Investigating the role of Socialization in Project Learning

What is the context for Project-Based Organizations?

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What is the context for Project-Based Organizations?

by

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Preface

Studying in such a prestigious institution such as TU Delft, had been my dream ever since I was a bachelor student back home in Greece. This thesis serves as the culmination of my efforts during this master program. At the same time, my time as a student is finally up, as I start thinking about my future. During my 2 years in the Netherlands I was lucky enough to broaden my horizons, meeting people and students from all over the world.

I first would like to thank my graduation committee, Dr. Ad Straub and Dr. Ir. Erik-Jan Houwing, and Ir. J. P. G. Ramler (Hans) Ramler. Writing a thesis is not an easy process, and I truly appreciate your support in navigating the topic of this thesis, as well as other critical considerations. Your comments and expertise helped me understand how to formulate a scientific problem, and to consider possible solutions.

I would also like to thank once again my friends and fellow students. The discussions I had with them was worth more than any lessons learned session, as it offered to me the different perspectives that may manifest. I see myself maturing further, and moving forward with all the required tools to start effectively in the job market.

My best memory from the Master program, is when we had a group project on innovation and entrepreneurial thinking. It allowed me to think out of the box, whilst keeping it as a fun project, full of uncertainty and curiosity. Our group was a truly international one, and it showed that international collaboration is possible.

Finally, I want to thank my parents, Stelios and Giovanna. They are my guiding lights and I always try to uphold the ideals that they instilled in me. Having mixed roots, from Greece and Italy, while speaking both languages, helped me embrace the international mindset throughout my life.

Now, as this period comes to a close, I reflect with pride at what has been a challenging but fun journey. I am looking forward to whatever comes next.

Vasileios Pentheroudakis
Delft, October 2025

Summary

This thesis investigates the role of socialization in project learning within Project-based Organizations (PBOs) operating in the construction sector. Construction projects are inherently complex, involving diverse teams, high uncertainty, and strict time and cost constraints. These conditions often lead to knowledge fragmentation, where valuable lessons are lost between projects and organizations "reinvent the wheel." To address this persistent problem, the study explores how tacit knowledge is transferred among practitioners and how socialization, as a people-based process, complements codification, the technology-based mode of knowledge transfer. By focusing on socialization, this research contributes to a deeper understanding of the human dimension of project learning, which remains underexplored compared to formalized knowledge management systems.

The research adopts a qualitative design based on semi-structured interviews with professionals from Greece, Italy, and Iran, offering perspectives across different organizational and cultural contexts. In total, eight interviews were conducted with practitioners from varied roles within construction-related PBOs, capturing a broad range of experiences in knowledge sharing and collaboration. The data was analyzed using the Gioia methodology, which allowed for systematic coding of interview transcripts. This process generated 261 initial codes, distilled into 32 first-order concepts, six second-order themes, and two aggregate dimensions, providing a structured foundation for interpreting how socialization functions in practice.

The empirical findings reveal that knowledge transfer in construction PBOs occurs through both formalized and informal mechanisms. Formalized knowledge exchange includes scheduled meetings, project kick-off sessions, ISO-driven corrective action processes, and lessons learned reviews. Informal socialization, on the other hand, takes place in everyday interactions such as coffee breaks, shared meals, team-building activities, or retirement gatherings. These informal spaces foster trust, strengthen relational ties, and create opportunities for spontaneous exchange of tacit knowledge. In addition, mentored experiential learning emerged as a central practice, where junior staff shadow more experienced colleagues and acquire knowledge through on-the-job guidance. Finally, the findings confirm that personal communication modalities, particularly face-to-face conversations and sketches during site discussions, remain the most effective channels for transferring complex and context-specific knowledge.

Despite these positive practices, several barriers were identified. Organizational silos and hierarchical structures restrict communication across departments and levels, leading to knowledge hoarding and limiting opportunities for lateral exchange. Cultural differences and expertise-based communities of practice can reinforce boundaries, making it difficult to share knowledge beyond immediate teams. These barriers are compounded by time pressure, which often prioritizes delivery over reflection. Nevertheless, the findings highlight that trust and relational enablers, such as openness, psychological safety, and mutual respect, are critical conditions for overcoming such obstacles and making socialization effective.

The discussion situates these findings within the broader literature on project learning and knowledge management. It emphasizes that socialization is not only a method of transferring tacit knowledge but also a foundation for creating shared understanding, strengthening team cohesion, and fostering innovation. At the same time, it shows that mentorships and lessons learned processes often remain underdeveloped, reducing their potential to generate deeper forms of learning. Bridging these barriers requires creating stronger cross-departmental networks, reframing mentorship as a dialogic and reflective practice, and institutionalizing knowledge-sharing processes that extend beyond single projects.

Overall, the study demonstrates that while codification remains an important part of organizational knowledge management, it is insufficient on its own. Socialization is indispensable for the transfer of

tacit knowledge, especially in construction projects where much of the expertise is embedded in people's experiences and practices. By enhancing socialization practices, through trust-building, inclusive communication, and integrative organizational structures, PBOs can strengthen project learning, reduce fragmentation, and improve knowledge integration across projects. This, in turn, can contribute to more efficient project delivery, reduced cost overruns, and sustainable organizational growth.

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Nomenclature

Abbreviation	Definition
CoP	Community of Practice
HR	Human Resources
ICT	Information and Communication Technology
ISO	International Organization for Standardization
KM	Knowledge Management
KPI	Key Performance Indicator
KT	Knowledge Transfer
LL	Lessons Learned
LM	Learning Mechanisms
OC	Organizational Culture
OL	Organizational Learning
PBO	Project-Based Organization
PL	Project Learning
PMBOK	Project Management Body of Knowledge
RFI	Request for Information
SECI	Socialization, Externalization, Combination, Internalization (framework)

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Introduction

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1.1. Background

The construction sector holds significant importance for most countries worldwide. According to Hasan et al. (2018), the construction industry corresponds to no more than 9% and no less than 6% of the Gross Domestic Product worldwide while also displaying significant growth in some cases (Karousos & Vlamis, 2008).

However, construction projects are also inherently complex, a condition that introduces uncertainties and unknown factors (Aljohani et al., 2017; Jarkas, 2017). Organizational complexity, in particular, has been identified as a key dimension of this challenge, involving "a lack of efficiency in information generation, transmittals, and feedback required along the course of the construction process" (Jarkas, 2017). This complexity, coupled with a lack of perfect management, often leads to significant problems. Indeed, the vast majority of projects face severe delays (time-related problems) and cost overruns (cost-related problems) (Hasan et al., 2018).

These complex projects are most often undertaken by entities known as **Project-based Organizations (PBOs)**, which have the sole purpose of undertaking and completing construction projects. Given this peculiar requirement, PBOs are forced to "cycle from project to project" (Miterev et al., 2017), as projects are their only means for financial remuneration. This dynamic business model means that PBOs observe that their project teams disband and are generally dynamically structured from one project to the next.

As a result, the construction sector suffers from issues related to "fragmentation" (Alashwal, 2015; Riazi et al., 2020), and the same is valid for the knowledge produced in project settings (Bresnen et al., 2003). Consequently, PBOs often tend to "reinvent the wheel" (Newell, 2004), without exploring past projects and solutions and applying them to future problems. In order for PBOs to be more successful, they have to develop better capabilities (Green et al., 2008). A key component in developing such capabilities lies in the knowledge that can be obtained in project settings, so that it can be utilized (exploited) in future scenarios. This knowledge could also be perceived as an important asset, with the main challenge being how to collect it properly. The process of collecting knowledge in order to improve the organization's actions is also known as learning (Yap et al., 2018).

The lack of experience and appropriate knowledge on the contractor's side has been identified as a primary reason for cost overruns and project failure (Aljohani et al., 2017). Therefore, attention can be shifted towards the flow and transfer of this knowledge in PBOs. There are two main modes of knowledge transfer in PBOs: the people-based approach (socialization) and the technology-based approach (codification). While codification has become a standardized and well-documented process, research suggests that "knowledge is still people-based" (Moczydłowska & Sadkowska, 2021), highlighting the continued importance of socialization. This indicates that while the technological approach to knowledge management is vital, a deeper understanding of the informal, human-centric process is necessary to address the root causes of fragmentation and inefficiency.
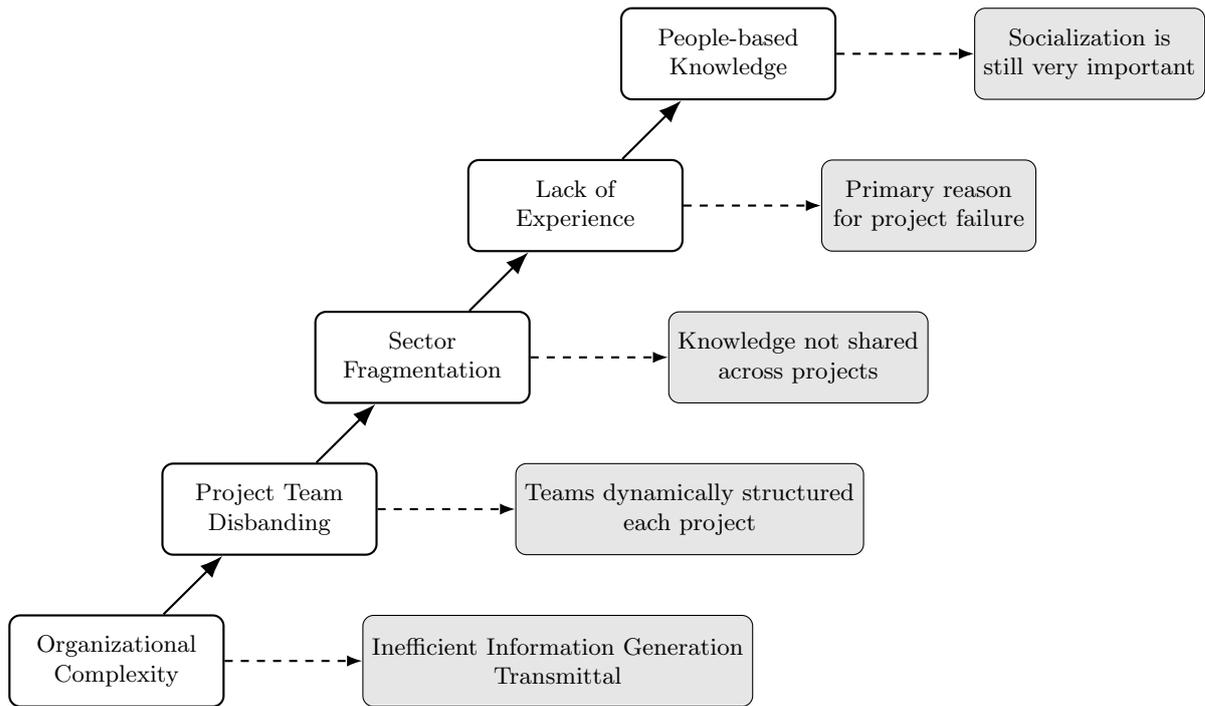
Figure 1.1: Construction Project Challenges

1.2. Problem Statement

The financial and scheduling challenges faced by Project-based Organizations (PBOs) are often a symptom of more fundamental issues related to knowledge management. In construction-sector PBOs, these issues are amplified by knowledge fragmentation (Alashwal, 2015; Riazi et al., 2020) and the frequent need to redesign solutions without reference to lessons from previous projects (Jugdev, 2012; Shokri-Ghasabeh & Chileshe, 2014). While formalized knowledge transfer through codification has been widely studied (Cacciatori et al., 2012; Cohendet & Meyer-Krahmer, 2001; Hall, 2006), the people-based approach of socialization remains underexplored and difficult to measure. The lack of understanding of how socialization contributes to knowledge sharing limits our ability to enhance learning within PBOs. Therefore, this study investigates the role of socialization in construction-sector PBOs, asking: **To what extent is socialization employed as a knowledge transfer method in Project-based organizations active in the construction sector?**
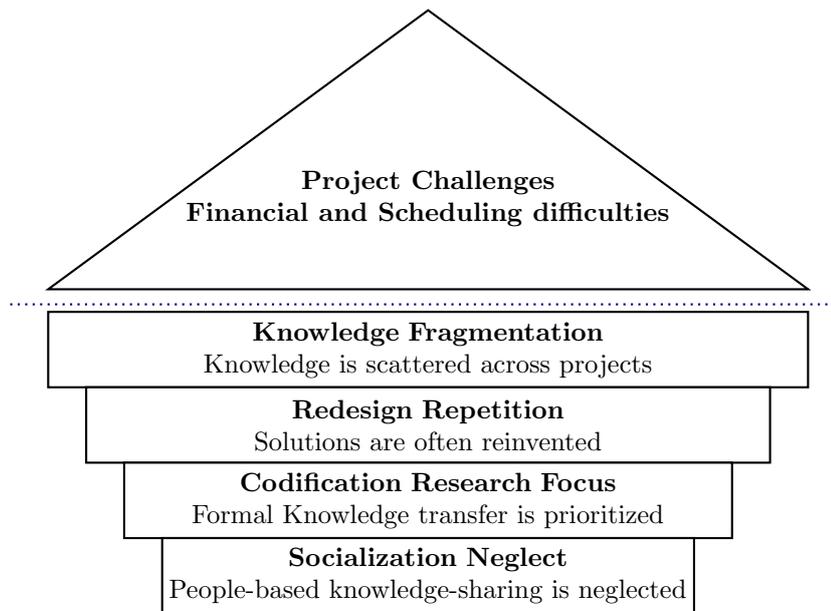
Figure 1.2: Problem "Iceberg"

1.3. Research Objective

The objective of this research is to explore the underlying context in Project-based Organizations, with regard to the transfer of knowledge. This study investigates the role of socialization as a knowledge transfer mechanism, as well as its usage rate in PBOs. Additionally, it also provides some empirical insights as far as the existing barriers in the process of socialization are concerned.

1.4. Research Question

To address the research gap, we need to explore the following main research question along with its corresponding sub-questions (see Figure 1.3):
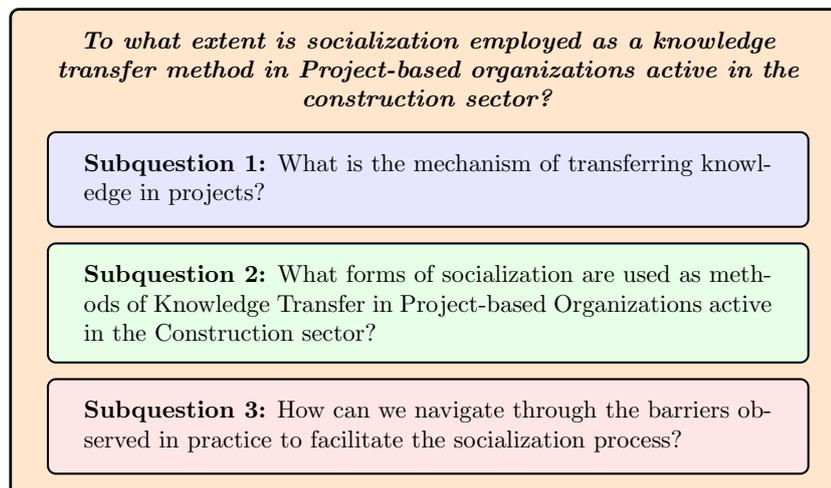
Figure 1.3: Research Question and Sub-questions

SQ1: **What is the mechanism of transferring knowledge in projects?**, attempts to describe the knowledge transfer mechanisms that are recorded in the construction industry. In order to explore this question, the mechanisms that generate knowledge via learning are also explored.

SQ2: **What forms of socialization are used as methods of Knowledge Transfer in Project-based Organizations active in the Construction sector?**, attempts to find out the manner under which socialization is used in PBOs. Additionally, the motivation behind such interactions is explored.

SQ3: **How can we navigate through the barriers ob- served in practice to facilitate the socialization process?**, attempts to analyze the most prominent barriers that are encountered within the socialization process. The end goal is to control and propose how to faciliatate the process of socialization despite having such barriers.

1.5. Thesis Outline

The thesis is planned to consist of six chapters, while the link between its outline and the research questions can be seen in figure 1.4.

Chapter 1: Introduction acts as a means to set the scene and the motivation for this research. **Chapter 2: Theoretical Framework** includes an overview of the theoretical foundations for this research, with them being the definition of knowledge transfer and learning. **Chapter 3: Research Methodology** will present the methodology that was followed in order to formulate this research and led to the findings. **Chapter 4: Empirical Research** will include the details of the research and semi-structured interviews that will be conducted with the professionals and practitioners who are eligible for the research itself. **Chapter 5: Discussion** will provide a critical insight into the research conducted and also present the limitations of the research. **Chapter 6: Conclusion** will answer the research questions and concisely present the main findings.

Chapter 1: Introduction	→	Research Proposal
Chapter 2: Theoretical Framework	→	What is the mechanism of transferring knowledge in projects?
Chapter 3: Research Methodology		
Chapter 4: Empirical Findings	→	What forms of socialization are used as methods of Knowledge Transfer in Project-based Organizations active in the Construction sector?
Chapter 5: Discussion	→	How can we navigate through the barriers ob- served in practice to facilitate the socialization process?
Chapter 6: Conclusion	→	Answer the Main Research Question and Subquestions.

Figure 1.4: Thesis Outline and Research Questions

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Theoretical Background

This chapter outlines the theoretical concepts and frameworks that inform the analysis presented in the subsequent empirical sections. It introduces the key ideas relevant to the study, including the structure and functioning of project-based organizations, the principles of knowledge management, and the processes of organizational and project learning. Particular attention is given to the distinction between tacit and explicit knowledge, mechanisms of knowledge transfer, and the role of social interaction in shaping these processes. The chapter concludes by presenting the theoretical and conceptual frameworks developed to examine how socialization influences knowledge practices in project environments.

2.1. Knowledge as an added value

Knowledge has been on the way to becoming a crucial asset, particularly for project-based organizations (Pathirage et al., 2007), as it involves the performance of the organization. In other words, the strategic value of knowledge has increased over the years. Knowledge acquired through project work could become part of a broader feedback mechanism. This mechanism could help organizations, as it could lead to the following of a more informed approach, estimation, and forecasting (Castro Miranda et al., 2022; Salling & Leleur, 2015). When the value of knowledge is realized, the next logical step is to explore how to create it.

Knowledge itself cannot emerge from nothing. It is the product of a trial-and-error mechanism known as learning. In a project environment, learning could lead to a more optimized utilization of resources. As Newell and Edelman (2008) put it: "Organizations often reinvent the wheel," leading to the need for further research in this field. Particularly in sectors other than construction, such as the commercial, governmental, and military sectors, learning capabilities and the capture of lessons learned are perceived as strategic (Patrick SW & Jimmy CH, 2006). In contrast, in the construction sector and in project-based organizations (PBOs) active in the field, little to no recording of best practices and other lessons is consistently observed (Paranagamage et al., 2012; Patrick SW & Jimmy CH, 2006). As several studies have shown, PBOs in construction tend to function as isolated entities with minimal organizational memory or knowledge retention mechanisms. For example, Patrick SW and Jimmy CH (2006) found that construction professionals mainly share knowledge within their project teams but rarely extend it across the wider organization, resulting in repeated mistakes and missed opportunities for organizational improvement. Post-project reviews, when conducted, often fail to propagate lessons beyond the immediate team, and the information is "not effectively reutilized" (Resende et al., 2020). This ineffective learning process is further compounded by fragmented knowledge management systems and poor integration of technological solutions, which make it difficult to capture, store, and disseminate knowledge across projects (Yepes & López, 2021). Thus, while construction PBOs repeatedly engage in project execution, they largely fail to institutionalize learning, effectively operating as "empty boxes" devoid of enduring organizational knowledge.

2.2. Project-based Organizations

Project-based Organizations (or PBOs in short) are enterprises that are fundamentally structured around the undertaking of projects with the aim of delivering them to a client and meeting their needs (Barbosa & Carvalho, 2024; Blindenbach-Driessen & Van Den Ende, 2010). In general, project-based firms are defined operationally by the type of projects that they undertake (Blindenbach-Driessen & Van Den Ende, 2010). According to Blindenbach-Driessen and Van Den Ende (2010) and Hobday (2000), in project-based organizations, it is the project managers who constitute their organizational fulcrum. Another important aspect for PBOs active in the construction sector is their Social Capital in general. More importantly, PBOs differ with respect to a traditional organization, as the staff is engaged in projects in a circular pattern, going from project to project (Miterev et al., 2017). Temporary organizations, with Special Purpose Vehicles being a prime example, can also be categorized as project-based organizations. PBOs are reported to have better control and processes, as well as reduced lead time at their disposal (Di Vincenzo & Mascia, 2012). Typical roles in a PBO include the *Project Manager*, who oversees coordination and delivery; the *Design Lead* or *Architect*, who translates client requirements into buildable plans; various *Engineering Specialists* (structural, civil, MEP) who support technical design and implementation; the *Contractor or Construction Manager*, responsible for site execution and logistics; the *Site Engineer or Superintendent*, who supervises daily operations; the *Cost Engineer* for cost control; the *Project Engineer* handling the scheduling; the *Quality and Safety Manager*; and finally, the *Facility or Operations Manager* who ensures operability post-handover (Hughes et al., 2015; Latiffi et al., 2016). Another important department for PBOs is the Legal Department, with which the organization handles external issues. These roles cycle through projects in matrix or functional arrangements, with varying levels of permanence depending on the organization's internal resourcing model.

2.3. Knowledge Management

Knowledge Management has many definitions with no clear consensus as to which definition is the most appropriate one (Terzieva & Morabito, 2016). Kotnour and Vergopia (2005) defines Knowledge Management as "a set of proactive activities to support an organization in creating, assimilating, disseminating, and applying its knowledge". In particular, the creation, update, sharing, and use of knowledge can be essential components of any organization (Terzieva & Morabito, 2016). According to the Project Management Body of Knowledge (PMBOK), knowledge management involves the conversion of personal information and experience with the help of a structured and methodological way of managing information and learning (McClory et al., 2017). Gasik (2011) mentions the aspect of applying the knowledge, which has to be also sufficient, in "situated contexts". In other words, the knowledge has to be applied in contexts similar to those in which it was also generated. This definition hints at the exploitative nature of knowledge. Yepes and López (2021) defines Knowledge Management as "a systematic, organized, and continuous process whose objectives are to increase competitiveness, promote organizational learning, and preserve knowledge." Additionally, Yepes and López (2021) mention that Knowledge Management as an activity has to balance three components: Technology, human relations, and strategic management. Table 2.1 contains a summary of the definitions of knowledge management. Next, the interest lies in understanding the building blocks that constitute knowledge management, as well as the underlying sub-processes.

Table 2.1: Definitions and Perspectives on Knowledge Management

Key Idea	Source
KM lacks a single, universally accepted definition but involves creating, updating, sharing, and using knowledge.	Terzieva and Morabito (2016)
KM is a proactive process for creating, assimilating, disseminating, and applying organizational knowledge.	Kotnour and Vergopia (2005)
KM converts personal knowledge into actionable knowledge using structured and methodological approaches.	PMBOK (McClory et al. (2017))
KM emphasizes applying knowledge in contexts similar to those where it was created.	Gasik (2011)
KM is a systematic, organized, and continuous process aiming to increase competitiveness, promote learning, and preserve knowledge, while balancing technology, human relations, and strategic management.	Yepes and López (2021)

2.3.1. Types of Knowledge

As it can be seen in table 2.2, data, information, and knowledge are interrelated. Data is the building block of information, while making sense of information creates knowledge. Based on the nature of knowledge, it can be classified as either tacit or explicit (Chinowsky et al., 2007). Tacit knowledge is related to the experience level and the skills of the individuals as it is the direct product of this process (McClory et al., 2017; Terzieva & Morabito, 2016). Moreover, tacit knowledge is usually subconscious and not easily distinguishable and detectable (Anh Thi Lê & Brønn, 2007; Koners & Goffin, 2007; Terzieva & Morabito, 2016). Connected to this aspect is the fact that tacit knowledge has also been referred to as "sticky" due to its difficulty in transferring it (Inkpen, 2000; Y. Liu et al., 2021). According to Martin and Emptage (2019) and Schenkel and Teigland (2008), tacit knowledge resides in organizations at a greater scale compared to explicit knowledge. In particular tacit knowledge manifests in the form of metaphors and stories (Koners & Goffin, 2007), thus not disposing of additional documentation (Gasik, 2011).

Explicit knowledge is knowledge that is formal, structured in sentences, and documented in a systematic manner (Lindner & Wald, 2011; Terzieva & Morabito, 2016). Examples of this type of knowledge are management directives, executive orders, policy manuals, meeting minutes, and technical documentation,schemata, diagrams, and charts (Anh Thi Lê & Brønn, 2007; Inkpen, 2000; Martin & Emptage, 2019; Terzieva & Morabito, 2016). According to Gasik (2011) explicit knowledge is also known as codified knowledge and is relatively easy to transfer and acquire (Inkpen, 2000).

Tacit and explicit knowledge complement each other, as a result often the application of explicit knowledge and the way of accomplishing it has a tacit dimension (Inkpen, 2000). There are also ways of converting one type to another and vice-versa (Hartmann & Dorée, 2015). However, they can be time-consuming as they require a repeated dialogue between the participants of a project and coworkers in general (Love et al., 2002).

Content-wise, knowledge can have different dimensions. More specifically, it can be technical knowledge about a certain specific application, or procedural knowledge, mainly about a process and how to apply it in a specific context (Wiewiora et al., 2013). Furthermore, Wiewiora et al. (2013) adds the know-what, know-how, know-why, and know-when. The latter corresponds to the timing of applying the knowledge of interest. The know-what knowledge is one that is easily codifiable, and know-why refers to laws and principles (Ahmad, 2010). Another type of knowledge, which is tacit in nature, is one known as cognitive knowledge, which includes personal ideas and viewpoints (Ahmad, 2010). The variations between implicit and explicit knowledge can be seen in figure 2.1.

Table 2.2: Definitions of Data, Information, and Knowledge from different authors (Stenmark, 2001)

Author(s)	Data	Information	Knowledge
Wiig (1994)	–	Facts organised to describe a situation or condition	Truths, beliefs, perspectives, judgements, know-how and methodologies
I. Nonaka and Takeuchi (1995)	–	A flow of meaningful messages	Commitments and beliefs created from these messages
Van der Spek and Spijkervet (1997)	Not yet interpreted symbols	Data with meaning	The ability to assign meaning
Davenport (1997)	Simple observations	Data with relevance and purpose	Valuable information from the human mind
Davenport and Prusak (1998)	A set of discrete facts	A message meant to change the receiver's perception	Experience, values, insights, and contextual information
Quigley and Debons (1999)	Text that does not answer questions to a particular problem	Text that answers the questions who, when, what, or where	Text that answers the questions why or how
Choo et al. (2000)	Facts and messages	Data vested with meaning	Justified, true belief

Figure 2.1: Diagram of Data to Knowledge Transformation (Adapted from Henczel (2001))

2.4. Learning

Learning as a process is directly related to knowledge, with these two being mutually reinforcing processes. In addition, learning has the potential to produce original knowledge which can also alter future learning efforts (Julian, 2008). Learning is a highly complex process that can take place in the individual, project, organizational, and inter-organizational realms. In addition, it can also occur in "loops". More specifically, three types of looped learning (Inkpen, 2000; McClory et al., 2017; Prencipe & Tell, 2001; Styhre et al., 2004) are mentioned: **Single-loop learning, Double-loop learning, and Triple-loop learning**.

Single-loop learning is the simplest form of learning in organizations and projects. It merely involves the correction of an error without the change of the overarching system. In other words, based on the outcome, only the actions are subject to change (see figure 2.2). In summary, the fundamental goal of single-loop learning is to answer the question: **Are we doing things right?**.
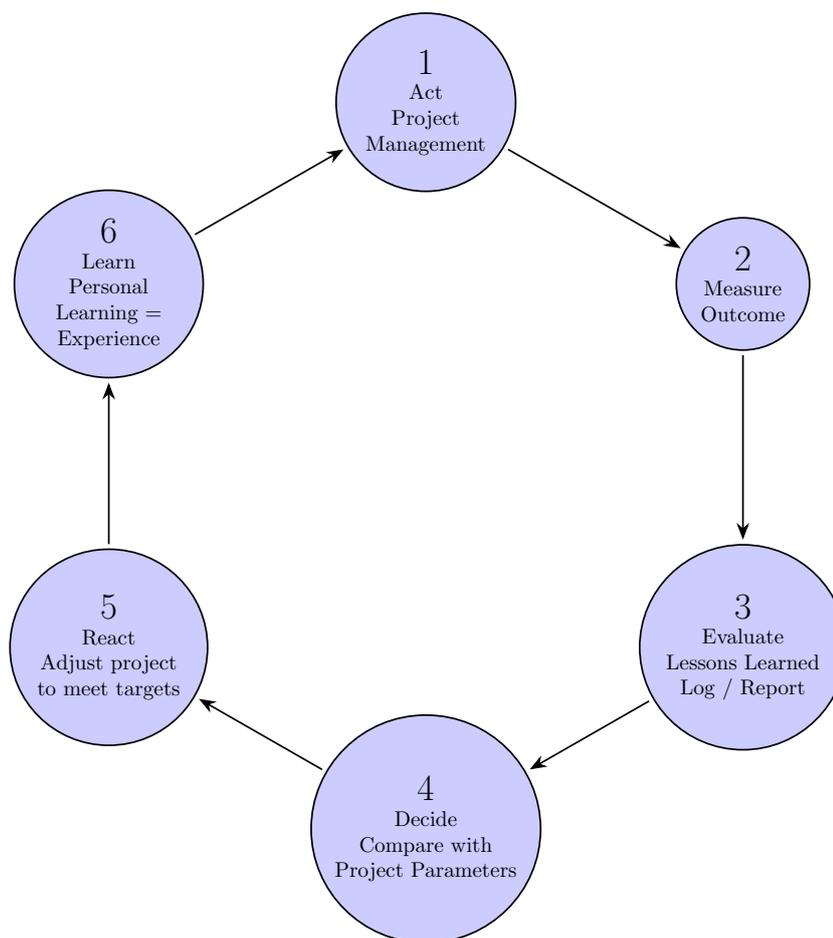
Figure 2.2: Single-Loop Learning (McClory et al., 2017)

Double-loop learning adds an extra level of complexion, as once again the consequences of past actions are understood but in this occurrence, external stimuli lead to the change of "mental models" (Inkpen, 2000). In other words, a certain level of reflection takes place, which leads to a general improvement in the long run (see figure 2.3). Summarizing, double-loop learning aims to answer the question: **Are we doing the right things?**.
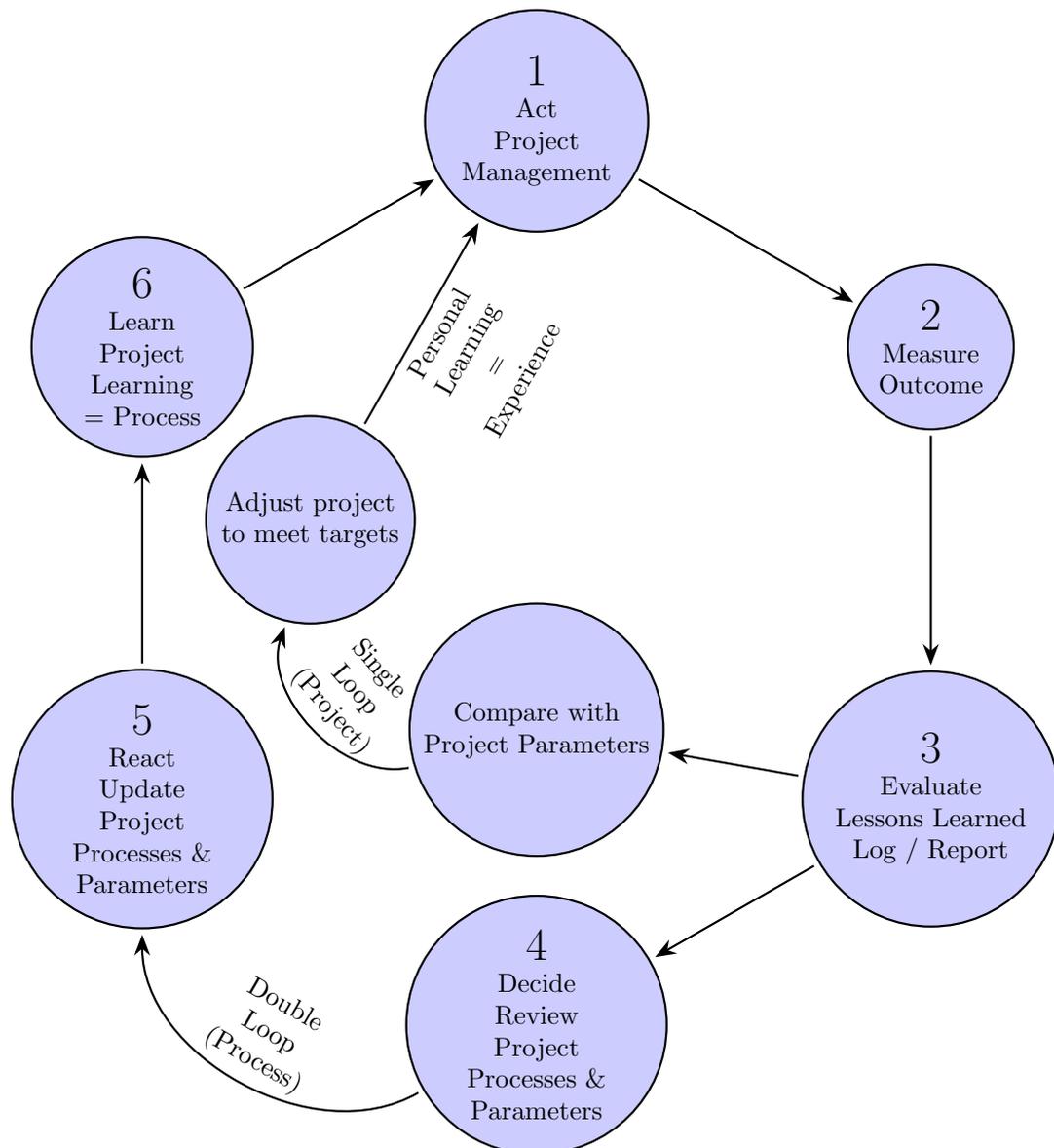
Figure 2.3: Double-loop learning (McClory et al., 2017)

Triple-loop learning is related to the overall organizational strategy and the values and long-term goals that shape it (McClory et al., 2017). In other words, the context of the operations is always subject to changes in order to ensure the outcome. This notion includes both the past actions and the processes that affect them (see figure 2.4). Summarizing, triple-loop learning aims to answer the question: **How do we decide what's right?**.
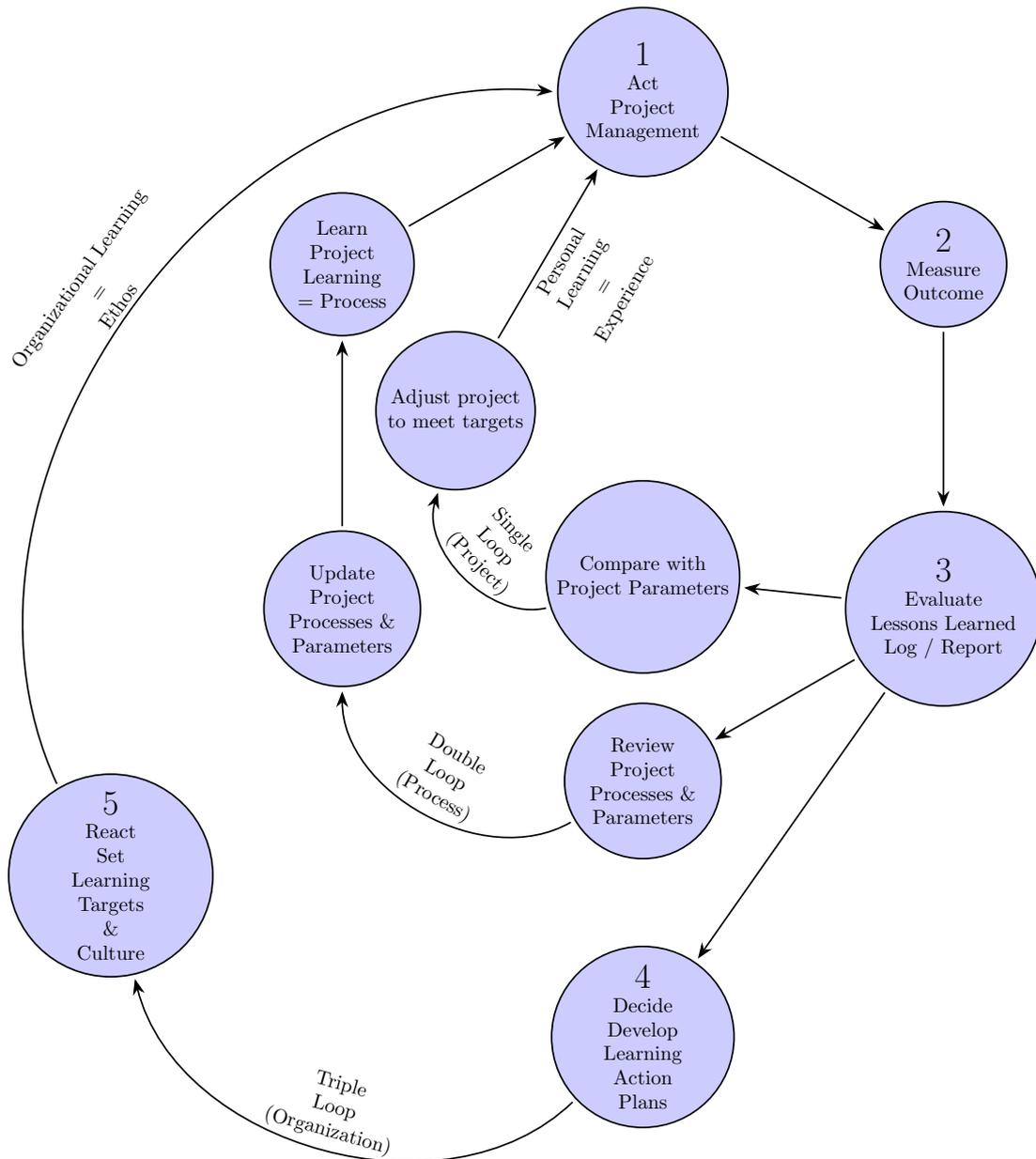
Figure 2.4: Triple Loop Learning (McClory et al., 2017)

2.4.1. Organizational Learning

Organizational learning is a continuous process through which organizations acquire, assimilate, and apply knowledge to improve processes, adapt to changes, and enhance performance. According to Easterby-Smith and Lyles (2011), organizational learning involves both the content, the knowledge itself, and the process, how the organization acquires and integrates it. This distinction highlights the dual nature of organizational learning as both a mechanism for understanding past experiences and a tool for shaping future strategies. Another name for these separate operations is explorative learning and exploitative learning, respectively.

Exploitative learning focuses on refining existing knowledge, improving processes, and maximizing efficiency. It involves leveraging established skills and competencies to achieve incremental improvements. Exploitative learning is critical for maintaining competitiveness in stable environments, as it

prioritizes consistency and short-term gains.

2.4.2. Learning Barriers

The most significant of the challenges reported in the literature is time pressure. When projects operate under tight deadlines, opportunities for reflection, mentoring, or informal dialogue often shrink. In such conditions, collaboration is deprioritized, and decision-making becomes more centralized and top-down, curbing both initiative and shared learning.

Bureaucratic procedures and rigid organizational routines also restrict learning. Meetings, while formally dedicated to knowledge exchange, may become ritualized and repetitive, with participants feeling they have nothing new to contribute. In these cases, the structure intended to support communication instead stifles it, especially when the space for genuine engagement is overshadowed by a need to maintain appearances.

A further obstacle arises from functional silos, where teams operate as isolated units focused solely on their immediate responsibilities. This inward focus hinders the flow of knowledge across boundaries, despite the presence of formal mechanisms intended to facilitate cross-departmental exchange. Even in organizations with shared infrastructure or regular meetings, meaningful collaboration across units may remain minimal, limited by professional boundaries and a lack of trust or incentive to engage.

Another layer of difficulty stems from a cultural resistance to knowledge codification. In some organizational settings, documentation exists primarily for legal or compliance reasons rather than as a tool for learning. Records are often in physical form, unsearchable and difficult to access, making them practically useless for daily operations. The absence of usable knowledge bases reinforces the reliance on tacit, experiential knowledge, which, while valuable, is not easily transferred or retained beyond the individual. A complex set of enablers and barriers shapes learning, Kotnour and Vergopia (2005) provides a useful classification into six interrelated areas (see: figure 2.5).
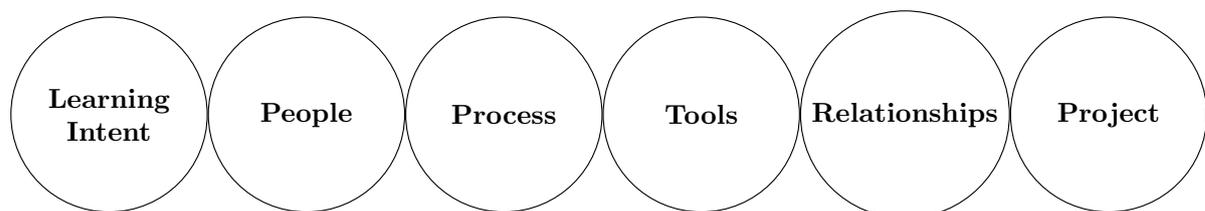
Figure 2.5: Areas affecting learning ((Kotnour & Vergopia, 2005)

Learning intent reflects the organization's underlying mindset. In some settings, learning is seen as essential; in others, the emphasis is narrowly on delivery. The latter environment often fosters a culture where reflection is sacrificed for productivity, reinforced by limited time, risk aversion, and low tolerance for open discussion (Julian, 2008). Defensive routines may become embedded, protecting individuals from discomfort while also preventing them from identifying or resolving deeper structural issues (Julian, 2008; Schindler & Eppler, 2003). When reflective practices are viewed as threatening rather than developmental, learning stagnates.

A key challenge in project-based organizations is the perceived incompatibility between learning and tight delivery schedules. Projects are time-bound by nature, and the variability of scope, cost, and design further fuels skepticism about the applicability of generalized learning tools (Newell, 2004; Swan et al., 2010). As a result, knowledge remains experiential, intuitive, and highly context-dependent, an issue compounded by assumptions that each project is too unique for lessons to transfer meaningfully across contexts (Fong, 2005; Lindner & Wald, 2011). On a process level, the absence of formal experience-capturing mechanisms weakens the learning potential of project teams. Debriefings, if conducted, are often reduced to praise or superficial reviews, failing to uncover deeper lessons. For some, these activities feel more like an additional workload than a valued opportunity to grow (Hartmann & Dorée, 2015). The tools designed to support knowledge sharing are also met with skepticism. Project

participants may see limited value in structured systems or databases, especially when the information is outdated, hard to access, or disconnected from their current task demands (Swan et al., 2010).

There is often a weak link between experience accumulation and formal articulation or codification, leaving organizations reliant on individual memory and informal communication. The relational dimension adds further complexity. Trust, norms, and shared values often form within tightly knit communities of practice, but these same bonds can hinder broader knowledge transfer. Knowledge becomes embedded in interpersonal relationships, making it difficult to share beyond immediate circles (Bresnen et al., 2003; Ruikar et al., 2009). Finally, the project structure itself poses a challenge. Fixed timelines discourage the use of learning tools, and the frequent reassignment of personnel leads to knowledge loss, as individuals carry their tacit knowledge with them when they move on to new projects. This phenomenon contributes to a recurring "reinvention of the wheel," where insights are not retained or reused effectively (Bresnen et al., 2003). For a summary of the learning barriers see table 2.3.

Table 2.3: Barriers to Learning in Projects

Subdivision	Barriers	Sources
Learning Intent	Focus on "getting the job done" rather than learning.	Kotnour and Vergopia (2005)
	Defensive routines preventing the discovery of the root causes of issues.	Julian (2008) and Schindler and Eppler (2003)
	Reflective practices reinforcing defensive mechanisms.	Julian (2008) and Schindler and Eppler (2003)
People	Limited time, resources, and risk tolerance impact attitudes toward learning.	Julian (2008)
	Frequent project changes lead to tacit knowledge loss.	Bresnen et al. (2003)
	Communities of practice fail to transfer knowledge effectively due to reliance on trust, norms, and shared values.	Bresnen et al. (2003) and Ruikar et al. (2009)
Process	Absence of experience-recording mechanisms in project management.	Schindler and Eppler (2003)
	Ineffective debriefing methods, focusing on praise rather than meaningful knowledge capture.	Hartmann and Dorée (2015)
	Debriefing is perceived as additional workload.	Hartmann and Dorée (2015)
Tools	Skepticism about Knowledge Management tools due to project variability.	Swan et al. (2010)
	Poor connection between experience accumulation, articulation, and codification.	Swan et al. (2010)
Relationships	Limited trust and shared values inhibit knowledge transfer in communities of practice.	Bresnen et al. (2003) and Ruikar et al. (2009)
Project	Fixed deadlines discourage the use of learning tools.	Newell (2004) and Swan et al. (2010)
	Lessons learned are often not applied to future projects due to "unique" or "context-specific" perceptions.	Fong (2005) and Lindner and Wald (2011)

Communication channels

Communication channels in project-based organizations (PBOs) can be broadly classified as vertical or horizontal (Safapour et al., 2021; Yakubu et al., 2019). Vertical communication refers to the exchange of information between the project team and the project manager, whereas horizontal communication occurs "between the components of the chain of command" (Safapour et al., 2021).

Beyond the direction of communication, the formality of interaction also plays an important role. Dainty et al. (2007) observed that physical meetings prevailed over all other forms of communication. They further introduced the concept of "formality" to describe the group-based communication and socialization processes in projects. Formality reflects the official and functional purpose of project groups, which makes them more stable in nature (Dainty et al., 2007).

However, communication is not limited to the availability of channels for sending messages. In PBOs, these channels only represent part of the picture. A fuller understanding also requires attention to organizational culture, which influences both the direction of communication and the possible pathways for transmitting information. This dimension is closely related to what has been termed **knowledge governance** (Pemsel & Müller, 2012). As Pemsel and Müller (2012) emphasize, knowledge-creating processes are particularly challenging in PBOs, given their fragmented structure across different departments.

Digital communication

Communication can be significantly enhanced by the use of digital means. It can serve as a facilitator for delivering a key message through the use of animations and other digital tools. However, other sources of communication can be detrimental to the effectiveness of communication. Yakubu et al. (2019) mention that e-mails cause the message to lose its impact, as information such as body language, cadence, and tone are lost. There is a clear preference for in-person gatherings and meetings in the construction sector (Choon Hua et al., 2005). The digital means can then cover the role of an activator, to guide the conversation and not govern it completely.

Communication richness

According to Choon Hua et al. (2005), communication should be based on the "richness" of the shared meanings conveyed. The lack of physical meetings altogether can cause severe disruptions in the execution of a project (Taleb et al., 2017). However, El-Saboni et al. (2009) mentioned that the use of digital tools to monitor the project's parameters, such as via project extranets or centralized email systems, not only enhanced transparency and documentation but also facilitated trust-building and organizational change. In particular, digital platforms enabled faster response times to Requests for Information (RFIs), improved stakeholder visibility across distributed teams, and fostered a more project-centric structure within traditionally hierarchical organizations. Rather than replacing face-to-face interaction, these tools functioned as a complementary layer, reinforcing communication by ensuring that critical project data was accessible, traceable, and permanently recorded.

Organizational silos

A predominant feature observed across many PBOs is the presence of organizational silos, which manifest in two key ways: through decision-making hierarchies and through discipline-specific specialization. Silos, in general, have their own set of pros and cons. Silos can offer a sense of psychological safety, as the work required could be defined properly (De Waal et al., 2019). Additionally, a set of sub-cultures could be developed, increasing the cohesiveness of each department (De Waal et al., 2019). Lastly, silos offer a degree of isolation in the case of bigger and more complex corporations. On the other hand, silos can be sources of internal conflicts as well as "focusing inward" (De Waal et al., 2019). In such an environment, information and knowledge exchange can be limited as some key insights may be lost between departments (De Waal et al., 2019). Silos are closely connected with the organizational culture of a Project-based organization, as well as the management style (De Waal et al., 2019). In hierarchical structures, decision-making power tends to be concentrated at higher levels, resulting in top-down communication patterns. This limits the opportunity for upward or lateral exchange of insights and restricts employees, particularly newcomers, from engaging in interactive forms of learning or feedback. Socialization in such contexts becomes primarily manager-driven, with knowledge dissemination

occurring via supervisors who act as the central node for communication and control.

Barriers to knowledge sharing

Bresnen et al. (2003) argue that hierarchical and functionally fragmented structures often inhibit the flow of tacit knowledge, particularly in project settings that depend on cross-functional collaboration. The lack of dialogue communication and the prevalence of one-way reporting practices undermine the potential for employees to actively engage in or initiate knowledge-sharing processes, thereby reducing the effectiveness of socialization as a mutual learning activity. Additionally, the presence of expertise-based silos within organizations, where staff are grouped according to their technical specialization, can restrict knowledge transfer across project domains. Sydow et al. (2004) describe this as the formation of "bounded communities of practice," which reinforce internal expertise but hinder broader organizational learning. While such arrangements may support technical depth, they limit horizontal integration and the diffusion of best practices across teams or disciplines. This fragmentation can result in socialization being limited to intra-departmental norms rather than encompassing the broader culture of the project or organization.

Cultural perspective

From a cultural perspective, Ajmal and Koskinen (2008) emphasize that hierarchical environments often encourage norms of compliance and information control, rather than openness and collaboration. This inhibits the development of trust-based relationships that are essential for effective socialization, particularly in settings that rely on tacit knowledge and informal communication. In such contexts, the absence of reciprocal dialogue and limited access to informal networks reduce the opportunities for new employees to internalize project culture, norms, and values through observation and participation. In contrast, more flexible structures, such as matrix or hybrid forms, are recognized in the literature as being more conducive to learning and socialization. Turner et al. (2000) propose that project-based learning is most effective when supported by structures that facilitate movement across roles, functions, and projects. Such arrangements enhance exposure to diverse experiences and enable the cross-pollination of knowledge, thereby enriching both individual learning and organizational capability.

Tacit knowledge transfer

Nonetheless, Project-based organizations in the construction sector often employ a traditional hierarchical structure and seem to encourage it throughout all their ranks. The main reason for this choice is indeed to have control over the final decision and filter out some potentially unwanted feedback. However, junior staff members are given the opportunity to voice their opinion when the situation at hand requires it. The other side of this situation is when junior employees feel isolated and do not have access to information and knowledge that could be beneficial to them, due to the restricted knowledge exchange. In Project-based organizations, the so-called seniority level of an employee provides the appropriate clearance to them in order to access it. The construction industry, like any industry, attracts younger professionals. Particularly, in Australia, younger professionals enter the industry with no experience but with novel techniques obtained from their university degree (Jepson et al., 2018). The findings of this study indicate that tacit knowledge is primarily transferred through interpersonal interaction, particularly between more experienced and less experienced staff members. Informal mechanisms such as mentoring, shadowing, and spontaneous workplace conversations facilitate the exposure of newcomers to the organizational logic, routines, and nuanced practices embedded in project-based work. Rather than relying on structured documents or formal training, new employees tend to learn through observation and emulation of experienced colleagues. This process reflects Polanyi (2009) notion that "we can know more than we can tell", emphasizing the non-verbalized, experiential, and often subconscious nature of tacit knowledge.

Trust as a condition for tacit knowledge

These forms of social learning allow individuals to internalize knowledge that is highly contextual, situated, and difficult to codify. Supporting this interpretation, Kucharska et al. (2017) argue that tacit knowledge sharing is most effective in environments characterized by trust, a collaborative culture, and voluntary engagement, rather than in systems that depend on digital tools or top-down procedures. In such environments, individuals are more inclined to openly exchange experiential insights, facilitat-

ing continuous learning that adapts to the evolving demands of project work. The findings suggest that social exposure and day-to-day collaboration serve as critical mechanisms through which project-based organizations internalize and disseminate expertise. These practices not only expedite individual learning but also contribute to the formation of shared understanding and collective competence, both of which are essential for successful project delivery. Socialization and the exchange of tacit knowledge are also essential in the project team-building process. According to Kucharska et al. (2017), socialization is extremely beneficial when it comes to enhancing the creativity of a project team. Particularly, the construction sector requires a different set of participants and components within project teams.

Trust in project-based organizations

A fundamental component for project teams for their operations is what could be described as trust. Wiewiora et al. (2010) proposed a framework for describing trust in Project-based organizations. The framework itself is comprised of three pillars or domains (Mayer et al., 1995), as cited in Wiewiora et al. (2010): Ability, Benevolence, and Integrity. Ability encompasses the skills, competencies, and characteristics of a person, group, or organization (Wiewiora et al., 2010), and more importantly, the knowledge and know-how these parties might possess. Benevolence is used to describe the best interests that one individual or party might have in order to achieve a favorable result. Wiewiora et al. (2010) mention that in order to witness benevolence within a project-based organization, there has to exist a form of relationship and attachment between the two interested parties. Mayer et al. (1995) mention the relationship of the mentor with their apprentice or trainee, as an example of such a bond. A similar example would be a senior manager with their project team. Benevolence is also similar to what has been defined as "affect-based trust" (McAllister, 1995), as cited in Wiewiora et al. (2010). Integrity refers to "the trustor's perception that the trustee adheres to a set of principles that the trustor finds acceptable" (Mayer et al., 1995), as cited in Wiewiora et al. (2010).

Table 2.4: Trust Dimensions and Indicators adapted from Wiewiora et al. (2010)

Trust Dimensions	Ability	Benevolence	Integrity
Definition	A perception that another party is knowledgeable or possesses a certain level of competence.	Suggests that the trustee has some specific attachment to the trustor and would keep the best interests of the trustor at heart.	A perception that the trustee adheres to a set of principles that the trustor finds acceptable.
Indicators	Competence, Skill, and Experience	Positive Intentions and Willingness to help	Honesty and Credibility

Trust and knowledge sharing

In the taxonomy for classifying trust proposed by McAllister (1995) as cited in Wiewiora et al. (2010), the same elements can be seen. More precisely, trust is divided into affect-based trust and Cognitive-based trust. Affect-based trust is concerned with interpersonal and social bonds, as well as concern between coworkers. On the other hand, cognition-based trust relates to the competence levels of the workers, coupled with their reliability (Wiewiora et al., 2010). In project-based settings, interpersonal relationships often carry more weight than formal hierarchies, and trust becomes a practical necessity for coordination and learning. As Savolainen (2008) highlights, trust functions as a relational and motivational force for tacit knowledge sharing, and the quality of relationships within project teams directly influences whether such knowledge is exchanged or withheld. Conversely, in environments where fear or mistrust prevailed, where job insecurity and competitiveness undermined collaboration, the absence of affective and integrity-based trust resulted in knowledge hoarding and emotional withdrawal. In that sense, both trust and its absence shaped the emotional and cognitive dimensions of team functioning, revealing how critical it is for organizations to consciously foster trust-rich environments to enhance learning and performance.

2.4.3. SECI Framework

I. Nonaka (1994) proposed a framework to analyze the different modes of knowledge transfer: tacit to tacit, tacit to explicit, explicit to explicit, and explicit to tacit. This model is instrumental when dealing with knowledge transfer (Faith & Seeam, 2018).

The conceptualization includes four different stages I. Nonaka (1994) and Sian Lee and Kelkar (2013):
Socialization, Externalization, Combination, and Internalization

According to I. Nonaka (1994) and L. Nonaka et al. (1996), socialization as a knowledge conversion mode requires having some form of shared experiences. Then, people are more open to sharing their thinking process and ideas. Socialization involves an immediate level of feedback and is one of the richest forms of communication (Sian Lee & Kelkar, 2013). Externalization is the next step, where tacit knowledge is converted to explicit forms. Here, the knowledge is narrativised, for the purpose of creating a perspective and the rationalization of an individual's or a groups knowledge. The exchange mechanisms are phone conversations, meetings, and performing actions such as writing a description of work processes while self-reflecting or debating (Faith & Seeam, 2018; I. Nonaka, 1994; Sian Lee & Kelkar, 2013). Then, externalization is achieved by converting the tacit knowledge at hand into explicit knowledge. In the externalization phase, L. Nonaka et al. (1996) mention that expressions and metaphors are used to convey a meaning to the concepts. Metaphors then form the backbone of common speech and create further connections between concepts, both concrete and abstract ones (L. Nonaka et al., 1996). This explicitation of the concepts leads to a better representation of said concepts.

The next stage, once knowledge is converted to explicit form, is defined as Combination (I. Nonaka, 1994). Here, different forms of explicit knowledge are consolidated in a unified body of knowledge. Forms of explicit knowledge that are relevant to this stage are documents, meetings, meeting slides, telephone conversations, and ICT-based communication networks (L. Nonaka et al., 1996). The combination of the different sources of information could lead to further understand "what goes well" and "what does not go well", in a business related context (L. Nonaka et al., 1996).
Lastly, Internalization takes the stage once Combination is achieved at a satisfactory level (L. Nonaka et al., 1996). According to (L. Nonaka et al., 1996), internalization bears significant parallels with the learn-by-doing mode (L. Nonaka et al., 1996). The previous stages aid further this stage, as verbalized knowledge, when conveyed in diagrams, other visualizations, and documentations in general, is easier to turn into tacit knowledge. Manuals and other documents facilitate the transfer of knowledge to other individuals (L. Nonaka et al., 1996). Otherwise, internalization allows others to "re-experience" other people's experiences (I. Nonaka, 1994). Figure 2.6 includes the SECI Model as well as the "knowledge spiral" (L. Nonaka et al., 1996).

Dialogue

Learn by Doing
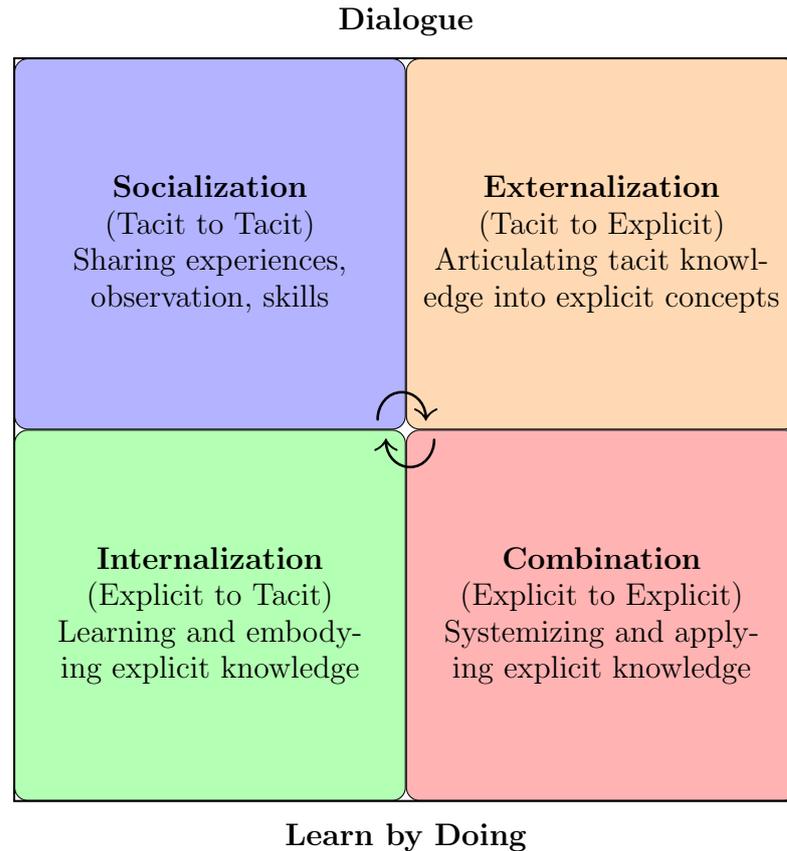
Figure 2.6: SECI Model Cycle (L. Nonaka et al., 1996)

2.4.4. Project Learning

Project learning, as the name suggests, takes place in the project level. It draws parallels with the definition of organizational learning. In principle, there are two modes of project learning: intra-project learning (learning-by-doing), and inter-project learning (learning from projects). The former refers to learning efforts that take place within the project environment, while the latter considers the possibility of utilizing knowledge from other similar projects. Essentially, the explorative phase is highlighted by instances in which there is high uncertainty, possibly early in the project, where there is still the need to define what needs to be learned in order to complete the project. The exploitative phase, as highlighted by Y. Liu et al. (2021), is the one in which meaning is assigned to the project, possibly by setting benchmarks with other projects.

Alashwal and Abdul-Rahman (2014) proposed a model of inter-project learning (see figure 2.7), which was largely based on previous research conducted by Prencipe and Tell (2001). The model itself illustrates project learning as a process. There are four phases, namely: Experience Accumulation, Knowledge Articulation, Knowledge Codification, and Knowledge Transfer.
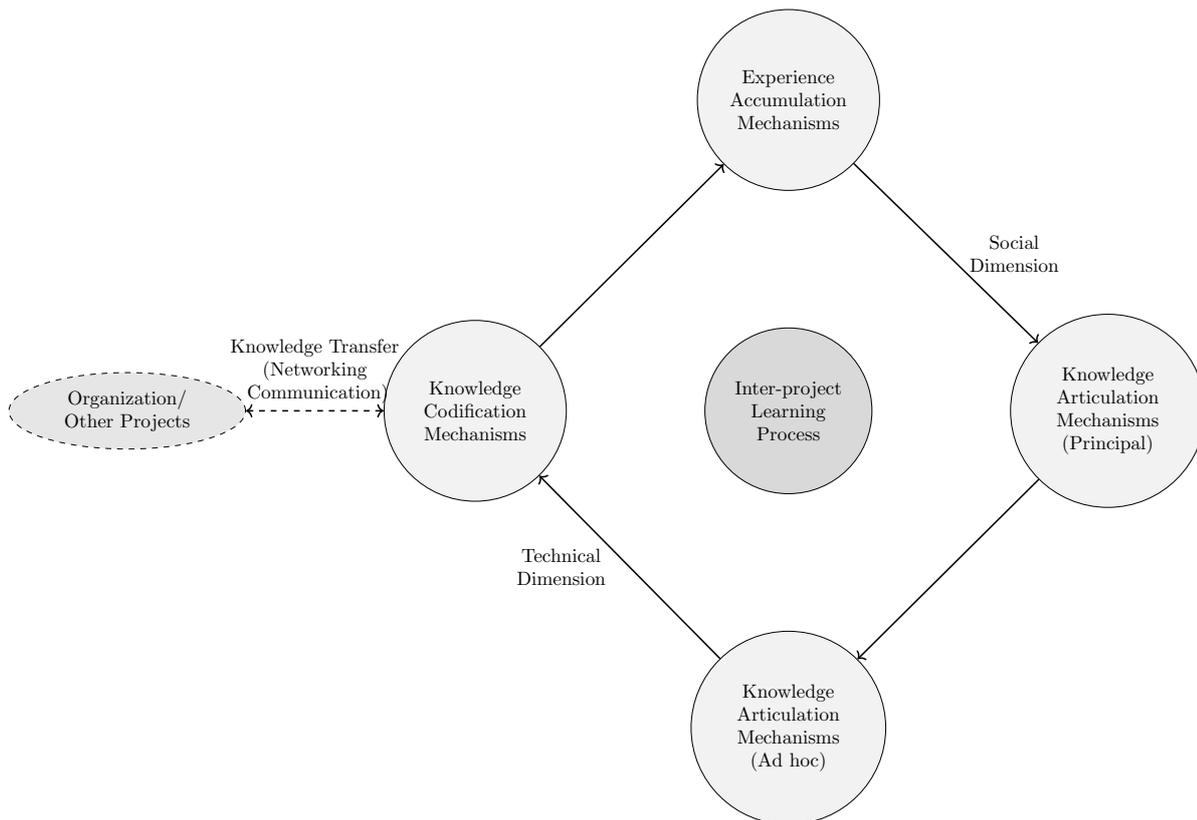
Figure 2.7: Inter-project Learning Process Diagram (Alashwal & Abdul-Rahman, 2014)

Experience accumulation refers to group thinking and brainstorming, informal encounters, and imitation techniques (Alashwal & Abdul-Rahman, 2014). According to Swan et al. (2010), experience accumulation is perhaps the lowest-level mechanism of organizational learning. More importantly, experience accumulation is closely related to the tacit (internalized) experience in the individuals' minds (Schindler & Eppler, 2003) and its use, which can lead to gradual improvements in practice processes over time. Swan et al. (2010) add that experience accumulation can also be defined as the individual 'trial and error' phase which affects the learning curve or the time. The learning curve in particular is a function of an individual's ongoing adaptation and refinement of tasks through repeated efforts over a certain period of time (Yelle, 1979).

Knowledge articulation can be perceived as a more effective learning process than accumulating experiences (Swan et al., 2010; Zollo & Winter, 2002). In addition, articulating knowledge in clear terms can lead to "reflecting practitioners" (Prencipe & Tell, 2001), encouraging double-loop learning, while also working out "what does or does not work" (Zollo & Winter, 2002). Reflective practice can also initiate discussions and important dialogue sessions between project team members, in which they are encouraged to confront their respective viewpoints on an issue at hand (Zollo & Winter, 2002). A popular way to articulate knowledge is through professional meetings, where lessons learned during the project are recorded. The meetings and post-mortem sessions sit within the **Externalization** section of the SECI model proposed by L. Nonaka et al. (1996). To be more precise, these meetings can be treated as the prelude for generating explicit knowledge. As a result, implementing such sessions can lead to a better retention of knowledge (Kotnour & Vergopia, 2007). Kotnour and Vergopia (2007) emphasize the fact that there are 4 levels of learning. Table 2.5 has a summary of the levels, along with their description. Level I learning is concerned with assessing the project's current status by collecting and analyzing relevant data. This phase is primarily focused on generating information that forms the foundation for more advanced learning. Level II learning builds upon these insights by identifying deviations from the project plan and taking corrective actions. It involves problem-solving and reallocating resources, such as tasks, budget, and personnel, to steer the project toward success. At Level III, the emphasis shifts toward enhancing the methods and practices used within the project team itself. In contrast, Level IV

learning targets improvements at the organizational level, aiming to refine core processes, tools, and capabilities across the company. As a result, control and monitoring reviews are classified as Level I and Level II project reviews. Incidentally, Level I and Level II practices were observed during the current research project. The emphasis was put on controlling the projects and their progress compared to traditional benchmarks, while also handling the changes and change requests that were presented during the project.

Table 2.5: Levels of Project Review and Learning (Kotnour & Vergopia, 2007)

Level	Description
Level I	Status reviews that focus on sharing facts about the project.
Level II	Control reviews that focus on adjusting project actions.
Level III	Learning that improves the current project's practices.
Level IV	Learning that improves the organization's core practices, processes, capabilities, and tools.

The purpose of the lessons learned sessions is to capture what has been learned from experience and share it with fellow coworkers or project team members (Kotnour, 2000). In particular, Busby (1999) formulated the confrontation as follows: first a dialectic argument is registered between participants, where different explanations are voiced, then the events are mentally "rehearsed" in the order they occurred. Thirdly, a mental simulation often takes place to work out what would have happened in an alternative scenario, which is almost entirely hypothetical. Busby (1999) refers to this way of thinking as "causal reasoning", or attributing causal relations to events, namely correlating a specific cause with a corresponding effect. Julian (2008) and Kotnour (2000) mention the importance of timing in holding such important meetings. To be more precise, the majority of the meetings take place at the last stages of a project. These post-project reviews are also referred to as "post-mortem" (Kotnour, 2000). These reviews also serve the purpose of identifying the lessons to be learned, thus creating a loop-like process (Koners & Goffin, 2007). However, according to Newell (2004) this practice is not exactly helpful, although they are known as "best practice". Once these steps are complete, the knowledge can be generated from the project to set the stage for its transfer.

2.5. Knowledge Transfer

The first part of the model was concerned with how is knowledge genarated, and how it is expressed in project settings. Now we can move to the last stage, which concerns how the knowledge is transferred from projects to other projects. There are two possibilities: either use ICT-based technology (Codification), or employ personalization strategies (Anh Thi Lê & Brønn, 2007; Fong, 2005; Newell, 2004). At an organizational level, there are two approaches mirroring the knowledge transfer strategies: the cognitive approach, and the community approach (Newell, 2004).

2.5.1. Socialization

Socialization is an embedded knowledge transfer mechanism present in project-based organizations (PBOs) and other enterprises. It relies on differences in individual experiences and facilitates the acquisition of tacit knowledge, which, as L. Nonaka et al. (1996) emphasize, is primarily gained through experience. A central component of socialization is paired on-the-job training, or "learn by doing," often implemented through mentoring or shadowing, where less experienced employees learn directly from seasoned professionals (Beane, 2019; Marchand, 2013; Vasset & Almås, 2015). New hires are typically paired with more experienced colleagues, enabling them to learn the nature of the work and their duties.

Socialization is frequently informal and observational. Safety procedures, work practices, and organizational norms are often transmitted experientially rather than through formal instruction (Gherardi &

Nicolini, 2002). Gherardi and Nicolini (2002) describe this as a "secondary socialization" process, occurring predominantly in workplace contexts. Learning in this setting has a distinctly social dimension and is often driven by imitation and emulation. Serial socialization, where newcomers are guided by experienced role models, ensures continuity and cultural alignment, particularly in environments where tacit knowledge and situated learning are essential (Houghton, 2014; Van Maanen & Schein, 1977). In contrast, disjunctive socialization, where role models are absent, places the burden of sense-making solely on the newcomer, which can lead to confusion but also potentially foster innovation. In construction PBOs, where roles are defined according to specific project tasks, mentoring and shadowing are dominant, reflecting a preference for serial over disjunctive socialization.

Socialization also emerges through social events or shared activities, underscoring its inherently social dimension. Brainstorming sessions, informal gatherings, and team celebrations provide opportunities for tacit knowledge exchange, often outside hierarchical constraints (Nesvåg & Duckert, 2017; L. Nonaka et al., 1996; Turner et al., 2000). These occasions create relational and emotional atmospheres conducive to candid dialogue, tension resolution, and collaborative problem-solving. While alcohol may sometimes be present, it is not necessary; informal events such as retirements or project milestone celebrations serve similar purposes. These spaces allow individuals to step out of rigid roles and engage in reciprocal knowledge exchange.

Formalized socialization practices also exist. Conferences, team-building activities, and structured hybrid spaces, such as tearooms or shared commutes, function as "in-between" learning spaces that blur the boundaries between work and non-work (Solomon et al., 2006). Such settings reduce hierarchical pressures and foster tacit knowledge exchange, reflection, and collective learning. Tea room conversations, for example, often evolve into reflective dialogues where colleagues "analyse, reflect, and improve" without explicitly recognizing it as learning (Solomon et al., 2006).

Structured socialization mechanisms in PBOs deliberately integrate newcomers and cultivate competence. Mechanisms such as role rotations, mentoring systems, annual career reviews, and intentional peer-pairing programs systematically develop knowledge and skills (Turner et al., 2000). Spiral staircase career models, where individuals rotate through diverse project roles, provide exposure to technical, contractual, and interpersonal dimensions of work, contrasting with traditional functional silo career paths. These rotations are often complemented by mentoring, informal planning committees, and career reviews that align developmental needs with project opportunities.

In more formalized environments, pairing mechanisms offer a deliberate alternative to the ad hoc "sitting next to Nellie" approach, enabling peer-to-peer learning even in the absence of experienced mentors (Turner et al., 2000). Certification programs, such as PMI or PRINCE2, provide structured frameworks that institutionalize expectations for project competencies. Post-experience training modules further reinforce tacit knowledge through explicit instruction. However, such sessions are often oriented toward monitoring project outcomes rather than promoting learning, a limitation noted by Turner et al. (2000) more than two decades ago.

People-based or community approaches to knowledge transfer tend to be more effective and appealing than purely cognitive approaches (Styhre et al., 2004). Tacit knowledge requires shared mental models or common understandings for effective application (Bresnen et al., 2003; Newell, 2004). Communities of Practice (CoPs) provide such structures, comprising networks of relationships and activities that evolve over time to foster knowledge exchange (Glassey, 2008; Ruikar et al., 2009). CoPs exist at multiple organizational levels from departments such as finance, HR, or legal, to project-specific domains and are equivalent to what Y. Liu et al. (2021) define as learning networks. These networks may focus on safety, automation technologies, civil engineering, or management domains relevant to projects.

Sustaining effective CoPs depends on informal, in-person interactions, although technological support remains important (Ruikar et al., 2009; Schenkel & Teigland, 2008). CoPs facilitate the sharing of insights, expertise, and best practices, creating a shared understanding that enhances the application of tacit knowledge. Nonetheless, CoPs can become insular if not actively maintained, which may reduce their effectiveness and limit organizational learning (Ruikar et al., 2009).

2.5.2. Codification

Knowledge codification refers to the practices that lead to the conversion of tacit knowledge transmitted during the project to explicit knowledge. At an organizational level (see table 2.6), knowledge codification corresponds to the cognitive approach in order to facilitate its retention and circulation within a project organization (Bresnen et al., 2003). As Prencipe and Tell (2001) put it: "Codification is the process of conversion of knowledge into messages that can be processed as information". The information itself can come in the form of messages, rules, and relationships. This step is of significant importance as explicit knowledge (and information) can be more easily accessible. According to Swan et al. (2010) and Zollo and Winter (2002), knowledge codification is a step beyond knowledge articulation and is not dependent on personal networking. Instead, the main vehicle for its completion is disposing of information technology and database systems (Anh Thi Lê & Brønn, 2007). Having such systems facilitates the storage, sharing, search, and retrieval operations (Fong, 2005). However, not every single important detail is codified. A prominent form of codification is project documents. These documents include information regarding standardized procedures (procedural knowledge), procurement methodologies, and quality management (Hartmann & Dorée, 2015). Other documents are denoted as working documents, important to a project's progress, and can be tender documents, calculations, work drawings, and designs (Hartmann & Dorée, 2015).

Table 2.6: Summary of Organizational Learning Mechanisms

Mechanism	Description and Key Points	References
Experience Accumulation	- Group thinking, brainstorming, informal encounters, and imitation techniques. - Considered the lowest level of organizational learning. - Relies on tacit knowledge and leads to gradual process improvements. - Involves individual trial and error, contributing to the learning curve.	(Alashwal & Abdul-Rahman, 2014; Schindler & Eppler, 2003; Swan et al., 2010; Yelle, 1979)
Knowledge Articulation	- A more effective learning process than experience accumulation. - Encourages reflective practice and double-loop learning. - Promotes discussions and dialectic arguments during professional meetings. - Often conducted as "post-mortem" reviews to identify lessons learned.	(Busby, 1999; Kotnour, 2000; Prencipe & Tell, 2001; Swan et al., 2010; Zollo & Winter, 2002)
Knowledge Codification	- Converts tacit knowledge into explicit knowledge. - Facilitated by IT systems for storage, retrieval, and sharing. - Includes procedural knowledge, procurement methodologies, and quality management in project documents.	(Anh Thi Lê & Brønn, 2007; Fong, 2005; Hartmann & Dorée, 2015; Prencipe & Tell, 2001)
Knowledge Transfer	- Two approaches: ICT-based (codification) or people-based (personalization). - Cognitive approach: Codifies knowledge for retention and circulation. - Community approach: Builds shared understanding through Communities of Practice (CoP). - CoPs foster informal interactions and learning networks but risk isolation.	(Bresnen et al., 2003; Glassey, 2008; Y. Liu et al., 2021; Newell, 2004; Ruikar et al., 2009; Styhre et al., 2004)

2.6. Theoretical Framework

A theoretical framework can be seen in figure 2.8. The framework delineates the interdependent relationships among knowledge management, project-based organizations (PBOs), and organizational learning processes. At the apex, knowledge management establishes the formal structures, procedures, and regulatory mechanisms that govern the creation, storage, and dissemination of knowledge, whereas PBOs operationalize these structures within the context of project execution. This dual positioning reflects the necessity of aligning strategic knowledge management imperatives with the practical realities of project-based work, ensuring that organizational learning is both institutionally supported and contextually responsive.

Central to the framework, organizational learning mediates the transformation of knowledge into actionable insights. It is shaped by both enabling mechanisms, such as the SECI model of knowledge conversion (i.e. socialization, externalization, combination, and internalization), and constraining factors represented by organizational barriers. SECI processes facilitate iterative interactions between tacit and explicit knowledge. The resultant knowledge transfer manifests through codification and socialization,to reflect both formalized documentation and informal, relational knowledge exchange.
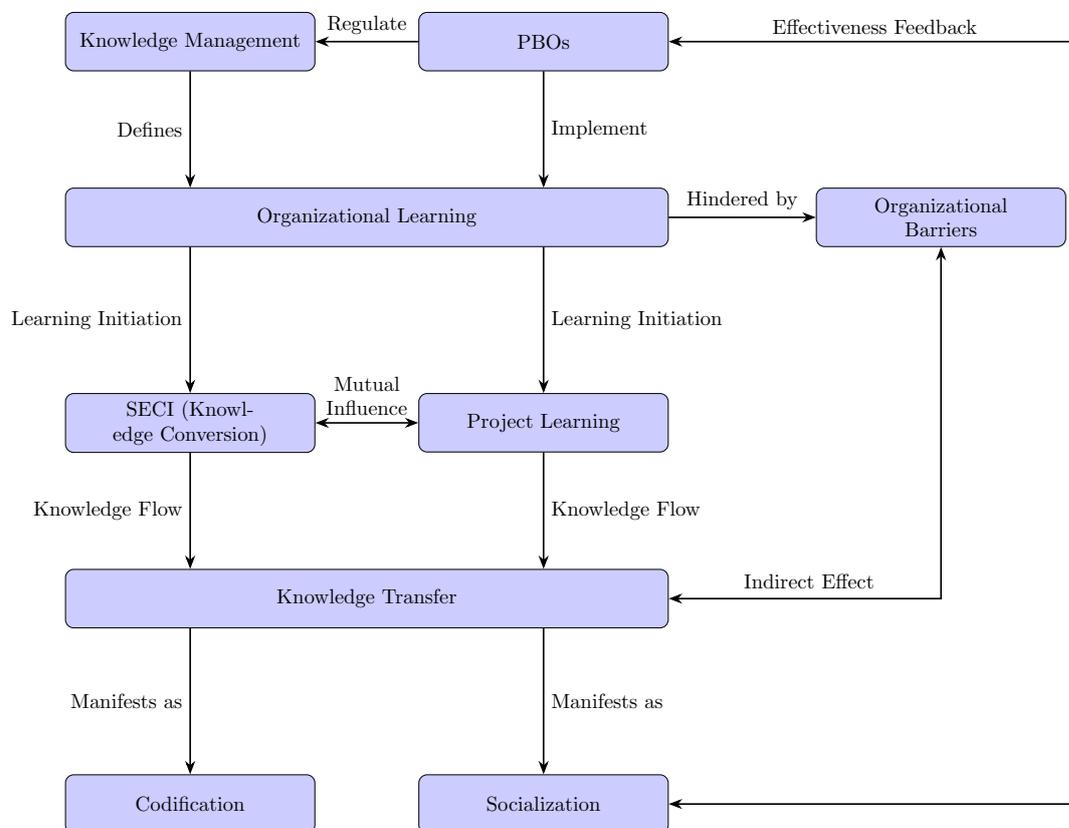
Figure 2.8: Theoretical Framework

2.7. Conceptual Framework

In order to explore the problem further and obtain practical insights, it is good practice to conceptualize it. In this case, the conceptual framework attempts to illustrate the "how" dimension of the research problem. The point of interest is related to PBOs in the construction sector. As a result, we can start by modeling the structure of such an organization (see figure 2.9).
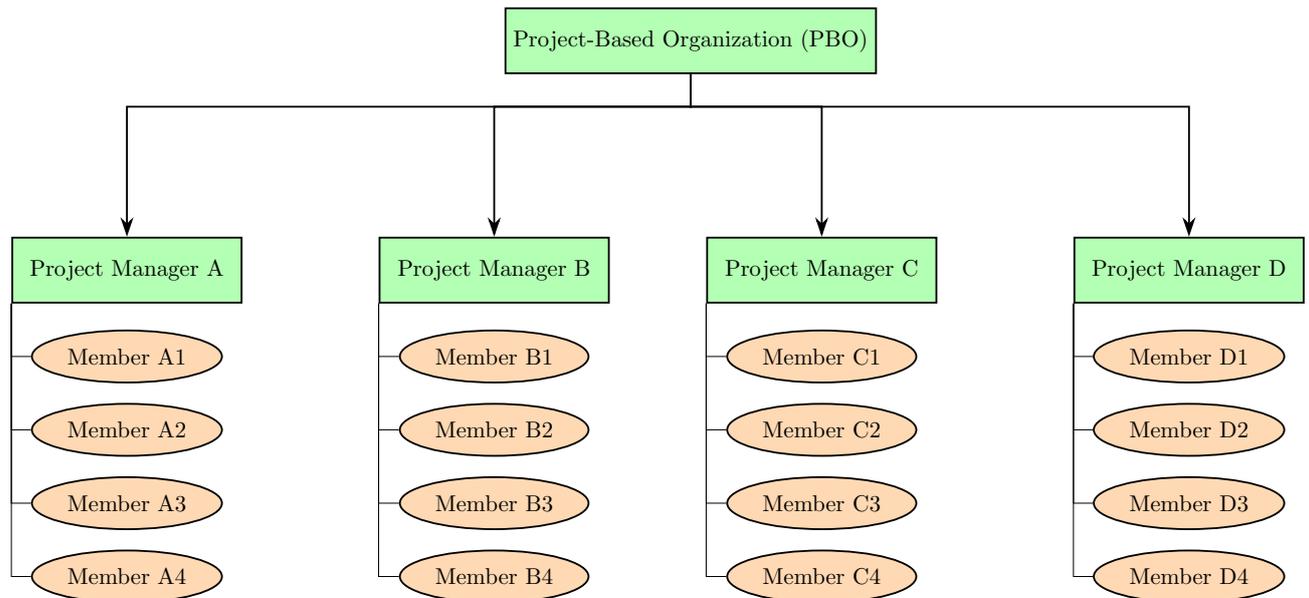
Figure 2.9: Organizational Structure for PBOs (adapted from Prouska and Kapsali (2021))

PBOs have top leadership that delegates the work to project managers and their teams. But what happens in between? To navigate this question, a framework was proposed, having 4 dimensions. A definition of said dimensions follows below. For the summary of these dimensions, see table 2.8.

Communication is one important factor that affects knowledge transfer (Gupta et al., 2000; Kwofie et al., 2014). In addition to that, communication when effective could increase motivation levels and learning intent (Lee & Kim, 2018). In general, communication follows a sender-receiver approach, while also being highly contextual (Kwofie et al., 2014; Lee & Kim, 2018). Another important aspect of communication is what Lee and Kim (2018) describe as "information processing". The accessibility of information is elucidated with respect to the manner in which it is stored and accessed. Familiarity with any particular topic is also important as information can potentially become part of the so-called "working memory" (Lee & Kim, 2018). So, for new information to become part of an individual's memory it has to be meaningful in a way. Communication in project settings has its own types and purposes. Table 2.7 illustrates the main purposes of communication in construction projects.

Table 2.7: Table describing different communication purposes in project management. (Lee & Kim, 2018)

Purpose	Description	Example
For Instruction	To enable an individual or a group to accomplish particular tasks	Specifications, Weekly Meetings
For Consolidation	To bring about interrelationship among various project participants	Project Meetings
For Information	To inform an individual or a group about particular tasks, policies, or procedures	Daily Reports, RFIs
For Evaluation	To examine tasks performed by an individual or a team	Checklists
For Direction	To issue directions by top management or manager to the lower level	Construction Change Directives
For Training	To teach or educate workers about particular tasks, policies, or procedures	Toolbox Talks
For Influence	To persuade others	Submittals, Change Order Requests
For Image Building	To project the image of the firm in society	Vision and Mission Statements
For Orientation	To help people become acquainted with others and with policies, objectives, rules, and regulations	Kick-Off Meeting

As for the knowledge types concerned, as also pointed out in section 2.3.1, they can be related to project management, technical, and entrepreneurial aspects (Tshuma et al., 2018). In construction projects, communication also has an interface with their social side, as social communication skills are required (Kwofie et al., 2014). This, of course, can be interpreted as follows: project team members need to be able to convey project-related information with each other (Kwofie et al., 2014). Goh (2002) add to the discussion about communication and knowledge transfer the dimensions of trust and "willingness to share". The communication channels according to Goh (2002) have to be horizontal in order to facilitate knowledge transfer, hence socialization. Figure 2.10 showcases the framework used to explore the effectiveness of communication.
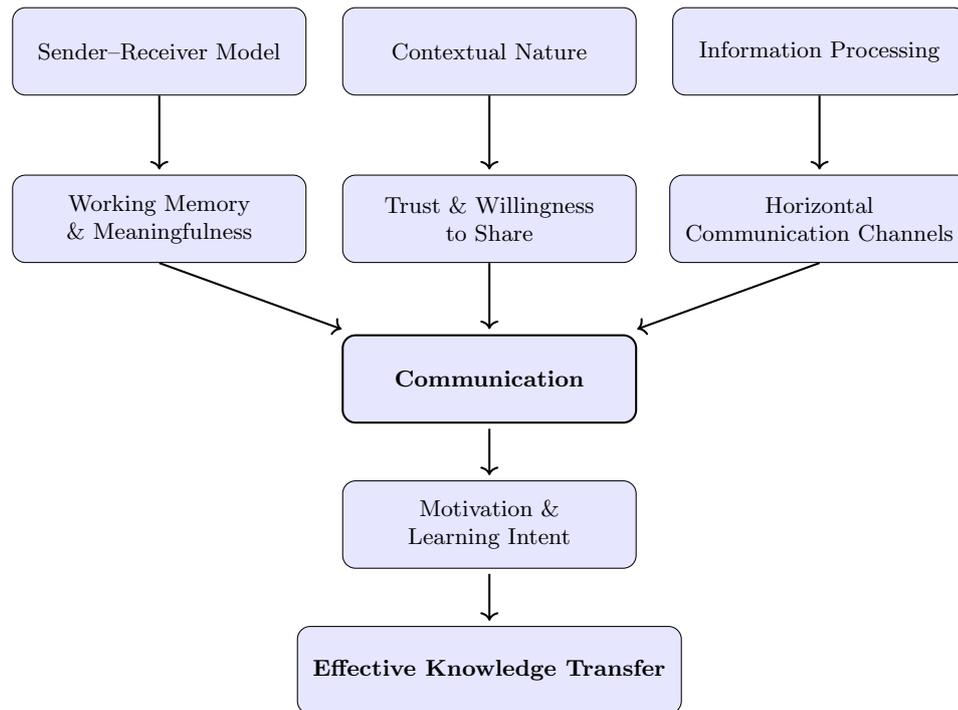
Figure 2.10: Communication and Knowledge Transfer Framework (Goh, 2002; Kwofie et al., 2014; Lee & Kim, 2018; Tshuma et al., 2018)

Organizational absorptive capacity can be defined as the ability of an organization to accept, embrace, and assimilate new information while also becoming familiar with it, in order to obtain innovative and cost-effective solutions (Singh et al., 2023; Zahra & George, 2002). In general, absorptive capacity is dynamic, as it is directly dependent on the moving "social capital" within the organization (Singh et al., 2023). Zahra and George (2002) highlight four dimensions of absorptive capacity: *acquisition*, *assimilation*, *transformation*, and *exploitation*.

Acquisition refers to the ability of the firm to identify and obtain externally generated knowledge (Zahra & George, 2002), which is shaped by the organization's prior expertise and knowledge base (Chauvet & Guiot-BP, 2002). Chauvet and Guiot-BP (2002) further emphasize the importance of a "commitment to gather knowledge", which involves not only the flow and speed of information, but also the discussions and observational capabilities of employees. *Assimilation* is linked to the organization's routines and processes that allow it to analyze, interpret, and internalize new knowledge (Chauvet & Guiot-BP, 2002; Zahra & George, 2002). In this sense, socialization may function as a process to facilitate the exchange of knowledge between employees and stakeholders within the organizational setting (Singh et al., 2023). Finally, absorptive capacity can be distinguished as either "potential" (acquisition and assimilation of new knowledge) or "realized" (transformation and exploitation of knowledge) (Singh et al., 2023), with both stages pointing to the positive outcomes that emerge when knowledge is effectively harnessed.

Within project-based organizations (PBOs), absorptive capacity takes on a particularly critical role. Since PBOs are temporary and highly dependent on inter-project learning, their ability to acquire and assimilate knowledge across project boundaries determines whether valuable lessons are institutionalized or lost. In this context, absorptive capacity shapes how project teams exchange expertise, interpret new information, and translate it into improved practices. High absorptive capacity in PBOs enables project teams to integrate external knowledge, learn from past projects, and adapt to dynamic environments, whereas low absorptive capacity often results in fragmented learning, and limited knowledge diffusion.

Institutionalization is a term that denotes collective and formal tactics that organizations can imple-

ment in their operations. However, with respect to knowledge transfer, two approaches are present: collective (Institutionalization), and individual (individualization). Individual mechanisms are ad-hoc and informal, while collective mechanisms enable access to knowledge for more members of the organization. Both mechanisms complement each other with their own set of trade-offs. As Boh (2007) describe it, "individualized knowledge sharing mechanisms allow knowledge sharing to take place using an informal and decentralized approach". This means that the organization invests no effort in moderating and monitoring the process itself, thus not choosing the content of learning and information (Boh, 2007). Boh (2007) argue that institutionalized mechanisms allow a better exploitation of knowledge, while decreasing the flexibility of the organization. This, of course, stems from the presence of databases and forums for further discussions and reflection of repeated activities. However, as it has been mentioned earlier, socialization co-exists with codification efforts. As a result, Boh (2007) have proposed a framework composed of four quadrants, as it can be seen in figure 2.11.
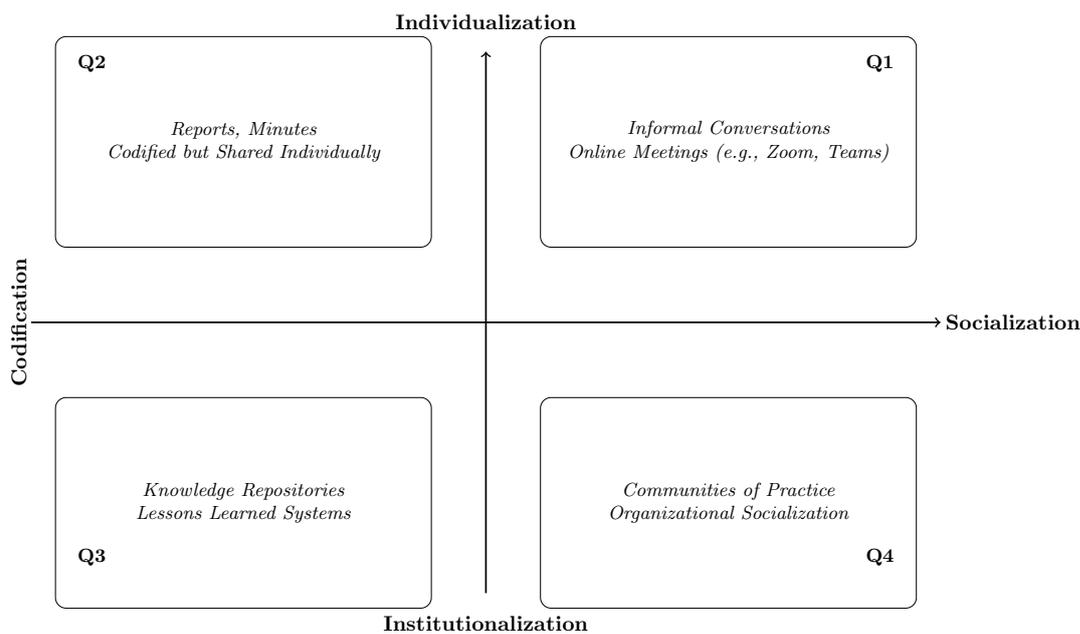
Figure 2.11: Knowledge Sharing Mechanisms Framework (Boh, 2007)

Quadrant 1 refers to the informal side of knowledge sharing between individuals, usually conducted face-to-face. With the COVID-19 pandemic, more and more applications and media were introduced to set the stage for so-called online meetings, eliminating the fact that distance could hinder such occasions. Some examples of such applications are Microsoft Teams and Zoom workplace.

Quadrant 2 is related to the individualized side of codification efforts. As a result, it focuses on the interchange of project reports, meeting minutes, and other codified project artifacts shared between individuals.

Quadrant 3 refers to the codification mechanisms that are effectively encouraged by the organization, thus making them institutionalized. As Boh (2007) put it: "The fundamental idea for this class of knowledge-sharing mechanism is to capture specialist knowledge in knowledge bases that other specialists can access." The institutionalization of knowledge sharing is an important endeavor that is related to the levels of IT capabilities of the organization, and repositories that capture the experiences of the organization (Boh, 2007; Newell, 2004).

Lastly, quadrant 4 is related to the socialization mechanisms that are, in turn, encouraged by the organization. Here Boh (2007) add the fact that the codification of the collected knowledge can be beneficial, as knowledge sometimes has to reside within the experts in order to be then transferred to less experienced individuals.

An important notion that has to be defined is culture, a rather abstract concept with various interpretations and dimensions. According to Hofstede (2011), culture is defined as "the collective programming of the mind that distinguishes the members of one group or category of people from others". Culture can encode different shared values, attitudes, beliefs, assumptions, and artifacts of a given group (Tharp, 2009). Culture traditionally refers to different nationalities and tribes. It could also refer to people of the same profession or "professional culture". In a broader sense, culture can also be used as a concept to designate an organization or firm, thus gaining the "organizational culture" nomenclature. The latter can play an important role in helping explain the connections between individuals and employees. Firms often constitute a micrography of the society that surrounds them. A popular model that classifies the different organizations was proposed by Cameron and Freeman (1991). In it four dimensions are used for the purposes of classification: Clan, Adhocracy, Hierarchy, and Market (see also figure 2.12).

Organizations that fit in the Clan (Collaborate) category, often put their focus on materializing the right conditions for shared understanding and commitment, with no formalized communication processes (Wiewiora et al., 2013). Organizations that operate within the Clan archetype try to encourage teamwork and the inclusion of their employees in their operations and mentoring sessions. This archetype is most often seen in small, community-driven firms or family-owned businesses, where relationships and loyalty are central to success.

Organizations that are part of the Adhocracy category revolve around enhancing creativity, entrepreneurship, and flexibility (Tharp, 2009; Wiewiora et al., 2013). These organizations have a broader future outlook and are typically involved in the technological sector. The condition of success becomes synonymous with innovation and constant progress. Some examples of such firms are the following: Google, Apple, Microsoft (Tharp, 2009).

Organizations that are regarded as Hierarchy, embody classic characteristics of large bureaucratic corporations (Tharp, 2009). They display an important degree of predictability and internal focus (Tharp, 2009; Wiewiora et al., 2013). The key aspects of such organizations is standardization, routines, information management, documentation, control, and a well-defined structure. Typically, governmental agencies employ this type of culture.

Organizations that are part of the Market category are similar to those that belong in the Hierarchy category. Both value stability and control. The distinctive feature between the two, however, is the fact that market-culture organizations have an external focus while hierarchical organizations have an internal focus (Tharp, 2009; Wiewiora et al., 2013). They sustain relationships with external suppliers, contractors, unions, legislators, consultants and the external environment in general (Wiewiora et al., 2013). Market organizations emphasize on competitiveness, goal and results clarity, efficiency, and accomplishment. In addition, their strategy is to gain important competitive advantages and market penetration (Cameron & Freeman, 1991; Wiewiora et al., 2013).

CLAN	ADHOCRACY
• Mentoring • Extended family, nurturing • Participation • Teamwork • Employee involvement • Corporate commitment to employees • Rewards based on teams, not individuals • Loyalty • Informality • Job rotation • Consensus	• Dynamic • Entrepreneurial • Risk-taking • Rapid change • Innovation • Creativity • Temporary structure • Power flows from individual to individual or team to team • Sometimes exists in large organisations with a dominant culture of a different type
HIERARCHY	**MARKET**
• Structure • Control • Coordination • Efficiency • Stability • Procedures govern what people do • Formal rules and policies	• Results-oriented • Gets job done • Competition and achievement • Focus on transactions with external suppliers, customers, and contractors • Productivity • Tough and demanding leaders • Emphasis on winning • Success is defined in terms of market share and penetration

Figure 2.12: Organizational Culture Types (Adapted from Wiewiora et al. (2013)

According to Gupta et al. (2000), organizational culture is regarded as one of the most critical factors in sharing knowledge, learning, and creating new knowledge. The research conducted by Prencipe and Tell (2001), attempted to reconcile the organizational culture of a firm with its knowledge-related tendencies and operations. The framework that resulted from this research mainly tried to explain the connection between inter-project learning and culture. It consists of three levels of analysis: Individual, Group/Project, and Organizational. Based on these dimensions Prencipe and Tell (2001) identify three types of possible learning mechanisms that take place in firms. These are: Explorer (or L-Shaped), navigator (or T-shaped), and exploiter (or staircase). They can be found in Appendix A.

The Explorer, also known as the L-shaped learning landscape, characterizes firms that heavily rely on experience accumulation and informal, people-based knowledge transfer. These firms value personal interactions as a key mechanism for project-to-project learning and often emphasize the role of corporate culture in fostering collaboration. Typically, the size and organizational layout (e.g., open-plan offices) enable seamless knowledge flow among employees. However, these firms often lack formal tools for knowledge codification, making it challenging to systematically capture and reuse knowledge. This approach tends to highlight flexibility and responsiveness, leveraging interpersonal connections to explore various learning opportunities, albeit at the cost of scalability and systematic documentation.

The Navigator or T-shaped learning landscape focuses on mechanisms that articulate knowledge and

institutionalize learning processes. These firms adopt structured approaches, such as lessons-learned meetings at the end of project phases, to systematically reflect on actions and improve practices. Such mechanisms bridge individual and organizational levels, aiming to embed learning into processes and standards while maintaining room for individual insights. Navigators often face challenges in ensuring widespread adoption and balancing formal codification with the spontaneity of informal knowledge exchanges. This approach enables firms to navigate a blend of personal experience and structured learning to improve long-term project outcomes.

The Exploiter, or staircase landscape, represents firms at the advanced stage of knowledge codification, where the emphasis is on deliberate efforts to document and systematize knowledge. These firms use ICT-based tools to codify project knowledge, creating easily accessible repositories for future use. Codified knowledge supports efficient knowledge diffusion and reuse, significantly enhancing organizational learning capabilities. However, the over-reliance on formal mechanisms can sometimes overshadow the benefits of informal knowledge-sharing practices. The staircase model prioritizes precision and re-usability of knowledge, aligning with a strategic focus on operational efficiency and scalability.

Table 2.8: Key concepts related to knowledge transfer and organizational learning.

Concept	Description	Key References
Communication	Central to knowledge transfer, effective communication enhances motivation and learning intent, depending on sender–receiver dynamics, context, and information processing. Memory integration requires accessibility, familiarity, and meaningfulness. Its purposes include instruction, information sharing, evaluation, training, influence, and orientation.	(Gupta et al., 2000; Kwofie et al., 2014; Lee & Kim, 2018)
Absorptive Capacity	The organization's capacity to acquire, assimilate, transform, and exploit knowledge—expressed as potential (acquisition, assimilation) and realized (transformation, exploitation), depends on prior knowledge, commitment to learning, and socialization. In project-based organizations, it supports cross-project expertise sharing, learning from experience, and translating knowledge into improved practices, driving innovation and competitiveness.	(Chauvet & Guiot-BP, 2002; Singh et al., 2023; Zahra & George, 2002)
Institutionalization	Two complementary knowledge transfer mechanisms: Individualization such as informal: ad hoc, decentralized, and flexible (e.g., face-to-face interactions, reports, meeting notes); and Institutionalization: formal, collective, IT-enabled, reducing flexibility but enhancing systematic codification and knowledge use (e.g., databases, forums).	(Boh, 2007)
Organizational Culture	Shared values, beliefs, and practices that shape knowledge sharing and learning. Cultures can be Clan (collaboration, teamwork), Adhocracy (innovation, entrepreneurship), Hierarchy (bureaucracy, control), or Market (competitiveness, external focus). Organizational culture influences inter-project learning and knowledge creation through explorer, navigator, and exploiter models.	(Cameron & Freeman, 1991; Hofstede, 2011; Prencipe & Tell, 2001; Tharp, 2009; Wiewiora et al., 2013)

The conceptualization integrates the four key dimensions illustrated in the organizational structure from Figure 2.9, with the complete model depicted in Figure 2.13. IIn Figure 2.13a, an organizational diagram of a PBO is depicted. At the apex of the structure resides the Project-Based Organization (PBO), which serves as the central coordinating entity connecting multiple project managers and their respective teams.

Each project manager (A through n) oversees a distinct project team. The communication flows have two dimensions: vertical internal hierarchical communication within each team (from project managers downward through team members), and a horizontal cross-functional communication across equivalent roles in different teams (e.g., $A_1 \rightarrow B_1 \rightarrow C_1 \rightarrow D_1$). This dual communication structure underscores the importance of both vertical coordination and horizontal collaboration for effective sharing of insights and knowledge.

Complementing the communication flows, the project teams' ability to identify, assimilate, and apply external knowledge. More precisely, the project teams learn from past experiences and translate knowl-

edge into improved practices. This process culminates in the creation of lessons learned (L_1–L_n), which capture project-specific experiential knowledge at the operational level.

Encapsulating the entire PBO structure is the organizational culture, highlighting how learning processes and communication patterns are fundamentally shaped by the organization's shared values, norms, and behavioral expectations.

At the foundation, a formalization process ensures that project-derived insights transcend their immediate context, becoming institutionalized into the organization's enduring practices. This cyclical integration of experiential knowledge back into the organizational framework completes the learning continuum, enabling continuous refinement of collective capabilities.

Figure 2.13b illustrates the multidimensional nature of socialization as a mechanism that enables project learning in Project-Based Organizations (PBOs). It visualizes how socialization manifests through the four key organizational dimensions: organizational culture, communication, absorptive capacity, and institutionalization, each encompassing practices that facilitate the exchange, internalization, and reinforcement of tacit knowledge.

Within organizational culture, socialization occurs through mentoring, shadowing, rituals, and communities of practice that reinforce shared values and norms. Communication fosters informal and horizontal knowledge sharing through peer-to-peer coordination, brainstorming, and spontaneous interactions that build mutual understanding. Absorptive capacity reflects socialization as a learning process through doing, role rotation, and shadowing, which enable the transformation of individual experience into organizational knowledge. Finally, institutionalization anchors socialization structurally by embedding it into formal mechanisms such as mentoring systems, hybrid workspaces, and monitoring processes that sustain knowledge retention across projects.
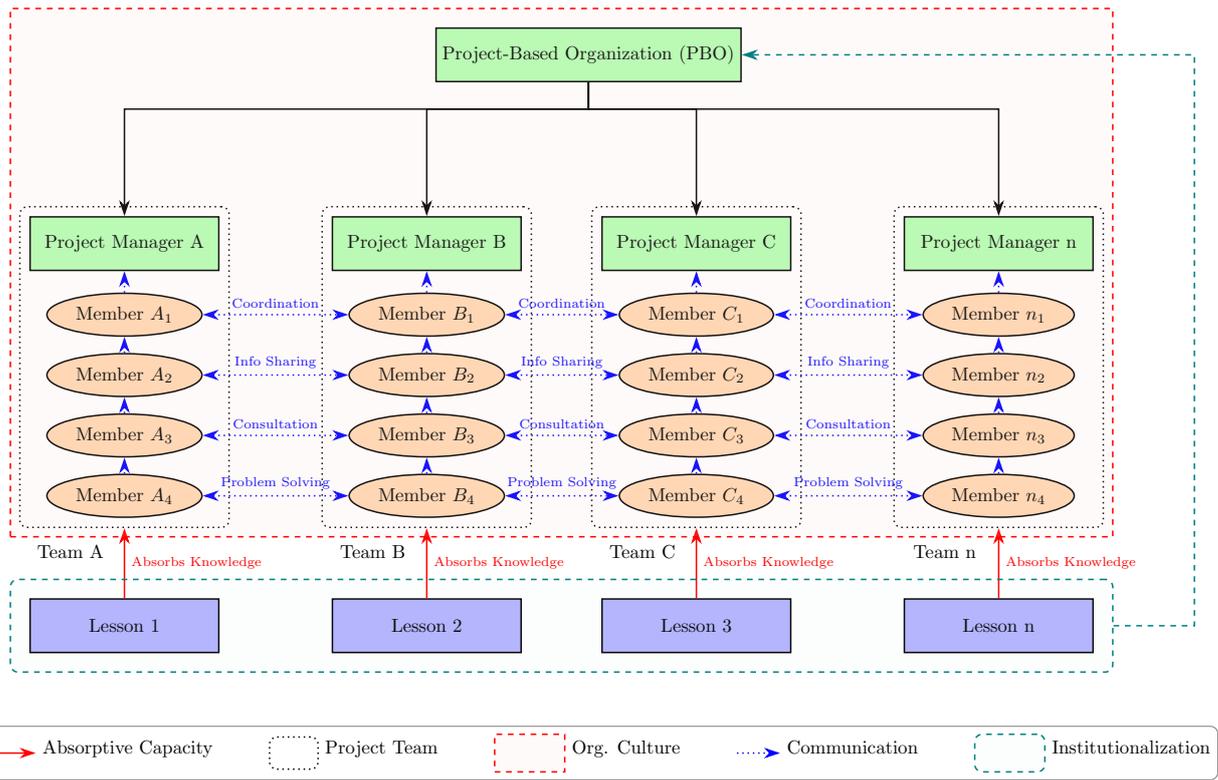
(a) Organizational Structure
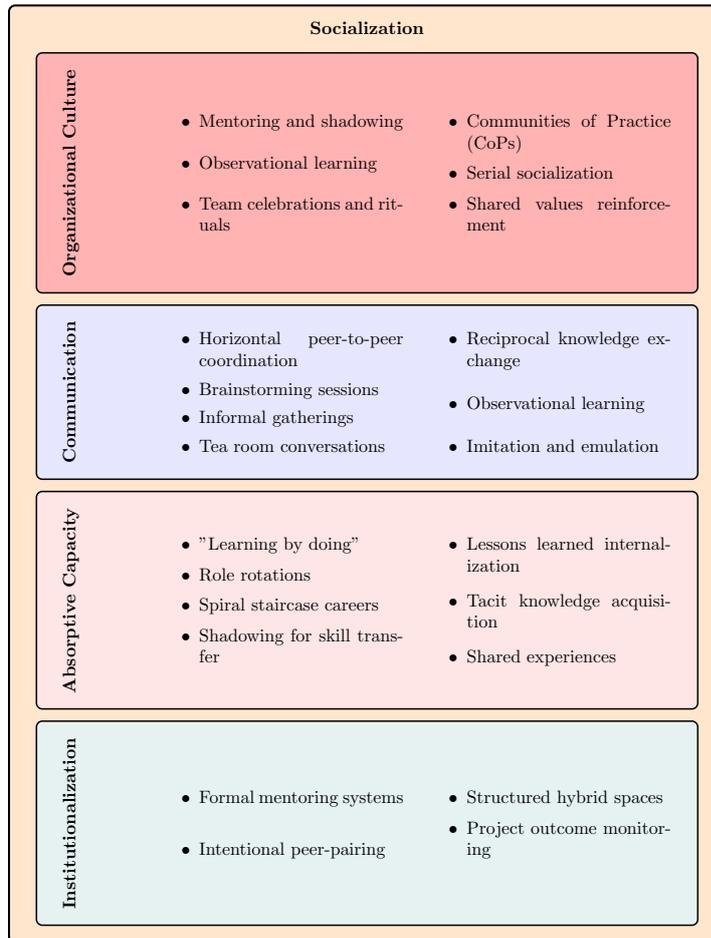
(b) Socialization Process

Figure 2.13: Conceptual Framework

3

Research Methodology

This chapter is concerned with the methodological approach adopted to address the research objectives of the thesis. It outlines the overall research design, data collection strategy, and analytical procedures employed to explore the research problem. The chapter explains the rationale for selecting a qualitative approach, with semi-structured interviews as the main data collection method, and the Gioia method as the tool for interpretation. It further addresses issues of validity through verification techniques and includes a brief discussion on ethical considerations pertaining to the involvement of human participants.

3.1. Research Design

In order to formulate the research problem, an in-depth literature review was conducted. The main sources of reference were Google Scholar, Science Direct, and other scientific journal databases. The keywords that were applied in order to facilitate the research were the following: "Knowledge Management (KM)", "Organizational Learning (OL)", "Project Learning (PL)", "Learning mechanisms (LM)", "Lessons Learned (LL)", "Organizational Culture (OC)", "Knowledge Transfer" (KT) and others. A comprehensive database of the relevant papers was constructed and imported to the Atlas.ti software package (ATLAS.ti Scientific Software Development GmbH, 2024). Figure 3.1 summarizes the keywords that helped with the orientation of the research. From the literature review, a theoretical framework was produced to, in the words of Varpio et al. (2020): "provide the grounding of the research, unite them through logical connections, and relate these concepts to the study that is being carried out". Then, a conceptual framework was presented to provide a snapshot of the problem. In other words, it provided the researcher's "understanding of the problem' (Tamene, 2016).
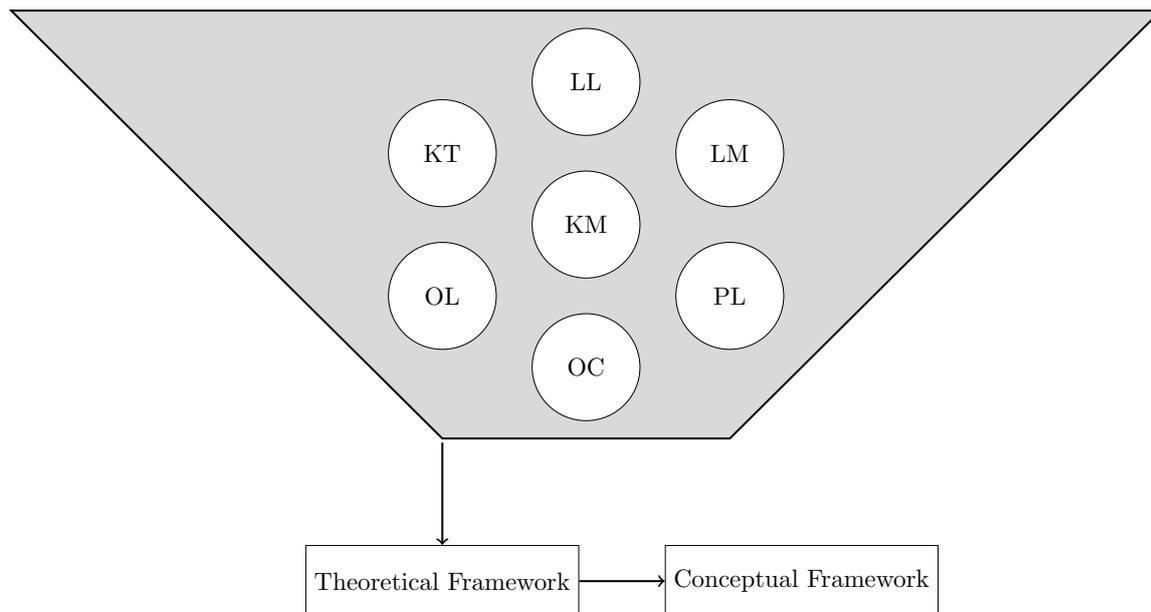
Figure 3.1: Keywords

According to Henderson (2016), the research design is influenced by the philosophy, the methodology and, the methods. Research can be quantitative and qualitative in nature (Basias & Pollalis, 2018; Henderson, 2016). Quantitative research consists of numbers, the researcher's point of view, and is static, taking place with "artificial settings" (Basias & Pollalis, 2018; Henderson, 2016). On the other hand, qualitative research contains qualitative data (words), is concerned with the points of view of the participants, and is governed by "natural settings" (Henderson, 2016).

3.2. Semi-structured Interviews

Semi-structured interviews have become one of the most popular data collection method when treating qualitative data. Semi-structured interviews are conducted mostly at an individual basis, with individuals that have experience and knowledge relevant with the research scope and objective (Adeoye-Olatunde & Olenik, 2021). The participants can be treated as experts who can provide their perspectives, beliefs, and opinions (Mathers et al., 1998), and they are the "key stakeholders" of the research problem (Adeoye-Olatunde & Olenik, 2021). With the latter in mind, the participants have to operate in the construction industry and possibly populate upper management positions. The interviewees were selected with these criteria in mind and based on the researchers personal network. The interviewees selected occupied managerial positions mostly, as they

The research problem was not considered confined to a specific case, leading to the elimination of case studies as possible choices for research. On the other hand, the empirical research consisted of a broad range of interviewees, with their demographics being illustrated in table 3.1. The interviews were conducted in a virtual format with the help of the Microsoft Teams software package. A form, attached in Appendix B, was sent to inform the participants about the research and the interview protocol. At the end of the interviews, a transcript was kept for further analysis.

The interviewees received a list of questions before the interviews in order to prepare and provide the information required at the best of their knowledge. The list itself was based on the conceptual framework developed during the thesis, presented in section 2.7. The questions themselves were used as a guideline and provided grounds for follow-up questions that emerged during the interview.

Table 3.1: Demographic Information of Interviewees

ID	Position	Country	Age	Years of Experience	Industry	Affiliation
EX1	CEO, Construction Manager	Greece	65	35	Construction	Contractor
EX2	Managing Director	Netherlands	30	5	Industrial Maintenance	Contractor
EX3	Engineering Consultant	Iran	27	4	Consulting	Contractor
EX4	General Manager	Greece	65	35	Consulting	Contractor
EX5	Project Manager	Iran	55	27	Consulting & Construction	Contractor
EX6	Project Manager	Greece	65	35	Construction & Maintenance	Client
EX7	Design Engineer	Iran	55	27	Infrastructure	Contractor
EX8	Project Engineer	Italy	65	32	Construction	Client

3.3. Gioia Method

In order to analyze and interpret the interview transcripts, the Gioia method was selected. This approach is particularly suited for qualitative research as it provides a systematic and transparent way of moving from raw data toward theoretical insights. The method directly responds to long-standing criticisms of qualitative research, such as lack of rigor, subjectivity, and difficulty in replication, by emphasizing methodological clarity and traceability between data, codes, and concepts.

Following D. Gioia (2021), the Gioia methodology (see figure 3.2) incorporates the principle of groundness, ensuring that emerging theoretical dimensions are firmly rooted in the informants' own accounts. By starting with first-order concepts in the participants' terms, then abstracting them into second-order themes, and finally consolidating them into aggregate dimensions, the method not only strengthens the credibility of the findings but also fosters novel theoretical contributions grounded in empirical evidence.
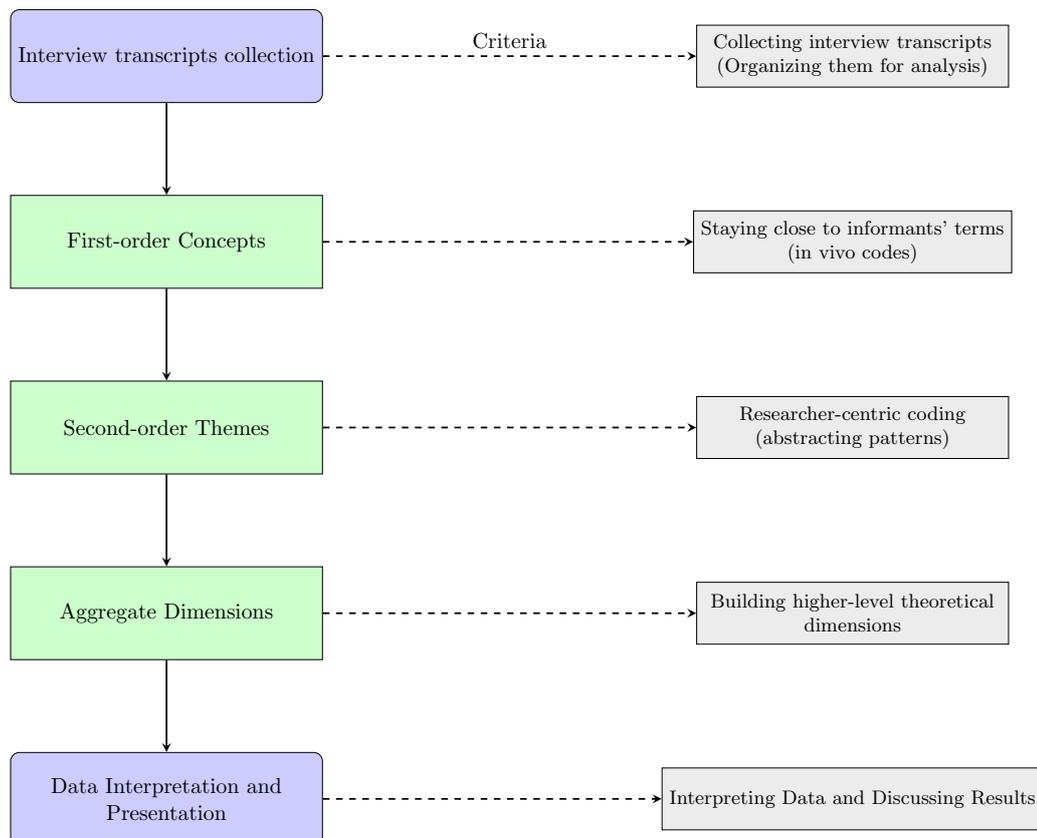
Figure 3.2: Gioia Method Process (D. Gioia, 2021)

3.3.1. Interview transcripts collection

The process begins with the systematic collection of interview transcripts. At this stage, the raw material for analysis is organized and prepared for coding. Transcripts are reviewed to ensure accuracy and completeness, creating the foundation for subsequent steps. The process for their review can be seen in figure 3.3. The three criteria for the exclusion of certain codes were three (see table 3.2): Redundancy, Relevance, and Specificity. These criteria were applied jointly to the empirical dataset to reduce it to a more refined dataset.

Table 3.2: Exclusion criteria for reducing in-vivo codes

Criterion	Description and Rationale
Redundancy	Codes that capture the same or highly overlapping ideas are merged or one is excluded. This prevents duplication and ensures a streamlined code set.
Relevance	Codes that do not directly relate to the research question (e.g., forms of socialization for knowledge transfer in project-based construction organizations) are excluded. This keeps the analysis focused.
Specificity / Analytical Value	Codes that are too vague, generic, or lack analytical depth (e.g., "communication" without context) are excluded. Retained codes must offer clear meaning and contribute to category or theme development.

```
┌─────────────────────────────┐
│    In-vivo codes generated   │
│  from transcripts (n = 261)  │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│    Codes after initial du-   │
│   plicate removal (n = 0)    │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐        ┌─────────────────────────────┐
│   Codes screened (n = 261)   │───────▶│   Codes excluded (n = 20)    │
│                              │        │   **Reason: Redundancy**     │
└─────────────────────────────┘        └─────────────────────────────┘
              │
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┌─────────────────────────────┐        ┌─────────────────────────────┐
│     Codes assessed for       │───────▶│   Codes excluded (n = 50)    │
│     relevance (n = 241)      │        │   **Reason: Irrelevance**    │
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│   Codes assessed for speci-  │───────▶│     Codes excluded (n = 159)      │
│ ficity/analytical value (n = 191)│    │ **Reason: low analytical value**  │
└─────────────────────────────┘        └───────────────────────────────────┘
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              ▼
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│  Final codes included in the-│
│   matic synthesis (n = 32)   │
└─────────────────────────────┘
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(a) Flow chart of exclusion process.
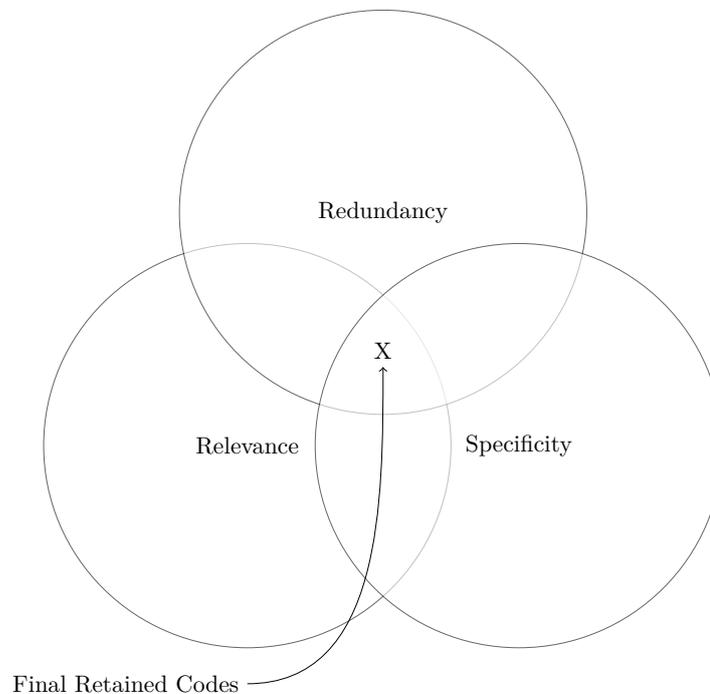
(b) Solution space for criteria.

Figure 3.3: Overview of the exclusion process and solution space for criteria.

3.3.2. First-order concepts

In line with the Gioia methodology, first-order concepts are derived from the raw interview data using the participants' own words (D. A. Gioia et al., 2013). This process typically involves in vivo coding or open coding, where researchers label meaningful segments of text directly from interviews (Corbin & Strauss, 1990; Khandkar, 2009). Such coding helps to "stay true" to the informants' voices and preserves their perspectives, ensuring that the emerging analysis is firmly rooted in their lived experiences (Locke, 2001).

3.3.3. Second-order themes

First-order concepts are then grouped into more abstract second-order themes. At this stage, the researcher introduces interpretation, clustering related concepts together to uncover broader patterns and relationships (Nag et al., 2007). These themes represent a step toward theorization, as the researcher begins to distill higher-level meanings from participants' statements (Langley, 1999).

3.3.4. Aggregate dimensions

Second-order themes are further consolidated into aggregate dimensions, representing higher-level theoretical constructs D. A. Gioia et al., 2013. Aggregate dimensions capture the core insights from the data structure and provide the conceptual scaffolding for new theory development (Nag & Gioia, 2012). These dimensions move beyond informant-centric codes and researcher-centric themes to reflect the broader theoretical contribution.

3.3.5. Data interpretation and presentation

Finally, the aggregate dimensions are interpreted and situated within the broader research framework. This step involves linking empirical findings with existing theory, discussing implications, and presenting the results in a transparent and systematic way (Eisenhardt, 1989). The data structure (first-order concepts, second-order themes, and aggregate dimensions) serves not only as a visual representation of the analytical process but also as evidence of rigor and transparency in inductive theory building (Pratt, 2009).

3.4. Verification

The collected transcripts from the interviews were used to produce an analysis of the analytical framework that was devised for this thesis. The last step in order to ensure that the content and information collected corresponds to factual details would be to discuss the findings with other experts, (Buchbinder, 2011). The latter stage is important as potential misconceptions by the researcher were cleared out. Moreover, a verification interview is essential as a countermeasure to potential biases that can be displayed by the researcher (Sánchez-Guardiola Paredes et al., 2021). Validity itself is defined as the extent to which a research artifact comprehensively captures all relevant aspects of a construct (Brod et al., 2009).

Table 3.3: Demographic Information of Experts

ID	Position	Age	Years of Experience	Industry
VEX1	Project Manager	70	40	Construction
VEX2	Site Engineer	65	35	Infrastructure

3.5. Ethical considerations

The interviewees and experts were informed that, as participants of this study, their data and answers were considered confidential. Consent forms were prepared and distributed to all participants in this study. These forms informed the interested parties about the study focus and other details that required personal input.

3.6. Summary

A summary of the research methodology and process that was utilized in this thesis project can be seen in figure 3.4. The project had three important stages: Research Problem Definition, Research method Selection & Participants, and Results Analysis & Interpretation. The literature review guided the research as relevant information was collected and used to define the research problem and the questions needed to investigate it. An important consideration was the feasibility of the study, with the focus being on the manageability of it. Then, the research method was selected on the basis of the problem not being case-sensitive. The type of data that would prove useful in the overall investigation of the problem was of equal importance. As the problem involved opinions, attitudes, and other soft-related criteria, qualitative data was exclusively collected. For its analysis, the Gioia method proved to be the appropriate one, being used in interpreting both the preliminary results and the expert information.
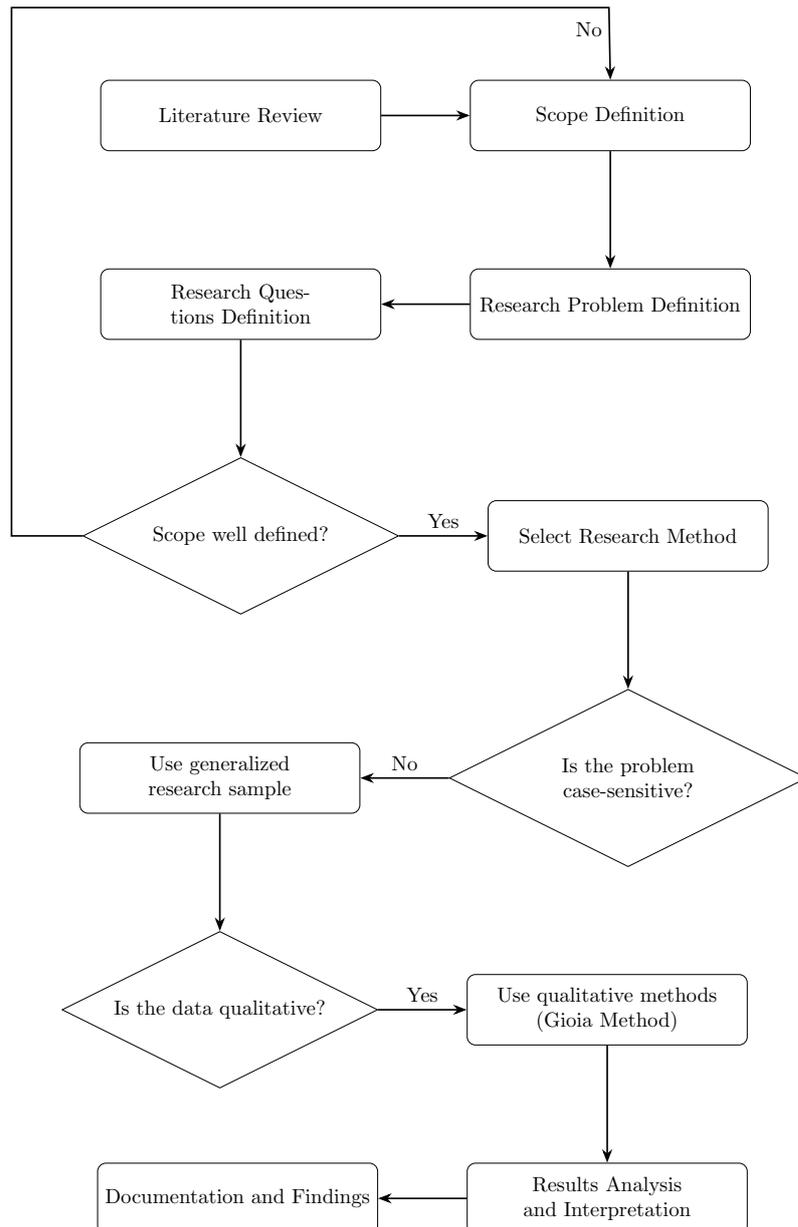
Figure 3.4: Research Methodology Process

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Empirical Findings

This chapter presents the empirical findings of this study, structured around a systematic analysis of qualitative data collected from eight semi-structured interviews with professionals in project-based organizations (PBOs). The initial open coding process generated 261 in-vivo (open) codes, which were refined and consolidated into 32 first-order concepts (see table 4.1). These codes were further organized into six second-order themes, reflecting distinct dimensions of knowledge sharing and socialization within PBOs: (1) Formalized Knowledge Exchange, (2) Informal Social Bonding, (3) Mentored Experiential Learning, (4) Personal Communication Modalities, (5) Knowledge Hoarding & Cultural Barriers, and (6) Trust & Relational Enablers.

Each theme is discussed in detail, illustrating how individuals and organizational structures contribute to knowledge transfer. The first four themes capture the organization's knowledge-sharing practices, including formal mechanisms, informal social interactions, mentorship, and communication modalities that enable learning. The latter two themes highlight socio-cultural enablers and barriers, such as relational trust, role clarity, hierarchical limitations, and cultural silos, which influence the effectiveness of knowledge exchange.

Finally, the chapter synthesizes these findings into aggregate dimensions, following the Gioia methodology (D. Gioia, 2021), distinguishing between (1) organizational knowledge-sharing practices and (2) socio-cultural enablers and barriers. This structure provides a comprehensive framework for understanding how knowledge is created, shared, and constrained in PBOs, and sets the stage for subsequent discussion and interpretation in relation to the study's research objectives. The complete data structure is illustrated in Figure 4.1.

Table 4.1: 1st-Order Concepts (Informant-Centric Terms)

Subdivision	1st-Order Concept
A. Formalized Knowledge Exchange	
EX1	Weekly meetings
EX5	Weekly coordination meetings
EX5	Project kick-off meetings
EX1	Discussing past projects
EX8	Lessons learned exercises
EX5	ISO corrective action processes
EX5	Performance-based bonus rewards
EX6	Fault-reporting platform with KPIs
B. Informal Social Bonding	
EX1	Informal interactions (training retreats, shared meals)

1st-Order Concepts (continued from previous page)

ID	1st-Order Concept
EX1	Team-building events (rafting, sailing, basketball etc.)
EX1	Informal lunches outside the office
EX8	Coffee break discussions
EX7	Retirement parties as knowledge events

C. Mentored Experiential Learning

ID	1st-Order Concept
EX2	Shadowing the old-timers
EX4	The more experienced ones pass on knowledge to the younger staff
EX5	New personnel placed alongside experienced employees
EX8	Structured tutorship programs for newcomers
EX4	Asking the person who's done it before

D. Personal Communication Modalities

ID	1st-Order Concept
EX4	Face-to-face is better for clarification
EX3	In-person communication is far more effective for exchanging ideas
EX6	Prefer face-to-face meetings; stronger sense of connection
EX2, EX4	Primarily verbally (on the job)
EX2	Sketching together on paper
EX4	Send an email as a summary, then follow up in person

E. Knowledge Hoarding & Cultural Barriers

ID	1st-Order Concept
EX2	Knowledge is power
EX1	Withholding knowledge to strengthen one's own profile and influence
EX1	Department heads promote their own functional area rather than collaborate
EX3	The organization tends to operate in silos
EX7	Hierarchy destroys flexibility; people don't want to speak up
EX3	Clash of professional cultures (e.g., designers vs. cost estimators)

F. Trust & Relational Enablers

ID	1st-Order Concept
EX2	A very simple and very open, relaxed working culture
EX1	Informal interactions build trust and team spirit
EX4	Knowing who is strong in what (e.g., bridge works vs. mechanical tasks)
EX5	Performance-based financial rewards for significant savings
EX3	Emotional support helps stress management and burnout issues

4.1. Formalized Knowledge Exchange

One grouping that emerged from the data relates to the formal, institutionalized mechanisms introduced by the organization. These are structured efforts that are embedded in organizational routines and are designed to support coordination, monitoring, and knowledge transfer. Participants described regular meetings and review sessions as important spaces for aligning project teams and addressing corrective actions. Respondents also noted the role of performance-based incentives, such as financial bonuses tied to individual or team outcomes. In addition, the use of Key Performance Indicators (KPIs) was mentioned as a way to assess whether employees were meeting organizational goals and working in alignment with the broader operations of the project-based organization. Together, these mechanisms highlight the organization's attempt to formalize learning and ensure consistency across projects.

4.2. Informal Social Bonding

A second grouping relates to the informal, socially driven efforts initiated by employees and managers themselves. These practices were described as spontaneous and voluntary, emerging from the everyday interactions of colleagues rather than being prescribed by official structures. Examples provided by participants included shared lunches, coffee breaks, and social gatherings, such as retirement parties or birthday celebrations. Such occasions were viewed as valuable opportunities for team members

to exchange experiences in a more relaxed setting, outside the constraints of formal meetings. Several respondents emphasized that these informal spaces helped people get to know each other better, strengthened team cohesion, and created a sense of belonging within the project environment.

4.3. Mentored Experiential Learning

A third grouping that manifested in the data concerns mentoring and experiential learning opportunities. Respondents highlighted practices such as shadowing more experienced colleagues, tutorship arrangements, and on-the-job guidance as important ways of learning within the organization. Unlike formal meetings, these interactions were described as more personalized and developmental, enabling newer employees to gain insight from those with longer experience. Participants stressed that such arrangements helped them not only to acquire technical knowledge but also to better understand the nuances of project work. This suggests that learning was seen as a process that unfolded through direct exposure and guided practice, rather than only through structured training or written procedures.

4.4. Personal Communication Modalities

A fourth grouping that emerged from the data concerns the modality of communication. The empirical data revealed a strong preference among participants for face-to-face communication as the primary mode of interaction. In-person communication was consistently perceived as clearer, more engaging, and more reliable compared to hybrid or written channels. Written formats such as emails and reports were not dismissed outright, but they were usually described as secondary tools, mainly for documentation or as a baseline to prepare for discussions. Similarly, other codes emphasized verbal and collaborative practices, such as "sketching together on paper", which highlight the importance of immediacy and interaction in the communication process.

4.5. Knowledge Hoarding & Cultural Barriers

A fifth grouping that was made apparent in the data relates to cultural barriers and detrimental behaviors with respect to knowledge. Participants often described knowledge as being treated as an individualized asset, something that could provide leverage or power rather than something to be openly shared. This perception was reinforced by the presence of departmental silos, where information tended to remain within specific units, limiting cross-functional exchange. In this context, silos were understood as isolated organizational areas that hindered collaboration and made collective learning more difficult.

In addition, the hierarchical structure of the organization was frequently portrayed as a limitation. Rather than supporting knowledge sharing, hierarchy was perceived as rigid and inflexible, slowing down communication and restricting openness between different levels of staff. Finally, respondents pointed to professional cultures and ways of working tied to specific roles or functions, which sometimes clashed with each other. These cultural differences, whether departmental or professional, created further obstacles and occasionally led to frustration or conflict in project collaboration.

4.6. Trust & Relational Enablers

A sixth grouping centers on trust and relational enablers that facilitated collaboration within the project. Participants repeatedly emphasized the role of an open and relaxed working culture, where informal interactions contributed to building trust and team spirit. Trust was further reinforced by having a clear sense of individual expertise and strengths, such as distinguishing between bridge works and mechanical tasks. Emotional support also played a notable role, helping team members manage stress and prevent burnout, thereby sustaining collaborative capacity over time. At the same time, financial incentives emerged as a structural mechanism influencing collaboration. Performance-based rewards for significant savings were described as a positive motivator, while such incentives were also viewed as a countermeasure to cultural barriers that might otherwise hinder cooperation. Taken together, these accounts highlight how relational trust, role clarity, emotional support, and incentives functioned in tandem as enablers of knowledge sharing and effective teamwork.

The third level of the analysis refers to the aggregate dimensions, following the framework described by D. Gioia (2021). The organization can be understood as comprising two main components: its processes, which facilitate knowledge transfer and sharing, and its personnel, often referred to as social capital in the literature. Social capital constitutes the backbone of the organization, as personnel interact, exchange experiences, and collectively shape the organizational environment. Capturing the contextual nature of knowledge sharing is therefore essential, which helps explain the observed preference for in-person interaction as the primary mode of knowledge transfer.

In addition, the organization actively invests in developing its own talent through mentorship programs, shadowing practices, and other structured experiential learning opportunities. These four pillars, formalized processes, informal social bonding, mentored learning, and personal communication practices, collectively constitute the organizational knowledge-sharing practices observable in project-based organizations (PBOs).

At the same time, the data indicate a tradeoff between enablers and barriers. Knowledge can be hoarded, flow may be restricted, and hierarchical or professional silos may limit collaboration. Conversely, relational factors such as trust, interpersonal clarity, and supportive social norms serve as socio-cultural enablers, strengthening team cohesion and facilitating the flow of knowledge. Together, these dynamics form the second aggregate dimension: socio-cultural enablers and barriers, which are deeply embedded in the culture of a PBO. The overall data structure reflecting these dimensions and their relationships is presented in figure 4.1.

1st Order Concepts

2nd Order Themes

Aggregate Dimensions

• Weekly coordination meetings
• Project kick-off meetings
• Post-project reviews / lessons learned
• ISO corrective action processes
• Performance-based bonus rewards
• Fault-reporting platform with KPIs

Formalized Knowledge Exchange

• Team-building events (e.g., rafting, sailing, basketball etc.)
• Informal lunches outside the office
• Coffee break discussions
• Retirement parties as knowledge events

Informal Social Bondings

Organizational Knowledge-Sharing Practices

• Shadowing the old-timers
• Structured tutorship programs for newcomers
• New personnel placed alongside experienced employees
• Asking the person who's done it before
• The more experienced ones pass on knowledge

Mentored & Experiential Learning

• Face-to-face clarification
• Preferring in-person meetings
• Sketching together on paper
• Primarily verbal, on-the-job talk
• Email as summary, follow up in person

Personal Communication Modalities

• Knowledge is power
• Withholding knowledge to strengthen profile
• Departmental silos / promoting own area
• Hierarchy destroys flexibility to speak up
• Clash of professional cultures

Knowledge Hoarding & Cultural Barriers

Enablers and Barriers

• A very simple, open, relaxed working culture
• Informal interactions build trust and team spirit
• Knowing who is strong in what
• Financial incentives to share
• Emotional support helps with stress management and burnout issues

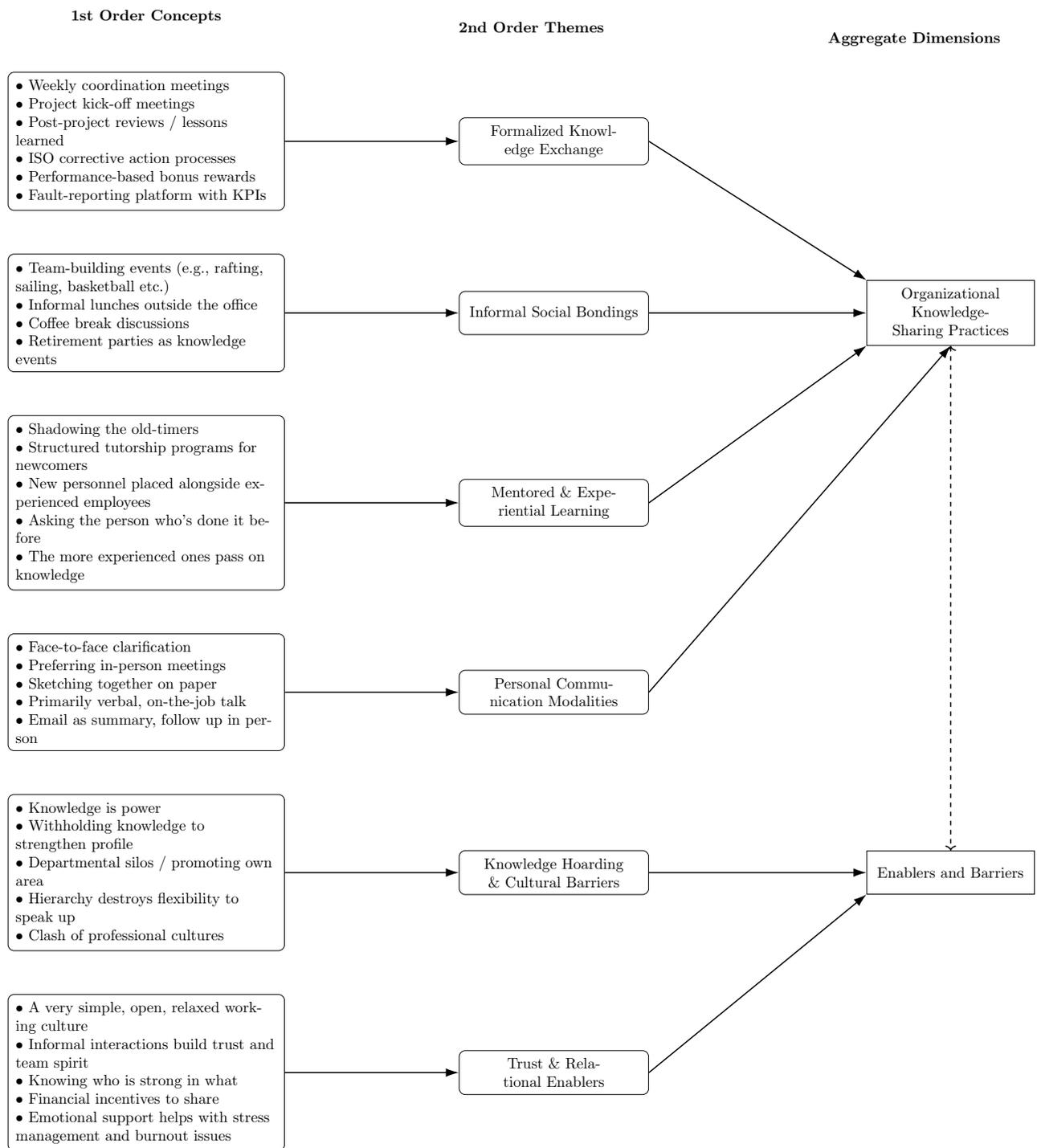Trust & Relational Enablers

Figure 4.1: Empirical Data Structure

5

Discussion

This chapter discusses the findings of the study in relation to existing literature, focusing on the ways socialization practices shape knowledge transfer and learning in project-based organizations (PBOs). The analysis is organized around six thematic categories, each presented in tables that distinguish between positive and negative practices. These categories highlight formalized knowledge exchange mechanisms, informal social bonding, mentored experiential learning, personal communication modalities, cultural barriers such as knowledge hoarding and silos, and relational enablers like trust. Together, these themes provide a detailed view of how knowledge is perceived, shared, and withheld in PBOs, and how organizational culture and structure either encourage or inhibit collaboration. By linking these empirical findings to concepts such as absorptive capacity, mentorship, and the SECI model, the chapter explores how socialization supports project learning but also reveals its limitations if not complemented by explicit articulation and codification. The discussion concludes by reflecting on the implications for practice, the modified conceptual framework, and areas where further research is needed.

Table 5.1 begins with Formalized Knowledge Exchange processes. Weekly and coordination meetings emerged as particularly positive practices, as they enable the alignment of project teams on a regular basis. Holding such meetings once per week is considered effective, since the information accumulated in that time frame remains manageable and easier to process, thereby facilitating timely knowledge absorption. Project kick-off meetings, on the other hand, are standard procedures at the beginning of nearly every project and can therefore be regarded as a neutral practice. Reflective activities such as discussing past projects and conducting lessons-learned sessions were described as important opportunities for PBOs to capitalize on accumulated experience and generate actionable knowledge for future projects. Performance-based rewards and bonuses tied to individual contributions represent another positive mechanism, as they provide tangible incentives for personnel to actively engage in knowledge sharing. Finally, the establishment of platforms for fault reporting was viewed as beneficial, since such systems promote transparency, collective problem solving, and collaboration among employees.

Table 5.1: A. Formalized Knowledge Exchange

1st-Order Concept	Polarity
Weekly meetings	+
Weekly coordination meetings	+
Project kick-off meetings	+ / -
Discussing past projects	+
Lessons learned exercises	+
ISO corrective action processes	+ / -
Performance-based bonus rewards	+
Fault-reporting platform with KPIs	+

Table 5.2 highlights the category of Informal Social Bonding. All practices included in this grouping can be characterized as positive, as they contribute directly to strengthening interpersonal relationships within the project team. Informal interactions between employees foster a sense of belonging and cohesion, which in turn enhances collaboration. Shared meals outside the formal workplace setting were noted as particularly valuable, since they create a relaxed atmosphere where ideas and opinions can circulate more freely. Retirement parties were also described as meaningful occasions, as they provide opportunities to honor commitment, celebrate contributions, and reinforce mutual respect among colleagues. Finally, team-building events, often structured around group-oriented activities or sports, were seen as invaluable because they simulate the challenges of everyday work. By requiring cooperation and joint problem solving, such events encourage collaboration and strengthen the collective identity of the team.

Table 5.2: B. Informal Social Bonding

1st-Order Concept	Polarity
Informal interactions (training retreats, shared meals)	+
Team-building events (rafting, sailing, basketball etc.)	+
Informal lunches outside the office	+
Coffee break discussions	+
Retirement parties as knowledge events	+

Table 5.3 addresses the category of Mentored Experiential Learning, which focuses on the transfer of knowledge from more experienced employees to their younger peers. One of the most frequently mentioned initiatives was shadowing, whereby junior employees follow senior colleagues in their daily tasks, observing both their responsibilities and approaches to problem-solving. This practice essentially situates the junior employee in the role of the senior, with the objective of learning "how the job gets done" through direct exposure. A related but more structured approach is formal tutorship, where learning steps are deliberately designed and guided by the organization to ensure a systematic transfer of skills and expertise. Finally, a more pragmatic form of knowledge sharing was also observed: employees simply reaching out to colleagues who had performed similar tasks in previous projects. While less formal, this practice underscores the importance of accessible expertise and peer support in fostering project learning.

Table 5.3: C. Mentored Experiential Learning

1st-Order Concept	Polarity
Shadowing the old-timers	+
The more experienced ones pass on knowledge to the younger staff	+
New personnel placed alongside experienced employees	+
Structured tutorship programs for newcomers	+
Asking the person who's done it before	+

Table 5.4 refers to Personal Communication Modalities, which highlight the preferred ways employees exchange and clarify knowledge in project-based organizations. A strong emphasis is placed on face-to-face interactions, which are consistently described as more effective than mediated communication channels. Respondents highlight that in-person exchanges provide a stronger sense of connection, facilitate clarification, and support richer idea-sharing. Moreover, personal communication extends beyond verbal dialogue: practices such as sketching together on paper or discussing issues directly on the job site were noted as valuable tools for ensuring mutual understanding. Interestingly, digital tools are not rejected but rather positioned as supplementary, for example, sending an email to summarize discussions is considered useful, but the real value lies in following up in person to confirm alignment. These findings illustrate that personal, direct interaction remains central to effective knowledge transfer in project-based organizations, fostering immediacy, trust, and shared understanding in ways that purely digital communication cannot fully replicate.

Table 5.4: D. Personal Communication Modalities

1st-Order Concept	Polarity
Face-to-face is better for clarification	+
In-person communication is far more effective for exchanging ideas	+
Prefer face-to-face meetings; stronger sense of connection	+
Primarily verbally (on the job)	+
Sketching together on paper	+
Send an email as a summary, then follow up in person	+

Table 5.5 illustrates the negative cultural conditions that restrict knowledge transfer within project-based organizations. Knowledge is sometimes treated as a form of power, with individuals withholding it to consolidate influence or strengthen their professional profile. This behavior can be reinforced by organizational structures, where department heads prioritize their own functional area rather than cross-departmental collaboration. Such siloed operations create an environment where hierarchical barriers suppress flexibility and discourage employees from speaking up. Additionally, clashes between different professional cultures, such as those of designers and cost estimators, further limit the free flow of knowledge. These findings suggest that cultural and organizational norms can act as significant barriers to socialization, constraining the interpersonal trust and openness required for effective knowledge sharing.

Table 5.5: E. Knowledge Hoarding & Cultural Barriers

1st-Order Concept	Polarity
Knowledge is power	–
Withholding knowledge to strengthen one's own profile and influence	–
Department heads promote their own functional area rather than collaborate	–
The organization tends to operate in silos	–
Hierarchy destroys flexibility; people don't want to speak up	–
Clash of professional cultures (e.g., designers vs. cost estimators)	–

In contrast, Table 5.6 highlights trust and relational dynamics as key enablers of knowledge sharing. Although the entries in this category remain concise, the underlying rationale is that trust mitigates tendencies toward knowledge hoarding by creating a climate in which individuals feel secure to share experiences, insights, and expertise without concerns of exploitation or judgment. Relational enablers such as mutual respect, reciprocity, and a shared commitment to project objectives strengthen team cohesion and motivate employees to collaborate more openly. Emotional support further contributes by helping individuals manage stress and reduce the risk of burnout, thereby sustaining their willingness to engage in collective learning processes. Within project-based organizations, where interpersonal interactions contribute significantly to success, trust acts as a catalyst for socialization, transforming informal encounters into meaningful opportunities for learning.

Table 5.6: F. Trust & Relational Enablers

1st-Order Concept	Polarity
A very simple and very open, relaxed working culture	+
Informal interactions build trust and team spirit	+
Knowing who is strong in what (e.g., bridge works vs. mechanical tasks)	+
Performance-based financial rewards for significant savings	+
Emotional support helps stress management and burnout issues	+

5.1. Perception of knowledge in PBOs

Knowledge has an important standing as an asset. In the context of PBOs, it can be utilized in such a way that it can increase the bargaining power of the personnel over their colleagues. This characteristic can be mapped with what Ren et al. (2018) defines as *"transfer intention"*, in other words: willingness to share (Goh, 2002). It is related to the subjective nature of individuals, and the quality as well as the quantity of the knowledge that is transferred. Having such strong opinions further highlights the fact that knowledge is important; however, it can be detrimental to the overall knowledge transfer process.

PBOs can then step in. In general, in order to align their employees with the desired actions, they tend to offer rewards that can be monetary or non-monetary. Reward systems can be beneficial in stimulating knowledge sharing, as they signal that the organization values collaboration and the dissemination of expertise. Both financial and non-financial incentives, such as recognition or career development opportunities, may motivate personnel to contribute actively, reducing duplication of effort and fostering learning across projects (Wang & Noe, 2010). In this way, rewards help align individual behavior with organizational goals, ensuring that knowledge contributes not only to project performance but also to the long-term knowledge base of the organization (Cabrera & Cabrera, 2005).

However, the use of rewards is not without drawbacks. Overreliance on extrinsic incentives may nullify intrinsic motivation, leading employees to share knowledge only when a reward is at stake, or to focus on the quantity rather than the quality of what is shared (Zhao et al., 2022). Moreover, poorly designed reward schemes can create perceptions of unfairness or encourage competition rather than collaboration, ultimately hindering trust and openness among project members (Wang & Noe, 2010). Given the project-based and temporary nature of PBOs, reward mechanisms that emphasize short-term outcomes may also misalign with the long-term objectives of knowledge retention and transfer (Cabrera & Cabrera, 2005). As a result, while rewards can facilitate knowledge sharing, they must be designed carefully to avoid undermining the very behaviors they seek to encourage.

5.2. Organizational Silos

Project-based organizations (PBOs) often operate within hierarchical structures, which are widely criticized for fostering organizational silos. This structure, centered on a vertical chain of command, reinforces functional units at the expense of cross-disciplinary integration. As Clegg et al. (2011) argue, such hierarchies prioritize managerial control, which inherently impedes the lateral coordination crucial for innovation and complex project work (Mintzberg, 1993). This control-centered logic creates communication bottlenecks, as decisions must traverse multiple management layers, introducing delays (Mintzberg, 1993). Furthermore, rigid hierarchies inhibit the informal networks essential for collaboration and knowledge sharing, hardening departmental boundaries and causing a narrow focus on sub-unit goals over system-wide objectives (Burns & Stalker, 1961; Kerzner, 2017).

In the construction industry, these siloed structures have important consequences. They lead directly to miscommunication, duplicated effort, rework, and delays, as critical information is not shared across departmental lines (Gann, 2000). Subcontractors and design teams operating in isolation create information gaps that result in quality issues and schedule slippage. The present study's interviews suggest these silos are often manifested as a means for certain departments to improve their standing, further fragmenting project knowledge and undermining integrated workflows.

The impact on project performance is measurable. Concentrated authority stifles frontline autonomy and initiative, slowing responses to emergent issues (Burns & Stalker, 1961). Cross-functional teams, essential to project-based work, struggle to form, causing delays at functional interfaces and a loss of overall agility. This is compounded by what J. Liu et al. (2015) term "high decision-chain steepness," which is linked to poor coordination. Consequently, tasks requiring input from multiple disciplines are delayed, and budget and schedule targets are frequently missed (Wideman, 2001).

5.3. Mentorships and On-the-job learning

In general, mentorship programs are chosen for the fact that they fulfill two primary directives: they prepare younger personnel to undertake different roles, and they are cost-effective (Villar & Strong, 2007).

Mentoring is the most functionally aligned learning activity in PBOs. The goal is to pair up two individuals: a mentor and a mentee. The reasoning behind such programs, is to "develop specific skills and abilities" (Wiewiora et al., 2020). Additionally, it can also constitute a learning path, as the goal can be established by the mentee and then be assigned a mentor (Wiewiora et al., 2020). Nevertheless, having mentorship programs that are over-structured or rigid, can "suffocate everyone involved" (Karallis & Sandelands, 2009), while little structure can lead to once again undesired outcomes with poor communication and lack of commitment from both parties (Karallis & Sandelands, 2009; Wiewiora et al., 2020).

Mentorships have the characteristic of integrating a young professional into the business unit, which is the project team. Furthermore, young individuals are expected to learn how to navigate the same issues as their mentors by applying similar methodologies by default. However, there was no instance recorded in this research where the young professionals reflected or engaged in "double-loop" learning activities. What has been described so far falls under the category of "single loop" learning. The focus falls merely on executing the tasks in the "right" way, as the mentor suggests. However, there is no dialogue regarding the chosen methodology or certain steps in the processes.

Effective mentorship in project management should evolve from a monologic model of instruction, which merely transmits established methods (Ziek & Anderson, 2015), to a constitutive dialogue where mentor and mentee collaboratively question processes, analyze contexts, and co-create new approaches (Karallis & Sandelands, 2009; Ziek & Anderson, 2015). This shift transforms mentorship into a powerful engine for double-loop learning, moving beyond the limitations of simply replicating the "right" way.
This study found that this integration is most successful through face-to-face communication, which was cited as "far more effective for exchanging ideas" and superior for immediate clarification. The learning observed often occurred primarily verbally and on the job, with participants highlighting a stronger sense of connection in person. Common practices included sketching together on paper to solve problems, followed by a summary email and an in-person follow-up. In summary, face-to-face interaction is considered the richest communication medium, as it combines verbal, non-verbal, and contextual cues that are essential for establishing the points of interest and the actual issues (Daft & Lengel, 1986).

5.4. Socialization as a foundation

Socialization serves as an activator for project learning. It lays the groundwork for better social ties, communication, and inclusivity. Having the right environment allows for the sharing of knowledge and its flow between departments and people. However, it can be argued that socialization functions as a primer for the transfer of knowledge. People come together and engage in group-related activities. Trust and affinity are also attributes that can be cultivated through socialization.

The process of socialization initiates the development of psychological safety, a shared belief that the team is safe for interpersonal risk-taking (Edmondson, 1999). In this context, trust is not merely skill-bound but is fundamentally relational. It is cultivated through repeated social interactions where individuals observe that others will not embarrass or punish them for speaking up, asking questions, or admitting mistakes. This offers profound psychological safety by encouraging an open, relaxed culture where vulnerability is not a liability but a prerequisite for learning. As Jowett et al. (2023) demonstrated, when individuals feel safe, they are more likely to engage in open communication and effective conflict management. These behaviors are perceived by others as trustworthy, creating a virtuous cycle where psychological safety and trust mutually reinforce one another. Socialization provides the initial platform for this cycle to begin.

However, in order to delve deeper into the sharing practices, one has to go beyond initial socialization to nurture this climate of safety intentionally. This creation of safety and belonging fulfills essential human needs, much like the foundational levels of the hierarchy of needs conceptualized by Maslow and Lewis (1987). Maslow's model is typically depicted as a pyramid, where the lower levels (physiological needs such as food, shelter, and rest, followed by safety needs) must be satisfied before individuals can meaningfully pursue higher-level needs. In a team context, psychological safety functions as this foundational "safety need." Above these foundations come social belonging, esteem, and ultimately self-actualization, which represents the fulfillment of one's potential and, for a team, translates

to innovation and peak performance. Just as an individual cannot focus on self-actualization without first securing basic safety, a team cannot achieve deep, creative collaboration and knowledge sharing without first establishing a baseline of psychological safety and social cohesion through socialization.

5.5. Modified Conceptual Framework

Based on the empirical findings, the conceptual framework was modified as shown in Figure 5.1. The lessons were not collected. Moreover, the absorptive capacity of the project teams appeared limited, as opportunities for project-related discussions were scarce. As a result, both properties have been denoted as gray in the framework.
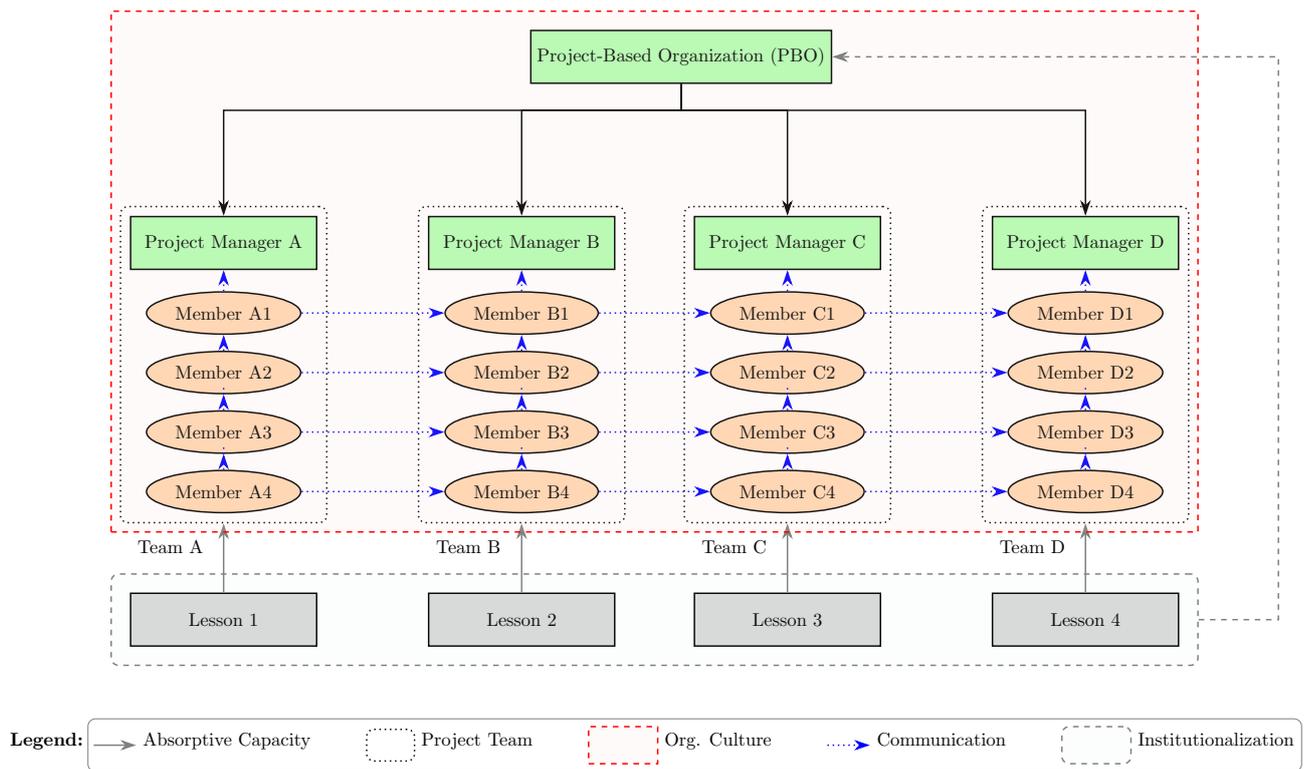

Figure 5.1: Modified Conceptual Framework

In order to cultivate the dialogue, one has to go further than socialization in the SECI model by I. Nonaka and Takeuchi (1995), or further than accumulating experience in the project learning model by Alashwal and Abdul-Rahman (2014). The next step lies in articulating the knowledge in explicit concepts, or in other words, externalizing it. Therefore, the SECI cycle has been modified accordingly, with the point of interest being the interface between socialization and externalization (see figure 5.2). Similarly, the issue can be mapped with the knowledge articulation processes (see figure 5.3).

For a lessons learned process to gain traction, it should be structured to increase the overall "transfer intention" among participants. In Project-Based Organizations (PBOs), where cost and time are primary performance parameters, this is achieved by explicitly linking learned lessons to these key metrics. This practical focus is further supported by an organizational culture that favors matrix-like structures over rigid hierarchies. Such an environment promotes cooperation between subordinates and superiors, as well as with the functional manager who oversees the learning process. Within this framework, mentoring remains a pillar of PBO operations, but it is supplemented by structured, collaborative learning activities. Self-reflection is formally encouraged through the preparation of reports analyzing cost-related issues and other project performance metrics. The very act of preparing these reports stimulates cooperation between interested parties, effectively countering organizational silos.
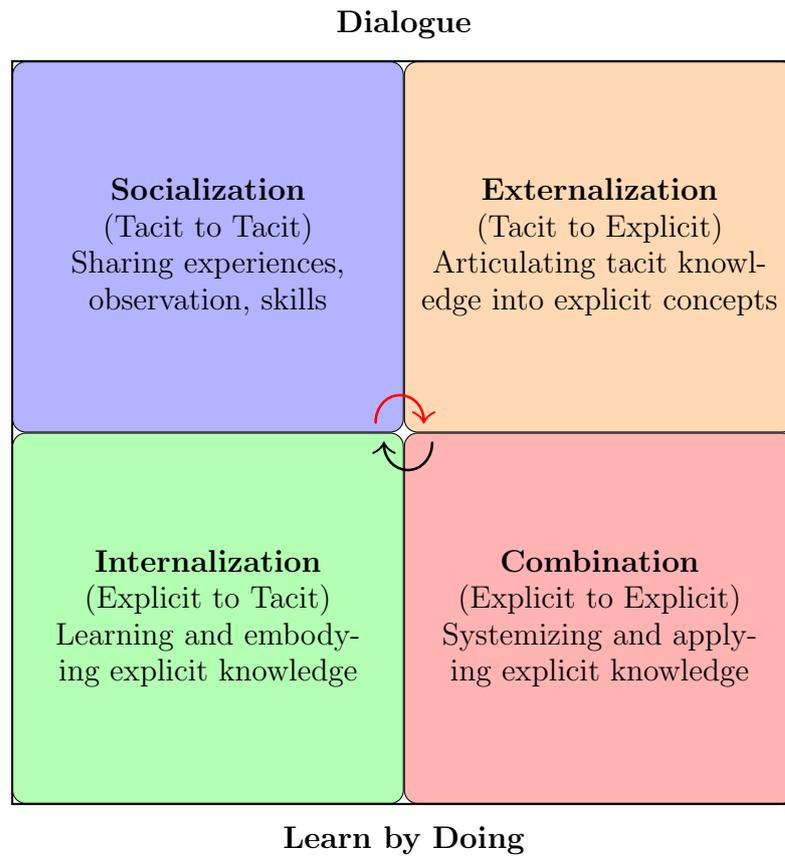
Dialogue

Socialization
(Tacit to Tacit)
Sharing experiences,
observation, skills

Externalization
(Tacit to Explicit)
Articulating tacit knowl-
edge into explicit concepts

Internalization
(Explicit to Tacit)
Learning and embody-
ing explicit knowledge

Combination
(Explicit to Explicit)
Systemizing and apply-
ing explicit knowledge

Learn by Doing

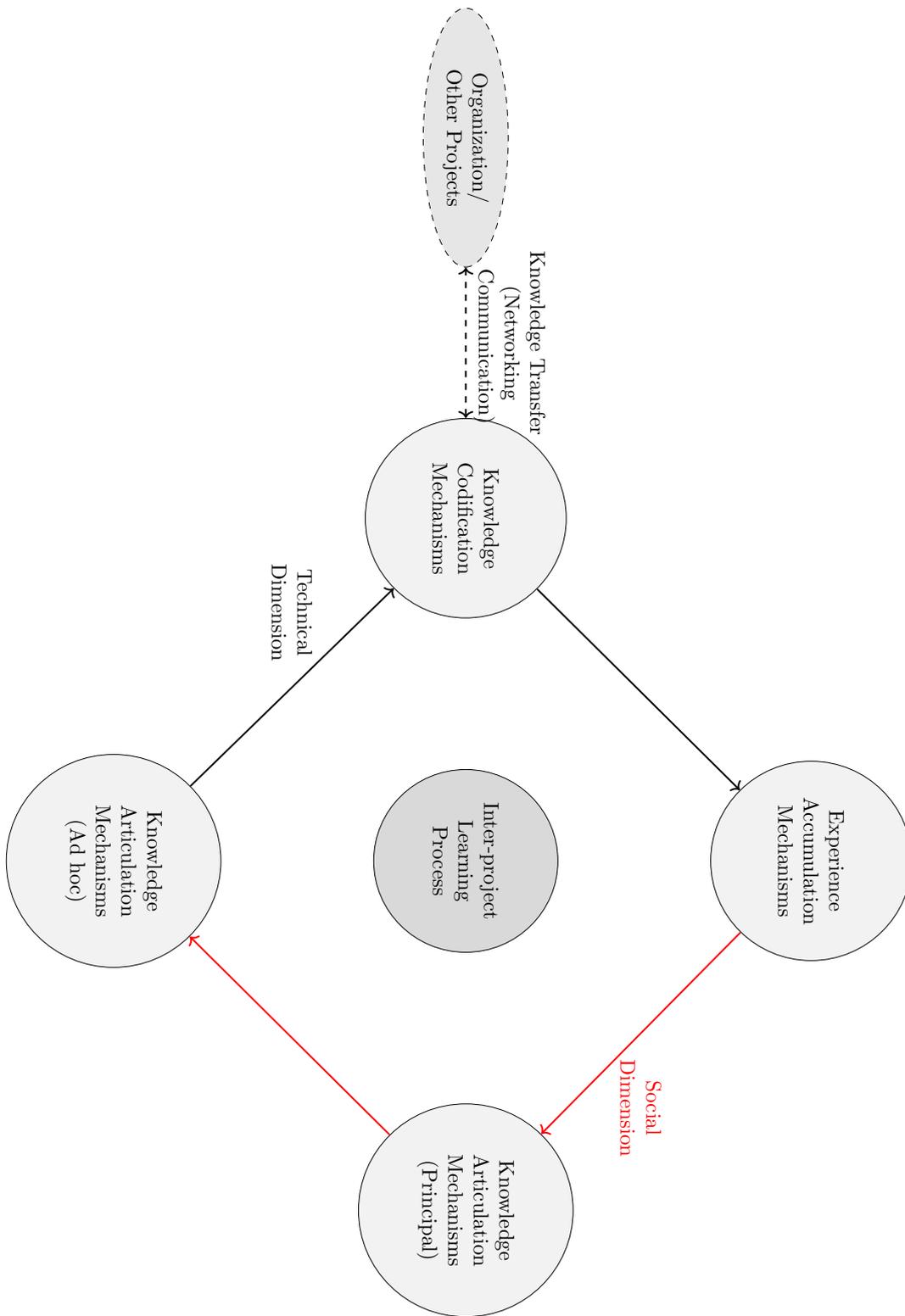**Figure 5.2:** Modified SECI cycle

Figure 5.3: Modified Project Cycle

5.6. Lessons Learned Process

Figure 5.4 presents a structured decision-making framework for conducting root cause analysis of project cost variances. The process is initiated by the Construction Manager's and the Project Manager's analysis of total cost deviation, which triggers a sequential interrogation of causative factors. The primary diagnostic branch distinguishes between variances attributable to exogenous factors, which necessitate formal Claims Management handled by the Legal Department, and those arising from endogenous project factors. For internally-caused variances, the model further differentiates between planning deficiencies by the Cost Engineer and execution-level discrepancies, which are investigated through a comparative analysis of material, subcontractor, equipment, and personnel costs by the respective functional managers. The framework culminates in a Lessons Learned session when variances are not linked to external factors or planning failures, thereby closing the feedback loop into organizational learning and continuous improvement processes. This flowchart constitutes a systematic, role-based approach to managerial cost control, emphasizing accountability.

Figure 5.5 delineates a procedural framework for diagnosing and managing schedule variances within a construction project context. The protocol is initiated by the Construction Manager's and the Project Manager's analysis of the total time deviation, which serves as the primary trigger for a structured root cause analysis. The model's core logic hinges on a critical decision node that segregates delays originating from exogenous factors from those inherent to the project's internal execution. Variances attributed to external factors are escalated to the Legal Department for Gains Management, a process likely encompassing the formal pursuit of time-related claims and extensions. Conversely, when delays are determined to be endogenous, the process mandates a detailed comparative analysis of planned versus actual time allocations, conducted jointly by the Project Manager and Project Finance, culminating in a Time Variance Report. This bifurcated approach ensures that external risks are managed through contractual and legal channels, while internal performance issues are formally documented to facilitate accountability and organizational learning, by concluding with a Lessons Learned session.
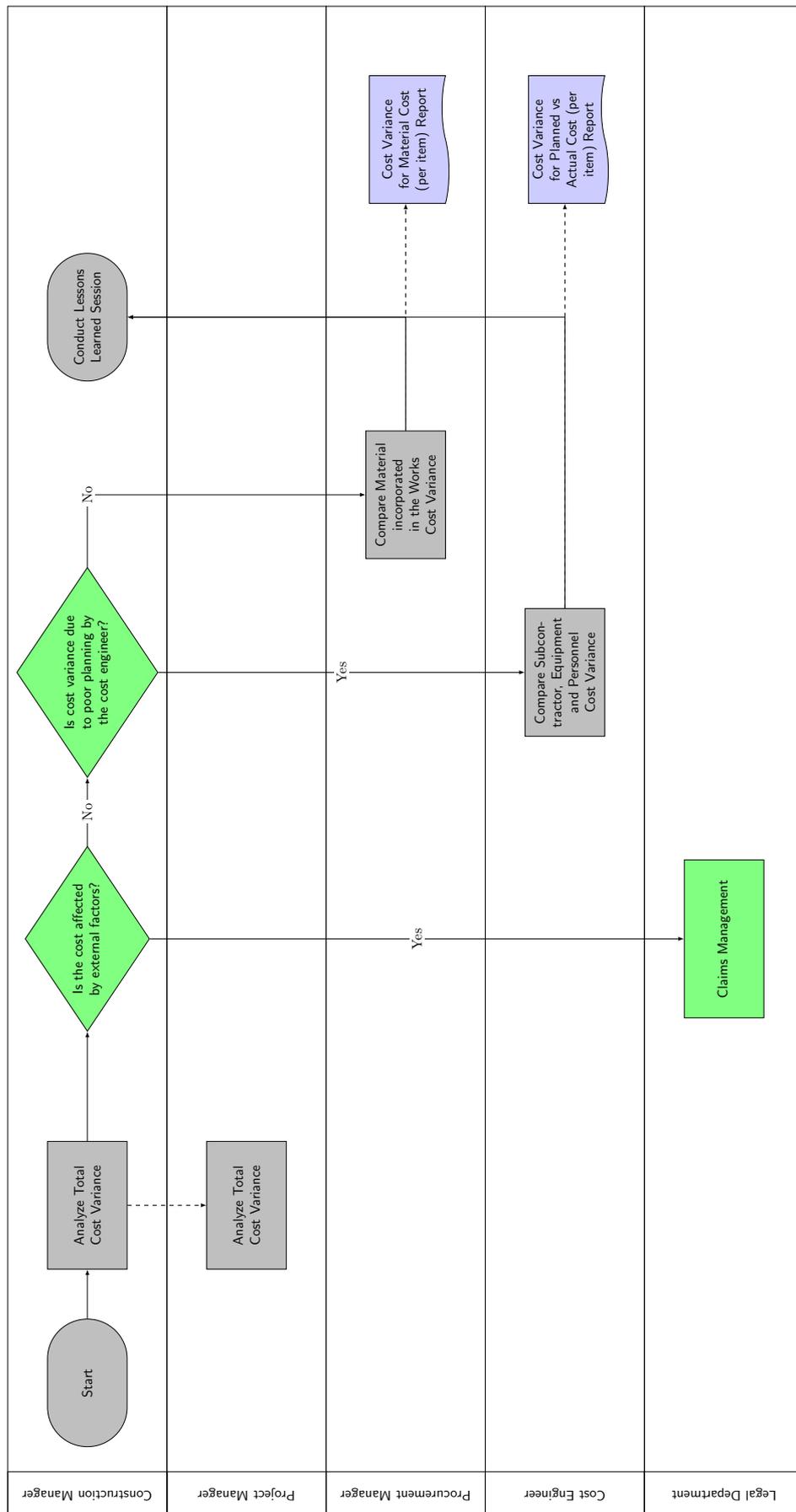
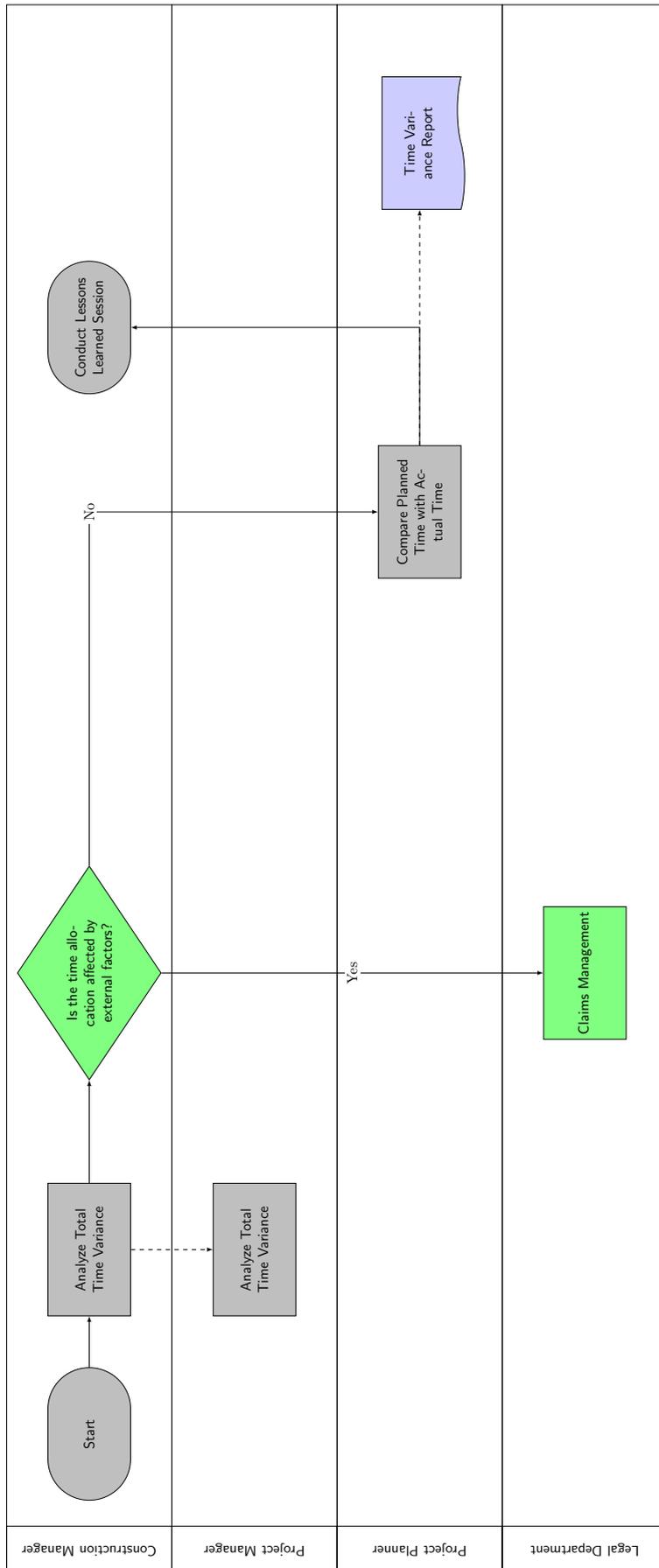**Figure 5.4:** Lessons Learned Process for Cost-related issues (Author)

Figure 5.5: Lessons Learned Process for Time-related issues (Author)

5.7. Verification

The research project's final stage required the involvement of two additional experts, VEX1 and VEX2. The goal of this step was to validate and verify the research findings and to explore potential future additions. The choice of interviewees was motivated by their experience in the construction sector and Project-Based organizations, with more than 30 years of experience. They were able to reflect on the findings. This section presents an overview of the interview process, significant findings, and the feedback provided to the researcher.

The interviews were recorded with prior consent, and they involved presenting the research results as outlined in the thesis, including the role of socialization, as well as its implications on learning. This feedback was gathered through questions such as "What are your thoughts?", "Is this the case?", and "How would it be improved?". While the interviewees agreed with the research results, they emphasized the need to make the research practical and exploitable. They also mentioned the absence of an organized approach towards learning.

5.8. Limitations

This study was subject to several limitations that should be acknowledged when interpreting its findings. The pool of interviewees was restricted by both time constraints and the overall scope of the research, which may have influenced the diversity and breadth of perspectives captured. The participants were exclusively practitioners employed in project-based organizations within the construction sector, a focus that necessarily narrows the applicability of the results to other contexts. Moreover, all interviewees were based in Greece, Italy, and Iran, and it is plausible that conducting a similar study in different geographical or cultural settings would yield different outcomes.

The involvement of human subjects introduces an inherent degree of bias, as respondents may have shaped their answers in socially desirable ways or emphasized certain experiences over others. In addition, the study primarily examined soft parameters and the interpersonal dimensions of knowledge transfer between projects. While this lens provides valuable insights, it inevitably simplifies a phenomenon that is complex and multi-faceted. Future research would benefit from integrating a broader range of perspectives to enrich the analysis. Moreover, to ensure the credibility of the findings, a verification step was incorporated into the research design. This reflective process served to cross-check and authenticate the data collected, thereby contributing to the robustness of the study's conclusions.

6

Conclusion

This chapter includes the answer to each individual research sub-question. Additionally, it includes recommendations for practitioners and for further research.

6.1. Sub-question 1: What is the mechanism of transferring knowledge in projects?

Knowledge transfer in projects refers to the processes through which expertise, insights, and lessons gained during a project are shared and disseminated within and across Project-Based Organizations. Fundamentally, it is a subset of organizational knowledge management, focused on the effective movement of knowledge rather than its generation. For knowledge transfer to occur effectively, a certain degree of expertise must first be cultivated within the organization. Once this expertise exists, individuals must engage with each other, exchanging ideas, discussing approaches, and connecting across teams.

Critical to knowledge transfer is the articulation of knowledge in terms that are generally understandable within the organization. This articulation allows reflective practices to identify which actions or decisions contributed positively or negatively to the project's outcomes, essentially a "mental rehearsal" of experiences. Lessons learned sessions, after-action reviews, and project debriefings serve as the primary vehicles through which knowledge is codified, discussed, and shared within the project. These processes collectively constitute intra-project knowledge transfer, where knowledge circulates and becomes accessible during the lifecycle of a specific project.

Beyond the boundaries of a single project, knowledge can be transferred to other similar projects through different mechanisms. Explicit knowledge may be codified and stored in databases, documentation, or knowledge repositories, while tacit knowledge may be shared through social interactions, mentoring, or knowledge networks. This broader dissemination is known as inter-project knowledge transfer, emphasizing the social and structural channels that facilitate learning across projects.

Knowledge transfer processes align closely with the SECI model of knowledge creation, which describes the interplay between tacit and explicit knowledge. Initially, most project knowledge is tacit, residing in the experiences of individuals. Through articulation in lessons learned sessions, meetings, or collaborative discussions, tacit knowledge is converted into explicit knowledge. When multiple explicit knowledge artifacts from different projects are combined, they form a consolidated body of knowledge, often captured as "best practices." These best practices can then be internalized by other individuals in the organization, reconverting explicit knowledge back into tacit knowledge and completing the knowledge transfer cycle.

6.2. Sub-question 2: What forms of socialization are used as methods of Knowledge Transfer in Project-based Organizations active in the Construction sector?

The empirical research shows that socialization in construction-related Project-based Organizations (PBOs) takes diverse forms, both formal and informal, which collectively enable the transfer of tacit knowledge between individuals and across project teams. These practices are embedded in day-to-day work processes, organizational routines, and social interactions, highlighting the people-centered nature of knowledge exchange in the construction sector.

First, formalized knowledge exchange mechanisms play a significant role in structuring how information is shared. Examples include project kick-off sessions, weekly coordination meetings, lessons learned exercises, and ISO-driven corrective action processes. These events are deliberately designed to facilitate communication, ensure alignment across stakeholders, and capture critical insights from ongoing or completed projects. While they often emphasize explicit knowledge, such as documented performance reports or standardized checklists, they also provide opportunities for tacit knowledge to be exchanged through discussion and clarification of issues.

Second, the findings reveal that informal social bonding is equally crucial in fostering effective knowledge transfer. Social activities such as coffee breaks, shared meals, team-building exercises, or even retirement parties create relational spaces where individuals feel more comfortable sharing experiences, perspectives, and work-related concerns. These occasions often bypass hierarchical or procedural constraints and encourage openness, trust, and inclusivity. Informal exchanges, while not officially recorded, frequently act as vehicles for passing on context-specific insights that may not surface in formal meetings.

Third, mentored experiential learning emerges as a particularly effective mode of socialization. Newcomers and junior staff frequently shadow experienced professionals, learning through observation, guided practice, and iterative feedback. This apprenticeship-like model allows tacit know-how—such as decision-making under uncertainty, negotiation with stakeholders, or adapting technical solutions on-site, to be internalized in ways that codified manuals cannot replicate. In this sense, mentorship functions not only as knowledge transmission but also as social integration into the organizational and project culture.

Fourth, there is a strong reliance on personal communication modalities, with face-to-face interaction identified as the preferred and most effective channel of knowledge transfer. In the construction sector, professionals favor verbal explanations, on-site discussions, sketches, and spontaneous conversations over digital tools or written documentation. These forms of direct communication allow for immediate feedback, clarification, and the sharing of nuances such as tone, emphasis, or body language, factors that significantly enrich understanding and reduce misinterpretation.

Taken together, these findings indicate that knowledge transfer in construction-sector PBOs is heavily dependent on human interaction. Unlike codification, which is structured and technology-driven, socialization relies on trust, relationships, and shared experience. The research highlights that these forms of socialization not only support project learning but also reinforce team cohesion and collective competence, making them indispensable for knowledge transfer in project-based settings.

6.3. Sub-question 3: How can we navigate through the barriers observed in practice to facilitate the socialization process?

The empirical findings of this research identify several barriers that are detrimental to the socialization process in construction Project-Based Organizations (PBOs). These include the prevalence of knowledge hoarding, where expertise is perceived as a source of individual power; organizational and hierarchical silos that restrict cross-functional communication; clashes in professional cultures; and the pervasive time pressure that prioritizes project delivery over reflective learning. Navigating these barriers requires a deliberate, multi-level strategy that addresses both the structural and socio-cultural dimensions of the organization.

Firstly, at the cultural and relational level, the cultivation of psychological safety is paramount. The findings indicate that trust is a foundational enabler for tacit knowledge exchange. Organizations must actively foster an environment where interpersonal risk-taking is safe by institutionalizing anti-blame protocols and legitimizing informal interactions. Social bonding activities, such as team-building events, shared meals, and informal gatherings, serve as critical mechanisms for building the relational trust and affinity necessary for open dialogue. This creates a virtuous cycle where psychological safety encourages vulnerability, which in turn strengthens trust and facilitates richer knowledge exchange.

Secondly, structural interventions are required to deconstruct organizational silos and mitigate hierarchical rigidity. The research demonstrates that functional and hierarchical boundaries create significant bottlenecks for knowledge flow. To navigate this, PBOs should implement systematic job rotation programs and constitute cross-disciplinary project teams with explicit knowledge-integration mandates. Adopting matrix-based organizational structures can enhance lateral communication, while regular inter-departmental forums can be established to articulate and share insights across traditional boundaries, thereby counteracting the inward-focused tendencies of siloed units.

Thirdly, the role of mentorship must be reconceptualized from a monologic model of instruction to a dialogic, reflective practice. Currently, mentorship often facilitates only single-loop learning, focusing on the replication of established methods. To overcome this limitation, mentorship engagements should be structured as collaborative sense-making exercises. This involves training mentors in facilitative questioning techniques and integrating reflective protocols, such as after-action reviews, that challenge underlying assumptions. This transformation empowers mentees to engage in double-loop learning, thereby deepening the learning value derived from social interactions.

Finally, the socialization process must be strategically aligned with formal organizational systems to ensure its sustainability and impact. Isolated informal interactions are insufficient if their outcomes are not captured and leveraged. Organizations should create explicit links between socialization and performance metrics, for instance, by documenting insights from informal discussions in lessons-learned repositories and demonstrating their impact on key performance indicators like cost savings or schedule adherence. Furthermore, incentive structures should be designed to reward collaborative behaviors and knowledge contribution, thereby signaling the organizational value placed on sharing rather than hoarding expertise.

In conclusion, navigating the barriers to socialization is not a matter of implementing isolated initiatives but requires a systemic and integrated approach. By concurrently fostering psychological safety, redesigning structures to enhance connectivity, transforming mentorship into a dialogic practice, and embedding socialization into formal value-recognition systems, PBOs can effectively facilitate the socialization process. This enables them to convert latent tacit knowledge into a dynamic organizational capability, thereby mitigating knowledge fragmentation and enhancing project learning across the organization.

6.4. Main question: To what extent is socialization employed as a knowledge transfer method in Project-based organizations active in the construction sector?

This research concludes that socialization is employed as a pervasive and foundational knowledge transfer method within construction Project-Based Organizations (PBOs). Its use is extensive and deeply embedded in the daily operations of these organizations, forming the primary mechanism for the exchange of the tacit, experiential knowledge that is critical to navigating project complexity. However, its application is largely informal, emergent, and not systematically leveraged as a strategic organizational capability.

The empirical evidence demonstrates that socialization manifests through a multifaceted array of formal and informal practices. These range from structured interactions like project kick-off meetings and weekly coordination sessions to highly informal ones such as coffee breaks, shared meals, and team-building events. Furthermore, mentored experiential learning, through shadowing and on-the-job guidance, is identified as a central channel for transferring nuanced, practical know-how. A strong preference for rich, personal communication modalities, particularly face-to-face interaction, further underscores the sector's intrinsic reliance on social processes for effective knowledge exchange.

While formal codification systems exist, socialization often functions as an essential compensatory mechanism for their shortcomings. Lessons-learned databases and formal reviews are frequently perceived as underutilized or ineffective, leading practitioners to rely on their interpersonal networks to access the context-specific knowledge necessary for problem-solving. In this sense, the de facto knowledge transfer system in construction PBOs is more heavily dependent on socialization than the formally documented systems would indicate.

Despite its prevalence, the full potential of socialization is constrained by significant organizational barriers. Knowledge hoarding, entrenched silos, rigid hierarchies, and intense time pressure often fragment these vital social learning networks. Consequently, while socialization is employed extensively on an informal level, it remains an undermanaged and under-optimized resource. Its power is often left to chance rather than being deliberately cultivated.

In final analysis, the extent of socialization's employment is characterized by a critical duality: it is ubiquitous in practice yet underdeveloped in strategic intentionality. For construction PBOs to truly mitigate knowledge fragmentation, the imperative is not merely to acknowledge the role of socialization but to transition from passive reliance to its active facilitation. This involves systematically dismantling barriers, fostering psychological safety, transforming mentorship into a reflective dialogue, and integrating social learning outcomes into the formal value structure of the organization.

6.5. Recommendations for Practitioners

Drawing upon the empirical findings and theoretical framework developed in this research, this section delineates a comprehensive set of evidence-based recommendations for practitioners in construction Project-Based Organizations (PBOs). These recommendations are synthesized into an integrated framework (see figure 6.1) that conceptualizes knowledge transfer enhancement as a cyclical, self-reinforcing process comprising four interdependent dimensions.

6.5.1. Cultivating Psychological Safety

The foundational recommendation emerging from this research concerns the systematic cultivation of psychological safety through deliberately structured informal socialization practices. The empirical data substantiate that interpersonal risk-taking and vulnerability, which are essential for tacit knowledge exchange, are contingent upon establishing environments where team members feel secure in sharing uncertainties and errors. Practitioners should therefore institutionalize formally scheduled, organizationally-sanctioned informal interaction opportunities while implementing systematic anti-blame

protocols that reconceptualize errors as learning catalysts rather than performance failures. This involves the deliberate design of physical and temporal spaces conducive to spontaneous knowledge exchange, coupled with leadership practices that consistently model and reinforce psychological safety norms throughout the organization.

6.5.2. Deconstructing Organizational Silos
A critical imperative identified in this study involves implementing structural interventions to mitigate knowledge fragmentation across functional boundaries. The research findings demonstrate that expertise frequently becomes trapped within departmental silos, thereby constraining organizational learning capacity and leading to the recurrent "reinvention of the wheel" phenomenon. To address this, practitioners should deploy systematic job rotation protocols across functional domains and constitute cross-disciplinary project teams with explicit knowledge integration mandates. Furthermore, the institution of regular inter-departmental knowledge articulation forums and the adoption of matrix-based organizational structures can significantly enhance lateral communication channels, thereby facilitating the cross-pollination of expertise and best practices throughout the organization.

6.5.3. Articulating Value through Performance Metric Integration
The empirical evidence indicates that knowledge sharing behaviors are substantially influenced by perceived utility and organizational reward structures. Consequently, practitioners must render the benefits of knowledge sharing explicit through its systematic integration with established performance measurement systems. This entails formally linking lessons learned documentation to quantitative performance indicators and developing organizational dashboards that visually demonstrate knowledge reuse outcomes. Additionally, implementing recognition systems that valorize knowledge contribution behaviors, coupled with the systematic documentation and dissemination of knowledge reuse success narratives, serves to reinforce the tangible value proposition of active participation in organizational learning processes.

6.5.4. Transforming Mentorship through Dialogic Reflective Practice
The research reveals that current mentorship practices predominantly facilitate single-loop learning while neglecting the potential for deeper, transformative learning experiences. To address this limitation, practitioners should reconceptualize mentorship from a unidirectional knowledge transmission model to a dialogic reflective practice. This transformation involves developing comprehensive mentor training programs focused on facilitative questioning techniques and structuring mentorship engagements as collaborative sense-making exercises rather than instructional sessions. By institutionalizing reflective protocols that challenge underlying assumptions and integrating methodologies such as after-action reviews into regular mentoring practices, organizations can foster the double-loop learning essential for innovation and adaptive problem-solving.

6.5.5. Sustaining the Organizational Learning Cycle
The proposed framework ultimately conceptualizes knowledge enhancement as a perpetual, self-reinforcing organizational process rather than a finite initiative. To sustain this continuous improvement cycle, practitioners should implement periodic audits of knowledge sharing efficacy and utilization, while establishing robust feedback mechanisms that demonstrate cyclical improvement outcomes to organizational stakeholders. Developing adaptive refinement processes based on empirical performance data and integrating knowledge management metrics into organizational performance evaluation systems ensures that learning remains embedded within organizational routines rather than being treated as a peripheral activity.

The systematic implementation of these evidence-based recommendations enables construction PBOs to transform socialization from an incidental interpersonal phenomenon into a strategically managed organizational capability. This transformation directly addresses the fundamental challenge of knowledge fragmentation identified throughout this research, thereby enhancing project performance, reducing recurrent errors, and ultimately developing sustainable competitive advantage through superior organizational learning mechanisms.
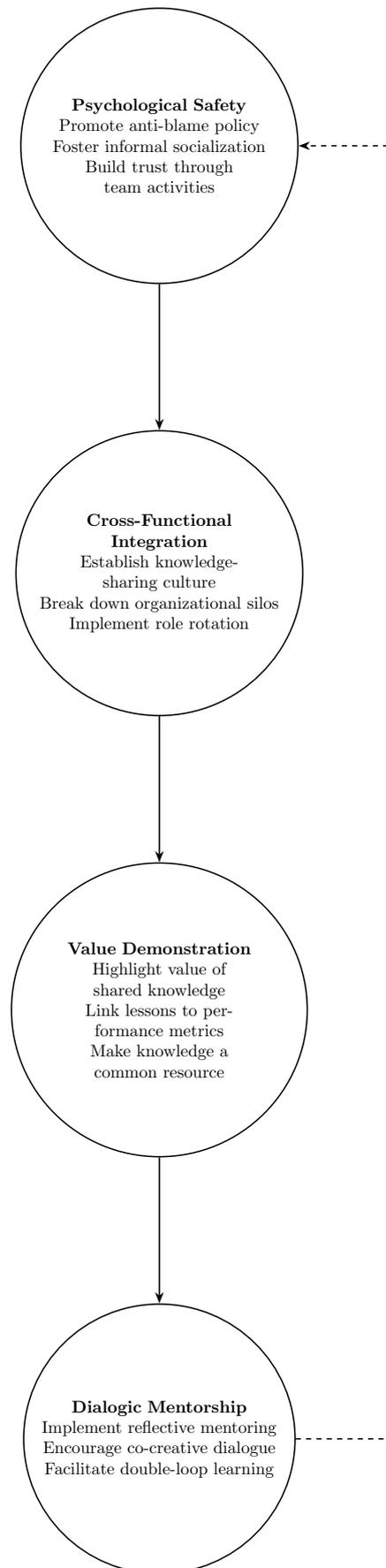
Figure 6.1: Recommendations for Practitioners

6.6. Recommendations for Further Research

This research emphasized the role of socialization in project-based organizations within the cultural contexts of Greece, Italy, and Iran. While these countries differ in cultural dimensions, their relative geographical proximity and shared regional practices may have shaped similar approaches to knowledge transfer. Future studies could investigate whether similar patterns emerge in different cultural and organizational environments, such as in North or South America, or in other European contexts like the Netherlands, France, or Germany. Such cross-cultural comparisons would contribute to a broader understanding of how national culture influences socialization practices and project learning.

A second promising direction for future research involves a deeper exploration of the SECI framework introduced earlier. This study focused primarily on the 'Socialization' phase, which serves as the foundation of the model. The next step would be to examine how organizations transition from socialization to 'Externalization', in which tacit knowledge is articulated and shared more formally. Practices such as post-project reviews, lessons learned sessions, and post-mortem analyses could be studied to understand their role in institutionalizing learning within project-based settings.

These practices may be conceptualized as formal business processes, and tools like swimlane diagrams could be employed to clarify the responsibilities of different actors at each step of the process. Applying such visualizations across multiple projects could support organizational learning progression toward the 'Combination' phase, where explicit knowledge is systematized, and eventually to 'Internalization', where best practices are absorbed into the routines of the organization.

From Externalization to Institutionalization, future work should formally map this journey by developing structured process models, such as swimlane diagrams, to delineate the responsibilities of different actors (e.g., project managers, engineers, knowledge managers) in capturing, validating, and integrating lessons learned. This could be complemented by action research projects that collaborate with PBOs to implement and refine these formalized processes while measuring their impact on reducing cost overruns and delays through the reuse of codified knowledge in subsequent projects. In addition, further investigation is needed into the technological tools and platforms that best support the transition from Combination (systematizing explicit knowledge) to Internalization (embedding it into organizational routines), moving beyond simple repositories toward interactive, integrated systems.

In addition, this research also highlighted the importance of in-person meetings and interactions for effective knowledge transfer. Future research could explore how these practices are being reshaped by the growing use of digital tools, platforms, and media. With the increasing prevalence of remote work, virtual project teams, and collaborative software in the construction sector, it is important to understand how digital environments influence trust-building, tacit knowledge sharing, and socialization more broadly. Comparative studies could examine whether digital tools replicate, replace, or complement traditional face-to-face practices, and whether they can facilitate socialization across geographical and cultural distances. Investigating hybrid approaches that blend in-person interaction with digital collaboration may also provide insights into how organizations can maintain strong relational ties while leveraging the efficiencies of technology. Such research would not only address the evolving nature of project communication but also shed light on the future trajectory of project learning in increasingly digitalized PBOs.

Lastly, another promising avenue for research lies in exploring the impact of Artificial Intelligence (AI) on project learning and socialization processes. AI-driven tools have the potential to transform how lessons learned are captured, analyzed, and disseminated across projects. For instance, natural language processing could automatically extract insights from meeting transcripts, while machine learning algorithms could identify recurring patterns or risks across multiple projects. AI-enabled recommendation systems might also support project teams by suggesting relevant past experiences or experts within the organization, thereby bridging the gap between codification and socialization. Future research could investigate not only the technical feasibility of such applications but also their implications for trust, collaboration, and the human dimensions of project learning. Understanding how AI complements, enhances, or potentially disrupts existing socialization practices would provide valuable insights into the next stage of knowledge management in PBOs.

Table 6.1: Future Research Directions in Project Learning and Socialization

Limitation	What Can Be Done	Potential Topic
Limited cross-cultural evidence	Conduct studies in different cultural and organizational contexts (e.g., North/South America, Netherlands, France, Germany)	Cross-cultural comparison of socialization practices in PBOs
Focus only on Socialization phase of SECI	Examine transitions to Externalization, including post-project reviews and lessons learned sessions	Progression through SECI phases and institutionalization of knowledge
Lack of structured process models	Develop swimlane diagrams to map responsibilities and formalize processes from Externalization to Institutionalization	Process modeling for project learning in PBOs
Impact of digital tools on socialization unclear	Investigate hybrid work environments, digital platforms, and virtual teams	Digital and hybrid collaboration in project-based organizations
Role of AI in knowledge management not explored	Study AI-driven tools for capturing, analyzing, and recommending lessons learned; assess human and relational implications	Artificial Intelligence in project learning and socialization

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A
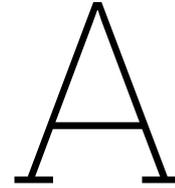
Organization types

Level of analysis	Experience accumulation	Knowledge articulation	Knowledge codification
Individual	• On-the-job training • Job rotation • Specialisation • Re-use of experts	• Figurative thinking • "Thinking aloud" • Scribbling notes	• Diary • Reporting system • Individual systems design
Group/Project	• Developed groupthink • Person-to-person communication • Informal encounters • Imitation	• Brainstorming sessions • Formal project reviews • De-briefing meetings • Ad-hoc meetings • Lessons learnt and/or post-mortem meetings • Intra-project correspondence	• Project plan/audit • Milestones/deadlines • Meeting minutes • Case writing • Project history files • Intra-project lessons learnt database
Organisational	• Informal organisational routines, rules, and selection processes • Departmentalisation and specialisation • Communities of practice	• Project manager camps • Knowledge retreats • Professional networks • Knowledge facilitators and managers • Inter-project correspondence • Inter-project meetings	• Drawings • Process maps • Project management process • Lessons learnt database

Figure A.1: Learning Landscape (Prencipe & Tell, 2001)

Level of analysis	Experience accumulation	Knowledge articulation	Knowledge codification
Individual	• On-the-job training • Job rotation • Specialisation • Re-use of experts	• Figurative thinking • "Thinking aloud" • Scribbling notes	• Diary • Reporting system • Individual systems design
Group/Project	• Developed groupthink • Person-to-person communication • Informal encounters • Imitation	• Brainstorming sessions • Formal project reviews • De-briefing meetings • Ad-hoc meetings • Lessons learnt and/or post-mortem meetings • Intra-project correspondence	• Project plan/audit • Milestones/deadlines • Meeting minutes • Case writing • Project history files • Intra-project lessons learnt database
Organisational	• Informal organisational routines, rules, and selection processes • Departmentalisation and specialisation • Communities of practice	• Project manager camps • Knowledge retreats • Professional networks • Knowledge facilitators and managers • Inter-project correspondence • Inter-project meetings	• Drawings • Process maps • Project management process • Lessons learnt database

Figure A.2: L Learning Landscape (Prencipe & Tell, 2001)

Level of analysis	Experience accumulation	Knowledge articulation	Knowledge codification
Individual	• On-the-job training • Job rotation • Specialisation • Re-use of experts	• Figurative thinking • "Thinking aloud" • Scribbling notes	• Diary • Reporting system • Individual systems design
Group/Project	• Developed groupthink • Person-to-person communication • Informal encounters • Imitation	• Brainstorming sessions • Formal project reviews • De-briefing meetings • Ad-hoc meetings • Lessons learnt and/or post-mortem meetings • Intra-project correspondence	• Project plan/audit • Milestones/deadlines • Meeting minutes • Case writing • Project history files • Intra-project lessons learnt da
Organisational	• Informal organisational routines, rules, and selection processes • Departmentalisation and specialisation • Communities of practice	• Project manager camps • Knowledge retreats • Professional networks • Knowledge facilitators and managers • Inter-project correspondence • Inter-project meetings	• Drawings • Process maps • Project management process • Lessons learnt database

Figure A.3: T Learning Landscape (Prencipe & Tell, 2001)

Level of analysis	Experience accumulation	Knowledge articulation	Knowledge codification
Individual	• On-the-job training • Job rotation • Specialisation • Re-use of experts	• Figurative thinking • "Thinking aloud" • Scribbling notes	• Diary • Reporting system • Individual systems design
Group/Project	• Developed groupthink • Person-to-person communication • Informal encounters • Imitation	• Brainstorming sessions • Formal project reviews • De-briefing meetings • Ad-hoc meetings • Lessons learnt and/or post-mortem meetings • Intra-project correspondence	• Project plan/audit • Milestones/deadlines • Meeting minutes • Case writing • Project history files • Intra-project lessons learnt database
Organisational	• Informal organisational routines, rules, and selection processes • Departmentalisation and specialisation • Communities of practice	• Project manager camps • Knowledge retreats • Professional networks • Knowledge facilitators and managers • Inter-project correspondence • Inter-project meetings	• Drawings • Process maps • Project management process • Lessons learnt database

Figure A.4: Staircase Learning Landscape (Prencipe & Tell, 2001)

Level of analysis	Experience accumulation	Knowledge articulation	Knowledge codification
Individual	• On-the-job training • Job rotation • Specialisation • Re-use of experts	• Figurative thinking • "Thinking aloud" • Scribbling notes	• Diary • Reporting system • Individual systems design
Group/Project	• Developed groupthink • Person-to-person communication • Informal encounters • Imitation	• Brainstorming sessions • Formal project reviews • De-briefing meetings • Ad-hoc meetings • Lessons learnt and/or post-mortem meetings • Intra-project correspondence	• Project plan/audit • Milestones/deadlines • Meeting minutes • Case writing • Project history files • Intra-project lessons learnt database
Organisational	• Informal organisational routines, rules, and selection processes • Departmentalisation and specialisation • Communities of practice	• Project manager camps • Knowledge retreats • Professional networks • Knowledge facilitators and managers • Inter-project correspondence • Inter-project meetings	• Drawings • Process maps • Project management process • Lessons learnt database

Figure A.5: Levels of Analysis in Knowledge Management

B

Consent Form

Informed Consent Form

Opening Statement (Interview)

You are being invited to participate in a research study titled **Investigating the role of Socialization in Project Learning**. This study is being done by **Vasileios (Vassilis) Pentheroudakis** from TU Delft.

The purpose of this research study is to provide understanding about the impact of the inter-personal interactions in the project level, and will take you approximately 60 minutes to complete. The data will be used for the master thesis of Vasileios (Vassilis) Pentheroudakis. We will be asking you to provide information related to your understanding or opinion related to the role of socialization in project learning, including its implications (both positive and negative) in relation to learning.

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. The interview results published on the thesis will be coded and completely anonymous. With your permission, the interview will be recorded, and if via online meeting, the text will be automatically transcribed using Microsoft Teams and manually adjusted. Original transcripts and recordings will be made available to the thesis supervisors, will remain unpublished, and will be removed approximately two years after the completion of the study. However, you also have the option to review them in order to ensure their accuracy. Your participation is entirely voluntary.

Below is the informed consent form. Please tick the boxes to indicate your consent.

Contact Details

Corresponding Researcher
Vasileios (Vassilis) Pentheroudakis

Responsible Researcher
Erik-Jan Houwing

Please Tick the Appropriate Boxes

A: General Agreement – Research Goals, Participant Tasks and Voluntary Participation	Yes	No
1. I have read and understood the study information above. My questions have been answered.	❑	❑
2. I consent voluntarily and understand I can withdraw at any time.	❑	❑
3. I understand that taking part involves: - The interview will be semi-structured with open-ended questions related to the viability of green maritime methanol in the shipping industry. - A recorded interview that will be conducted via Microsoft Teams or Face-to-Face. - If via Microsoft Teams, the recording will be transcribed as a text directly from Microsoft Teams and the researcher will edit the text by listening to the interview recording and adjusting the written transcription to the original spoken text. - The interview recording will be stored on the personal storage of Vasileios (Vassilis) Pentheroudakis on the TU Delft OneDrive and will be destroyed the maximum of two years after the study has been completed.	❑	❑
4. I understand that I will not be financially compensated for my participation.	❑	❑
5. I understand the study will end by September 2025	❑	❑
B: Potential Risks of Participating (Including Data Protection)		
6. I understand the potential risks and mitigation steps.	❑	❑
7. I understand that taking part in the study also involves collecting specific personally identifiable information (PII) (name, occupation, contact information) and associated personally identifiable research data (PIRD), with the potential risk of my identity being revealed, the risk of re-identification and the subsequent risk of affecting my public or professional reputation.	❑	❑
8. I understand that some of this PIRD is considered as sensitive data within GDPR legislation, specifically job position and political, economic, social, technological, or environmental view.	❑	❑
9. 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. The interview will be conducted anonymously. Personal information of the interviewees will not be published to anyone who is not involved in the research. After the research is completed, the personal data will be deleted.	❑	❑
10. I understand that personal information collected about me that can identify me, such as my name and contact information, will not be shared beyond the study team.	❑	❑

11. I understand that the (identifiable) personal data I provide will be destroyed after the research has ended, which will be conducted the maximum of two years after the graduation of the researcher.	❏	❏
C: Research Publication, Dissemination and Application		
12. I understand that after the research study the de-identified information I provide will be used for the following purposes. The anonymised interview results will be published along with the master thesis on the TU Delft Repository, including the anonymised coding of the interviews.	❏	❏
13. I agree that my responses, views or other input can be quoted anonymously in research outputs.	❏	❏
D: (Long-term) Data Storage, Access and Reuse		
14. I give permission for the de-identified interview results that I provide to be archived in the TU Delft repository (https://repository.tudelft.nl/) in the form of anonymous coded interviews so it can be used for future research and learning. The original transcribed interviews will not be made available to the public or be stored on the TU Delft repository	❏	❏
15. I understand that access to the repository where the master thesis is stored is openly available on the internet.	❏	❏
16. I understand that the collected data may be reused for future scientific publications and educational activities on the topic of project learning.	❏	❏

Signatures

Name of participant: _____

Signature: _____   Date: _____

I, as researcher, have read the information to the participant and ensured understanding.

Researcher name: _____

Signature: _____   Date: _____

C

Data Management Plan

Plan Overview

A Data Management Plan created using DMPonline

Title: Master Thesis Vasileios Pentheroudakis

Creator: Vasileios Pentheroudakis

Principal Investigator: Vasileios Pentheroudakis

Data Manager: Vasileios Pentheroudakis

Project Administrator: Erik-jan Houwing

Affiliation: Delft University of Technology

Funder: Delft University of Technology

Template: TU Delft Data Management Plan template (2025)

Project abstract:
  Research Project to partially fulfill requirements for Construction Management and
  Engineering (CME) M.Sc Degree.

ID: 173180

Start date: 23-10-2024

Last modified: 18-03-2025

Master Thesis Vasileios Pentheroudakis

0. Adminstrative questions

1. Provide the name of the data management support staff consulted during the preparation of this plan and the date of consultation. Please also mention if you consulted any other support staff.

Xinyan Fan, Data Steward at the Faculty of CiTG, has reviewed this DMP on 17/03/2025.

2. Is TU Delft the lead institution for this project?

- Yes, the only institution involved

I. Data/code description and collection or re-use

3. Provide a general description of the types of data/code you will be working with, including any re-used data/code.

Type of data/code	File format(s)	How will data/code be collected/generated? *For re-used data/code: what are the sources and terms of use?*	Purpose of processing	Storage location	Who will have access to the data/code?
Personally Identifiable Information (PII) of participants: (names, emails)	.xlsx	Contact information for participants taking part in research, received from participant sign-ups.	For administrative purposes: obtaining consent and communicating with participants.	TU Delft OneDrive	TU Delft Project Team
Interview Recordings: audio format	.mp3, .m4a	Captured with the use of a CE Certified device. For analysis and Transcript generation.	To verify transcription and data authenticity.	TU Delft OneDrive	Researcher
Interview Recordings: video format	.mp4 file	Generated by the use of Microsoft Teams. For analysis and Transcript generation	To verify transcription and data authenticity.	TU Delft OneDrive	Researcher
Interview Transcripts	.docx, .pdf	Auto-generated transcripts from Microsoft Teams. In other cases, manual transcription will be required.	To analyze opinions and views on socialization for the purpose of learning in construction projects.	TU Delft OneDrive	Researcher, corresponding Interviewee
De-identified transcripts	.docx, .txt	PIRD will be removed from transcripts manually	To analyze opinions and views on socialization for the purpose of learning in construction projects.	TU Delft OneDrive	TU Delft Project Team
Personally Identifiable Research Data (PIRD): Professional background, job, and experience.	.xlsx	Data will be collected during the interview.	To analyze opinions and views on socialization for the purpose of learning in construction projects.	TU Delft OneDrive	Researcher, TU Delft Project Team
Signed Consent Form	.pdf, .paper	Signed digitally and/or in-person to be digitalized.	To ensure the ethical side of data collection.	TU Delft OneDrive (digital copy), locked drawer (physical copy)	Researcher, TU Delft Project Team
Input data for Atlas.Ti software package	.docx, ,mp4	Interviews and data processed by Microsoft Teams.	Input data for processing and analysis via Atlas.ti qualitative analysis software.	TU Delft OneDrive	Researcher, TU Delft Project Team
Output data for Atlas.Ti software package	.docx	Processed by Atlas.Ti	To analyze themes and patterns from the interviews.	TU Delft OneDrive	Researcher, TU Delft Project Team

II. Storage and backup during the research process

4. How much data/code storage will you require during the project lifetime?

- < 250 GB

5. Where will the data/code be stored and backed-up during the project lifetime? (Select all that apply.)

- TU Delft OneDrive

III. Data/code documentation

6. What documentation will accompany data/code? (Select all that apply.)

- Data – Methodology of data collection

IV. Legal and ethical requirements, code of conducts

7. Does your research involve human subjects or third-party datasets collected from human participants?

If you are working with a human subject(s), you will need to obtain the HREC approval for your research project.

- Yes – please provide details in the additional information box below

I intend to apply for ethical approval from the Human Research Ethics Committee, but have not yet done so.

8. Will you work with personal data? (This is information about an identified or identifiable natural person, either for research or project administration purposes.)

- Yes

9. Will you work with any other types of confidential or classified data or code as listed below? (Select all that apply and provide additional details below.)

If you are not sure which option to select, ask your Faculty Data Steward for advice.

- No, I will not work with any other types of confidential or classified data/code

10. How will ownership of the data and intellectual property rights to the data be managed?

For projects involving commercially-sensitive research or research involving third parties, seek advice of your<u>*Faculty Contract Manager*</u> *when answering this question*

As a master's student, I have ownership on the data that will be generated by the research, unless stated otherwise.

11. Which personal data or data from human participants do you work with? (Select all that apply.)

- Other types of personal data or other data from human participants – please provide details below
- Telephone number, email addresses and/or other addresses as contact details for administrative purposes
- Names as contact details for administrative purposes
- Proof of consent (such as signed consent materials which contain name and signature)
- Video materials
- Audio recordings

12. Please list the categories of data subjects and their geographical location.

Interview participants are Project Managers in Greece, Italy, and Iran.

13. Will you be receiving personal data from or transferring personal data to third parties (groups of individuals or organisations)?

- No

16. What are the legal grounds for personal data processing?

- Informed consent

17. Please describe the informed consent procedure you will follow below.

The researcher will inform the potential participants about the goals and procedures of the research project. The researcher will also inform them about the personal data that are being processed and for what purpose. This information will be provided to the potential participants as follows: The informed consent form will be emailed to the participants, along with the opening statement that will describe the research and its goals. All participants will be asked for their consent to take part in the study and for data processing by signing a physical or digital informed consent form before the start of the interview.

18. Where will you store the physical/digital signed consent forms or other types of proof of consent (such as recording of verbal consent)?

The digital copies of informed consent will be stored in the TU Delft OneDrive. For the physical ones, they will be stored in a locked drawer.

19. Does the processing of the personal data result in a high risk to the data subjects? (Select all that apply.)

If the processing of the personal data results in a high risk to the data subjects, it is required to perform a Data Protection Impact Assessment (DPIA). In order to determine if there is a high risk for the data subjects, please check if any of the options below that are applicable to the processing of the personal data in your research project.

If any category applies, please provide additional information in the box below. Likewise, if you collect other type of potentially sensitive data, or if you have any additional comments, include these in the box below.

If one or more options listed below apply, your project might need a DPIA. Please get in touch with the Privacy team (privacy-tud@tudelft.nl) to get advice as to whether DPIA is necessary.

- None of the above apply

23. What will happen with the personal data used in the research after the end of the research project?

- Anonymised or aggregated data will be shared with others

24. For how long will personal research data (including pseudonymised data) be stored?

- Personal data will be deleted at the end of the research project

25. How will your study participants be asked for their consent for data sharing?

- In the informed consent form: participants are informed that their personal data will be anonymised and that the anonymised dataset is shared publicly

V. Data sharing and long term preservation

27. Apart from personal data mentioned in question 23, will any other data be publicly shared?

Please provide a list of data/code you are going to share under 'Additional Information'.

- No other data/code can be publicly shared – please explain below why data/code cannot be publicly shared

VI. Data management responsibilities and resources

33. If you leave TU Delft (or are unavailable), who is going to be responsible for the data/code resulting from this project?

My supervisor Erik-Jan Houwing CiTG

34. What resources (for example financial and time) will be dedicated to data management and ensuring that data will be FAIR (Findable, Accessible, Interoperable, Re-usable)?

No additional budget is needed for Data Management and publication.

35. Which faculty do you belong to?

- Faculty of Civil Engineering and Geosciences (CEG)

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