges or resistance that may arise. Effective implementation demands clear communication, coordination, and a shared commitment to bringing the ideas to fruition (Thayer et al., 2018).

Recognizing these stages helps in understanding how different factors, including communication methods, impact the team innovation process at various points.

Historically, innovation was viewed as a linear progression from creativity (idea generation) to innovation (idea implementation). Anderson et al. (2014) describe this traditional approach, highlighting the sequential flow where creativity is considered the precursor to innovation. This model suggests a straightforward transition from generating ideas to implementing them. The linear model, as described by Anderson et al. (2014), emphasizes a clear distinction between the stages of idea generation and implementation, implying a structured and predictable process (Thayer et al., 2018).

Understanding this historical perspective helps in framing the evolution of innovation models and setting the stage for more dynamic approaches observed in contemporary practices.

In practice, however, the team innovation process is rarely linear. Real-world innovation often involves iterative cycles with continuous feedback loops and overlapping stages (Berntsson Svensson, 2017). The practical team innovation process involves iterative cycles where feedback from the implementation phase can lead to further idea generation and refinement. For instance, prototypes developed during implementation may uncover new possibilities or requirements, prompting additional creative thinking (Berntsson Svensson, 2017).

Sometimes, idea generation and implementation occur simultaneously. Teams might develop a minimum viable product (MVP) while continuing to brainstorm and ideate on improvements based on user feedback and implementation challenges (Rietzschel & Ritter, 2018). The boundaries between idea generation and implementation often blur in practice. Teams might revisit the idea generation phase multiple times during implementation to address unforeseen challenges or leverage new opportunities. Thayer et al. (2018) note that balancing creativity and structured implementation is crucial for managing the paradoxes inherent in the team innovation process.

Exploring these iterative approaches provides insights into how teams manage the dynamic nature of innovation, highlighting the need for flexible communication methods that can adapt to changing circumstances.

Measuring team innovation is complex and challenging due to its multifaceted nature. Traditional metrics, such as the number of patents or new products, can provide some insights but often fail to capture the full scope of innovation activities within teams (Berntsson Svensson, 2017). Metrics such as the number of new ideas generated, patents filed, and new products developed offer a quantitative assessment of a team's innovative output. However, these measures often overlook the quality and impact of the team innovations (Berntsson Svensson, 2017).

Qualitative assessments, including peer reviews, case studies, and narrative reports, can offer deeper insights into the innovation process. These methods capture the nuances of team dynamics, creativity, and the contextual factors influencing team innovation. Given the difficulties in measuring team innovation accurately, 'gut sense' or intuitive judgment can be a valuable indicator. Experienced team leaders and members often rely on their intuition to assess how various factors contribute to the team innovation process. Berntsson Svensson. (2017) highlight that while it is hard to come up with effective measures for team innovation, relying on 'gut sense' can be an important way to indicate how certain factors, including communication methods, contribute to team innovation.

For this research, the gut sense of team leaders and members will be used as a way to measure innovation within project teams. This approach acknowledges the subjective yet invaluable insights of experienced practitioners, providing a holistic view of how communication methods impact team innovation.

2.2 Communication Methods in Project Teams

After understanding the foundational importance of team dynamics within innovation teams, it becomes imperative to delve deeper into the intricate dynamics that underpin effective collaboration. Central to this discussion are the communication methods employed by teams, which serve as the conduit for sharing ideas, coordinating efforts, and driving collective creativity. Communication methods, encompassing various means or tools for exchanging information, are critical for effective team collaboration (Den Otter & Emmitt, 2007).

A meta-analysis by Hülsheger et al. (2009) revealed that communication significantly contributes to the level of innovation within teams. Previous studies have introduced different ways to categorize communication methods, distinguishing between formal and informal, synchronous and asynchronous, and internal and external communication. This research integrates these categories to provide a comprehensive analysis of communication within corporate project teams.

2.2.1 Formal and Informal Communication Methods

Formal communication methods are structured and follow predefined protocols or schedules. These methods, such as scheduled meetings, reports, and official emails, ensure that information is systematically shared and recorded, providing clear, documented records of decisions and discussions (Pinto & Pinto, 1990). This structure is essential for maintaining accountability and clarity in large and

complex projects. However, the rigid nature of formal communication can be a barrier to innovation, as it may be time-consuming and stifle spontaneous idea generation and problem-solving (Albuali, 2021). The formality can create an environment where team members may feel constrained, reducing their willingness to share creative ideas freely.

In contrast, informal communication methods are less structured and occur spontaneously. These methods, including impromptu discussions, phone calls, and casual conversations, facilitate quick information sharing and problem-solving, encouraging creativity and speed in resolving issues (Chiocchio, 2007). The spontaneity of informal communication can act as a facilitator for innovation by creating a more relaxed environment that fosters open dialogue and the free flow of ideas. However, the lack of documentation and formal follow-up in informal communication can be a barrier, leading to misunderstandings and lack of accountability, potentially affecting project outcomes (Pinto & Pinto, 1990). Without proper records, critical decisions and ideas might be lost or miscommunicated.

The distinction between formal and informal communication methods provides a comprehensive view of the entire spectrum of communication practices within teams, from structured, official interactions to spontaneous, casual exchanges.

2.2.2 Synchronous and Asynchronous Communication Methods

Synchronous communication methods involve real-time interactions where participants engage simultaneously, such as face-to-face meetings, video conferences, and live chats. These methods enable immediate feedback and clarification, reducing misunderstandings and enhancing team bonding (Den Otter & Emmitt, 2007). The immediacy of synchronous communication can be a facilitator for quick decision-making and resolving complex issues efficiently. However, coordinating synchronous communication can be a barrier, especially for global teams across different time zones, as it requires all participants to be available simultaneously (Chiocchio, 2007). This can lead to scheduling conflicts and reduced participation.

Asynchronous communication methods do not require participants to engage at the same time. Examples include emails, recorded video messages, and collaborative documents, allowing team members to contribute at their convenience and accommodating different time zones and schedules (Den Otter & Emmitt, 2007). Asynchronous communication is particularly beneficial for detailed responses and documentation but can slow down decision-making processes and reduce team cohesion over time (Chiocchio, 2007). The flexibility of asynchronous communication acts as a facilitator by allowing team members to reflect and provide thoughtful contributions. However, the delayed feedback inherent in asynchronous methods can be a barrier, causing communication lags and potential disconnects among team members. The distinction between synchronous and asynchronous communication addresses the timing of communication, which is crucial in today's global and often remote working environments.

2.2.3 Internal and External Communication

Internal communication refers to the exchange of information within the project team or organization, including interactions among team members and between different departments. These methods aim to coordinate activities, share information, and resolve issues within the team, ensuring that all members are aligned and informed about the project's progress and challenges (Hansen, 1999). Effective internal communication acts as a facilitator by fostering cohesive teamwork and efficient coordination, directly impacting the innovation process. However, internal communication barriers such as information silos and departmental isolation can lead to misalignment and inefficiencies (Hansen, 1999).

External communication involves interactions between the project team and external stakeholders such as clients, other teams, and external partners. These communications are crucial for gathering feedback, managing expectations, and ensuring that the project aligns with external requirements and standards (Hansen, 1999). External communication can be particularly beneficial in the initial stages of innovation,

bringing in new perspectives and knowledge from outside the team, fostering idea generation and creativity (Hansen, 1999). The influx of external insights can act as a facilitator by broadening the team's perspective and enriching the innovation process. However, external communication barriers may include differences in expectations, feedback delays, and challenges in integrating external perspectives (Rahy & Bass, 2019).

This categorization of internal and external communication encompasses all interactions within the team and with outside stakeholders, covering the full range of communication necessary for project success.

2.2.4 Overview of CM's

Table 2-1: Overview of communication methods

Category	*Communication Method*	*Reference*
Formal	• (Scheduled) Meetings • Reports • Emails	(Pinto & Pinto, 1990)
Informal	• Impromptu discussions • Phone calls • Casual conversations	(Klünder et al., 2016)
Synchronous	• Face-to-face (F2F) meetings • Video Calls • Brainstorm sessions • F2F Conversations	(Den Otter & Emmitt, 2007)
Asynchronous	• Email • Collaborative documents • Text message • Memos • Reports	(Den Otter & Emmitt, 2007)
Internal	• Interactions within the project team between team members and/or team leader	(Hansen, 1999)

External	• Interactions between the project team and external stakeholders such as.
	  ○ Customers
	  ○ External partners
	  ○ Other departments
		(Hansen, 1999)

2.2.5 CM's and team innovation

Effective communication strategies must be tailored to the specific needs and context of the team to enhance collaboration and innovation. The two stages of innovation, idea generation and idea implementation, require different communication approaches to optimize outcomes.

During the idea generation stage, informal communication methods are particularly valuable. These methods, which include impromptu discussions, brainstorming sessions, and casual conversations, create an open environment that encourages the free flow of ideas. Informal communication facilitates creativity, allowing team members to share novel and diverse perspectives without the constraints of

formal protocols (Chiocchio, 2007). This spontaneous nature can help spark innovative ideas that might not emerge in more structured settings.

Synchronous communication methods are also highly effective during idea generation. Real-time discussions, whether face-to-face or via video conferencing, enable teams to build on each other's ideas rapidly, fostering a collaborative atmosphere essential for creative thinking (Den Otter & Emmitt, 2007). The immediate feedback and dynamic interaction inherent in synchronous communication helps refine and expand ideas quickly, making it an ideal method for brainstorming and initial conceptual development.

Internal communication during idea generation ensures cohesive teamwork and efficient coordination. It helps maintain a shared vision and keeps all team members informed about progress and challenges, which is crucial for generating innovative ideas (Hansen, 1999). By facilitating a common understanding and encouraging the sharing of diverse viewpoints, internal communication enhances the team's creative output.

External communication introduces new perspectives and feedback, crucial for refining and validating innovative ideas. Engaging with clients, other teams, and external partners during the idea generation stage brings in fresh insights that can enhance creativity (Hansen, 1999). These external inputs can provide valuable context, helping to shape ideas in ways that are more likely to meet broader market needs or organizational goals.

In the implementation stage, formal communication methods become more important. Structured communication through meetings, reports, and official emails ensures that all team members are aligned and that there is a clear record of decisions and actions. This formal structure facilitates accountability and clarity, which are crucial for the successful execution of innovative ideas (Pinto & Pinto, 1990). By providing a clear roadmap and maintaining detailed records, formal communication helps teams stay on track and manage the complexities of implementing new ideas.

Asynchronous communication methods are also vital during this stage, providing flexibility that accommodates different schedules and time zones. Tools such as collaborative documents and emails allow team members to contribute thoughtfully and thoroughly, enhancing the documentation and iterative refinement of ideas (Den Otter & Emmitt, 2007). The flexibility of asynchronous communication ensures that all team members can participate fully, regardless of their location or time constraints, which is essential for maintaining momentum and ensuring thorough consideration of all aspects of the implementation process.

Internal communication during implementation ensures cohesive teamwork and efficient coordination, directly impacting the innovation process. Effective internal communication helps maintain a shared vision and keeps all team members aligned on progress and challenges (Hansen, 1999). By fostering a sense of unity and shared purpose, internal communication supports the team's efforts to bring innovative ideas to fruition.

External communication is crucial for gathering feedback, managing expectations, and ensuring that the project aligns with external requirements and standards. Engaging with clients, other teams, and external partners during implementation helps validate and refine innovative ideas (Hansen, 1999). These external interactions ensure that the implementation process remains aligned with broader organizational goals and market demands, increasing the likelihood of successful innovation outcomes.

The analysis of communication methods within corporate project teams reveals the importance of employing a mix of formal and informal, synchronous and asynchronous, as well as internal and external communication methods. Each category has its own set of advantages and potential drawbacks, which can significantly influence project outcomes. Effective communication strategies must be tailored to the specific needs and context of the team to enhance collaboration and innovation.

2.3 Level of Virtuality (LoV)

The concept of 'Level of Virtuality' (LoV) has evolved significantly with advancements in communication technology and the rise of remote work. Initially, virtuality was considered a binary characteristic, categorizing teams as either fully virtual or fully face-to-face, a perspective prevalent in early studies (Guzzo & Dickson, 1996). Early research primarily focused on the geographical dispersion of team members and the challenges of distance communication, such as time zone differences, cultural disparities, and difficulties in establishing trust (Maznevski & Chudoba, 2000). As technology progressed, researchers began to examine not just physical separation but also the extent and nature of virtual interactions within teams. This shift recognized that many teams operate in hybrid environments, using a mix of face-to-face and virtual communication tools depending on the context and needs of their tasks (Raghuram et al., 2019). The COVID-19 pandemic accelerated this shift, with many teams transitioning to hybrid or fully virtual modes, prompting extensive research into virtual collaboration's effectiveness and dynamics (Klonek et al., 2022).

For this research, 'Level of Virtuality' focuses on the proportion of teamwork conducted in virtual spaces rather than physical distance. According to De Jong & Dirks. (2016), LoV is defined as the extent to which team members use digital communication tools to coordinate their actions and execute tasks, emphasizing the frequency and ratio of virtual interactions relative to overall team communication. Another perspective by Schweitzer & Duxbury (2010) highlights the degree to which team members rely on virtual communication over face-to-face interactions, impacting team processes and outcomes. Thus, LoV can be defined as the extent to which team activities and interactions occur in a virtual space, encompassing both synchronous and asynchronous methods. This definition focuses on the operational aspect of virtuality, considering how frequently and extensively digital tools are used in team communication and collaboration (Gilson et al., 2015).

2.3.1 Applications of LoV

Understanding the definition of LoV helps in categorizing teams based on their communication practices and the extent to which they rely on virtual tools. This categorization will aid in exploring how varying levels of virtuality impact the effectiveness of different communication methods. By focusing on hybrid teams that blend face-to-face and virtual communication, this study explores the impact of virtuality on team dynamics and innovation outcomes, especially in the context of the COVID-19 pandemic.

In order to better understand LoV and the impact different levels can have on communication methods, a classification has been developed based on insights drawn from the literature.

Low Virtuality: Teams primarily interact face-to-face with minimal use of digital communication tools. Virtual interactions constitute a small fraction of their overall communication.

Medium Virtuality: Teams utilize a mix of face-to-face and virtual interactions, balancing synchronous and asynchronous communication. This hybrid approach is common in many modern workplaces, especially post-COVID-19 (Klonek et al., 2022).

High Virtuality: Teams rely almost entirely on digital communication tools, with face-to-face interactions being rare or non-existent. These teams use a variety of virtual platforms to collaborate and communicate effectively.

2.3.2 Influence of LoV on CM's and Team Innovation

Previous literature provides substantial insights into how different levels of virtuality can influence communication methods within project teams, and by extension, their ability to innovate:

Low Virtuality: Teams with low virtuality primarily rely on face-to-face interactions. These teams benefit from rich non-verbal cues and immediate feedback, These elements are particularly beneficial during the idea generation phase of innovation, as they foster a creative and collaborative environment where

spontaneous discussions can lead to the development of novel ideas. However, they may face challenges in maintaining effective communication if they suddenly need to shift to virtual tools without proper training and infrastructure (Foster et al., 2015). Digital tools are becoming more critical for the structured coordination required for the implementation phase of innovation. Without the effective integration of these tools, low virtuality teams may struggle with transparency and documentation, potentially leading to inefficiencies that hinder the execution of innovative ideas (De Jong & Dirks, 2016).

Medium Virtuality: Teams with medium virtuality use a balanced mix of face-to-face and virtual communication. This balance allows them to leverage the strengths of both communication modes. Such teams can maintain high levels of communication quality and cohesion by using face-to-face interactions for complex discussions and virtual tools for routine updates and asynchronous communication (Marlow et al., 2017). This flexibility is advantageous for both the idea generation and implementation phases of innovation, as it supports dynamic communication and adaptability (Marlow et al., 2017). However, the mixed use of communication methods can also result in communication overload and inconsistency, which can detract from the team's overall effectiveness. If not managed carefully, these issues can lead to misunderstandings and delays, ultimately impacting the team's ability to innovate efficiently (Foster et al., 2015).

High Virtuality: Teams with high virtuality depend heavily on digital communication tools, which offer significant advantages in terms of flexibility and efficiency, especially for geographically dispersed teams. The staggered nature of many virtual tools allows team members to contribute to the innovation process on their own schedules, promoting a more inclusive and thoughtful approach to idea generation (Raghuram et al., 2019). Nevertheless, high virtuality settings often face challenges related to reduced communication quality and social presence. The absence of non-verbal cues can lead to misunderstandings, while the lack of physical interactions can weaken team cohesion and trust—elements that are vital for sustained innovation (De Jong & Dirks, 2016; Handke et al., 2021). Additionally, the potential for communication overload in high virtuality teams can become a significant barrier, overwhelming team members and detracting from their ability to focus on creative tasks (Marlow et al., 2017).

2.4 Theoretical framework

In order to justify a theoretical link between the key concepts of this study, which are communication methods, team innovation, and the Level of Virtuality (LoV), contingency theory provides a useful lens. This theory helps explain how the effectiveness of communication strategies depends on the specific contexts in which project teams operate, particularly regarding team innovation and virtuality. Contingency theory, developed in the mid-20th century, asserts that there is no universal or "best" way to manage organizations or projects. The effectiveness of management practices depends on specific environmental and internal conditions (Hanisch, 2012). Early scholars like Burns & Stalker (1994) showed that organizations in rapidly changing environments benefit from flexible, organic structures, while stable environments favor more rigid, mechanistic structures. As the theory evolved, it has been increasingly applied to project management.

Howell et al. (2010) argue that contingency theory in project management emphasizes the need for tailored approaches to manage different types of projects. Factors like uncertainty, complexity, and team dynamics dictate which methods are most effective. Projects with higher uncertainty often benefit from flexible, emergent management styles, while projects with lower uncertainty can be managed with more rigid, plan-driven approaches. This demonstrates how project management strategies must align with the unique characteristics of each project. Chapman & Andersson (2017) apply this theory to radical innovation projects, which involve the highest levels of uncertainty and complexity. These projects require adaptive communication and management strategies that support ongoing learning and flexibility. Contingency theory thus provides a guide for managing projects as they evolve, ensuring communication strategies adjust to the project's demands.

In the context of this research, contingency theory serves as a lens for understanding how communication methods in corporate project teams can be adapted to optimize innovation. Specifically, it helps explore key factors such as Level of Virtuality (LoV) and the stages of innovation by emphasizing the importance of adapting communication strategies based on these contingencies.

The Level of Virtuality is one of the most significant factors in this study, as it influences how teams communicate when they are not co-located. Virtual teams, characterized by geographical dispersion, require different communication strategies compared to face-to-face teams. For example, in high virtuality settings, the absence of face-to-face interactions may amplify the importance of clear, structured communication protocols to compensate for the lack of non-verbal cues. In such environments, well-defined communication strategies become crucial for ensuring that innovative ideas are effectively communicated, refined, and implemented (Klonek et al., 2022). Conversely, in low virtuality settings, the benefits of spontaneous, face-to-face interactions are naturally enhanced, fostering a creative atmosphere conducive to the generation of new ideas. However, these settings may require additional efforts to incorporate digital tools that support the structured aspects of innovation, such as documentation and coordination during the implementation phase.

Contingency theory helps frame the need for more adaptive, flexible communication approaches in high-virtuality teams, as noted by Foster et al. (2015). Their findings support the idea that higher virtuality in teams demands real-time, flexible communication to ensure alignment and collaboration. Additionally, the stages of innovation present another critical contingency in your research. The communication needs of a team are likely to change as a project moves from the idea generation stage where open, creative communication is essential to the implementation stage, which may require more structured, task-oriented communication. Chapman & Andersson (2017) emphasize that radical innovation projects, which often involve high levels of uncertainty and ambiguity, require adaptive communication practices throughout the different stages of innovation. Contingency theory, therefore, helps in understanding how communication methods should evolve as the project progresses, ensuring that teams are equipped to manage both idea generation and implementation phases.

Contingency theory provides a robust perspective for analyzing how communication methods in corporate project teams can be tailored based on factors such as Level of Virtuality, and the stages of innovation. By applying this theory, this research gains a flexible, adaptive perspective that allows for a deeper understanding of how communication methods influence team innovation within corporate project teams. The theory's emphasis on fitting strategies to specific project contexts supports the broader findings of your research, ensuring that the communication approaches employed are aligned with the unique demands of the project.

A theoretical framework was developed based on the literature review, serving as a foundation to be further explored in this study. This framework illustrates how contingencies, such as Level of Virtuality (LoV) and the stages of innovation, influence different categories of communication methods. Additionally, this theoretical framework, along with the broader theoretical background, informed the

construction of the interview guide and guided the coding process during the analysis of the interview data.

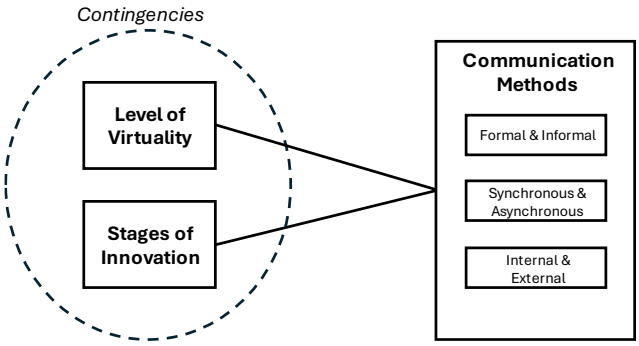

Figure 2-1: Theoretical framework

3 Research Methodology

3.1 Research Design

This research employs a qualitative, exploratory approach, focusing on the complex relationship between communication methods and innovation within corporate project teams. The qualitative nature of this study is particularly suited for understanding the rich, nuanced dynamics of communication and team interaction, which are not easily captured through quantitative measures (Gummesson, 2006). By relying on semi-structured interviews as the primary method of data collection, this approach ensures an in-depth exploration of how communication methods influence innovation.

The study adopts an exploratory research design to uncover insights about communication methods and their evolving role during different stages of innovation. Given the relatively uncharted nature of this research area, the flexibility offered by semi-structured interviews allows the researcher to follow up on emerging themes and adapt questions in real-time, ensuring that unexpected insights are captured (Adeoye-Olatunde & Olenik, 2021). The interviews aim to explore the perceived barriers and facilitators of communication methods, particularly in the context of hybrid work environments. Additionally, the research seeks to understand how the level of virtuality affects communication effectiveness and, in turn, innovation within project teams.

This research employs a deductive approach, starting with a theoretical background to develop a framework and guide the interview process. The framework, rooted in existing literature and theory, particularly around communication and innovation, served as the foundation for the study. The theoretical background was crucial not only in providing foundational concepts but also in shaping the interview guide. The interview guide was carefully designed to ensure alignment with the research questions, with each interview question directly linked to specific aspects of the framework. It includes detailed notes on how each question connects to the broader study aims, along with potential follow-up questions and references to relevant literature. This guide can be found in Appendix A. Once the interviews were conducted, the data collected was used to refine the initial theoretical framework, allowing for adjustments based on new insights derived from the findings. This approach ensured that while the study maintained a clear focus on its theoretical foundation, it was also flexible enough to incorporate new themes that emerged during discussions. By structuring the interviews in this manner, the research remained guided by its objectives while being open to the exploration of unexpected insights.

Moreover, drawing on the work of Berntsson Svensson (2017), this research acknowledges the value of 'gut sense' or intuitive judgment, particularly from experienced team leaders and members. These individuals often rely on their intuition to assess how various factors, including communication methods, contribute to innovation. By incorporating these subjective insights, the research provides a more holistic view of how communication methods impact innovation within project teams, capturing not only measurable outcomes but also the nuanced perceptions of those deeply involved in the process.

Figure 3-1 provides a research flow diagram to illustrate the structure of the research approach. This diagram visually represents how the various components of the research were conducted and interconnected to address the research questions.

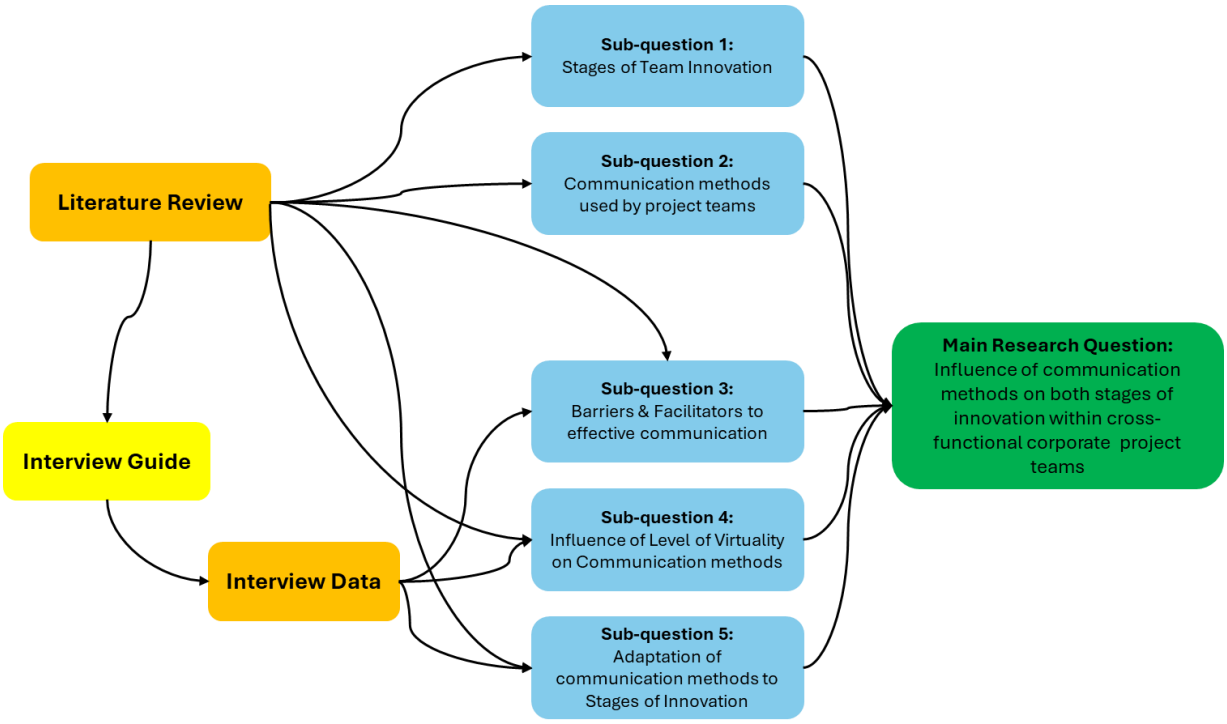

Figure 3-1: Research Flow Diagram

3.2 Data Collection

3.2.1 Sampling Strategy

As already mentioned in chapter 1, the unit of analysis for this study is project teams within companies engaged in technological innovation and product development. These industries, ranging from industrial automation software to machine building, are characterized by the complexity and dynamism inherent in their innovation processes. The diverse expertise required in these industries makes them ideal for studying corporate project team dynamics and the communication methods that drive innovation. For this research, interviews with both project managers and project members were conducted.

The selection of participants followed a purposive sampling approach, leveraging the researcher's professional network to identify project teams that aligned with the study's specific unit of analysis. This network, built through internships during a bachelor's study in mechanical engineering, facilitated access to project teams within companies engaged in technological innovation and product development. These industries, ranging from industrial automation software to machine building, are characterized by the complexity and dynamism inherent in their innovation processes. The purposive sampling ensured that the selected project teams shared essential characteristics, allowing for a deep exploration of communication methods within this specific context.

To expedite the recruiting process due to the limited time available for the master thesis, potential contacts from this professional network were contacted directly by phone. This approach allowed for swift scheduling of interviews, reducing delays in data collection and ensuring the process remained on track. Once initial participants were secured, the study employed a snowball sampling strategy to expand the pool of interviewees. Participants were asked to recommend colleagues or other professionals who matched the criteria of working in corporate project teams involved in technological innovation. This method maintained the focus on relevant expertise while facilitating the recruitment of additional participants (Browne, 2005).

Two key criteria were used to determine the suitability of participants. First, the project teams needed to have been operating long enough for communication methods (CMs) to have properly formed. Second, the teams required a high level of experience, as the study relies on the "gut sense" of experienced professionals to evaluate the effectiveness of CMs in promoting team innovation. Including less experienced teams could have compromised the reliability of these insights.

The study deliberately maintained low diversity in the sample, as the primary goal was to gain an in-depth understanding of communication methods within this clearly defined unit of analysis. Since the research focused on corporate project teams engaged in innovation in specific technological fields, the emphasis was on exploring the particularities of communication within this context, rather than striving for broad generalization. This specificity enhanced the richness of the qualitative insights gathered. Because of this focused unit of analysis, data saturation was reached relatively quickly. The narrow scope of the study, centered on experienced teams in highly technical fields, allowed for the identification of key themes and patterns without the need for a large sample size. As new interviews ceased to produce novel insights, the data collection process was deemed sufficient to address the research questions.

The final sample consisted of eight interviews across three different project teams, each from a distinct company. These interviews included both project managers and team members, providing a comprehensive view of the communication practices and challenges faced by corporate project teams.

The table below provides an overview of the different project teams, and the interviewed members involved in the study:

Table 3-1: Overview of project teams

Project Name	Industry	Company size	Team size	Project type	Project stage	Level of Virtuality
A	Automation & Robotics	100 thousand +	6	Software Automation Development	Mid-Development	High
	Interviewee ID	**Role**				
	A1	Project Manager				
	A2	Software Lead				
	A3	Software Engineer				
B	Food Processing Equipment	100-300	6	New Machine Development	Mid-Development	Medium
	Interviewee ID	**Role**				
	B1	Project Manager				
	B2	Senior Process Engineer				
	B3	Mechanical Engineer				
C	Industrial Equipment	100-300	5	Product Development	Early Stage	Low
	Interviewee ID	**Role**				
	C1	Project Manager				
	C2	Lead Engineer				

3.2.2 Detailed description of project teams

Project team A

The project team that was interviewed first operates within a large multinational company in the industrial automation and robotics industry. This team is engaged in a software automation development project, focusing on creating an innovative tool designed to upgrade end-of-life products to the latest version. The project is currently in its mid-development stage, where the technical details are being refined, and the software is being further developed.

The project team is composed of six members, each with clearly defined roles. The team is led by a project manager who oversees the overall progress, while a software lead takes charge of the technical decisions. The software engineers are responsible for executing the technical tasks essential to the

project's success. The team members bring a wealth of experience, having worked on similar projects within the company for several years, which adds depth to their collective expertise.

The company itself operates with a hierarchical structure and is part of a multinational organization with over 100,000 employees. The interviewed project team is a part of the Dutch division of the company, which adds a local context to their operations and communication dynamics.

The level of virtuality within this team is high, with most members working remotely. However, the team maintains regular in-person interaction through weekly face-to-face meetings. The team primarily uses Microsoft Teams, email, DevOps, and SharePoint for their communication and collaboration, reflecting the remote nature of their work while allowing them to stay connected and organized.

Project team B

The second interviewed project team works within a company that operates in the food processing equipment industry, specifically focusing on machinery and systems designed for the production of confectionery products. The company has a hierarchical structure, which is common in mid-sized industrial firms.

Key roles include the Project Manager, who oversees the project and coordinates team efforts, and the Project Engineer, responsible for technical documentation and engineering guidance. A Senior Process Engineer ensures alignment with client specifications, while R&D Engineers contribute to concept development and feasibility assessments. The Controls Engineer manages the control systems of the machinery, and the Technical Director provides oversight and practical insights, drawing from extensive production experience.

This team is characterized by a high level of experience. Many members have been with the company for years and bring substantial expertise to the project, having worked on similar projects in the past.

The project they are currently engaged in is related to the development of a new machine for the confectionery industry. It is in the mid-development stage, indicating that the initial idea generation and design phases have been completed, and the team is now focused on refining the product and moving towards implementation.

In terms of virtuality, this team operates in a hybrid environment. While most of the work is conducted on-site due to the hands-on nature of the project, remote work is also an option, especially for tasks that do not require physical presence. Communication within the team relies heavily on digital tools such as Microsoft Teams, email, and specialized platforms like DevOps and SharePoint, which are used for project management and collaboration.

Project team C

The project focuses on developing an innovative product within the industrial equipment sector. While the company has prior experience with similar projects, this initiative introduces new challenges due to a recent organizational restructuring. The project is in its early stages, but established communication methods and routines have already emerged.

The company, an industrial manufacturer, operates with a hierarchical structure typical of a Small to Medium-sized Enterprise (SME) and employs between 100 and 300 people. It is divided into two Business Units (BUs): one focused on industrial equipment and the other on rescue equipment. Each BU independently develops its version of the product to meet specific market needs.

The project team from the Industrial BU includes key roles such as the Project Manager, Project Architect, Mechanical Engineer, Electrical/Software Engineer, Sales Engineer, and Marketing Manager. The core team comprises five members, but the overall project involves more than 20 members when including the other BU's team. A delegation from the R&D department, supporting both teams, also plays a role. Combined progress meetings are held every two weeks to coordinate efforts between the BUs.

Team members, like in the other project teams, bring substantial experience, having worked on similar initiatives in the past. However, the division into separate BUs adds complexity, requiring careful coordination and communication. The team works primarily on-site, using Microsoft Teams and email as their main communication tools.

3.2.3 Commonalities & Differences

Across the three project teams, two significant commonalities emerge. First, all teams consist of experienced members, with many individuals having worked in their respective companies for several years. This experience is evident in the way team members navigate their tasks, having been involved in similar projects in the past. Second, the teams maintain a relatively small core size, with 5 to 6 members actively working on the project. In some cases, additional personnel from R&D or other departments may provide support, but the core team remains focused, working closely within their specialized roles.

On the other side, a significant difference between the project teams is the 'Level of Virtuality'. While both teams B and C operate primarily with an on-site presence, project team A is largely remote, conducting most of their work online. This distinction in how the teams are structured has implications for how communication is handled, with the remote team relying heavily on digital tools, whereas the on-site teams engage more frequently in face-to-face interactions.

3.2.4 Data collection method

As already mentioned in this chapter, the primary method of data collection for this study was semi-structured interviews. The interview guide was primarily based on the literature review. However, adjustments were made based on the experiences gathered from earlier interviews. Participants were provided with a short document prior to the interviews (see appendix B), clarifying key concepts such as "team innovation," to align their understanding with the research objectives. Although this document may have introduced some bias, it was considered necessary to ensure that participants approached the topic with a common understanding, reducing the potential for misinterpretation of the term "innovation." Additionally, participants were informed that their responses should be based on their current project, and the interviews began with questions designed to establish context around their role and the nature of the project.

While the interviews followed a structured guide, the flow often varied depending on the interviewees' responses. To maintain a natural conversational tone and foster a rapport with participants, the order of the questions was occasionally adapted. This flexibility was crucial for ensuring that the interviews were not rigid and allowed for a more genuine exchange of ideas, which enriched the data collection process. Both face-to-face and online interviews were conducted. Ideally, face-to-face interviews were preferred, as they tend to create rapport more easily. However, due to the availability and preferences of the interviewees, six out of eight interviews were conducted online through Microsoft Teams. In one case, geographical distance made a face-to-face interview impractical. Despite the differences in setting, both formats proved effective in eliciting detailed responses.

To create a comfortable atmosphere for the interviewees, the first questions focused on understanding their projects and their roles within the team. This approach helped ease participants into the interview, allowing them to provide more thoughtful responses as the discussion progressed. Building rapport in this way contributed to more open and productive conversations, helping interviewees feel at ease while discussing their communication practices. The interviews took place during the holiday season, which presented a challenge in scheduling. To address this, the researcher took proactive steps early in the research process to confirm interview dates, ensuring that data collection proceeded smoothly despite scheduling constraints. Additionally, there were concerns about sharing sensitive company information, which could have hindered the depth of responses. To mitigate this, participants were assured that all data would be anonymized in compliance with the university's ethical guidelines.

Each interview was recorded, with the recordings subsequently anonymized by muting any personally identifiable or company-sensitive information. The transcripts were then generated using the AI tool REV, followed by translation from Dutch to English using DeepL. Both tools were thoroughly vetted to ensure compliance with privacy standards, explicitly confirming that no data would be collected during the transcription and translation processes. All data was securely stored on the TU Delft OneDrive environment, ensuring it remained protected and accessible only to authorized personnel. This thorough approach to data collection allowed for a rich and detailed dataset, setting the stage for an in-depth analysis of how communication methods influence team innovation.

3.2.5 Reliability and Validity

"To ensure the reliability and validity of the data collected, several measures were implemented throughout the research process. To maintain reliability, a structured interview guide was followed consistently across all interviews. This ensured that core questions related to communication methods, barriers, and the level of virtuality were systematically addressed with each participant, whether the interview was conducted in person or online. The guide, which was linked directly to the theoretical framework, provided a standardized approach to data collection while allowing for flexibility to explore emerging themes during the interviews. Additionally, the coding process was rooted in the theoretical background, ensuring that codes and themes remained aligned with the research objectives during the first phase of coding. This approach supported the reliability of the coding process, as it allowed for consistent identification of relevant themes across the data.

However, while the interview process and coding were structured, the sampling method posed a challenge to reliability. The sampling strategy was largely based on the researcher's professional network, which could limit the repeatability of the study. Nonetheless, by employing purposive sampling and using snowball sampling to expand the participant pool, the study ensured that the selected project teams were highly relevant to the research objectives, providing rich insights into the communication methods used within technological innovation projects.

In terms of validity, the interview questions were directly linked to the theoretical framework and the research sub-questions, ensuring that the data collected was focused on addressing the key aspects of communication methods and their contingencies. Triangulation was employed by comparing responses across different project teams, which helped identify consistent patterns and themes related to communication methods in varying levels of virtuality. This comparison between teams provided an additional layer of validity by verifying the findings across multiple cases. Although no formal member checking was performed, the detailed coding process and cross-case analysis helped ensure that the results accurately reflected the data provided by participants.

3.3 Data Analysis

The data analysis for this study followed a deductive approach, where existing theoretical concepts shaped the framework for the analysis. Specifically, the theoretical background discussed in Chapter 2 was used to guide the initial stages of coding and analysis. The coding process was conducted in two phases: first, an initial round of coding was performed, guided by the theoretical framework, to capture relevant themes, followed by a second phase where codes were refined and grouped into broader categories. After the coding was completed, the data was analyzed in two stages: first through a theme-based analysis to examine key patterns across all teams, and then through a cross-case comparison to explore similarities and differences between the project teams. This deductive approach allowed the research to remain grounded in existing literature while exploring how empirical data supported or expanded upon those established concepts.

To facilitate the coding and data analysis process, Atlas.ti was used as the software tool. This software allowed for the systematic organization and management of the large volume of interview data. Atlas.ti was instrumental in assigning codes to segments of the interview transcripts, organizing those codes into groups and categories, and generating visual representations of the relationships between different groups and categories. The tool's features enabled efficient coding, easy retrieval of data segments linked to specific codes, and the ability to refine and reorganize codes during the second phase of analysis. Screenshots from Atlas.ti, illustrating the coding process and thematic organization, can be found in Appendix D.

During the first round of coding, the theoretical background served as a reference point for identifying relevant themes in the data. Interview transcripts were reviewed both line-by-line and transcript-by-transcript, which resulted in the creation of an initial set of 300 codes. These first-order concepts were short labels or keywords that described specific data segments (phrases, sentences, or paragraphs), also known as quotes. While the theoretical background guided this process, flexibility was maintained; when quotations did not directly fit into the existing theoretical framework, new codes were created to capture these emerging ideas.

The figure below shows the distribution of codes across the interviews during this first phase of coding. While there are variations in the number of codes across interviews, this reflects the differing richness of content from various participants. Some interviews contributed more heavily to the coding process, which may be attributed to factors such as the length of the interview or the depth of responses. However, these variations were not the primary focus of the analysis, as the aim was to ensure comprehensive coding coverage across all data sources.

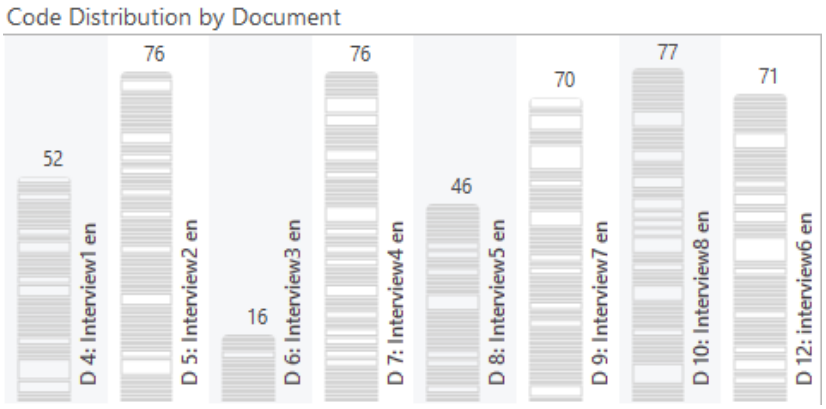

Figure 3-2;Code distribution per Interview transcript

In the second phase of coding, the initial set of 300 codes was refined and organized into broader code groups, guided by the theoretical background. During this process, similar codes were merged, and redundant or irrelevant codes were deleted, resulting in a final set of 271 codes. Each code was carefully reviewed to determine its relevance and alignment with the theoretical background, ensuring that the coding remained rooted in theory. Once the codes were grouped, the next step was to create code categories within each group. While these categories were primarily based on the theoretical background, room was left for the creation of new categories where the data revealed interesting or unexpected insights. These second-order concepts represented broader themes and categories that helped identify patterns, relationships, and commonalities across the data.

After organizing the data into broader themes and categories, the analysis proceeded in two stages. First, a theme-based analysis was conducted, where the data was examined within each key theme to identify relevant patterns, relationships, and insights across all project teams. This stage of the analysis allowed the research to answer the primary research sub-questions by exploring how different categories of communication methods (CMs) were used and adapted across varying levels of virtuality and stages of innovation.

Next, a cross-case analysis was conducted to compare how these key themes, specifically the categories of CMs, were manifested across the different project teams. By comparing the findings across teams, the analysis was able to highlight similarities and differences in how the effectiveness of CMs was influenced by factors such as the level of virtuality and the stage of innovation. This comparison allowed for a deeper understanding of how these contingencies shaped the use and adaptation of communication methods. The cross-case comparison is discussed in the findings chapter.

The codebook, included in Appendix C, provides a detailed overview of all the code groups and the respective code categories within each group. It also includes descriptions of each code category and example quotations from the interview transcripts that fit within those categories. This codebook was a crucial tool in ensuring consistency and clarity throughout the coding process. The findings are reported in a narrative format, supported by visual aids where appropriate, to better communicate complex relationships and trends identified in the analysis. This narrative approach helps clarify the implications of the data and provides a coherent story about how communication methods impact innovation within the teams studied.

3.4 Ethical Considerations

In line with the Human Research Ethics Committee (HREC) guidelines of TU Delft, this study adhered to strict ethical standards in the handling and management of data. A comprehensive Data Management Plan (DMP) was developed before data collection began, outlining the procedures for storing and managing all collected data securely. The DMP ensured that all data would be stored in a secure Microsoft OneDrive environment, accessible only to the researcher, thus maintaining the confidentiality and integrity of the data.

Participants were fully informed about the study's purpose and the nature of their involvement, and written consent was obtained prior to their participation. The informed consent form detailed how their data would be used, stored, and eventually destroyed after the completion of the research. This transparency helped to prevent any potential conflicts or ethical issues from arising during or after the study. Only anonymized or aggregated data will be shared in any publications or reports resulting from this research. Personal research data, including interview recordings and transcripts, will be destroyed after the end of the research project, ensuring that no sensitive information is retained beyond the necessary duration. The researcher also consulted with a data steward at TU Delft to ensure that the DMP and informed consent procedures met all institutional requirements and that no critical aspects of data management were overlooked. The informed consent template is included in appendix D for reference.

4 Findings

This chapter presents the findings of the study, derived from a structured analysis of the interview data. As detailed in Chapter 3, Atlas.ti was used to systematically process and analyze the data, ensuring that the analysis was aligned with the theoretical framework and research sub-questions outlined in Chapter 2. By grounding the analysis in the theoretical background, the study ensured that the identified themes and patterns were directly relevant to the research questions.

The analysis followed a two-stage approach. First, a theme-based analysis was conducted to explore how different categories of communication methods (CMs) were utilized across the various project teams. These themes, which were guided by the theoretical framework and research sub-questions, were organized into distinct code groups (see Figure 4-1). To gain deeper insights into each category, quotations corresponding to each theme within these code groups were analyzed. During the interviews and the first round of coding, the researcher recorded noteworthy observations and compiled relevant quotations in memos within Atlas.ti. This preliminary identification of key insights provided a starting point for a more focused analysis of each theme. By systematically analyzing these quotations, a clear narrative emerged for each theme. A visual representation of this process in Atlas.ti can be found in appendix E.

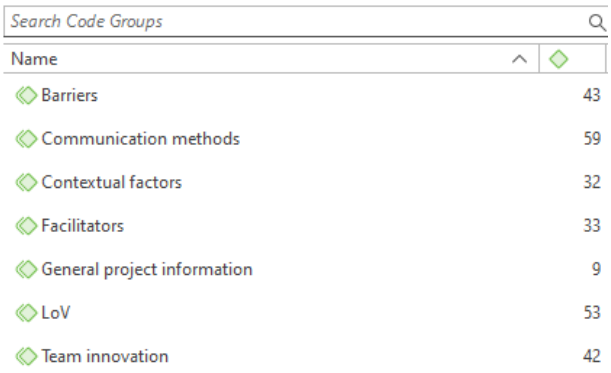

Figure 4-1; Final code groups created in Atlas.ti

After the thematic analysis, a cross-case analysis was conducted to compare how these themes (primarily represented by the code groups) manifested across the different project teams. This was done by creating a document group for each project team, where each document corresponded to the coded interview transcripts of a particular team. Using Atlas.ti's Code-Document Group Analysis function, which compares the codes across different document groups, similarities and differences in how each project team perceived the themes were identified.

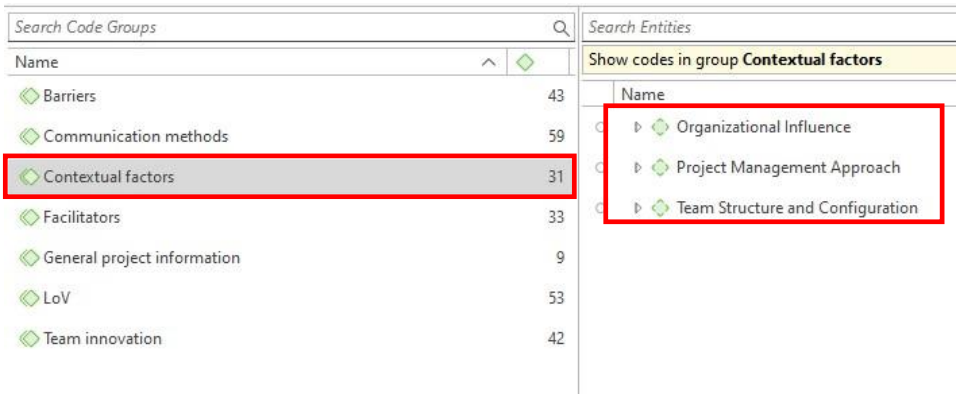

Figure 4-2; Dedicated code group for cross-case analysis

To enhance the depth of the cross-case analysis, an additional code group—Contextual Factors—was created (see Figure 4-2). This code group captured specific contextual elements raised by participants during the interviews, providing a nuanced understanding of the factors influencing communication methods in each project team. The thematic analysis also served as a foundation for the cross-case analysis, with the direct attribution of quotations to specific participants helping to identify differences and commonalities between the project teams.

4.1 Team Innovation

Innovation within corporate project teams is shaped by the methodologies they adopt, with teams describing different approaches to navigating the stages of innovation. From the interviews, two primary perspectives emerged: a flexible, agile process and a more traditional, linear process.

In agile teams, innovation is viewed as an iterative process where the stages of idea generation and implementation frequently alternate. This approach was emphasized by half of the participants (four out of eight), who noted that agile methodologies, such as Scrum, encourage teams to break projects into smaller parts. Participant A3 explained: *"You divide the project into very small parts. At each stage, you identify a problem, come up with a solution, and then work it out."* This reflects how agile teams continuously shift between developing ideas and executing them, allowing for quicker adaptation to project needs.

The advantage of this iterative approach is its ability to enable quick transitions between creativity and action. Four participants mentioned that agile teams frequently adjust their approach in response to new ideas or project challenges. The rapid interaction between idea generation and implementation ensures that teams remain flexible throughout the project, helping them stay aligned with evolving goals.

On the other hand, more traditional teams, which were described by three participants, tend to adhere to a linear innovation process where the stages of idea generation and implementation are clearly separated. Participant B1 explained: *"There's a rock-solid separation. When you're generating ideas, you can't start implementing anything."* This highlights the importance of detailed planning in traditional teams, where the idea-generation phase is completed before moving into implementation, minimizing potential disruptions later in the process.

Although both agile and traditional approaches were widely discussed, several participants noted that the working environment also plays a role in how teams experience these stages. Participants who worked remotely observed that the stages of idea generation and implementation were often more clearly delineated, with less immediate feedback compared to face-to-face interactions. In contrast, teams collaborating in-person tended to blend the two stages more seamlessly, allowing for spontaneous interaction and faster iteration. This relationship will be discussed in further detail in sub-chapter 4.4.

Overall, the primary elements of innovation, idea generation and implementation, are recognized across all the teams. However, the way these stages are navigated depends on the methodologies and environments in which teams operate. Agile teams, noted by four participants, tend to experience a fluid, continuous cycle between the two stages, while traditional teams, as described by three participants, maintain a more structured, linear approach.

The following table provides a brief overview of the key findings in this sub-chapter.

Table 4-1: Key findings team innovation

Category	*Key Findings*
Agile vs Traditional	• Agile teams use an iterative process, alternating between idea generation and implementation. Traditional teams follow a linear process, with clear separation between the two stages.
Stage recognition	• All teams recognize both stages of innovation, although in different forms.

4.2 Communication Methods

Formal & Informal Communication Methods

Project teams in this study frequently used a combination of formal and informal communication methods. Formal communication, such as scheduled meetings, emails, and documented processes, was highlighted by six participants as essential for maintaining structure and ensuring clarity. For example, daily stand-up meetings were regularly mentioned as a key component of team communication. Participant A2 explained, *"We schedule half an hour for a daily stand-up, where we run through tasks and discuss any problems."* The use of email for formal communication was mentioned by five participants, who stressed its importance in documenting decisions and tracking agreements. Teams often relied on email to provide a written record of project developments and tasks, ensuring accountability and clarity throughout the project.

In contrast, informal communication was often used for more spontaneous interactions. Seven participants described the value of informal conversations, particularly when working together in person, for addressing immediate issues and sharing ideas. Participant A2 noted, *"When we sit in the office, it's mostly informal. We usually sit together so we can talk and solve problems quickly."* These informal exchanges were seen as an important way to facilitate day-to-day problem-solving without the need for formal processes, allowing teams to address emerging issues more naturally.

Synchronous & Asynchronous Communication Methods

Synchronous communication, which involves real-time interaction, was commonly mentioned by eight participants as a critical component of their team's communication strategy. Face-to-face meetings, video calls, and instant messaging were identified as key tools for enabling quick decisions and fostering collaboration. Participant C2 noted, *"The face-to-face has the great advantage that you can switch quickly and also see what someone is thinking."* Video conferencing tools like Microsoft Teams were specifically mentioned by five participants, who used them regularly for structured discussions when working remotely. Synchronous communication methods were particularly effective for tasks requiring immediate attention and quick feedback.

On the other hand, asynchronous communication methods, such as email, were mentioned by six participants as a flexible way to share updates and assign tasks. Email was repeatedly emphasized as a tool that allowed team members to contribute at their own pace, which was especially useful in balancing workloads. Participant B2 remarked, *"Email... I use it as a to-do list. If someone needs something from me, I tell them to put it in an email."* However, three participants also noted that heavy reliance on

asynchronous communication, particularly email, could lead to information overload, making it important to manage this method carefully.

Internal & External Communication Methods

The distinction between internal and external communication was another common theme. Internal communication was primarily direct and informal, with five participants highlighting the use of tools like Microsoft Teams and Azure DevOps for internal task management. Participant A3 explained, *"Internally, we use Teams for quick updates, and we have an Azure DevOps page where tasks are defined and tracked."* These tools helped teams stay aligned and manage ongoing projects efficiently.

For external communication, six participants indicated that more formal methods, particularly email, were preferred when interacting with clients or other external stakeholders. Email was described as the main method for documenting formal exchanges with external parties, ensuring that all agreements and information shared were clearly documented. Participant A3 stated, *"Mail is mainly used for communication with the customer to exchange information."* This structured approach was essential in maintaining professionalism and accountability in external communications.

Communication Methods Across Multiple Categories

Interestingly, many communication methods used by project teams could be classified into multiple categories. For example, email was used both as a formal and asynchronous tool, helping teams document discussions while allowing team members to contribute at different times. Similarly, scheduled meetings were often both formal and synchronous, requiring real-time engagement while also adhering to a structured agenda to ensure tasks and decisions were addressed efficiently.

While formal and asynchronous communication methods were commonly used to handle documentation and manage long-term tasks, informal communication had a distinct role in driving creativity and solving problems on the fly. Informal exchanges, especially when team members were working face-to-face, offered the flexibility required to respond to issues spontaneously and brainstorm new ideas. This informal communication often acted as a foundation for the more formal and structured documentation that would follow, showing how teams naturally shifted between different communication styles depending on the task at hand. The combination of spontaneous discussions and structured communication allowed project teams to adapt to the changing demands of their work environment.

The following table provides a brief overview of the key communication methods identified across formal, informal, synchronous, asynchronous, internal, and external interactions.

Table 4-2: Key findings communication methods

Category	Key findings
Formal & Informal	• Formal methods (meetings, emails) ensure structure and documentation. • Informal methods (in-person chats) aid quick problem-solving.
Synchronous & Asynchronous	• Synchronous methods (face-to-face, video calls) enable real-time interaction. • Asynchronous methods (email) allow communication at different times.
Internal & External	• Internal communication uses tools like Teams and Azure DevOps for task tracking and updates. • External communication relies on email for formal exchanges with clients.

4.3 Barriers and Facilitators

4.3.1 Barriers

Effective communication is crucial for innovation in corporate project teams, but several barriers can hinder this process. These barriers, including communication lag, coordination challenges, lack of documentation, misinterpretation, communication overload, and the rigid nature of certain communication methods, can significantly impact the efficiency and effectiveness of team interactions. Each of these barriers can influence how well teams collaborate, generate ideas, and ultimately implement innovation. The following sections explore these barriers in greater detail.

Communication Lag

Communication lag occurs when there are delays between the sending and receiving of information. This is particularly problematic in asynchronous communication methods like email, where team members often have to wait for responses before making decisions or moving forward with tasks. In the context of innovation, these delays can disrupt the momentum of creative processes and lead to inefficiencies.

Five participants highlighted the impact of communication lag on project timelines. Participant B3 mentioned, *"You also see that through mail communication, we try to share and do a lot. But that often does not cover 100% of the information."* This illustrates how gaps in communication can lead to incomplete exchanges, which can result in misalignment among team members.

Moreover, communication lags during virtual meetings further exacerbate the issue by limiting active participation from remote team members. Participant B2 described how remote participants often experience a disadvantage because they are less engaged in discussions: *"Those are just the least left in discussions."* This disengagement not only limits the remote member's contributions but also diminishes the diversity of ideas that might emerge in brainstorming sessions, which are essential for innovation. These delays can negatively affect decision-making, as remote participants may not be able to provide immediate input on critical issues, which hampers the team's ability to act swiftly.

This issue is particularly important in dynamic innovation settings where rapid feedback is essential to capitalize on creative ideas. As communication lag persists, teams may lose opportunities to iterate on ideas quickly, slowing down the pace of innovation.

Coordination

Coordination challenges, another common barrier, often arise when teams struggle to synchronize their efforts, especially in environments where synchronous communication is required, such as face-to-face

meetings. Innovation often demands high levels of collaboration and ensuring that all team members are on the same page can be difficult, especially in cross-functional project teams where schedules and priorities differ.

Four participants emphasized the difficulty in maintaining consistent communication, particularly in face-to-face meetings. As participant A1 explained, *"You have to make it part of your system so that everyone is on the same page."* This quote reflects the effort required to develop and maintain routines of effective communication. In project settings, where team members may be working on multiple tasks simultaneously, the challenge of coordinating schedules becomes more apparent. Regular meetings and face-to-face interactions demand significant time and attention, which can be a logistical challenge when team members are spread across different locations or time zones.

The need for consistent participation in daily or weekly meetings can also be difficult to sustain over long periods. Participant A1 remarked, *"Having a daily progress meeting can be hard in the beginning when you are not used to it."* This highlights how building communication routines takes time and may initially reduce efficiency as teams adjust. However, in the long term, coordinated communication becomes vital for ensuring that all team members remain aligned on project objectives, roles, and progress.

The difficulty in maintaining proper coordination is particularly critical in innovation processes, where a lack of alignment can result in bottlenecks. Misaligned schedules or missed meetings can delay progress, cause confusion about roles and responsibilities, and prevent the team from addressing key challenges as they arise. Effective coordination is crucial for ensuring that innovation processes proceed smoothly, as it ensures that all team members have a clear understanding of their roles and contributions at every stage of the project.

Lack of Documentation

Lack of documentation represents another key barrier to effective communication. In many cases, informal communication, such as impromptu discussions or casual conversations, occurs without any formal record, which can lead to misunderstandings or lost information over time. This can be particularly problematic in fast-paced project environments where decisions need to be tracked and referenced later on.

Six participants highlighted the need for reliable records to maintain clarity. Participant B1 explained, *"If you do it personally, it's not fixed, because in a week or two or three they'll have forgotten."* This illustrates how the absence of documentation can result in confusion or disagreements about previous conversations. In an innovation context, where rapid idea generation is key, the failure to document important ideas can lead to missed opportunities or overlooked insights. Without formal documentation, valuable ideas may not be followed through to the implementation stage.

Participant C2 underscored the role of email in providing this formal documentation: *"You confirm things in the mail even though you've discussed them verbally."* This shows how formal communication methods like email are often used to solidify informal discussions. Without this, critical decisions may be lost, resulting in miscommunication and inefficiencies down the line.

In an innovation-focused project, the lack of proper documentation can result in misunderstandings about project direction, delays in decision-making, or the need to revisit previously settled issues. Effective documentation serves as a safeguard, ensuring that all team members are aligned and have access to a clear, consistent record of discussions and decisions.

Misinterpretation

Misinterpretation, particularly in asynchronous communication methods, poses a significant challenge to team dynamics. Without the immediacy of feedback and the ability to clarify misunderstandings, asynchronous communication, such as email, can lead to confusion and errors in interpretation.

Participant C2 illustrated this point, saying, *"When you send an e-mail... the moment you press send, then just wait and see what [the recipient] makes out of it on the other end."* This highlights the uncertainty inherent in text-based communication, where the sender has little control over how their message is interpreted. The lack of non-verbal cues in written communication, which are present in face-to-face or video interactions, further compounds the risk of misinterpretation.

In innovation projects, where complex and abstract ideas are often being discussed, misinterpretation can stifle progress. Participant C1 acknowledged that email is not always suitable for more intricate discussions, saying, *"You can't use email because it can't convey that complexity."* This emphasizes the need for choosing the right communication method to match the complexity of the subject being discussed. Failure to do so can lead to misunderstandings, which may require time-consuming clarifications or, worse, result in misaligned project goals.

Misinterpretation can also strain team dynamics. When communication is misunderstood, team members may feel frustrated or disengaged, which can harm the collaborative atmosphere that is crucial for innovation. It is important for teams to be aware of these risks and ensure that communication methods are chosen appropriately for the context.

Communication Overload

Communication overload is another critical barrier to effective collaboration, particularly in large teams or complex projects. When team members are overwhelmed by the sheer volume of communication, it becomes difficult to prioritize and respond to the most important messages. This not only slows down decision-making but can also lead to crucial information being overlooked.

Five participants described the negative impact of communication overload, particularly through email. Participant B2 commented, *"The e-mail traffic, especially the cc culture, could be reduced,"* reflecting the common issue of unnecessary emails cluttering inboxes. This overload can lead to inefficiency, as team members spend significant time filtering through irrelevant information rather than focusing on their core tasks.

Participant B2 provided a vivid example of how communication overload can cause important tasks to be neglected: *"I've had ten messages, and by the time I get to the last one, I forget about it."* This clearly illustrates the cognitive burden that communication overload places on team members, leading to missed deadlines and forgotten tasks, which can derail project progress.

In an innovation setting, where agility and quick responses are key, communication overload can significantly slow down the pace of progress. If team members are constantly bombarded with information, they may struggle to focus on the creative aspects of their work, leading to burnout and reduced productivity.

Rigid Nature

Finally, the rigid nature of formal communication methods, such as scheduled meetings or official emails, can inhibit the spontaneity and creativity that are essential for innovation. Formal communication often follows strict protocols, which can limit the flexibility needed to adapt to changing project requirements or the natural flow of ideas.

Four participants noted how this rigidity can stifle the creative process. Participant B1 remarked, *"You miss a piece of sociality, social cohesion, perhaps within your project, making it somewhat impersonal."*

This lack of personal interaction can reduce the sense of cohesion within the team, making it harder for members to engage in open, creative discussions.

Participant C2 emphasized how the rigid nature of formal communication can slow down the project process, saying, *"You start waiting for that person to be back tomorrow."* This reflects the inflexibility that can occur in projects when communication follows a strict, formal structure, rather than allowing for more dynamic, real-time interactions.

In innovation projects, where flexibility and rapid iteration are key, the rigid nature of formal communication can become a significant barrier. While formal communication is necessary for documentation and accountability, teams must strike a balance between structure and flexibility to maintain momentum and foster creativity.

To provide a clear, visual summary of the key barriers identified in this section, the following figure illustrates the relationship between the specific communication methods used by project teams and the associated barriers that hinder the effectiveness of these communication methods. Each communication method presents its own set of barriers, which are highlighted in the figure..

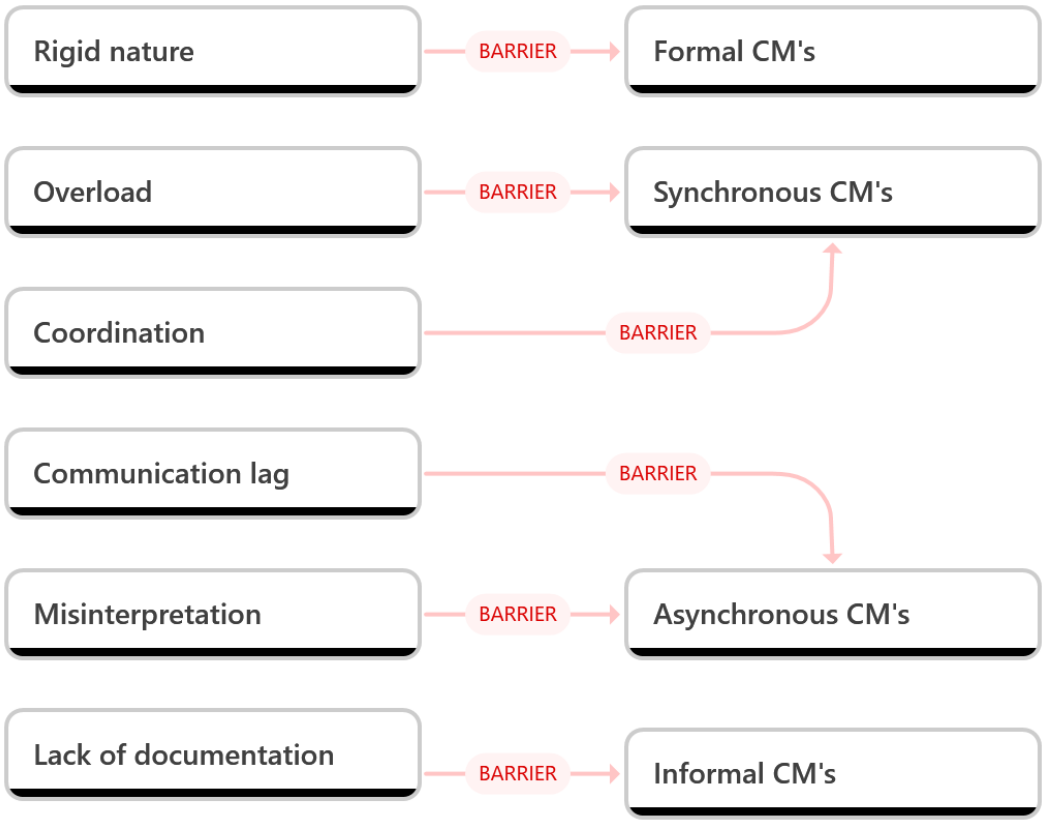

Figure 4-3: Overview of the Relationships between CM's and Barriers, Source: Atlas.ti

4.3.2 Facilitators

Effective communication in corporate project teams is supported by key facilitators that enhance its effectiveness. These facilitators include accountability, flexibility, immediacy, and the benefits of a personal work environment. Each of these elements plays a critical role in fostering smooth collaboration, and enhancing productivity. Below, we explore these facilitators in greater detail, supported by key insights from the interview data.

Accountability

Accountability ensures that responsibilities are clear and followed through, playing a central role in effective communication. Face-to-face interactions and formal documentation methods, such as emails, naturally foster accountability by creating a sense of commitment and providing a clear record of agreements.

Face-to-face communication strengthens the personal connection among team members, which, in turn, enhances accountability. When individuals interact directly, it becomes easier to address responsibilities and expectations in real-time. This is particularly valuable for team dynamics, where clear responsibility often translates to better collaboration and higher performance. Participant A2 noted, *"When you interact and talk to each other in real life, that gives you that sense of connection or commitment."* This highlights the warmth and immediacy of in-person interactions, making it easier for team members to align objectives and take ownership of their tasks.

Similarly, formal communication methods, particularly email, serve as a powerful tool for maintaining accountability. By providing a clear and accessible record of discussions, emails ensure that tasks are clearly assigned, and expectations are documented, leaving little room for ambiguity. This creates a structure where all parties are held accountable for the tasks they commit to, reducing misunderstandings and ensuring follow-through on agreed actions. As participant C2 expressed, *"You confirm things in the mail even though you've discussed them verbally."* This shows how documentation in email supports accountability by providing a formal record that can be referenced later if necessary.

Both face-to-face communication and formal documentation, like email, enhance accountability by fostering personal commitment and creating a clear record of agreements, ensuring that team members follow through on responsibilities.

Flexibility

Flexibility is a crucial facilitator of effective communication, especially in asynchronous methods such as email. Flexibility allows team members to manage their tasks and communication at their own pace, accommodating differences in working schedules, time zones, and individual task priorities.

Asynchronous communication methods like email offer a unique advantage by allowing team members to reflect on tasks and respond when they are ready. This reduces the pressure of real-time interactions and provides more time for thoughtful consideration and thorough task completion. Participant B2 emphasized this by stating that email allows them to manage their workflow effectively: *"I also use my e-mail as a kind of to-do list."* This reflects how asynchronous methods offer a structured way to prioritize tasks and track progress without the immediacy required in synchronous interactions.

This flexibility is particularly valuable in corporate project teams, where members often work on multiple projects simultaneously. Asynchronous communication allows individuals to manage overlapping responsibilities, which can be critical to sustaining momentum in innovation-focused environments. Moreover, the flexibility of these methods fosters autonomy, enabling team members to take ownership of their work while adapting to the specific demands of their tasks.

Asynchronous communication methods like email provide flexibility by allowing team members to manage their tasks and communication at their own pace, which is essential for balancing multiple responsibilities and maintaining progress in innovation-driven projects.

Immediacy

Immediacy refers to the ability of communication methods to facilitate rapid response and decision-making. Synchronous communication methods, such as face-to-face meetings and video calls, are highly effective in providing immediacy, enabling teams to address issues and make adjustments as they arise.

The immediate nature of face-to-face communication allows teams to discuss problems in real-time, leading to quick resolutions and faster decision-making. This is particularly important in dynamic environments, where teams need to iterate and pivot quickly to stay ahead. As participant C2 mentioned, *"The face-to-face has the great advantage that you can switch quickly and also see what someone is thinking about it."* This immediacy makes face-to-face communication ideal for resolving issues on the spot, especially in the context of fast-moving, innovation-centric projects.

In addition, face-to-face communication enables the quick exchange of ideas, fostering a collaborative atmosphere where team members can build on each other's input. This immediacy reduces the risk of delayed decision-making, which can slow down progress, and ensures that teams are always moving forward with the most up-to-date information.

Synchronous communication methods, particularly face-to-face interactions, provide immediacy by facilitating real-time responses and decisions, which are crucial for quick problem-solving and keeping innovation processes on track.

Personal Work Environment

A personalized work environment is another key facilitator, especially in the context of informal communication. Informal communication methods, such as casual conversations or brainstorming sessions, tend to thrive in settings that are more relaxed and conducive to creativity. These environments allow team members to engage in open and spontaneous discussions, which can spark new ideas and enhance collaborative thinking.

Participant C1 illustrated how informal communication, in a flexible work environment, supports creativity: *"That informal way of just looking along... you notice that a lot when you're still in the design phase."* This quote underscores how informal interactions, particularly in less structured settings, foster creative thinking. The flexibility of such environments allows team members to collaborate more freely, which is essential during the ideation phase of innovation.

Personal work environments also allow for the kind of interactions that can lead to serendipitous discoveries where team members come across solutions or ideas that they weren't initially seeking. By encouraging a free flow of communication, personal environments make it easier for teams to explore new perspectives and capitalize on unexpected insights. This adaptability in communication style is a significant advantage when working on complex, innovation-driven projects, where creative problem-solving is key to success.

Informal communication in a personalized work environment encourages spontaneous, creative interactions, which are crucial during the ideation phase of innovation, fostering a free flow of ideas and collaborative thinking.

To offer a comprehensive view of how specific communication methods facilitate the innovation process within project teams, the following visual summarizes the key relationships. This network diagram illustrates how certain communication methods are linked to various facilitators.

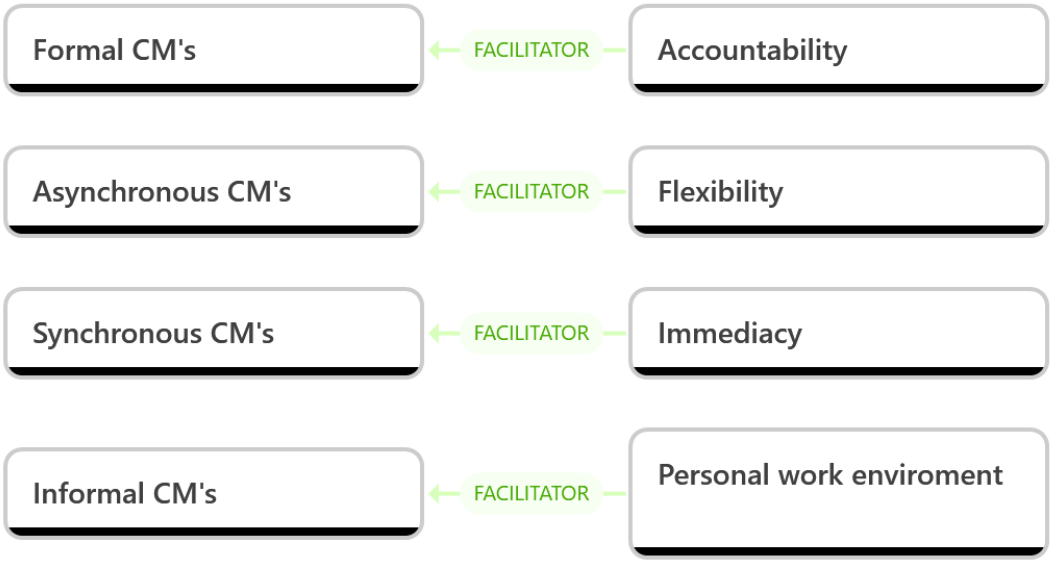

Figure 4-4: Overview of the Relationship between Communication Methods and Facilitators, source: Atlas.ti

4.4 Influence of the LoV

4.4 Influence of the Level of Virtuality (LoV)

This section examines how varying levels of virtuality ranging from fully remote to hybrid and fully face-to-face (F2F) setups influence communication methods within corporate project teams. The table provided in chapter 3 showed how the different project teams all have a different level of virtuality. Team A operates with a high level of virtuality, as most of their work is conducted remotely. Team B has a medium level of virtuality, utilizing a hybrid work model that combines remote and in-office work. Finally, Team C exhibits a low level of virtuality, as they predominantly work together in the same office.

Increased Flexibility with Virtual Communication

One of the primary benefits observed with higher levels of virtuality is the increased flexibility and efficiency in communication. Five participants mentioned that virtual platforms such as Microsoft Teams provided a significant advantage in facilitating quick, structured communication. As participant B3 remarked, *"Teams is just top for getting somebody tackled quickly for, yes, for short clear consultations."* This underscores the usefulness of virtual platforms for spontaneous communication, especially when team members are geographically dispersed.

Furthermore, virtual work allows team members to manage their schedules more effectively. Three participants highlighted that virtual environments enable them to multitask during meetings. For instance, Participant B3 mentioned, *"It's much easier to choose to just listen in from a distance and in the meantime continue working."* This flexibility is an essential benefit, as it allows for continuous productivity, even when physical presence is not necessary.

Loss of Spontaneity and Informal Communication

While virtual tools like Teams offer flexibility, they also introduce barriers to the informal, spontaneous communication that is often key to innovation. Four participants pointed out the challenges posed by virtual settings in maintaining these types of interactions. Participant A3 said, *"You have very big gaps when you don't speak to each other,"* indicating that the immediacy and spontaneity of face-to-face interactions are difficult to replicate in virtual environments.

Moreover, three participants expressed that virtual meeting often led to a reduced sense of engagement. For example, participant A2 stated, *"I feel more impatient, say, to answer a question through Teams than if it's in real life,"* highlighting how the asynchronous nature of virtual communication can diminish the quality of interactions and slow down collaboration.

Challenges of Hybrid Work in Balancing Participation and Engagement

Hybrid setups, where some participants attend in person and others join virtually, present unique challenges in terms of participation and engagement. Four participants noted that hybrid meetings often favor those who are physically present, creating a disparity in contribution. Participant A2 explained, *"Most of the synergy happens at the table. It's harder to contribute to that online."* Remote participants often struggle to engage fully, particularly when discussions move quickly.

In addition, three participants shared that those attending virtually often multitask or disengage more easily. Participant C1 admitted, *"I catch myself, and others as well, still doing my other things in between,"* indicating that maintaining focus and active participation is more difficult for those not physically present. Participant B2 echoed this, noting that virtual attendees *"are the least left in discussions"* due to delays and the slower pace of responding online. This creates a communication gap that affects both engagement and overall team cohesion.

Differences Based on Level of Virtuality

Teams with high levels of virtuality appeared to be more accustomed to the challenges posed by hybrid meetings. Participant A1 from a highly virtual team explained that their experience working with international, remote teams long before the pandemic made the transition to hybrid and virtual communication smoother. He shared*: "We've been working on international projects for years, long before Skype existed. Back then, we used conference calls without even having video, so for us, the shift to using tools like Teams wasn't a big shock."* This suggests that for teams with a long history of virtual collaboration, hybrid meetings are less disruptive and more integrated into their normal workflow.

In contrast, teams with lower levels of virtuality struggled more with the dynamics of hybrid meetings. Participant A2 from a low-virtuality team highlighted the difficulties in maintaining synergy between those physically present and those joining virtually: *"Often it's a combination of someone dialing in online while the rest are sitting at the table, but you still find that most of the synergy happens at the table."* This illustrates how teams less accustomed to virtual collaboration may experience more challenges in balancing the engagement and contribution of all participants during hybrid meetings.

The Role of Virtual Tools in Formalizing Communication

As teams increase their level of virtuality, communication methods often become more structured and formal. Four participants noted that tools like Teams and email have replaced many informal interactions that would typically occur in a physical office environment. Participant B2 commented*, "Walking by has actually been replaced by sending a message on Teams."* While this transition can provide documentation and structure, three participants indicated that the spontaneity and immediacy of face-to-face interactions, particularly for making quick adjustments, are harder to achieve virtually. As participant C2 observed, *"Quick adjustments are easier to make face-to-face than if you share something in Teams."*

Concluding, the findings show that the level of virtuality significantly impacts communication methods within project teams. While virtual platforms enhance flexibility and structure, they can limit spontaneity and engagement. Hybrid work environments, though blending in-person and remote participation, often create disparities in contribution and focus. As virtuality increases, communication becomes more formalized, with a growing reliance on digital tools, but at the cost of immediacy and informal interaction.

The following table provides a brief overview of the key findings in this sub-chapter.

Table 4-3: Key findings LoV

Category	*Key Findings*
High Virtuality	• High virtuality allows for multitasking and asynchronous communication but reduces spontaneity. Reduced non-verbal cues and team cohesion in virtual environments.
Medium Virtuality	• Balances the use of face-to-face and virtual tools, offering flexibility in communication. Can lead to communication overload due to mixed communication modes (synchronous and asynchronous).
Low Virtuality	• Face-to-face interactions foster spontaneity, creative discussions, and immediate feedback. Challenges arise when transitioning to virtual tools without sufficient infrastructure or training.
Hybrid Work Challenges	• Remote participants in hybrid meetings often feel sidelined, reducing engagement and participation.
High Virtuality	• High virtuality allows for multitasking and asynchronous communication but reduces spontaneity. Reduced non-verbal cues and team cohesion in virtual environments.

4.5 Adaptation of CM's

This section explores how corporate project teams adapt their communication methods in response to different stages of the innovation process. The analysis indicates three major adaptations as projects move from the idea generation phase to the implementation phase:

Shift from Informal to Formal Communication

During the idea generation phase, teams rely heavily on informal communication methods such as impromptu discussions and brainstorming sessions. This is primarily because these methods allow for the free exchange of ideas, fostering creativity and collaboration. Participant A2 highlighted this by stating, *"Idea generation works better in real life because you're more receptive to other opinions, especially when brainstorming together in a room."* This sentiment was echoed by 5 other participants, who also emphasized the importance of face-to-face interactions during the early stages of innovation.

However, as the project progresses into the implementation stage, communication shifts to a more formal and structured approach. This shift is necessary to ensure clarity and efficiency in task execution. Participant C1 explained, *"In the beginning, you want to be creative and informal, but as things become more concrete, they need to happen, so the communication becomes more structured."* This was supported by 4 other participants, who similarly noted that as the project moves into more concrete phases, formal communication (such as emails and reports) becomes essential.

Teams adapt by transitioning from informal, spontaneous communication during ideation to structured, formal communication as the project moves into implementation, ensuring that tasks are executed efficiently. This pattern was observed in 4 out of 8 participants.

Frequency of Communication Changes Over Time

During the idea generation phase, communication is more frequent and largely internal. Face-to-face interactions are prioritized, enabling team members to engage in collaborative brainstorming. Participant C2 described this phase as more focused on internal interactions: *"In the idea phase, we are a little more internal... as we move toward the implementation phase, more external parties get involved."* This shift in communication focus from internal to external was noted by 4 participants, who observed a similar transition toward communicating more with external stakeholders as the project matured.

In contrast, during the implementation phase, communication becomes less frequent internally, but more frequent with external stakeholders. This shift is driven by the need to coordinate with other departments, suppliers, and clients. Communication becomes more targeted, focusing on task management and external alignment. Participant C2 noted, *"The more you move toward the implementation phase, the more parties have to be hooked up to get something done as well."* This was supported by 3 other participants, who observed a similar need for increased external communication as the project progresses.

Communication frequency decreases internally but increases externally as teams move from idea generation to implementation, reflecting the evolving needs of the project. 4 participants observed a shift in the focus and frequency of communication across the stages.

Shifting from Collaborative Creativity to Task-Driven Isolation

Another observed change in communication is the dissolution of collaborative efforts as teams move from the initial stages of innovation into execution. During the idea generation phase, there is a sense of excitement, with frequent communication and engagement from all members. Participant B2 noted: *"People are excited, and everybody is needed at the start. But once it crystallizes... you see people going back to their own tasks."* This transition from collaboration to more isolated, task-focused work was mentioned by 4 participants, who noted a decrease in team-wide communication as the project moved into implementation.

In the implementation phase, communication becomes more isolated as team members focus on completing their individual tasks. This leads to fewer interactions and a decreased emphasis on group collaboration, resulting in what one participant called a sense of "islands" forming. This phenomenon was noted by 3 other participants, who observed that as the project moves toward execution, the team naturally shifts from collaborative brainstorming to more isolated task work.

Collaboration and frequent communication decrease as the project moves into implementation, with team members becoming more isolated and focused on their individual tasks. 5 participants noticed this shift from collaborative work to more individual-focused efforts as the project reached the implementation phase.

The following table provides a brief overview of the key findings in this sub-chapter.

Table 4-4: Key findings adaptation of CM's

Category	*Key Findings*
Shift in Communication	• Communication shifts from informal (e.g., brainstorming) in the idea generation phase to formal (e.g., reports) in implementation.
Internal Communication	• Internal communication tools (e.g., Microsoft Teams, DevOps) are used for quick updates and task management.
External Communication	• External communication primarily relies on formal methods (e.g., emails) for accountability and documentation with stakeholders.
Collaboration Decline	• Collaboration and creativity often decline as teams move from ideation to task-driven execution.
Formality vs Flexibility	• While formal communication ensures structure and accountability, it can reduce spontaneity and creativity.

4.6 Cross-case analysis

The cross-case analysis involved exploring several contextual factors that were coded under the "Contextual Factors" code group in Atlas.ti. The code-document analysis (Figure 4-5) was instrumental in highlighting which code categories were more frequently discussed in relation to each team. It's important to note that a higher prevalence of a code category in a particular team does not necessarily indicate its stronger influence on CMs; rather, it signifies that this theme was more prominent in the discussions during the interviews. However, the frequent mention of a category could imply a potential impact on how communication methods are shaped within that team.

	Project A	Project B	Project C	Totals
Organizational Influence	22.22%	11.11%	66.67%	100.00%
Project Management Approach	57.14%	21.43%	21.43%	100.00%
Team Structure and Configuration	14.29%	57.14%	28.57%	100.00%

Figure 4-5: Code-Document Group analysis. executed for the code group 'Contextual Factors'. From Atlas.ti

Organizational Influence

The influence of organizational structure emerged most prominently in Project Team C, as indicated by the frequent coding of this category in the interviews (see Figure 4-3). This team operates within an organization structured into two separate business units (BUs), each working on a similar project but with different applications. As a result, the project team navigates not only its internal communications but also periodic consultations with the other BU. This unique structural complexity within Project Team C's organization led to the adoption of more formal communication methods—such as structured meetings and detailed documentation—to ensure clarity and alignment between the units. In contrast, Project Teams A and B did not emphasize organizational structure as strongly during their interviews. This suggests that, while an organizational factor may still be present, it did not significantly influence their CMs or was not actively perceived as a challenge by the interviewees.

The contrast between Project Team C and the others suggests that the complexity of the organizational structure can shape the way communication is managed. In Team C, the dual-BU setup necessitates formal communication to navigate corporate politics and inter-unit coordination. Meanwhile, Teams A and B, with simpler structures and more autonomous operations, can adopt less formal communication methods. This indicates that the organizational context, specifically its structure and the need for cross-functional interaction, can drive a team's preference for more formal or flexible CMs.

Project Management Approach

As discussed in Chapter 4.1, the teams used two different project management approaches: Agile and Stage-Gate, leading to different interpretations of the stages of innovation. The project management approach influences how communication methods are utilized. Team A, which follows an Agile methodology, is characterized by iterative, fast-paced stages that require frequent, real-time interactions. This approach results in a consistent use of synchronous communication methods, such as daily stand-ups via Microsoft Teams, throughout the project. The rapid succession of stages in Agile makes it difficult to switch communication methods, resulting in a relatively uniform communication pattern across the project lifecycle.

In contrast, Teams B and C use a stage-gate approach, which structures their projects into distinct phases. This structure allows for more variation in communication methods as the project progresses. During the implementation phase, for instance, both teams reported a greater reliance on asynchronous methods

(e.g., emails and formal reports) to accommodate an expanded team and the need for detailed documentation.

Team Configuration
The configuration and composition of project teams also influence communication practices. Project Team B stands out in this regard. Unlike Teams A and C, which maintain a stable team composition throughout their project lifecycle, Team B's configuration changes during the implementation phase, incorporating delegates from other departments such as procurement and production. This influx of diverse disciplines introduces a higher degree of cross-functionality, necessitating a shift in communication methods. During interviews, participants from Project Team B indicated a growing preference for asynchronous communication methods, such as emails, to accommodate the varying schedules and expertise of the expanded team. Asynchronous methods allowed them to document information effectively and maintain clarity in appointments and agreements across different functional areas. This shift was less evident in Teams A and C, where the stable team configuration did not require such adjustments. In these teams, established communication routines persisted, reducing the need for extensive asynchronous documentation as the projects progressed.

This comparison suggests that changing team configurations can influence communication methods, particularly when there is an expansion in team size and cross-functionality. In Team B, the influx of new members from different departments during the implementation phase prompted an increased use of asynchronous methods to keep communications clear and accessible for a broader audience. Teams A and C, with their stable configurations, did not experience this dynamic, allowing them to maintain more consistent communication methods throughout their projects. Table 4.5 gives an overview of the key findings of the cross-case analysis on contextual factors between the project teams.

Table 4-5: Key findings Contextual factors

Contextual Factor	***Project Team A***	***Project Team B***	***Project Team C***
Organizational Influence	No influence was discussed	No influence was discussed	Organizational structure of 2 BU's and company politics caused the CM's to become more structured and asynchronous
Project Management Approach	Agile approach, causing to use more synchronous CM's (Daily stand-up Meetings)	Stage Gate Approach	Stage Gate Approach
Team Configuration	Stable throughout project	Changes during implementation phase, causing CM's to become more asynchronous and formal	Stable throughout project

Contingencies
The Level of Virtuality (LoV) introduced notable differences in how the teams managed their communication. Team A, operating in a highly virtual environment, relied heavily on asynchronous tools like Microsoft Teams and SharePoint for coordination, which sometimes led to delays in decision-making. In contrast, Team B worked in a hybrid setting, allowing for a balance between synchronous

and asynchronous communication. This flexibility helped them adapt to changing project needs, particularly during critical stages. However, the medium LoV also brought its challenges, such as difficulties in maintaining consistent communication when switching between in-person and virtual interactions, occasionally causing information gaps or misunderstandings. Team C, with its low virtuality, primarily used face-to-face communication, fostering spontaneous discussions but facing challenges in documentation and coordination, especially when engaging with other business units.
A key finding across these cases is that communication methods tend to become increasingly asynchronous as the level of virtuality rises, while lower levels of virtuality favor more synchronous, real-time interactions. This trend underscores the influence of LoV on shaping a team's communication strategy and highlights the need to adapt CMs to suit the virtuality context of the project. For teams with high LoV, deliberately incorporating more synchronous communication methods, such as regular video meetings, can help counter the negative effects of over-reliance on asynchronous tools. By being aware of the tendency for high LoV to increase asynchronous communication—and the associated risks like delays and misunderstandings—teams can proactively use synchronous methods to enhance collaboration and maintain clearer, more dynamic interactions.

Interestingly, the cross-case analysis reveals that the preferences for communication methods during different stages of innovation are quite similar across all three teams. During the idea generation stage, informal and synchronous methods such as brainstorming sessions and in-person discussions are preferred for fostering creativity and quick exchanges. As the projects transition to the implementation stage, all teams shift towards formal and asynchronous methods, such as emails and reports, to document progress and ensure accountability.

The thematic analysis provides a basis for this similarity. Regardless of the project type or team structure, the contingency of innovation stages drive the need for flexibility in communication methods. Thus, while the teams differ in their context and dynamics, the fundamental requirements of each innovation stage result in parallel communication preferences. Table 4-6 gives an overview of the key findings of the cross-case analysis on contingencies between the project teams.

Table 4-6: Key findings contingencies

Contingency	***Project Team A***	***Project Team B***	***Project Team C***
Level of Virtuality	High LoV, asynchronous methods dominate	Medium, balance between synchronous and asynchronous	Low, face-to-face synchronous methods dominate
Stages of Innovation	No differences between project teams	No differences between project teams	No differences between project teams

5 Discussion

5.1 Interpretation of Findings

Sub-Question 1

"What are the stages of innovation within corporate project teams?"

This sub-question focuses on exploring two critical stages of innovation within corporate teams: the idea generation phase, where new concepts are developed, and the idea implementation phase, where these ideas are put into action.

Understanding the Idea Generation Phase

The idea generation phase is fundamental to innovation, where teams focus on formulating new and useful ideas. Research by Anderson et al. (2014) highlights the importance of an open and creative environment to enable innovation during this stage. The findings from the research show that teams strive to create settings where members can freely exchange ideas without fear of judgment, thus encouraging creativity and diverse perspectives.

In practice, teams utilize informal strategies such as brainstorming and digital collaboration tools to promote idea generation. These approaches allow for quick and dynamic exchanges of ideas. According to Cropley, (2015) and Hughes et al. (2018), generating ideas requires flexible and open communication methods to ensure that teams can fully explore different possibilities before narrowing down the most viable ones.

Defining the Idea Implementation Phase

Once ideas are conceived, teams move into the idea implementation phase, focusing on executing these ideas effectively. This stage requires a more structured and coordinated approach, as teams work to turn innovative concepts into reality (Thayer et al., 2018). The findings indicate that structured processes and formal communication become crucial during implementation to ensure that all components of the idea are executed efficiently.

For teams following traditional models such as the stage-gate process, innovation progresses in a linear fashion from idea generation to implementation, with clearly defined steps for each phase (Thayer et al., 2018). The structured approach ensures that resources are managed well, challenges are addressed, and the project stays on track. Formal communication, including reports and meetings, plays a key role in maintaining coordination during the implementation phase.

Influence of Methodology on Innovation Phases

The project methodology used by teams significantly impacts how they experience the two innovation phases. Agile teams, for instance, often see the idea generation and implementation phases as part of a continuous cycle, where both stages overlap. This iterative approach allows teams to swiftly transition between developing new ideas and putting them into practice, ensuring adaptability in response to project changes (Berntsson Svensson, 2017; Rietzschel & Ritter, 2018).

In contrast, traditional teams using methodologies such as waterfall or stage-gate view the phases as more distinct. Anderson et al. (2014) found that these teams tend to finish the idea generation phase before moving into implementation, maintaining clear boundaries between the two. The findings confirm that traditional teams rely on structured planning and a well-organized implementation process to reduce risks and ensure smooth project progression.

The findings are consistent with the literature, which emphasizes the distinct characteristics of the idea generation and idea implementation phases. While the idea generation phase encourages creativity, flexibility, and open idea exchanges, the implementation phase is centred on structure, coordination, and execution. The methodology chosen by teams significantly influences how these phases are approached. Agile teams experience the phases as a fluid cycle, while traditional teams follow a more linear, step-by-step process.

Sub-Question 2

"What specific communication methods do corporate project teams employ to run their projects?"

This sub-question seeks to describe the specific communication methods used by corporate project teams, categorizing them into formal and informal, synchronous and asynchronous, as well as internal and external methods. Understanding how these methods are used offers insights into how teams structure their communication to meet project goals.

Formal and Informal Communication

The findings reveal that formal and informal communication methods are both integral to the functioning of corporate project teams. Formal communication, such as scheduled meetings and emails, was regularly used to ensure structured information exchange and documentation, aligning with the literature's emphasis on accountability and clarity in complex projects (Pinto & Pinto, 1990). These methods help maintain a clear record of decisions and agreements, providing a stable framework for coordinating tasks across the team.

In contrast, informal communication, which occurs through spontaneous discussions and casual interactions, facilitates quicker problem-solving and fosters a more dynamic exchange of ideas. This is consistent with Chiocchio (2007) who noted that informal communication can enhance creativity and speed by allowing team members to discuss issues in a more relaxed and open setting. However, as highlighted by Pinto & Pinto (1990), the lack of formal structure in informal communication may result in missed documentation, though it remains vital for day-to-day collaboration and resolving immediate issues.

Synchronous and Asynchronous Communication

The use of synchronous communication, such as face-to-face meetings and video calls, reflects its role in enabling real-time exchanges and immediate feedback. These methods are particularly useful when rapid decision-making or problem-solving is needed, a point supported by Den Otter & Emmitt (2007), who highlighted the value of synchronous methods in reducing misunderstandings through direct interaction.

Asynchronous communication, primarily via email, was another critical method, allowing team members to contribute at their own pace. This flexibility is particularly useful for teams working across different time zones or schedules, as suggested by Den Otter & Emmitt (2007). The findings confirm that asynchronous methods, such as email, are frequently used for task assignments and documentation, providing a flexible solution for non-urgent tasks, while ensuring a clear record of communication. However, as noted in the literature, asynchronous methods may slow down decision-making due to the delayed nature of feedback (Chiocchio, 2007).

Internal and External Communication

The distinction between internal and external communication methods was clear in the findings. Internal communication within teams often relied on tools like Microsoft Teams and Azure DevOps for task tracking and updates. These tools enabled teams to coordinate effectively, as suggested by Hansen (1999), who emphasized the importance of cohesive internal communication in supporting efficient team operations.

On the other hand, external communication, particularly with clients or stakeholders, was more formal and primarily conducted through email. This aligns with Hansen (1999), who noted the importance of formal methods in ensuring clear and documented exchanges with external stakeholders. The use of email in external communication ensures that all agreements and updates are properly recorded, facilitating accountability and maintaining professionalism.

In summary, the project teams employed a range of communication methods to suit different contexts. Formal communication methods ensured structure and documentation, while informal communication methods allowed for quick problem-solving and more dynamic collaboration. Synchronous methods enabled real-time interaction and decision-making, whereas asynchronous methods provided flexibility for task management and documentation. Internal communication tools like Microsoft Teams supported team coordination, while email was the preferred method for formal external communication with clients and stakeholders. These findings provide a clear picture of how corporate project teams manage their communication processes to meet the demands of their projects.

Sub-question 3

"What are the perceived barriers and facilitators to effective communication within corporate teams?"

This section analyzes the barriers and facilitators of communication methods (CMs) in corporate project teams, as identified from the interviews The focus is on how specific CMs either present challenges or offer support for team collaboration, particularly in relation to the demands of the idea generation and idea implementation stages. The contingency theory is used to explain how the stage of innovation influences which barriers and facilitators are more relevant. Finally, these findings are connected to the literature presented earlier, highlighting both alignments with and divergences from established theory.

Several key barriers were identified that hinder effective communication in project teams. These barriers include communication lag, coordination challenges, lack of documentation, misinterpretation, communication overload, and the rigid nature of formal communication methods. Each of these barriers directly relates to specific communication methods, highlighting the difficulties teams face in collaboration and innovation.

Communication Lag: Asynchronous methods, particularly email, are a significant source of communication delays, which can disrupt team decision-making and engagement. This is particularly problematic during the idea generation stage, where rapid iteration and immediate feedback are essential. As Den Otter & Emmitt (2007) pointed out, the delays inherent in asynchronous communication reduce efficiency, but our findings go further, highlighting that communication lag can also disengage team members, particularly in brainstorming sessions. This disengagement limits the diversity of ideas generated and slows down the creative process.

Coordination Challenges: Maintaining consistent team collaboration, particularly in synchronous communication settings such as face-to-face meetings, presents a logistical challenge. The logistical difficulty of bringing team members together for regular meetings is a barrier, especially during the implementation phase. In this stage, precise coordination is crucial for ensuring that tasks are aligned and executed on time. Chiocchio (2007) mentions these logistical issues, but our findings emphasize that coordination challenges grow in importance as the team moves into implementation, where misaligned schedules and delayed decisions can lead to significant project setbacks.

Lack of Documentation: Informal communication methods, such as impromptu discussions, often result in a lack of reliable documentation. In the idea implementation phase, this lack of formal records can lead to confusion, miscommunication, and inefficiencies, as project members may lose track of decisions made during earlier informal conversations. This aligns with Pinto & Pinto (1990), who noted the risks of relying on informal communication without follow-up documentation. This

study found that a failure to document critical discussions can derail the smooth transition from idea generation to execution, especially when those ideas need to be revisited during implementation.

Misinterpretation: Asynchronous communication methods, such as email, are particularly prone to misinterpretation due to the lack of immediate feedback. This is especially problematic during the idea generation stage, where complex and creative ideas need to be communicated with clarity. Den Otter & Emmitt (2007) recognized that asynchronous methods lack the real-time interaction required to resolve complex issues. Our findings emphasize that misinterpretation can derail the collaborative effort in this early phase by creating misunderstandings that lead to wasted time or misaligned objectives.

Communication Overload: Email overload is another significant barrier that affects team performance, particularly during the Implementation stage. The sheer volume of communication can overwhelm team members, making it difficult to prioritize critical messages. Chiocchio (2007) highlighted this issue, but our findings further emphasize the cognitive burden that communication overload places on teams engaged in innovation. Overwhelm can lead to important information being overlooked, which may result in delays and reduced focus on critical tasks.

Rigid Nature of Formal Methods: The structured nature of formal communication methods, such as scheduled meetings and official emails, can act as a barrier to creativity. While these methods provide accountability and clarity, they stifle spontaneity and flexibility, which are essential during the idea generation stage. This finding aligns with Pinto & Pinto (1990), who noted that formal communication can inhibit flexibility. This study shows that the rigidity of formal communication can present challenges during the ideation phase, where unstructured and dynamic exchanges are often more conducive to open discussions.

On the other hand, several facilitators were identified that enhance the effectiveness of communication, including accountability, flexibility, immediacy, and the personal work environment.

Accountability: Accountability is strongly linked to formal communication methods, particularly email, which serves as a reliable record of decisions and agreements. In the idea implementation stage, formal methods such as reports and structured emails are essential for maintaining clarity and accountability, helping to align the team's efforts with the project's goals. This finding reinforces Pinto & Pinto (1990) assertion that formal methods promote accountability by providing a documented trail of communication.

Flexibility: Asynchronous communication methods, such as email, provide a high degree of flexibility, which is especially valuable during the Idea Generation stage. These methods allow team members to manage their tasks independently and reflect on complex ideas, enabling more thoughtful contributions to the creative process. Den Otter & Emmitt (2007) recognized the value of flexibility in asynchronous communication, and our findings highlight how this flexibility supports the creative processes necessary in early-stage innovation.

Immediacy: Synchronous communication methods, particularly face-to-face meetings, are notable for their immediacy, making them crucial during the Idea Generation stage. Real-time communication enables rapid feedback and quick iteration on ideas, maintaining the momentum needed for innovation. As Den Otter & Emmitt (2007) observed, synchronous communication is highly effective for resolving complex issues in real-time. Our findings confirm that immediacy is vital during the creative process, as it prevents delays and fosters a dynamic exchange of ideas.

Personal Work Environment: Informal communication methods that foster a relaxed, personal work environment act as important facilitators for creativity, especially during the Idea Generation stage. Informal settings, such as impromptu discussions, encourage spontaneous idea-sharing and collaboration, promoting openness and creativity. This finding aligns with Chiocchio (2007)

assertion that informal communication methods foster creativity by reducing pressure and promoting a free flow of ideas.

The contingency theory suggests that the effectiveness of communication methods is not universal but depends on the specific stage of innovation the project is in. Each stage, whether idea generation or idea implementation, requires communication methods that enhance specific facilitators while minimizing the impact of barriers. Since these barriers and facilitators are closely linked to particular communication methods, selecting methods that align with the project's stage is important for effective team communication.

Idea Generation Stage: In this early phase, the project demands creativity, spontaneity, and collaboration, all of which are facilitated by informal and synchronous communication methods. Face-to-face meetings, brainstorming sessions, and impromptu discussions help teams exchange ideas quickly and build on each other's inputs. However, communication lag, misinterpretation, and the rigidity of formal methods are detrimental in this phase and must be minimized. By focusing on informal, flexible methods, teams can maintain the spontaneity and real-time feedback needed for rapid idea iteration.

Idea Implementation Stage: As the project transitions into implementation, accountability, structure, and documentation become more important. Formal and asynchronous communication methods such as emails, reports, and collaborative documents provide the necessary clarity and alignment to ensure that project goals are met. Barriers like lack of documentation and poor coordination become more problematic in this phase, making it essential to use formal methods that ensure proper tracking and execution of tasks.

In conclusion, selecting communication methods that either minimize barriers or enhance facilitators is important for having effective communication in different stages of the project. The findings reveal that different stages of innovation require distinct communication strategies: informal and synchronous methods are most effective during idea generation, while formal and asynchronous methods support the structure needed for implementation.

Sub-Question 4

"How does the level of virtuality influence the use of communication methods within corporate project teams?"

The Influence of Virtuality on Communication Methods

In this section, we focus specifically on synchronous and asynchronous communication methods because they form the core of how teams interact in both face-to-face and virtual settings. These communication methods—whether they involve real-time (synchronous) exchanges or delayed (asynchronous) interactions—are directly influenced by the level of virtuality. Understanding how virtuality shapes these communication methods is essential for exploring how teams can adapt their communication strategies.

Level of Virtuality strongly influences how synchronous communication methods, such as face-to-face meetings or video calls, function within project teams. Low virtuality settings, where most communication happens face-to-face, naturally facilitate immediacy and spontaneous interaction, allowing for real-time feedback and dynamic brainstorming. This immediacy is particularly beneficial during the idea generation phase, as it supports quick, back-and-forth exchanges that foster creative discussions.

However, as virtuality increases, the effectiveness of synchronous methods changes. For teams with high virtuality, synchronous communication methods often take the form of video calls or digital conferencing. While these methods still enable real-time discussion, the latency introduced by digital tools reduces the immediacy that face-to-face interactions provide. For example, brainstorming sessions held via video call lacked the dynamism of in-person meetings. The minor latency or interruptions in digital communication can hinder the rapid generation of ideas and reduce the creative spontaneity that is typically associated with face-to-face meetings.

This supports findings from the literature, where (De Jong & Dirks, 2016) emphasized that high virtuality settings can weaken team cohesion by limiting non-verbal cues and immediacy. Therefore, as virtuality increases, teams need to compensate for the reduction in spontaneous interaction by structuring meetings more deliberately, ensuring that all members are engaged.

If we look at asynchronous CM's, high virtuality environments rely heavily on asynchronous communication methods, such as email and collaborative documents. These tools offer flexibility, allowing team members to contribute to tasks at their own pace and across time zones. This flexibility supports the needs of teams during the implementation stage, where accountability and careful task management are essential.

In lower virtuality settings, asynchronous methods are less central to team communication but still play an important role in ensuring documentation and clear communication. However, as virtuality increases, asynchronous tools become indispensable. Teams accustomed to high levels of virtuality use asynchronous communication to maintain workflows without needing to synchronize schedules. For these teams, the flexibility offered by asynchronous communication helps mitigate the logistical challenges posed by geographical dispersion.

Yet, this reliance on asynchronous methods can also exacerbate communication lag, particularly in creative phases where rapid feedback is needed. The literature supports this challenge, as Den Otter & Emmitt (2007) highlighted the inherent delays in asynchronous communication, which can slow down decision-making processes, especially in high virtuality settings.

Hybrid Work and Prior Virtual Experience in Communication

Hybrid work, where some team members are physically present while others are remote, introduces distinct communication challenges. One of the most significant issues is the imbalance in participation during hybrid meetings, where in-person participants often dominate the discussions, leaving virtual participants struggling to engage equally. Several participants in the study noted that this disparity creates inefficiencies, as remote members may not be as actively involved or able to contribute as effectively. This observation is supported by (Klonek et al., 2022), who found that physically present team members tend to dominate discussions in hybrid settings, while remote participants often feel sidelined.

However, teams with more experience in virtual communication tools appeared to handle these hybrid dynamics more smoothly. Participants from teams with a high level of virtuality, who were accustomed to working remotely, experienced fewer difficulties during hybrid meetings. These teams had already developed robust communication protocols and a familiarity with digital tools, enabling them to maintain more balanced participation. This echoes the findings of (Foster et al., 2015), who suggested that teams with prior virtual experience are better equipped to manage communication across both virtual and in-person platforms.

This combined finding shows that while hybrid work creates unique challenges, particularly around balancing participation, teams that have previously worked in high-virtuality environments adapt more effectively. Their ability to seamlessly switch between virtual and in-person communication methods demonstrates the importance of prior virtual experience in overcoming the barriers typically associated with hybrid meetings.

Contingency Theory and LoV

In this study, contingency theory is used to understand how the effectiveness of communication methods depends on contextual factors, with LoV serving as a key modulating factor. Virtuality doesn't directly dictate the success or failure of a communication method; rather, it influences the degree to which certain facilitators or barriers are present.

For instance, in high-virtuality settings, the barrier of communication lag in asynchronous methods becomes more pronounced (Handke et al., 2021). However, the flexibility that asynchronous methods offer is also a significant facilitator in these environments. Similarly, in low-virtuality settings, synchronous methods excel in promoting immediacy and engagement, but they also demand higher levels of coordination (Foster et al., 2015).

This means that virtuality modulates the impact of communication methods, shaping how facilitators like flexibility and immediacy function. Teams must consider their level of virtuality when choosing communication strategies, recognizing that the barriers and facilitators inherent to each method will be strengthened or weakened based on their LoV.

The level of virtuality influences how communication methods are employed within corporate project teams. High virtuality settings rely on the flexibility of asynchronous communication, while low virtuality settings facilitate immediacy and spontaneous collaboration through face-to-face interactions. Hybrid environments present unique challenges, with teams needing to ensure balanced participation.

Sub-Question 5

"How do corporate teams adapt their communication methods and strategies in response to the stage of innovation?"

This sub-question explores how corporate project teams adjust their communication methods and strategies at different stages of the innovation process. Understanding this adaptation is crucial for optimizing communication efficiency, especially as teams navigate from the more creative phases of idea generation to the structured, execution-oriented phases of implementation.

Shift from Informal to Formal Communication

The findings illustrate a significant shift from informal to formal communication as projects progress from idea generation to implementation. In the early stages of innovation, informal communication methods, such as spontaneous discussions and brainstorming, are essential to promote creativity and collaboration. This reflects the inherent flexibility required to explore and refine ideas. Teams tend to prioritize face-to-face interactions in this stage, which fosters a free-flowing exchange of diverse perspectives. These methods were perceived as more effective for generating novel ideas and fostering team cohesion.

This transition is well-supported by the literature, particularly in Anderson et al. (2014) and Thayer et al. (2018), which emphasize that informal communication methods such as real-time discussions foster creativity by enabling teams to exchange ideas freely and without constraints. These studies align with the finding that informal communication is particularly effective during the idea generation phase. However, as projects move toward the implementation phase, the shift to formal and structured communication becomes necessary to ensure precision and accountability. This shift is explained by Contingency Theory, which suggests that communication methods should adapt to the specific demands of each stage. In line with this, Pinto & Pinto (1990) highlight the importance of structured communication methods, such as emails and reports, during project execution to ensure that responsibilities are clear, and progress is tracked effectively.

Frequency of Communication Changes Over Time

The study also identified a notable change in the frequency of communication across the stages of innovation. During the idea generation phase, communication is more frequent and primarily internal. Teams frequently engage in discussions to refine ideas and brainstorm solutions, often requiring rapid feedback loops within the group. However, as the project advances into the implementation phase, communication within the team becomes less frequent, while interactions with external stakeholders, such as suppliers or other departments, intensify. This shift is driven by the need to coordinate with external parties to ensure that the project's execution aligns with external requirements and deadlines.

This shift toward external communication is important, but internal communication remains essential during implementation. Hansen (1999) emphasizes that internal communication during implementation ensures cohesive teamwork and efficient coordination, directly impacting the innovation process. Effective internal communication helps maintain a shared vision and keeps all team members aligned on progress and challenges. Without it, teams may experience misalignment and inefficiency, even as they engage more with external stakeholders. Therefore, while there may be a shift towards external communication, it is crucial that teams do not reduce internal communication to the extent that cohesion is lost. This supports the finding that even though internal communication may decrease in frequency, its role in maintaining team alignment remains vital.

Shifting from Collaborative Creativity to Task-Driven Isolation

A final notable shift in communication is the transition from collaborative creativity during the idea generation phase to more task-driven isolation during the implementation phase. In the early stages of

the project, team members engage in frequent collaboration, brainstorming, and collective problem-solving, creating a high-engagement environment conducive to idea generation.

However, as the project moves into the implementation phase, team members increasingly focus on individual tasks, which leads to a decrease in team-wide communication. This phase is marked by the "isolation" of team members as they take responsibility for executing specific tasks independently, with less need for frequent, group-wide collaboration.

It is important to note that this finding diverges from the literature discussed in the review. The findings of this study suggest that internal communication decreases as team members focus more on task execution. This shift from collaborative creativity to task-driven isolation was observed in practice but is not explicitly supported or contradicted by the literature discussed in the review. This difference might be explained by the unique corporate environments observed in the study, where the complexity of tasks and the need for specialized skills lead team members to work more independently during the later stages of the project.

In summary, corporate teams adapt their communication methods dynamically, shifting from informal, frequent interactions during the creative, idea generation phase to formal, structured communication during the implementation phase. Additionally, the focus of communication moves from internal collaboration to external coordination, while team members shift from collaborative creativity to individual task-driven efforts. These adaptive communication strategies help teams manage the different demands of idea generation and implementation, aligning their communication methods with the specific needs of each phase.

5.1.1 Main Research Question

With all the sub-questions now addressed, we can proceed to answer the main research question.

"How do communication methods influence team innovation within corporate project teams?"

The findings reveal that the communication methods used within corporate project teams shape how teams navigate both stages of innovation: idea generation and idea implementation. Understanding how these methods align with the needs of each phase is crucial for facilitating effective teamwork and coordination.

In the idea generation phase, teams rely on creativity, spontaneity, and dynamic exchanges to develop novel ideas. This phase tends to benefit from informal and synchronous communication methods, which allow team members to interact in real-time, fostering rapid feedback and the free flow of ideas. For example, brainstorming sessions, face-to-face meetings, and video calls encourage spontaneous idea sharing, enabling participants to build on each other's contributions immediately. These communication methods create an open and flexible environment that supports divergent thinking.

Once teams move into the idea implementation phase, the focus shifts toward execution, structure, and coordination. At this stage, formal and asynchronous communication methods become more prevalent, providing the necessary structure to ensure tasks are carried out with precision and clarity. Methods like emails, detailed reports, and project management tools facilitate tracking progress, assigning responsibilities, and keeping team members aligned with project objectives. These tools also support documentation, which is critical for maintaining clarity and accountability during implementation.

Each category of communication methods has its own set of barriers and facilitators that either help or hinder team performance. For instance, in the idea generation phase, informal communication facilitates creativity by allowing for unstructured, spontaneous exchanges. However, the absence of formal documentation in this context can become a barrier, as it may lead to miscommunication or lost ideas when transitioning to implementation. Similarly, synchronous communication (e.g., face-to-face meetings) fosters immediacy and collaboration, but scheduling conflicts and the difficulty of

coordinating real-time interactions can present logistical barriers, especially in virtual or dispersed teams.

In the implementation phase, formal communication methods offer clear structure and facilitators like accountability and clarity, but they can also introduce barriers, such as the rigidity of formal protocols that stifle creativity. Likewise, asynchronous methods (e.g., emails) offer the flexibility needed for task execution, especially in high-virtuality environments, but they may also cause delays in feedback, slowing down the decision-making process.

The effectiveness of moving through both stages of innovation depends on adapting communication methods based on the unique needs of each phase. During idea generation, facilitators such as spontaneity and immediacy should be prioritized, while barriers like miscommunication or lack of documentation should be minimized. Conversely, during the idea implementation stage, teams must focus on communication methods that ensure clarity and coordination, using formal, asynchronous methods that provide clear documentation and allow team members to work independently without disrupting the flow of the project.

The contingency theory emphasizes that the effectiveness of communication methods depends on their alignment with the project's current stage. The barriers and facilitators linked to each communication method are thus influenced by the specific demands of each phase of innovation. By strategically selecting communication methods based on these demands, teams can navigate the distinct needs of each stage more effectively.

The Level of Virtuality (LoV) adds an additional layer of complexity to this contingency-based approach. In high-virtuality settings, teams are more likely to rely on asynchronous methods due to the challenges of coordinating real-time communication across dispersed locations. However, these methods may introduce delays that hinder creativity during idea generation. In contrast, low-virtuality settings, where face-to-face interaction is more frequent, enhance real-time collaboration and spontaneity, making synchronous methods more effective for creative processes. This means that virtuality modulates the impact of communication methods, shaping how barriers and facilitator's function. Teams must consider their level of virtuality when choosing communication strategies, recognizing that the barriers and facilitators inherent to each method will be strengthened or weakened based on their LoV.

In conclusion, communication methods do not uniformly apply across all stages of innovation. They need to be thoughtfully selected and adjusted to suit the specific needs of each phase and the team's level of virtuality. During the idea generation phase, informal, synchronous communication methods can support creative and dynamic exchanges, while the implementation phase often benefits from formal, asynchronous methods that provide structure and clarity. By recognizing the barriers and facilitators associated with each communication method and understanding how they align with the project's stage and virtuality context, teams can make informed decisions to better manage their communication strategies throughout the innovation process.

In addition, incorporating insights from the findings and discussion has led to the development of a matrix that outlines which communication methods (CMs) are most effective, given the stage of innovation and the Level of Virtuality (LoV) (Figure 5-1). This matrix helps to understand how different communication methods should be adapted to align with the team's specific context, ensuring that teams can maximize creativity during the idea generation phase and maintain structure and coordination during the implementation phase. By using this matrix as a guide, teams can make more informed decisions on selecting communication methods that best support their innovation objectives in both virtual and face-to-face environments

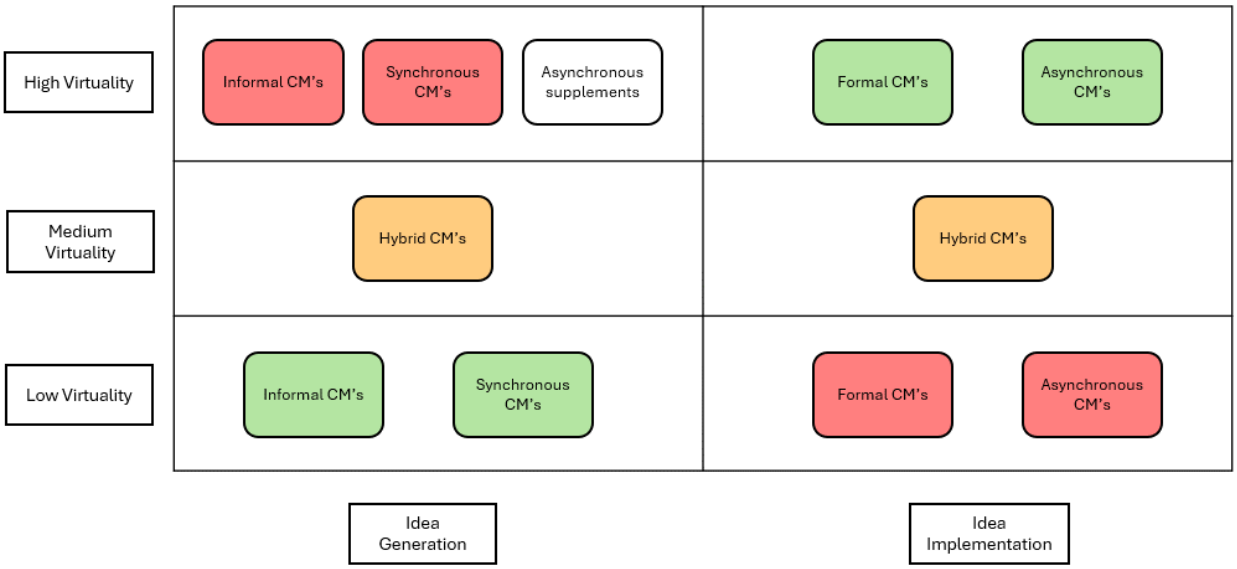

Figure 5-1: Matrix presentation of effectiveness of CM's for each Innovation stage and LoV

When examining the stages of innovation, a clear trend emerges: during the idea generation phase, there is a preference for informal and synchronous communication methods (CMs), while the idea implementation phase leans towards formal and asynchronous CMs. It is important to note that the presence of one type of CM in a specific stage does not mean the exclusion of others. A degree of balance is always necessary to ensure the smooth running of a project. In practice, teams use a mix of communication methods to adapt to the evolving needs of their projects. The Level of Virtuality (LoV) further influences the effectiveness and usability of these CMs, as indicated by the color codes in the matrix: green signifies beneficial, red indicates non-beneficial, and orange suggests both positive and negative potential. The specific scenarios are explained as follows:

Low LoV in the Idea Generation Phase: The matrix shows that the CMs used here are particularly beneficial (green). This is because teams with a low LoV mainly work face-to-face (f2f), allowing them to naturally engage in informal and synchronous CMs, such as spontaneous discussions and real-time brainstorming sessions. The in-person environment fosters immediacy and dynamic interaction, which are crucial for generating creative ideas. Teams in low virtuality settings can quickly build on each other's contributions, promoting a free flow of ideas.

High LoV in the Idea Generation Phase: A contradiction arises when teams have a high LoV during idea generation (red). These teams often rely on virtual synchronous methods, such as video calls, which can provide real-time discussion but lack the immediacy and dynamism of face-to-face interactions. The latency and interruptions common in digital communication tools can hinder the rapid generation of ideas and reduce the spontaneity essential to creative processes. For example, brainstorming sessions held over video calls may suffer from minor delays, limiting the vibrant, back-and-forth exchanges characteristic of in-person meetings.

Furthermore, teams with a high LoV are forced to use more asynchronous CMs as supplements, such as emails and collaborative documents, due to time zone differences and varying work schedules. While these methods provide flexibility, they are not beneficial in the idea generation phase because they slow down the iterative process, introduce communication lag, and reduce the immediacy needed for spontaneous brainstorming.

Medium LoV in Both Phases of Innovation: At a medium LoV, teams employ hybrid CMs, combining both in-person and virtual communication. In the idea generation phase, this can include synchronous & informal methods, like hybrid brainstorming sessions, and in the implementation phase, asynchronous

& formal methods, such as shared documents and project management tools. This level of virtuality has the potential to leverage the strengths of both virtual and face-to-face communication by allowing teams to switch between modes as needed. However, this flexibility comes with the risk of communication overload. The blend of f2f and online interactions can lead to an excessive flow of information across multiple channels, making it difficult for team members to prioritize messages and respond effectively. This ambiguity, where hybrid CMs can be both advantageous and potentially overwhelming, is reflected by the orange color in the matrix.

Low LoV in the Implementation Phase: In this phase, a low LoV is marked as non-beneficial (red) in the matrix. Teams working primarily f2f often prefer informal CMs, such as impromptu discussions. However, the implementation phase requires a greater emphasis on formal communication methods to ensure precision, structure, and accountability. Without formal documentation and structured updates, teams may face challenges in tracking progress, assigning responsibilities, and maintaining a clear project direction, all of which are critical during this phase.

High LoV in the Implementation Phase: Here, the matrix indicates a beneficial situation (green). Teams with a high LoV naturally rely more on asynchronous and formal CMs, such as emails, reports, and project management software. These tools provide the structure needed to manage tasks efficiently, especially when team members are geographically dispersed. The ability to document decisions, track progress, and assign responsibilities through asynchronous methods aligns well with the demands of the implementation phase, ensuring that tasks are completed with clarity and accountability.

5.2 Implications for Practice

The findings of this study provide actionable insights for different stakeholders within and around corporate project teams aiming to enhance innovation through effective communication strategies.

Individual team members play a key role in adapting communication methods based on the team's stage in the innovation process. During the Idea Generation phase, it's crucial for team members to actively engage in informal and synchronous methods, such as brainstorming sessions, video calls, or impromptu discussions. These methods foster creativity by allowing real-time idea sharing and dynamic exchanges. However, in the Implementation phase, members should shift to formal and structured communication methods like detailed reports, project management tools, and emails to ensure clear documentation, coordination, and accountability. By understanding when and how to transition between these communication methods, team members can collaborate more effectively and reduce miscommunication.

Project managers should take an active role in selecting and facilitating communication methods that align with the innovation process. During the Idea Generation stage, managers should actively schedule real-time brainstorming sessions using platforms like Microsoft Teams or Zoom and encourage informal face-to-face meetings to drive creativity. As the team moves into the Implementation phase, managers should introduce structured communication tools such as project management software (e.g., Trello or Asana) and documented meeting notes to ensure clarity and accountability. Additionally, managers need to consider the Level of Virtuality (LoV) within their teams. In high virtuality environments, where face-to-face interaction is limited, managers should prioritize synchronous tools such as video conferencing and collaborative platforms to maintain immediacy and reduce misinterpretation. Conversely, in low virtuality settings with more frequent in-person interactions, managers should leverage face-to-face meetings for spontaneous discussion while integrating asynchronous tools (e.g., shared documents or emails) for documentation and coordination, particularly in the implementation phase. By taking LoV into account, managers can better tailor communication strategies to suit the specific needs of their teams and the project's phase.

An ideal approach would be for project teams to adapt their LoV according to the different innovation stages. During the Idea Generation phase, teams would benefit from a low level of virtuality, promoting rich face-to-face interactions and real-time collaboration. As the project transitions between stages, adopting a hybrid LoV would provide the flexibility to balance the spontaneity of in-person meetings with the structure of online coordination tools. Finally, during the Implementation stage, a high LoV would be most beneficial, allowing team members to work independently while relying on asynchronous and formal communication methods like emails, reports, and project management software. Although changing the LoV dynamically may not always be feasible, understanding this ideal scenario can guide teams in adjusting their communication strategies to best align with their current situation.

Executives and senior leaders should acknowledge that communication methods must be tailored to both the stage of innovation and the team's virtuality level. Leaders should invest in digital infrastructure and communication tools that enable teams to seamlessly shift between synchronous and asynchronous methods. For instance, during ideation, they should provide access to informal tools like virtual whiteboards for brainstorming, while the implementation phase should focus on project management software that supports task tracking and formal documentation. Furthermore, executives should cultivate a culture of flexibility by allowing teams to experiment with various communication methods. Offering training sessions on effective use of these tools ensures that team members are equipped to choose the best method for each situation.

5.3 Limitations of the Study

While the study provides valuable insights into the effectiveness of different communication methods in project teams, several limitations should be acknowledged.

The study's sample size was relatively small, comprising only eight interviews conducted across three project teams. Although this provided in-depth insights into specific team dynamics and communication strategies, the findings may not be easily generalizable to a broader range of industries or corporate environments. Future research should aim to include a larger and more diverse sample of teams, ideally from various sectors, to test the robustness of these findings and assess whether the communication strategies identified are applicable in different organizational contexts.

Furthermore, the study relied primarily on qualitative methods, specifically interviews, which means the data was based on participants' subjective perceptions of communication effectiveness. While this approach yielded valuable insights into team dynamics and communication challenges, it is susceptible to bias or incomplete recollection by participants. Additionally, it is important to note that this study did not measure the direct impact of communication methods on team innovation performance; instead, it focused on how communication methods varied across different stages of idea generation, implementation, and levels of virtuality. To gain a more comprehensive understanding of how CMs might influence innovation outcomes, future research could adopt a mixed-methods approach. This could include quantitative data collection methods such as surveys or communication metrics, which would complement the qualitative insights and offer a more objective assessment of the potential relationship between different communication methods and team innovation performance.

Additionally, during this study, the Level of Virtuality (LoV) of project teams was treated as a given, influenced primarily by the team's working environment and organizational context. However, the hypothetical ideal situation outlined in the recommendations suggests that teams could adapt their LoV to align with the needs of different innovation stages. Future studies could explore LoV as a variable, investigating how consciously "choosing" an appropriate level of virtuality might contribute to more effective communication strategies depending on whether the team is in the idea generation or implementation phase. This approach could provide deeper insights into how flexible virtuality settings impact team communication and innovation.

Finally, although this study examined the Level of Virtuality (LoV) as a key factor in communication, there are other significant contingencies that were not fully explored. Factors such as organizational structure, whether hierarchical or flat, and the level of cross-functionality within teams, where diverse departments bring different communication styles, could significantly influence how communication methods are applied. These factors represent important avenues for future exploration to broaden the understanding of how communication strategies function in different organizational settings.

By addressing these limitations, future research can develop a more comprehensive and generalizable understanding of how communication methods affect team innovation in corporate environments.

6 Conclusion

This research explored how communication methods influence the innovation process within corporate project teams, focusing on the stages of idea generation and implementation. The findings suggest that communication methods support teams differently across various stages of the innovation process, with their effectiveness depending on the specific stage of innovation and the team's level of virtuality.

During the idea generation stage, informal and synchronous communication methods, such as brainstorming sessions and impromptu discussions, are beneficial for fostering creativity and spontaneity. These methods allow for the rapid exchange of ideas and immediate feedback, creating a dynamic and open environment where novel ideas can flourish. However, certain barriers, such as the lack of documentation and potential miscommunication from informal methods, can pose challenges as ideas are further developed.

In contrast, the implementation stage requires more structured, formal, and asynchronous communication methods. These methods, such as reports, emails, and collaborative documents, help ensure that team members remain coordinated, accountable, and clear on project objectives. The barriers during this stage, like communication lag in asynchronous methods or misinterpretation in formal communication, must be managed carefully to maintain smooth project execution.

The research also highlights that barriers and facilitators are linked to specific communication methods. For example, asynchronous methods may introduce flexibility but also create delays, whereas synchronous methods enhance immediacy but may be difficult to coordinate in global teams. Navigating both innovation stages may involve selecting communication methods that maximize facilitators (such as flexibility in asynchronous methods or immediacy in synchronous methods) and minimize barriers (such as communication lag or misinterpretation).

Contingency theory suggests that the appropriateness of communication methods depends on the innovation stage and Level of Virtuality (LoV), rather than having a universally effective approach. As innovation progresses from idea generation to implementation, the communication strategies must evolve, with the barriers and facilitators associated with each method shifting in relevance.

LoV also plays a crucial role as a contingency, shaping how communication methods function. In highly virtual environments, teams rely more on asynchronous methods due to geographical dispersion, but these methods can hinder spontaneity and idea generation. Conversely, teams with low virtuality, who interact more frequently face-to-face, can leverage synchronous methods to enhance real-time collaboration. Therefore, virtuality modulates how barriers and facilitators function, and teams must carefully select communication strategies that align with their level of virtuality.

In conclusion, communication methods are not universally effective across all innovation stages. Rather, teams must adapt their communication strategies based on the specific needs of each stage and the level of virtuality within their environment. Understanding the barriers and facilitators inherent to each method and how they align with the innovation process allows teams to optimize their communication strategies and drive better innovation outcomes.

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Appendices

Appendix A

Interview guide

Interview Guide for Team Leaders

Interview Questions	Research Questions	Expectations (Literature)	Backup/Follow-up Questions	Reasoning
Opening Questions (10 min)				
1. Can you describe your role within your team and your experience with a innovative project?				To set the stage with the help of a specific project done by the interviewee. Future questions will be mirrored against this case project
2. How do you reflect on the given explanation of innovation and the way of measuring it?			How do you personally define a successful innovative project?	To align the definition of team innovation between interviewer and interviewee.
Team Innovation & Communication Methods (10 min)				
3. Can you describe the typical communication methods your team uses?	SQ2: What specific communication methods do corporate project teams employ to run their projects?	Formal methods like meetings and reports; informal methods like calls and chats; synchronous (real-time) and asynchronous (delayed) methods	How do these methods vary across different project stages?	To identify the communication methods used by the team and how they change over time.

Interview Questions	Research Questions	Expectations (Literature)	Backup/Follow-up Questions	Reasoning
		(Albuali, 2021; Pinto & Pinto, 1990)		
4. How does your team generate new ideas? Can you provide examples of communication methods used during this process?	SQ1: What are the primary elements and stages of innovation within corporate project teams?	Idea generation often requires open, informal communication to foster creativity (Anderson et al., 2014; Hülsheger et al., 2009)		To understand the role of communication in the idea generation process.
5. Can you describe how your team implements new ideas? What communication methods are critical during this stage?	SQ1	Idea implementation requires structured communication, clear protocols, and effective coordination (Thayer et al., 2018)		To understand the role of communication in the idea implementation process.
Barriers and Facilitators (10 min)				
6. What are the main barriers your team faces in communication, and how do these affect your team's ability to innovate?	SQ3: What are the perceived barriers and facilitators to effective communication within corporate teams, and how do these factors impact innovation?	Barriers include communication overload, miscommunication, and lack of social presence; facilitators include supportive environment, clear protocols (Foster & Kirsch, 2015; Marlow et al., 2017)	If the interviewee doesn't mention a predicted barrier, try to steer it by asking if he also experienced one of the predicted barriers	To identify communication barriers and how they are addressed.

Interview Questions	Research Questions	Expectations (Literature)	Backup/Follow-up Questions	Reasoning
7. Can you provide examples of how specific communication methods have either helped or hindered your team's innovation efforts?	SQ3	Specific methods may either enhance clarity and speed or lead to misunderstandings and delays (Foster & Kirsch, 2015)	What strategies do you use to overcome communication barriers?	To understand the impact of communication methods on innovation.
Level of Virtuality (5 min)				
8. In your experience, how does the level of virtuality (e.g., face-to-face vs. virtual interactions) affect your team's communication?	SQ4: How does the level of virtuality influence the use of communication methods within corporate teams?	High virtuality can lead to communication challenges such as reduced non-verbal cues; low virtuality benefits from rich communication but may lack flexibility (Raghuram et al., 2018; De Jong et al., 2008)	Can you provide an example of a challenge faced due to virtual communication? How was it resolved?	To explore how different levels of virtuality impact communication.
Adaptation of Communication Methods (10 min)				
9. Can you describe how your team's communication methods evolve or adapt during different stages of innovation?	SQ5: How do corporate teams adapt their communication methods and strategies in response to the stage of innovation?	Early stages may require more brainstorming sessions, while later stages may need structured, formal communication (Thayer et al., 2018; Rietzschel, 2018)	Are there any specific tools or platforms that have been particularly helpful in different stages?	To understand how communication methods are adapted throughout a project.

Interview Questions	Research Questions	Expectations (Literature)	Backup/Follow-up Questions	Reasoning
10. How do you ensure that the communication methods used align with the innovation goals at each stage of innovation?	SQ5	Aligning communication methods with project goals can enhance effectiveness and innovation outcomes (Svensson et al., 2017)	How do you adjust communication strategies based on feedback from team members?	To explore alignment between communication methods and innovation goals.

Interview Guide for Team Members

Interview Questions	Research Questions	Expectations (Literature)	Backup/Follow-up Questions	Reasoning
Opening Questions (10 min)				
1. Can you describe your role within your team and your experience with a innovative project?				To set the stage with the help of a specific project done by the interviewee. Future questions will be mirrored against this case project
2. How do you reflect on the given explanation of innovation and the way of measuring it?			How do you personally define a successful innovative project?	To align the definition of team innovation between interviewer and interviewee.
Team Innovation & Communication Methods (10 min)				

Interview Questions	Research Questions	Expectations (Literature)	Backup/Follow-up Questions	Reasoning
3. What communication methods do you use most frequently in your daily work?	SQ2: What specific communication methods do corporate project teams employ to run their projects?	Emails, instant messaging, meetings, project management tools (Albuali, 2021; Pinto & Pinto, 1990)	How effective do you find these methods?	To identify the communication methods used by the team and their effectiveness.
4. How do you and your team members typically share new ideas?	SQ1: What are the primary elements and stages of innovation within corporate project teams?	Informal discussions, brainstorming sessions, collaborative tools (Anderson et al., 2014; Hülsheger et al., 2009)	Can you provide an example of a successful idea generation session?	To understand the role of communication in the idea generation process.
5. How do you and your team members typically implement new ideas?	SQ1	Idea implementation requires structured communication, clear protocols, and effective coordination (Thayer et al., 2018)		To understand the role of communication in the idea implementation process.
Barriers and Facilitators (10 min)				
6. What challenges do you face in communicating with your team, and how do these impact your ability to contribute to innovative projects?	SQ3: What are the perceived barriers and facilitators to effective communication within corporate teams, and how do these factors impact innovation?	Communication overload, lack of clarity, miscommunication (Foster & Kirsch, 2015; Marlow et al., 2017)	How does your team address these challenges?	To identify communication barriers and how they are addressed.

Interview Questions	Research Questions	Expectations (Literature)	Backup/Follow-up Questions	Reasoning
7. Can you provide examples of how specific communication methods have either helped or hindered your team's innovation efforts?	SQ3	Specific methods may either enhance clarity and speed or lead to misunderstandings and delays (Foster & Kirsch, 2015)	What strategies do you use to overcome communication barriers?	To understand the impact of communication methods on innovation.
Level of Virtuality (5 min)				
8. How does working virtually (e.g., remote work) impact your communication with team members?	SQ4: How does the level of virtuality influence the use of communication methods within corporate teams?	Challenges with virtual work include reduced non-verbal cues, communication delays (Raghuram et al., 2018; De Jong et al., 2008)	What tools or strategies have you found helpful for virtual communication?	To explore how different levels of virtuality impact communication.
Adaptation of Communication Methods (10 min)				
9. Can you describe any changes in communication methods that have helped your team during different innovation stages?	SQ5: How do corporate teams adapt their communication methods and strategies in response to the stage of innovation?	Adapting methods for brainstorming, planning, execution (Thayer et al., 2018; Rietzschel, 2018)	What specific tools or methods have been particularly effective?	To understand how communication methods are adapted throughout a project.
10. How do you ensure that the communication methods used align with the innovation	SQ5	Aligning communication methods with project goals can enhance	How do you adjust communication strategies based on feedback from team members?	To explore alignment between communication methods and innovation goals.

Interview Questions	Research Questions	Expectations (Literature)	Backup/Follow-up Questions	Reasoning
goals at each stage of innovation?		effectiveness and innovation outcomes (Svensson et al., 2017)		

Appendix B

Pre-Interview Overview:

Understanding Innovation and Communication Methods

Dear [Interviewee's Name],

Thank you for agreeing to participate in this interview. The purpose of our discussion is to understand how communication methods influence innovation within corporate project teams.

Reason for the Interview:
Your insights as a team leader/member are invaluable for this research. By using your intuitive judgment, we aim to capture a nuanced understanding of innovation in team settings. This interview will help us explore the practical aspects of communication and innovation in your team.

Key Concepts of Team Innovation:

- **Idea Generation**: This stage involves creating new and useful ideas in an open and supportive environment. We focus on how diverse perspectives and free thinking are encouraged within your team.
- **Idea Implementation**: This stage focuses on applying and executing these ideas through structured processes, clear communication, and effective coordination.

Measuring Team Innovation:
We believe that traditional metrics (e.g., number of patents) should be supplemented by the 'gut' sense of experienced team members. Your intuitive insights will help us understand the subtle dynamics of innovation.

Case Study Focus:
During the interview, we will refer to a specific project you have worked on or are currently involved in. This project will serve as a case study to mirror our questions and gain practical insights into your team's communication methods and innovation processes.

To provide a clear overview of the interview process, the following table outlines the main subjects to be discussed, along with the estimated time for each section.

Subject	Description	Estimated Time
Opening Questions	Discussing the interviewee's role, experience, and reflections on innovation and its measurement.	10 minutes
Team Innovation & Communication	Exploring typical communication methods, idea generation, and idea implementation processes.	10 minutes
Barriers and Facilitators	Identifying communication barriers and facilitators, and their impact on innovation.	10 minutes
Level of Virtuality	Discussing how virtuality affects team communication and examples of challenges faced and resolved.	5 minutes
Adaptation of Communication	Understanding how communication methods evolve during different stages of innovation.	10 minutes
		Total Time: 45 minutes

Your participation will provide valuable information that will contribute to a deeper understanding of how communication methods can enhance innovation within corporate teams.

Thank you for your time and cooperation.

Best regards,

Tim Petit

Appendix C: Code Book

Code Group	Category	Category Description	Quote examples from trancripts
Barriers	Communication lag	Delays in communication caused by asynchronous tools or time zone differences, which hinder real-time collaboration and decision-making.	Because then you think, yeah, I'll just go on like this here.... ...and then I'll talk to somebody again about it. But the further you walk down that road... ...the greater the barrier to return (9:83 ¶ 16 in Interview7 en)
	Coordination	Challenges in aligning tasks, schedules, and responsibilities among team members, especially in virtual or dispersed teams.	and that and for the rest then the problems you find with experiencing with communication is more that through lack of time or other priorities of the delusion of the day for example (6:52 ¶ 80 in Interview3 en)
	Lack of documentation	The absence or insufficient level of documentation, leading to gaps in communication, unclear task instructions, or loss of information over time.	Exactly. And then you can make it much more concrete. Look if you do it personally, it's not fixed, because in a week or two or three they'll have forgotten. Or they say, yes, you didn't say that like that or didn't mean that like that. Yes I think that in e-mail it is easier to capture that. And that will, look that could also be, for example, in a notule, a OneNote that you then share, so to speak. So via e-mail. (8:58 ¶ 119 in Interview5 en)
	Misinterpretation	Incorrect understanding of messages or instructions due to a lack of clarity or non-verbal cues, often a problem in virtual settings.	you also see that through mail communication we try to share and do a lot. But that often does not cover 100% of the information. Or does not give the right meaning to what you want to share. Yes. It can sometimes come across as critical via e-mail. As very rude and as a lout I hear responding. (7:65 ¶ 122 in Interview4 en)
	Mitigation	Strategies or actions taken to reduce or manage the negative impacts of identified barriers to effective communication or teamwork.	So in that sense, it does make it better to create a certain level of engagement by not just emailing, but using other means of communication such as physical personal contact or telephone. (8:56 ¶ 107 in Interview5 en)
	Overload	Excessive information or tasks that overwhelm team members, making it difficult to focus or maintain productivity, particularly in digital communication settings.	Of course, if you're sitting in such an open-plan office, it's always quite noisy and, yes, a lot of people come in with questions that have absolutely nothing to do with the project. (4:78 ¶ 190 in Interview1 en_

Code Group	Category	Category Description	Quote examples from trancripts
	Rigid nature	Inflexibility in processes or communication methods that stifles creativity, spontaneity, and adaptability, especially in fast-paced project environments.	Um Yes, it's not so what do you call it? It's not so personal. See if you use e-mails, for example, communication in e-mails, it's not personal (8:53 ¶ 101 in Interview5 en)
Communication methods	Asynchronous CM's	Communication methods that do not require participants to interact at the same time, such as email or collaborative documents, allowing flexibility but causing delays.	We do have a dashboard with all the, all the tasks and so on. (4:56 ¶ 22 in Interview1 en)
	Distance	The physical or geographical separation between team members that affects communication and coordination, often necessitating digital tools.	Yes distance. More formal More formal things. (10:75 ¶ 76 in Interview8 en)
	External CM's	Communication methods used to engage with external stakeholders, such as clients or partners, critical for managing expectations and aligning external objectives.	We have about um, every two three weeks we do have an um sitting together as well and um, we have also divided the project into small phases and so each phase also has a proof of concept and so then also the customer comes to, to the office and so then those, that piece of conversion comes there so also grasp. And and, and and take away and so on and so forth, so (4:68 ¶ 122 in Interview1 en)
	Formal CM's	Structured and documented forms of communication, such as reports or scheduled meetings, ensuring accountability and clarity but potentially limiting flexibility.	E-mail, OneNote and meetings. So we have I think every week a meeting that we sat together for to discuss the progress and kept in OneNote of course. And then of course you have the different data formats or document formats, like Word or Excel, for example. Or PowerPoint, and things like that. (8:40 ¶ 11 in Interview5 en)

Code Group	Category	Category Description	Quote examples from trancripts
	Informal CM's	Spontaneous and unstructured communication methods, such as casual conversations or impromptu discussions, that foster creativity and quick problem-solving.	we do by yes very short lines and also when we're on the case just preferably also just walk by (6:44 ¶ 18 in Interview3 en)
	Internal CM's	Communication methods used within the project team or organization to share information, coordinate tasks, and resolve issues.	Mutually we use Teams as... We have a Teams channel. Yeah is the files that are important. And we have an Azure DevOps page where the tasks are defined and the task board is on there. Yes perfect. Unless DSU is then our guide to just walk across the board then if certain things need to be created, we create a tasks on that. And that's basically the big canvas that everybody can look at. Yes. Yeah. (5:92 ¶ 127 in Interview2 en)
	Synchronous CM's	Real-time communication methods, such as video conferencing or live chats, enabling immediate feedback and discussion, crucial for dynamic team collaboration.	The face-to-face has the great advantage that you can switch quickly and also see what someone is thinking about it (10:87 ¶ 140 in Interview8 en)
Contextual factors	Organizational Influence	The effect of the broader organization's culture, structure, and policies on team communication methods and project innovation.	everything depends on size (6:53 ¶ 156 in Interview3 en)
	Project Management Approach	The strategies and methodologies (e.g., Agile, Waterfall) used to manage the project, influencing communication patterns and decision-making.	Yes the project that we do here, that there we use scrum. Only, the, the project team is only, yes, three and one intern. (4:55 ¶ 18 in Interview1 en)

Code Group	Category	Category Description	Quote examples from trancripts
	Team Structure and Configuration	How teams are organized, including roles, hierarchy, and cross-functionality, which affects how communication flows and tasks are managed.	Yes, of course that's the advantage of when you obviously have a smaller project team. You have your informal, you also walk to the gas station to get a sandwich or things like that. Yes, you do always have that with larger project teams Of course a lot less. (4:65 ¶ 86 in Interview1 en)
Facilitators	Accountability	Practices or communication methods ensuring team members are responsible for their tasks and deadlines, contributing to better project management.	Outlook is still a very good way of communicating to at least do assurance of information and of agreements, as in documents (7:74 ¶ 142 in Interview4 en)
	Flexibility	The ability to adapt communication methods or schedules to accommodate team members' varying needs, particularly important in hybrid or virtual teams.	we do by yes very short lines and also when we're on the case just preferably also just walk b7 (6:44 ¶ 18 in Interview3 en)
	Immediacy	The speed and directness with which communication is received and processed, crucial for decision-making and dynamic collaboration.	I also do think that even there, if you look at customer communication, that sitting together in real life does have an advantage for the idea-generation stage. (5:106 ¶ 219 in Interview2 en)
	Personal work enviroment	How individual team members' remote or physical workspace setup influences their productivity and communication within the team.	I think when you interact and talk to each other in real life, that gives you that sense of connection or commitment, also has a different form. It's also much warmer. It's also much easier to address certain responsibilities in real life. (5:98 ¶ 163 in Interview2 en)
LoV	Advantages of Virtual work	The benefits associated with virtual work environments, such as flexibility, efficiency in task management, and access to remote talent.	Yes I think it did become more difficult in some ways. Look the advantage of course is that you, and now you, you don't have to come to the office. So you… (4:82 ¶ 222 in Interview1 en)

Code Group	Category	Category Description	Quote examples from trancripts
	Challenges and Disadvantages of Virtual Work	The difficulties and obstacles posed by virtual work, including isolation, communication delays, and lack of non-verbal cues.	I think the disadvantage of brainstorming through Microsoft Teams is that you have to interrupt each other when you want to say something (7:63 ¶ 122 in Interview4 en)
	Hybrid work dynamics	The unique challenges and opportunities of working in a hybrid environment, where some team members are co-located and others work remotely.	For me it is very nice, because when I know I have something very concrete, which needs to be discussed very tightly. Then I know that I have to be physically present for a while at such a meeting. (7:77 ¶ 154 in Interview4 en)
	High level of remote work	The challenges, benefits, and communication strategies used when most or all team members work remotely.	we as a project team don't really work together as a project team either, so everyone really just works very much individually. We do need each other at certain times, but it's very dynamic. It's not like we sit in a room and work on one project. Pietje has seven projects Jantje has five projects that are in the start-up, that are in the completion phase, so it's very dynamic. So it is the way we do projects and going through it is not necessary that you really sit together as one team in one cubicle. (12:25 ¶ 250 in interview6 en)
	Microsoft Teams	The specific role and influence of Microsoft Teams as a collaboration tool in facilitating virtual communication and teamwork.	see it as a substitute or an extra dimension compared to emails or yes just phone calls, is it say, it can really be seen as a benefit that you have an additional way to make things clear (10:96 ¶ 204 in Interview8 en)
Team innovation	Communication Adaptation across Stages	How communication methods change and adapt as the project moves through different stages of innovation, such as idea generation and implementation.	.then certainly at that idea stage, say.... ...then I think the best method of communication is to just have a team that, say, sits together in a department. And what can just spar freely throughout the day (9:75 ¶ 12 in Interview7 en)
	Idea Generation stage	The phase in which new ideas are developed, often requiring more open and informal communication to foster creativity and innovation.	if you do go more in the creative direction, you have to make how we want that now and how people want to have people around the table. (7:73 ¶ 142 in Interview4 en)

Code Group	Category	Category Description	Quote examples from trancripts
	Idea Implentation stage	The phase where innovative ideas are executed and operationalized, often requiring more structured and formal communication methods.	And with the idea implementation, you do see much more that you go.... Goes diving towards actually capturing info, so still towards emails and towards documents. (7:82 ¶ 162 in Interview4 en)
	Stages of Innovation	The overall process of innovation, including the transition from idea generation to idea implementation, and how communication strategies evolve across these stages.	Stages, so to speak. Okay Right now, yes, what can I say about that? I feel that when I work online, for example, that those stages do get separated more clearly than when we're sitting together. (5:72 ¶ 59 in Interview2 en)

Appendix D

Informed Consent interview

You are being invited to participate in a research study titled 'Unlocking Innovation: Exploring Communication Methods in Cross-Functional Corporate Project Teams' . This study is being done by Tim Petit from the TU Delft.

The purpose of this research study is to understand the influence of communication methods on the innovation within a project team, and will take you approximately *60* minutes to complete. The data will be used for the following;

- Data analysis
- Master Thesis Report

We will be asking you to provide answers to questions regarding your experience with communication methods within project teams.

As with any online activity the risk of a breach is always possible. To the best of our ability your answers in this study will remain confidential. We will minimize any risks by Secure data storage (TU Delft institutional storage, accessible only to the TU Delft research team)

Tim Petit

Your participation in this study is entirely voluntary and you can withdraw at any time. You are free to omit any questions.

PLEASE TICK THE APPROPRIATE BOXES	Yes	No
A: GENERAL AGREEMENT – RESEARCH GOALS, PARTICPANT TASKS AND VOLUNTARY PARTICIPATION		
1. I have read and understood the study information above, or it has been read to me. I have been able to ask questions about the study and my questions have been answered to my satisfaction.	☐	☐
2. I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason.	☐	☐
3. I understand that taking part in the study involves: Audio-recorded interview, transcribed interview text.	☐	☐
4. I understand that the study will end on the 17th of October 2024		
B: POTENTIAL RISKS OF PARTICIPATING (INCLUDING DATA PROTECTION)		
5. I understand that taking part in the study involves collecting your name, contact information and job description with the potential risk of my identity being revealed	☐	☐
6. I understand that the following steps will be taken to minimise the threat of a data breach, and protect my identity in the event of such a breach; • Secure data storage (TU Delft institutional storage, accessible only to the TU Delft research team)	☐	☐
7. I understand that personal information collected about me that can identify me, such as my name and Email, will not be shared beyond the study team.	☐	☐
8. I understand that the (identifiable) personal data I provide will be destroyed at the latest, 1 month after the completion of the thesis	☐	☐
C: RESEARCH PUBLICATION, DISSEMINATION AND APPLICATION		
9. I understand that after the research study the insights I provide will be used for a Master thesis Report, which will be made publicly available. I understand that I will be anonymous in the thesis	☐	☐
10. I agree that my responses, views or other input can be quoted anonymously in research outputs	☐	☐

Signature

_____	_____	
Name of participant [printed]	Signature	Date

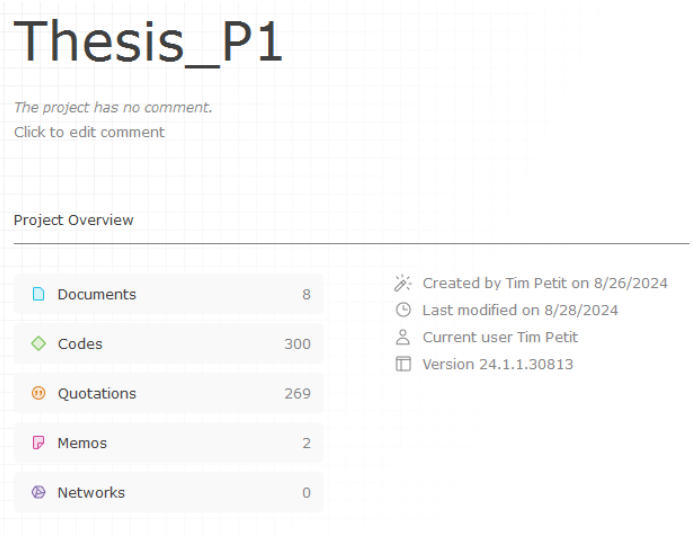
Study contact details for further information:
Tim Petit

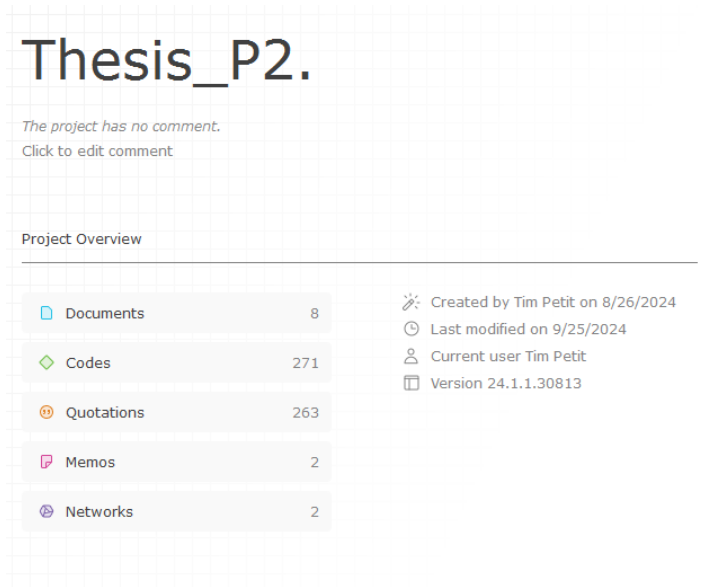
Appendix E: Visualization of coding & analysis process

This appendix gives an insight on how the coding and data analysis process has been executed in Atlas.ti. First, an overview of the project characteristics is given. Secondly, The coding process is shown and lastly, both data analysis approaches are shown.

Project Overview

An overview of the characteristics of both coding phasis can be seen here, such as the amount of interview transcripts (Documents), the number of codes created, and quotations linked to those codes.



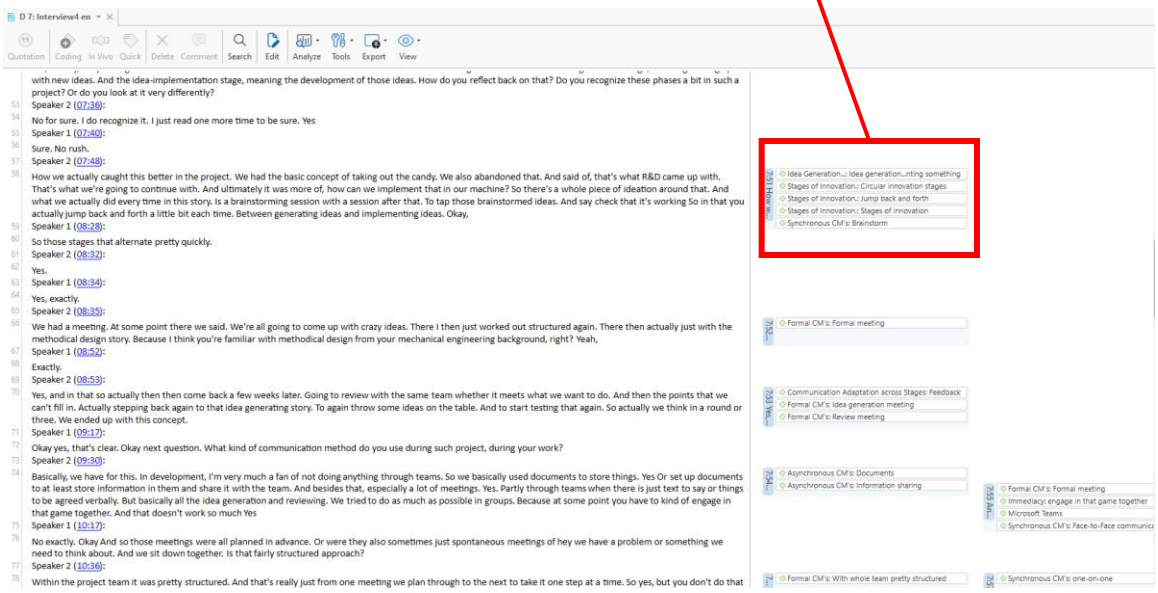


Coding process

1st coding phase:

Interview transcripts were reviewed both line-by-line and transcript-by-transcript, which resulted in the creation of an initial set of 300 codes.

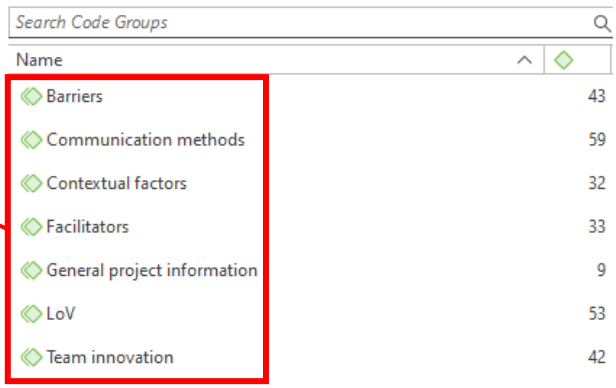
Created codes



2nd coding phase:

the initial set of 300 codes was refined and organized into broader code groups. During this process, similar codes were merged, and redundant or irrelevant codes were deleted, resulting in a final set of 271 codes.

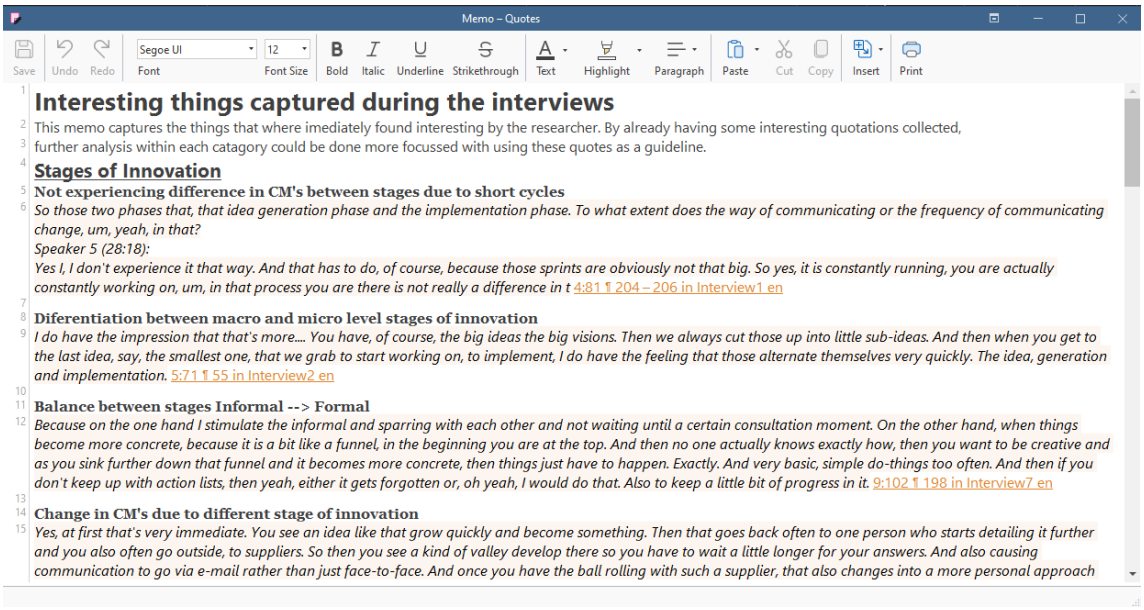
Created Code Groups



Data Analysis (Theme-based)

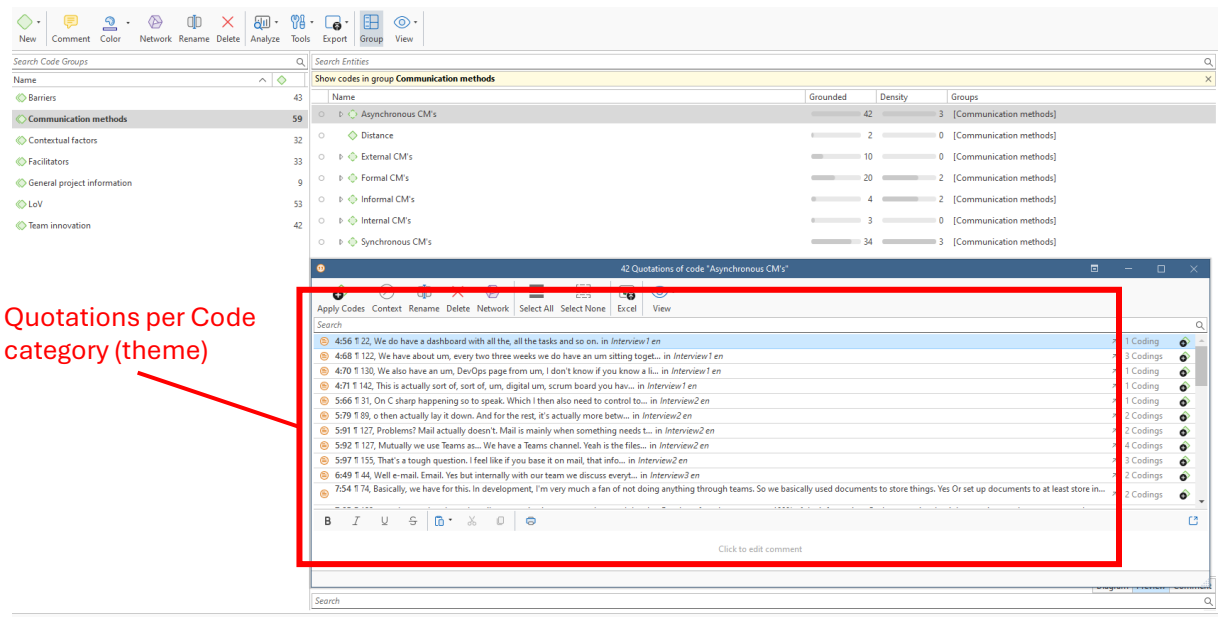
Memos

noteworthy observations and compiled relevant quotations were captured during the interviews and coding process. These observations were the starting point of the further thematic analysis



Theme analysis

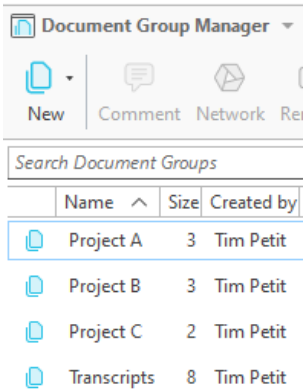
With the help of interesting observations from the created Memo, corresponding coded quotations were observed to create an clear narrative to present in the findings.



Data Analysis (cross-case)

Document groups

By creating different documents groups, the different project groups could be analyzed compared to each other.



Code-document Group analysis

A code-document group analysis was used as a starting point to identify interesting differences or similarities between the project groups.

	Project A	Project B	Project C	Totals
Organizational Influence	22.22%	11.11%	66.67%	100.00%
Project Management Approach	57.14%	21.43%	21.43%	100.00%
Team Structure and Configuration	14.29%	57.14%	28.57%	100.00%