Improving Inter-Project Learning within Project-Based Organizations

Master-Thesis

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TUDelft

Improving Inter-Project Learning within Project-Based Organizations

An explorative study of improving inter-project learning: A framework for project-based organizations.

By

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Preface

With pleasure and a deep sense of accomplishment, I present this thesis report as a culmination of my master's program, fulfilling the requirements to obtain my Master of Science degree in Construction Management and Engineering at Delft University of Technology. The thesis topic represents an exploration of a topic that piqued my interest from the first moment and has indeed broadened the horizon of my knowledge.

This thesis delves into the process of inter-project learning and how it can be improved within project-based organizations. I ardently aspire that this study will provide a valuable addition to the academic community and foster further research in the realm of organizational learning. I wish for this work to motivate the readers to be more aware of the importance of learning in organizations. Furthermore, I hope that this thesis's findings will significantly contribute to organizations that will help them improve their inter-project processes.

I want to extend my sincere gratitude to my thesis committee, Hans Wamelink, Erik-Jan Houwing, Sana Lateef, and Raoul Sheombar, whose professional expertise, invaluable guidance, and unwavering support played a crucial role in the completion of this thesis. Their great expertise, encouragement, and mentorship have undeniably enriched the quality of my work. I also want to thank Annemarijn Jelsma for giving me the opportunity to conduct my thesis at Sweco, an experience I cherish where I had a wonderful time working on my thesis. I also want to thank all the interviewees who agreed to participate in my case study and made a significant contribution to my study.

To my family and my friends, I would like to thank you for your unconditional love and support throughout this journey. The challenges I encountered were surmountable thanks to the strength I drew from your support and belief in me.

I hope you enjoy reading this report and I trust you will find it enlightening.

Wael Osman Abou
Rotterdam, November 2023

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Executive summary

In the rapidly evolving construction industry, the need for continuous improvement is inevitable. The complex nature of infrastructure presents additional challenges for project-based organizations (PBOs) to improve. PBOs are defined as organizations where projects are the essential units for innovation and production. As a result of this nature, limited space is given for evaluation and reflection as organizations focus on delivering projects on time, within budget, and at the required quality level. This often deprioritizes learning practices within organizations. Organizational learning is the transformative process altering knowledge, behaviour, and performance in organizations. The concept of organizational learning serves as a foundation that provides the possibility to delve into learning in projects.

In the realm of organizational learning within PBOs, different forms are taken. One important approach classified the process of learning in projects into two types. These two types are inter-project and intra-project learning.

Furthermore, recent scientific research indicates that inter-project learning (IPL) faces challenges due to several reasons. One such reason is the complexity of finding suitable solutions to apply transferred knowledge. Another challenge arises from the limited time and resources available for knowledge exchange across teams. Therefore, this study focuses on IPL within PBOs to improve organizational performance and eventually increase project values. Additionally, the scope of this study focuses on the construction industry as it is considered to be more reluctant to adopt new management approaches which makes it more challenging in the realm of IPL compared to other industries. Figure 1 provides a visual representation of the IPL cycle, showing the intricate process PBOs undergo.
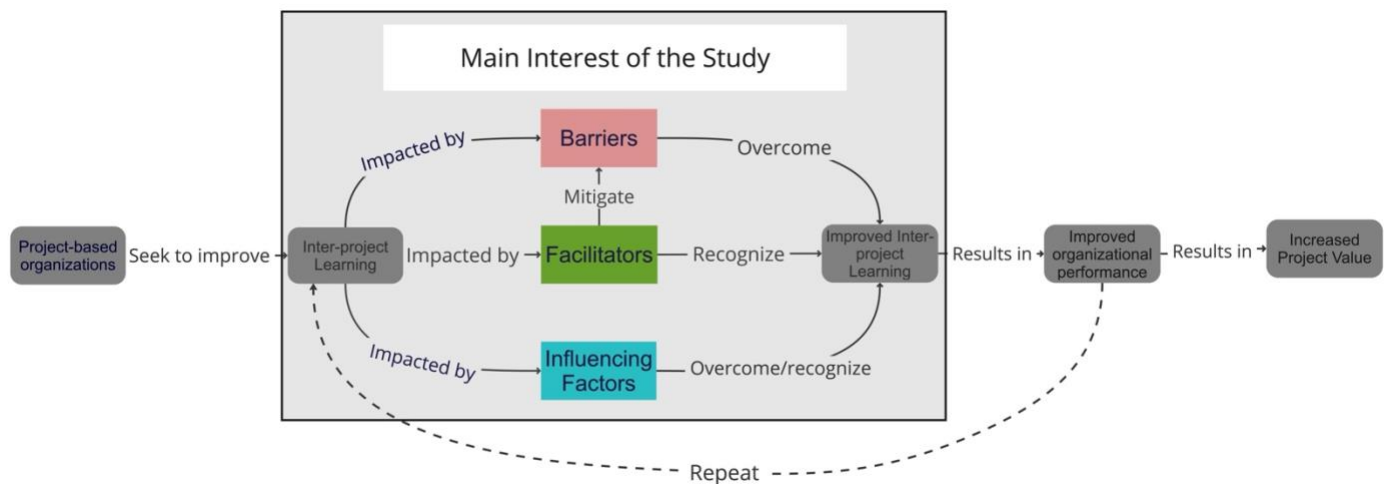

Figure 1 Inter-project Learning cycle (Author, 2023)

This study aims to enhance IPL in PBOs by investigating factors affecting it. The study aims to provide organizations with a roadmap framework that they can follow to improve their IPL processes. The following research question was formulated to achieve this objective.
How can inter-project learning be improved within project-based organizations?

Various methods have been employed in this study to answer the main research question and the other sub-questions. At first, an extensive literature review was conducted to gain a sufficient understanding of the concepts of organizational learning, project-based organizations, and inter-project learning. The literature review establishes a foundation, from which a hypothesis model was derived for empirical testing. The hypothesis model classifies the barriers, facilitators, and influencing factors into three main dimensions. Each

dimension represents a unique aspect of the IPL environment. The dimensions are Learning infrastructure, Knowledge accessibility, and organizational culture. Learning infrastructure embodies foundational factors for IPL; Knowledge accessibility encompasses factors from knowledge-sharing activities in PBOs, and organizational culture reflects shared values and norms influencing employee interactions and learning. Figure 2 illustrates the model. The main observation from the model is the level of complexity and the various interconnections between the facilitators, barriers, and influencing factors.

Therefore, the empirical study takes this hypothesis model as a starting point to identify the practical factors impacting the process of IPL within PBOs.
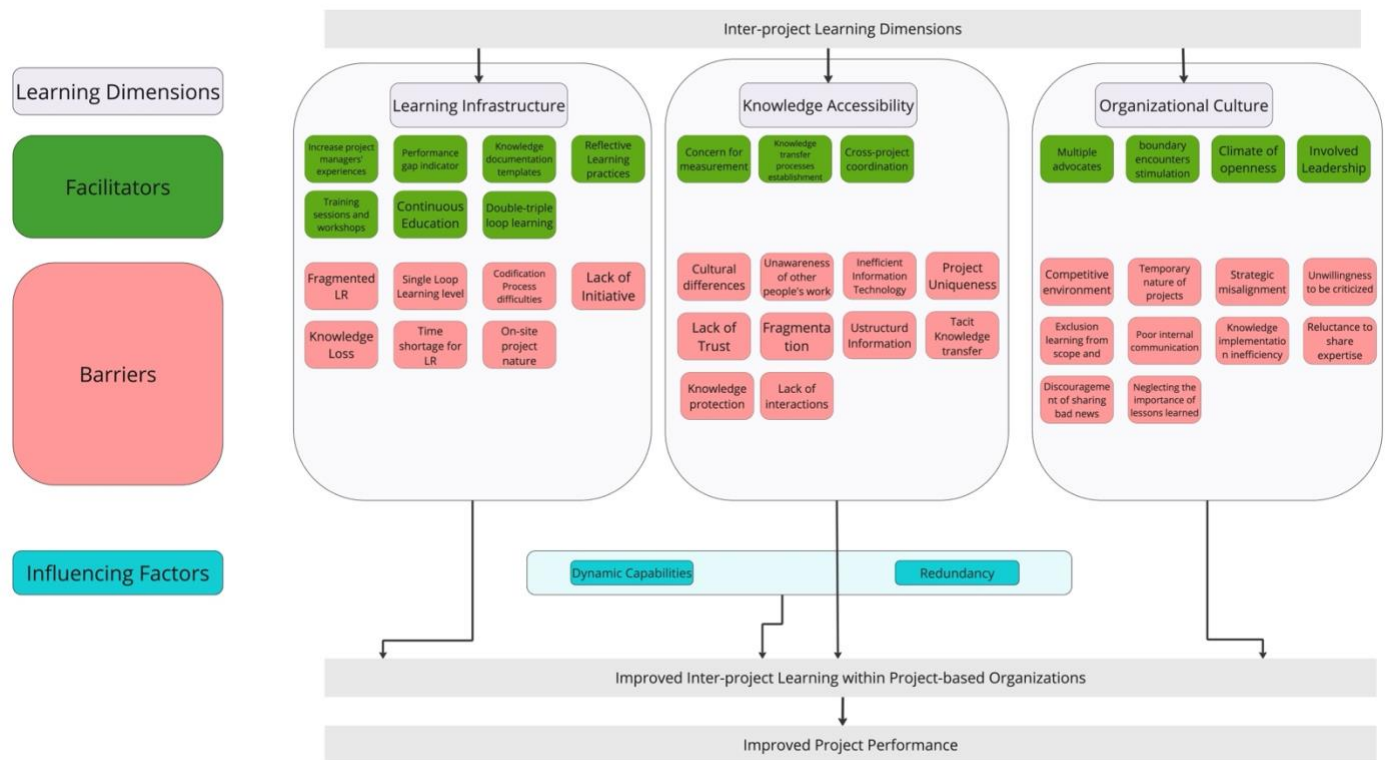

Figure 2 Hypothesis Model Based on the Literature Study (Author, 2023)

The empirical study involves a case study within a standard PBO. The case study consists of two parts. The first delved into understanding the learning processes in the organization to understand how IPL is currently being approached. The next part was about conducting semi-structured interviews with project managers from the organization who have experience in it in order to gather practical insights and impacting factors. In addition, the interviews helped to develop the final roadmap framework which was presented as an answer to the research question. The empirical study findings provide new insights into the realm of impacting factors and how to implement a successful IPL.

Empirical findings suggest that the found barriers, facilitators, and influencing factors can be presented in a more practical way for organizations to achieve their highest value. They can be better classified as factors that organizations can maximize the benefits of each one and consider it as facilitators for the process of IPL. Figure 3 illustrates the found factors from both literature and empirical studies classified into the three dimensions indicated above.
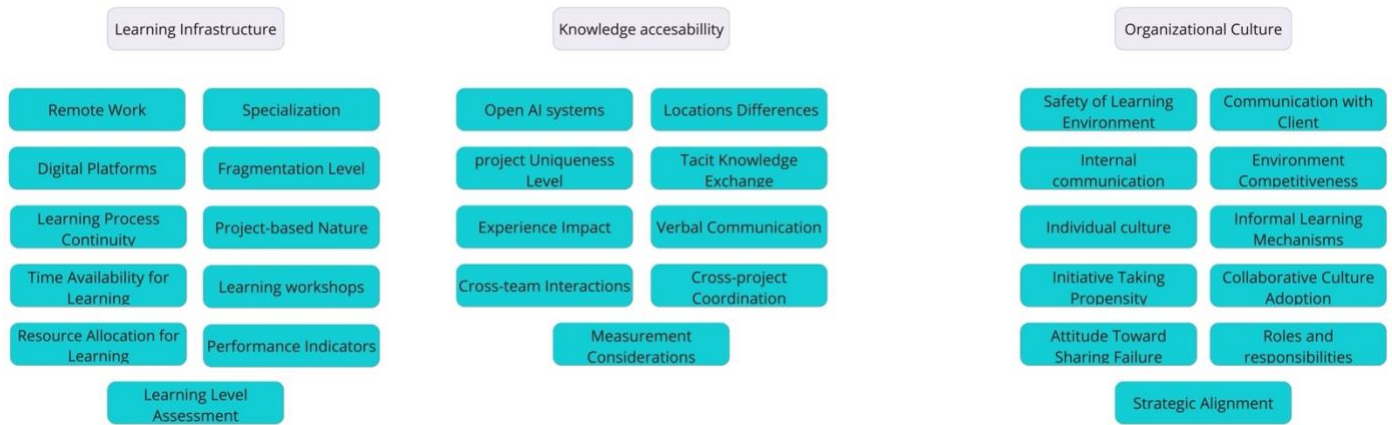
Figure 3 Factors Influencing Inter-Project Learning in Project-Based Organizations (Author, 2023)

Moreover, the results of this study show that the facilitators can be categorized using a distinct perspective to have a more practical classification. The results show that the factors can be classified according to their structural domains. Each structural domain represents various aspects of the process that impact the IPL's dynamics. In total, there were four structural domains identified. These are technological, social, organizational, and industrial domains. Figure 4 shows the structural domains and the factors in each one of them. It can be also observed that multiple factors lie in more than one domain. These domains help organizations to break down the broader dimension into specialized subsets to provide clarity for organizations on the critical areas requiring interventions.
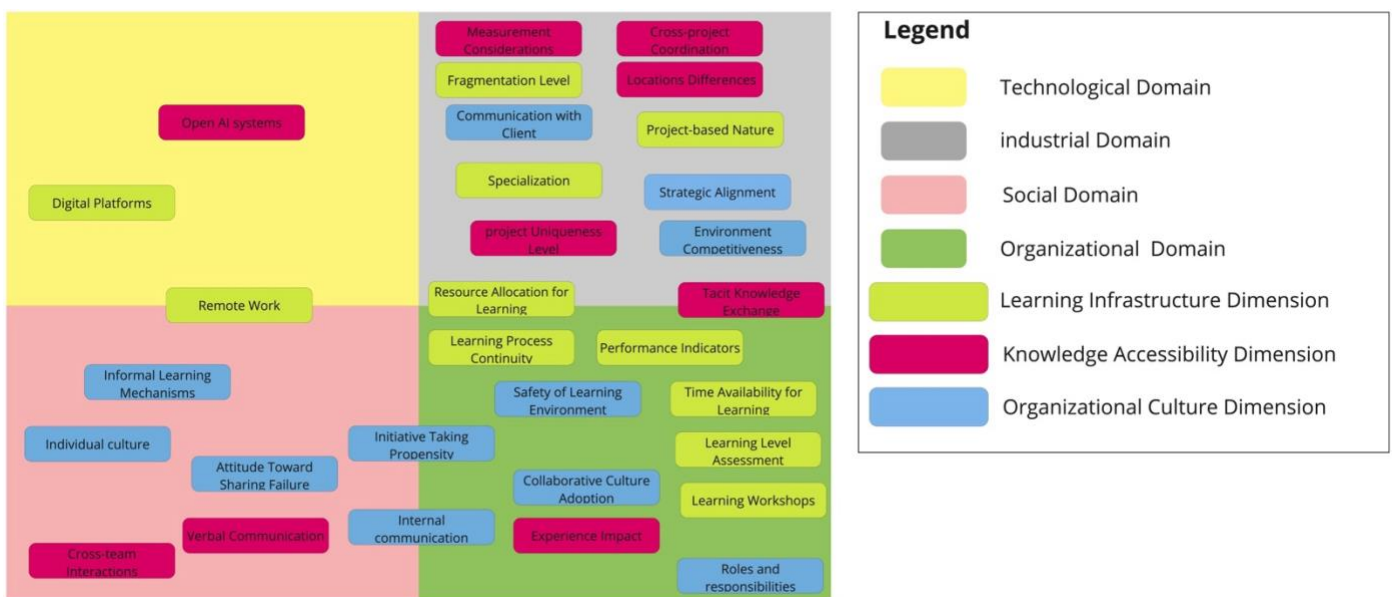

Figure 4 Structural Domains and Associated Factors for IPL in PBOs (Author, 2023)

Furthermore, to answer the main research questions, both theoretical and empirical findings were combined to come up with a roadmap framework model that guides PBOs on how to improve IPL. The roadmap framework consists of three concentric circles, each representing one dimension found in the literature. The empirical findings have been also integrated by including the structural domains in four segments. 22 steps have been made that organizations can undertake to improve their IPL process. Each step belongs to one or two domains and one dimension. Figure 5 shows the roadmap framework with steps and a brief description for each one. The framework also indicates the continuity of the process that organizations must continuously refine IPL processes.
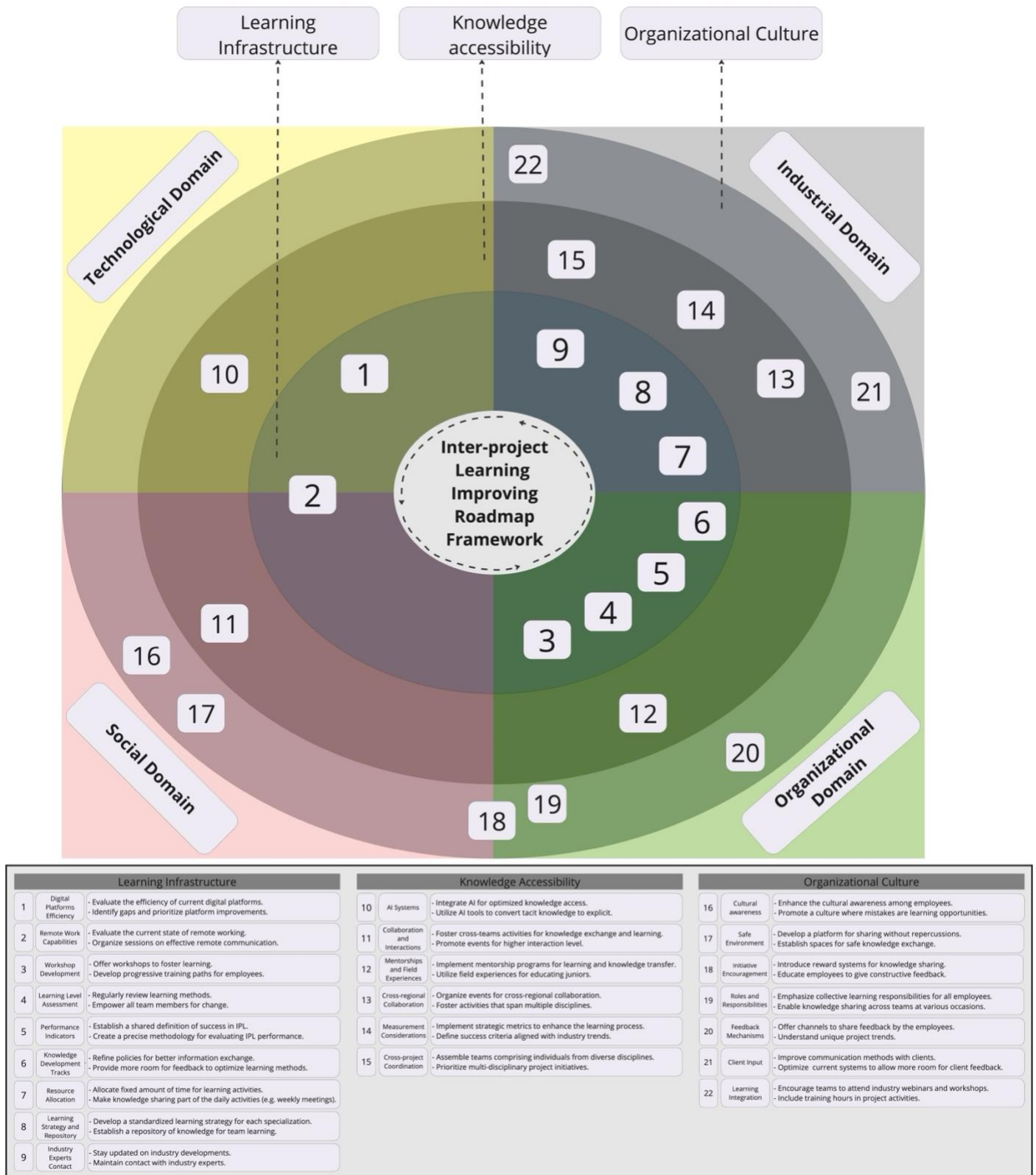
Figure 5 Improving Inter-project Learning Roadmap Framework (Author, 2023)

Learning Infrastructure

1	Digital Platforms Efficiency	- Evaluate the efficiency of current digital platforms. - Identify gaps and prioritize platform improvements.
2	Remote Work Capabilities	- Evaluate the current state of remote working. - Organize sessions on effective remote communication.
3	Workshop Development	- Offer workshops to foster learning. - Develop progressive training paths for employees.
4	Learning Level Assessment	- Regularly review learning methods. - Empower all team members for change.
5	Performance Indicators	- Establish a shared definition of success in IPL. - Create a precise methodology for evaluating IPL performance.
6	Knowledge Development Tracks	- Refine policies for better information exchange. - Provide more room for feedback to optimize learning methods.
7	Resource Allocation	- Allocate fixed amount of time for learning activities. - Make knowledge sharing part of the daily activities (e.g. weekly meetings).
8	Learning Strategy and Repository	- Develop a standardized learning strategy for each specialization. - Establish a repository of knowledge for team learning.
9	Industry Experts Contact	- Stay updated on industry developments. - Maintain contact with industry experts.

Knowledge Accessibility

10	AI Systems	- Integrate AI for optimized knowledge access. - Utilize AI tools to convert tacit knowledge to explicit.
11	Collaboration and Interactions	- Foster cross-teams activities for knowledge exchange and learning. - Promote events for higher interaction level.
12	Mentorships and Field Experiences	- Implement mentorship programs for learning and knowledge transfer. - Utilize field experiences for educating juniors.
13	Cross-regional Collaboration	- Organize events for cross-regional collaboration. - Foster activities that span multiple disciplines.
14	Measurement Considerations	- Implement strategic metrics to enhance the learning process. - Define success criteria aligned with industry trends.
15	Cross-project Coordination	- Assemble teams comprising individuals from diverse disciplines. - Prioritize multi-disciplinary project initiatives.

Organizational Culture

16	Cultural awareness	- Enhance the cultural awareness among employees. - Promote a culture where mistakes are learning opportunities.
17	Safe Environment	- Develop a platform for sharing without repercussions. - Establish spaces for safe knowledge exchange.
18	Initiative Encouragement	- Introduce reward systems for knowledge sharing. - Educate employees to give constructive feedback.
19	Roles and Responsibilities	- Emphasize collective learning responsibilities for all employees. - Enable knowledge sharing across teams at various occasions.
20	Feedback Mechanisms	- Offer channels to share feedback by the employees. - Understand unique project trends.
21	Client Input	- Improve communication methods with clients. - Optimize current systems to allow more room for client feedback.
22	Learning Integration	- Encourage teams to attend industry webinars and workshops. - Include training hours in project activities.

By adopting this roadmap framework, organizations can navigate the intricacies of enhancing IPL, ensuring improved performance and increased project value. The roadmap shows that the process of improving IPL is an iterative process as there is always room for improvement. This study recommends practitioners conduct a long-term observation of IPL processes to evaluate the effectiveness of the improvement pattern and make the required refinement when needed. The main limitation of this study is that it was a single organization focus which may have affected the generalizability of the roadmap framework despite concerted efforts to ensure broad applicability. For organizations, the key recommendation is to adopt this roadmap framework as a starting point and segment the IPL improvement process into manageable domains. For future research,

it was recommended to concentrate on the long-term implications of the roadmap in PBOs and delve into specific structural domains to enhance the understanding and improvement of inter-project learning processes.

Samenvatting

In de snel evoluerende bouwsector is de behoefte aan voortdurende verbetering onvermijdelijk. De complexe aard van infrastructuur brengt extra uitdagingen met zich mee voor projectgerichte organisaties (PBO's) om te verbeteren. PBO's worden gedefinieerd als organisaties waar projecten de essentiële eenheden zijn voor innovatie en productie. Als gevolg van deze aard wordt beperkte ruimte gegeven voor evaluatie en reflectie, omdat organisaties zich richten op het tijdig, binnen het budget en op het vereiste kwaliteitsniveau leveren van projecten. Dit zorgt er vaak voor dat leermethoden binnen organisaties geen prioriteit krijgen. Organisatorisch leren is het transformerende proces dat kennis, gedrag en prestaties in organisaties verandert. Het concept van organisatorisch leren vormt een basis die de mogelijkheid biedt om dieper in te gaan op leren in projecten.

Op het gebied van organisatorisch leren binnen PBO's worden verschillende vormen aangenomen. Een belangrijke benadering classificeert het proces van leren in projecten in twee typen. Deze twee typen zijn inter-project en intra-project leren. Bovendien geeft recent wetenschappelijk onderzoek aan dat inter-project leren (IPL) uitdagingen ondervindt vanwege verschillende redenen. Een van die redenen is de complexiteit van het vinden van geschikte oplossingen om overgedragen kennis toe te passen. Een andere uitdaging ontstaat door de beperkte tijd en middelen voor kennisuitwisseling tussen teams. Daarom richt dit onderzoek zich op IPL binnen PBO's om organisatorische prestaties te verbeteren en uiteindelijk projectwaarden te verhogen. Bovendien richt de scope van dit onderzoek zich op de bouwindustrie, omdat deze sector terughoudender wordt geacht bij het aannemen van nieuwe managementbenaderingen, wat het in het domein van IPL uitdagender maakt in vergelijking met andere industrieën. Figuur 6 geeft een visuele weergave van de IPL-cyclus, waarin de complexe processen van PBO's worden aangetoond.
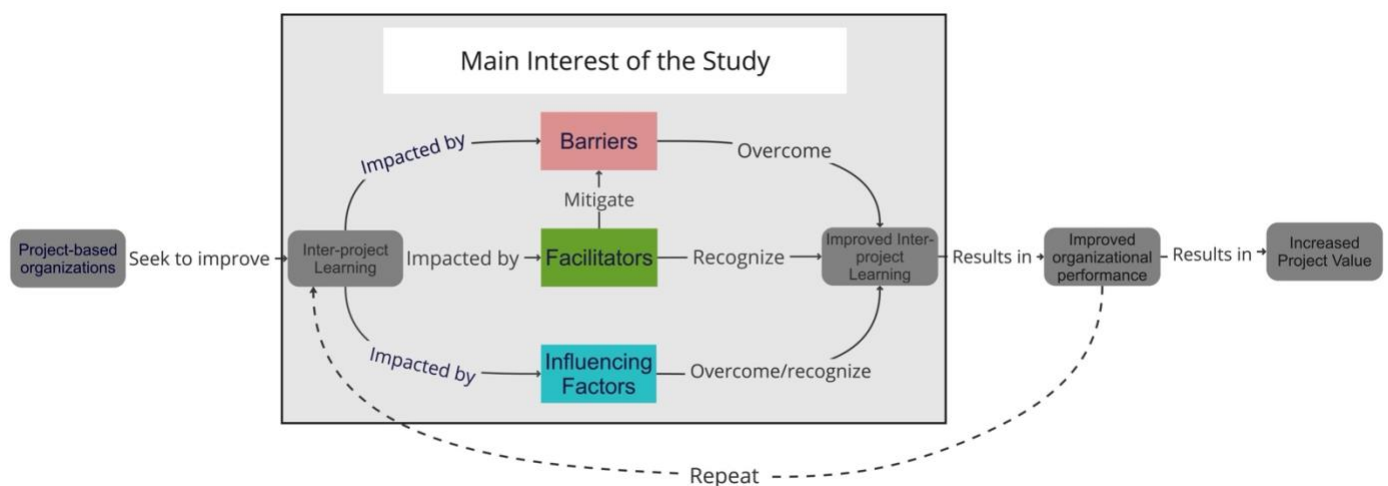
Figuur 6 Inter-project Leer Cyclus (Auteur, 2023)

Dit onderzoek heeft tot doel IPL in PBO's te verbeteren door de factoren die dit beïnvloeden te onderzoeken. Het onderzoek beoogt organisaties een framework te bieden dat ze kunnen volgen om hun IPL-processen te verbeteren. De volgende onderzoeksvraag is geformuleerd om dit doel te bereiken. Hoe kan inter-project leren worden verbeterd binnen projectgerichte organisaties?

Verschillende methoden waren in dit onderzoek toegepast om de hoofdvraag en de sub-vragen te beantwoorden. Ten eerste was er een uitgebreide literatuurstudie uitgevoerd om een voldoende begrip te krijgen van de concepten van organisatorisch leren, projectgerichte organisaties en inter-project leren. De

literatuurstudie legt een basis waaruit een hypothesemodel is afgeleid voor empirisch onderzoek. Het hypothesemodel classificeert de barrières, faciliteiten en beïnvloedende factoren in drie hoofddimensies. Elke dimensie vertegenwoordigt een uniek aspect van de IPL-omgeving. De dimensies zijn Leerinfrastuctuur, Kennistoegankelijkheid en organisatiecultuur. Leerinfrastuctuur omvat fundamentele factoren voor IPL; Kennistoegankelijkheid omvat factoren van kennisdeling in PBO's, en organisatiecultuur weerspiegelt gedeelde waarden en normen die van invloed zijn op de interacties en het leren van werknemers. Figuur 7 illustreert dit model, waaruit blijkt dat er complexe verbanden bestaan tussen de faciliteiten, barrières en beïnvloedende factoren.
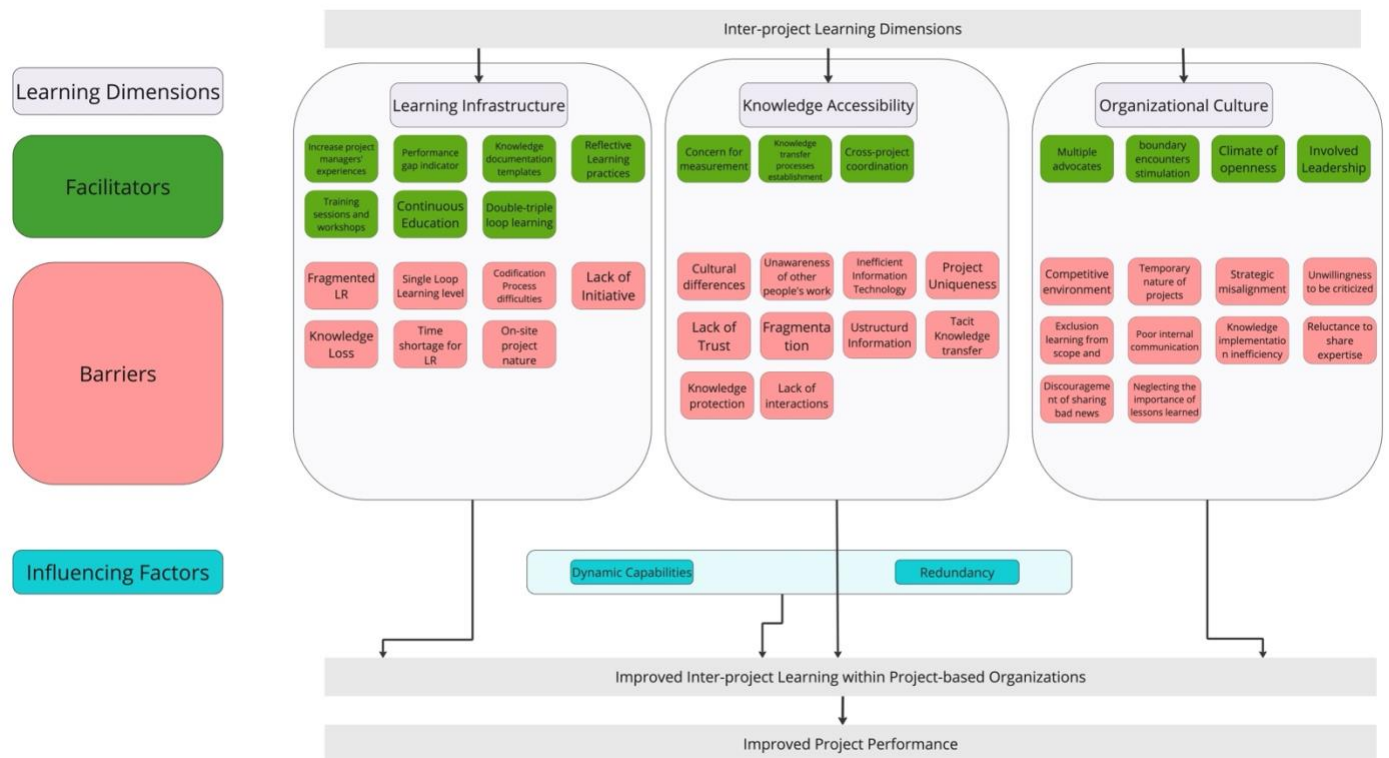
Figuur 7 Hypothesemodel gebaseerd op de literatuurstudie (Auteur, 2023)

De empirische studie omvat een casestudie binnen een standaard PBO. De casestudy bestaat uit twee delen. Het eerste deel ging diep in op het begrijpen van de leerprocessen in de organisatie om te begrijpen hoe IPL momenteel wordt benaderd. Het volgende deel ging over het uitvoeren van semigestructureerd interviews met projectmanagers uit de organisatie die ervaring hebben om praktische inzichten en beïnvloedende factoren te verzamelen. Bovendien hielpen de interviews bij het ontwikkelen van het uiteindelijke routekaart framework dat gepresenteerd geworden als antwoord op de onderzoeksvraag. De bevindingen van de empirische studie geven nieuwe inzichten in het gebied van beïnvloedende factoren en hoe een succesvolle IPL kan worden geïmplementeerd.

Empirische bevindingen suggereren dat de gevonden barrières, faciliteiten en beïnvloedende factoren op een meer praktische manier kunnen worden voorgesteld voor organisaties om hun hoogste waarde te bereiken. Ze kunnen beter worden beter geclassificeerd als factoren waarvan organisaties de voordelen van elk kunnen maximaliseren en die ze als faciliteiten voor het IPL-proces kunnen beschouwen. Figuur 8 illustreert de gevonden factoren uit zowel literatuur- als empirische studies die geclassificeerd zijn in de hierboven aangegeven drie dimensies.
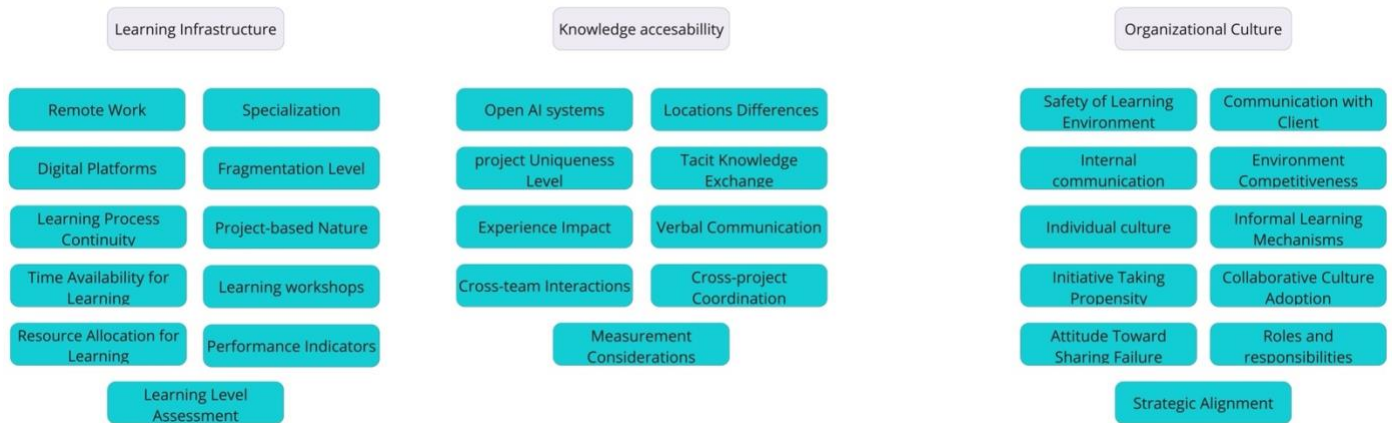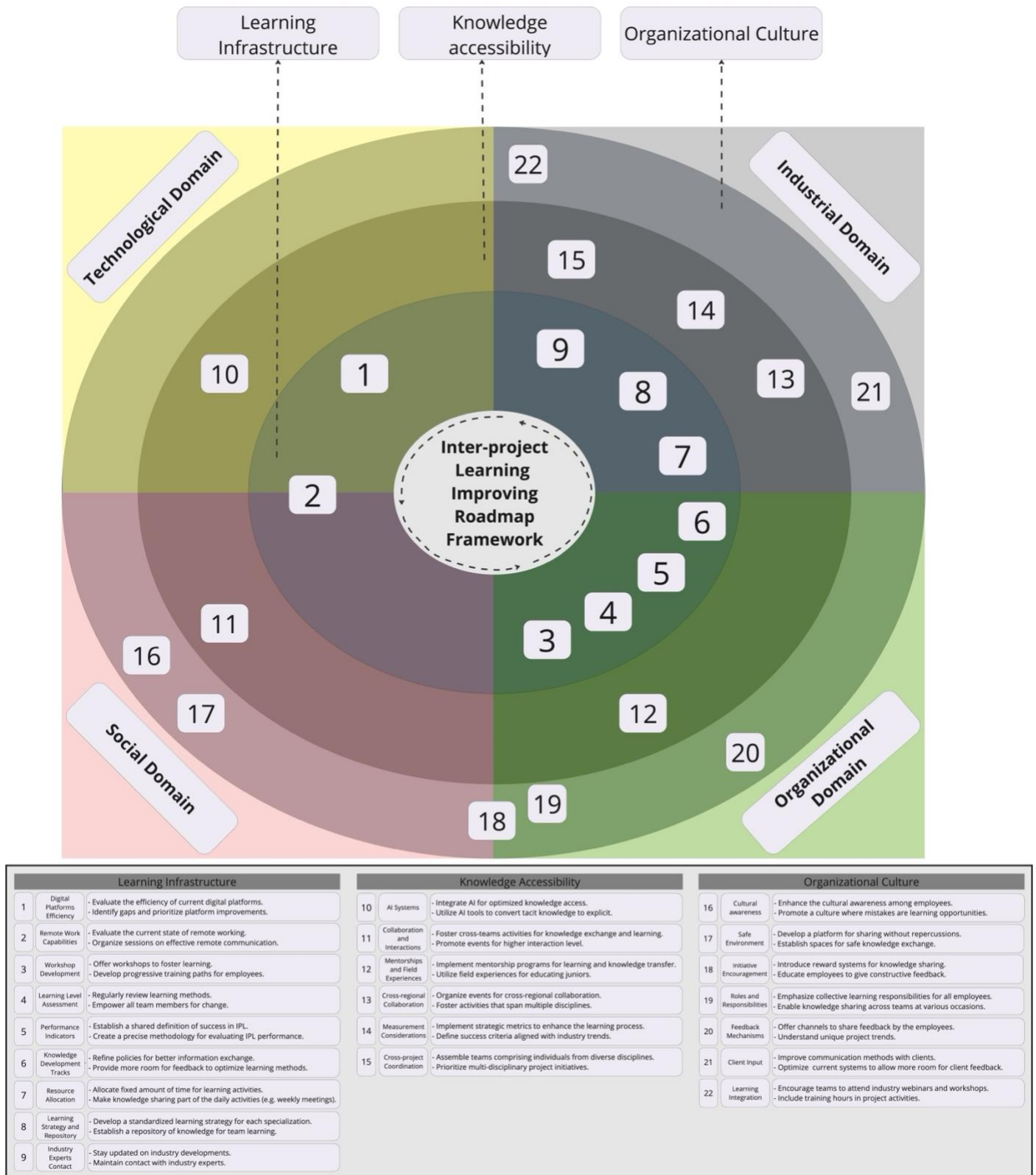
Figuur 8 Factoren die het leren tussen projecten in project gebaseerde organisaties beïnvloeden

Bovendien tonen de resultaten van dit onderzoek aan dat de faciliteiten kunnen worden gecategoriseerd met behulp van een apart perspectief om een meer praktische classificatie te hebben. De resultaten tonen aan dat de factoren kunnen worden geclassificeerd volgens hun structurele domeinen. Elk structureel domein vertegenwoordigt verschillende aspecten van het proces die impact hebben op de dynamiek van de IPL. In totaal waren er vier structurele domeinen geïdentificeerd. Dit zijn de technologische, sociale, organisatorische en industriële domeinen. Figuur 9 toont de structurele domeinen en de factoren in elk van hen. Ook kan worden opgemerkt dat meerdere factoren in meer dan één domein liggen. Deze domeinen helpen organisaties om de bredere dimensie op te splitsen in gespecialiseerde subsets om organisaties duidelijkheid te bieden over de kritieke gebieden waarop ingegrepen moet worden.
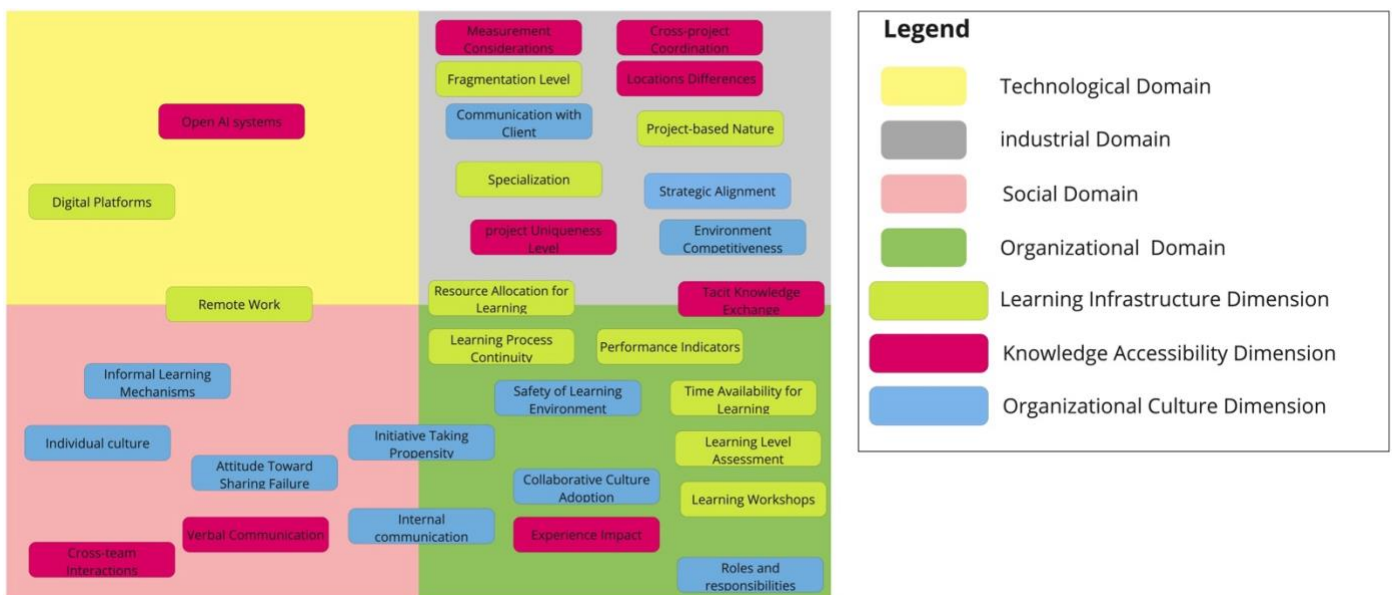
Figuur 9 Structurele domeinen en bijbehorende factoren voor IPL in PBO's (Auteur, 2023)

Daarnaast werden om de belangrijkste onderzoeksvragen te beantwoorden, zowel theoretische als empirische bevindingen gecombineerd om te komen tot een routekaartmodel dat PBOs leidt over hoe IPL te verbeteren. Het routekaart framework bestaat uit drie concentrische cirkels, elk die één dimensie vertegenwoordigen die in de literatuur gevonden werd. Verder zijn de empirische bevindingen geïntegreerd door de structurele domeinen in vier segmenten op te splitsen. Er zijn 22 stappen gemaakt die organisaties kunnen ondernemen om hun IPL-proces te verbeteren. Elke stap behoort tot één of twee domeinen en één dimensie. Figuur 10 toont het routekaart framework met stappen en een korte beschrijving. Het framework geeft ook de continuïteit van het proces aan dat organisaties hun IPL-processen continu moeten verfijnen.

Figuur 10 Verbetering van het inter-project Learning Routekaar Framework (auteur, 2023)

Door dit routekaart-framework te adopteren, kunnen organisaties de ingewikkeldheden van het verbeteren van IPL navigeren, wat zorgt voor verbeterde prestaties en verhoogde projectwaarde. De routekaart toont aan dat het proces van het verbeteren van IPL een iteratief proces is, er is altijd ruimte voorverbetering. Deze studie beveelt beoefenaars aan om een langdurige observatie van IPL-processen uit te voeren om de effectiviteit van het verbeteringspatroon te evalueren en de vereiste verfijning aan te brengen wanneer dat nodig is. De belangrijkste beperking van deze studie is dat het zich richtte op een enkele organisatie, wat de algemene toepasbaarheid van het routekaart framework mogelijk heeft beïnvloed, ondanks geconcentreerde inspanningen om een brede toepasbaarheid te waarborgen. Voor organisaties luidt de belangrijkste

aanbeveling om dit routekaart -kader als vertrekpunt te gebruiken en het IPL-verbeteringsproces in beheersbare domeinen op te splitsen. Voor toekomstig onderzoek, er was aanbevolen om zich te concentreren op de langetermijneffecten van de routekaart in PBO's en diepgaand te kijken naar specifieke structurele domeinen om het begrip en de verbetering van het inter-project leerproces te bevorderen.

Table of Contents

THIS CHAPTER DISCUSSES THE METHODOLOGICAL APPROACH UTILIZED IN CONDUCTING THIS RESEARCH. IT OUTLINES THE RESEARCH DESIGN, APPROACH, DATA COLLECTION METHOD, AND SAMPLING STRATEGY EMPLOYED FOR EMPIRICAL RESEARCH. ADDITIONALLY, IT INTRODUCES THE RESEARCH OPERATIONALIZATION TABLE, TRANSLATING THEORETICAL CONCEPTS INTO MEASURABLE VARIABLES. FURTHERMORE, THIS CHAPTER ELABORATES ON THE DATA ANALYSIS METHODOLOGY AND ADDRESSES ASPECTS SUCH AS VALIDITY, RELIABILITY, ETHICAL CONSIDERATIONS, AND LIMITATIONS INHERENT IN THIS EMPIRICAL RESEARCH...41

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Abstract

In project-based organizations, enhancing performance and augmentation of project value rely heavily on the effective assimilation of past experiences. Nevertheless, the intricate nature of projects and time constraints present extra challenges for an effective learning across various project teams. Inter-project learning, particularly in the context of specialized teams, increased complexities, and limited interactions, become more challenging. This thesis endeavours to propose innovative approaches that aim to help project-based organizations to improve their inter-project learning processes.

This research addresses a critical gap in the literature, as there is limited existing research on inter-project learning within project-based organizations. The study begins with an extensive literature review encompassing organizational learning, project-based organizations, and inter-project learning. Based on the literature study, a hypothesis model has been developed. This model categorizes the factors into three main categories: barriers, facilitators, and influencing factors. Moreover, the factors are classified into three dimensions, each representing components that constitute the learning infrastructure mechanisms, knowledge accessibility, or organizational culture.

Following this, empirical research took place through a case study within the organization under study. The case study focused on understanding the organization's existing approach to inter-project learning and involved interviews with experienced project managers to gain deeper insights into inter-project learning processes. The findings shed light on the continuous need for improvement in the inter-project learning process. The results suggest that the factors impacting inter-project learning can be classified differently than merely as barriers, facilitators, and influencing factors. Instead, they can be classified as factors into four structural domains. These domains encompass technological, social, organizational, and industrial. Each domain represents various aspects that can be covered by the organization and each domain offers a more nuanced understanding of the factors that shape the dynamics of inter-project learning.

The research presents a roadmap framework that guides project-based organizations on what steps they need to undertake to improve inter-project learning. Utilizing this roadmap framework will assist organizations in enhancing performance and eventually increasing project value as a result of the effective utilization of the learning processes. This roadmap can be used as a starting point to optimize inter-project learning and knowledge exchange processes and eventually improve performance and augment project values.

Keywords: Inter-project learning, knowledge sharing, project-based organizations, organizational learning, influencing factors, barriers, and facilitators.

1 Introduction

This chapter serves as an introduction to the study by setting the context and providing background information and problem statement. Additionally, this chapter outlines the scope of the thesis, identifies the research objectives, and research questions, addresses the conceptual framework, and provides an overview of the thesis structure.

1.1. Background Information

This section explores the challenges and opportunities of improving inter-project learning (IPL) within Project-Based Organizations (PBOs). Managing infrastructure systems is a multifaceted task that poses numerous challenges for organizations. Project managers often struggle to complete projects on time, within budget, and to a high standard of quality (Enshassi et al., 2009). As a consequence, these projects often face time and cost overruns, which vary across countries and project types (Famiyeh et al., 2017). Moreover, the complex involvement of various project actors and the influence of exogenous factors like climate change are seen as challenging for the current project settings (Huétink et al., 2010; Tong et al., 2015). These challenges highlight opportunities for enhancing work quality, reducing costs, and minimizing time overruns to increase project values and improve organizational performance.

To navigate these challenges, the focus on organizational performance becomes crucial. Organizational performance, as defined by Jenatabadi (2015), is the ability of an organization to consistently achieve its objectives by efficiently utilizing available resources. One crucial element in improving organizational performance is the learning process which includes utilizing knowledge from past experience (Abu Bakar et al., 2016; Prencipe & Tell, 2001). This process is part of a broader concept known as "organizational learning". Argote & Miron-Spektor (2011) have defined organizational learning as a transformative process within an organization that leads to changes in knowledge, behaviour, and optimized performance. The organizational learning concept serves as a foundation that can provide the possibility to delve into the learning in the project context.

To understand how learning occurs in project settings, it is essential to introduce the project-based organizations (PBOs) concept. PBOs are prevalent in various industries, such as construction, and serve as platforms to meet highly specialized needs (Sydow et al., 2004). Hobday (2000) defined PBOs as organizations in which a project is the essential unit for innovation, competition, and production. PBOs can take the form of private or public organizations. A lot of organizations are considered project-based, as many of their services or products are primarily delivered through projects (Turner & Keegan, 2000). PBOs have become popular due to their ability to increase expertise levels and integrate more specialized resources than other forms of organizations. In addition, it can help overcome many organizational barriers and provide more room for innovation (Sydow et al., 2004) in contrast to other forms of organizations where it might take longer to accomplish projects. The process of learning in PBOs is defined as integrating project knowledge into the organization (Bartsch et al., 2013). Project-based learning does belong to the theory of learning in organizations (Turner & Keegan, 2000).

Learning within PBOs takes different forms. However, the main difficulty in learning in projects is the uniqueness of each project and its varying characteristics. An approach by Chronéer & Backlund (2015) has classified learning in projects into two distinct types. The first type is learning between projects (inter-project learning) and the second type is learning within projects (intra-project learning). Both types are present within an organization due to their pivotal role in improving project performance. They help organizations to respond

to unexpected changes, offering opportunities for organizations to avoid repeating errors in projects and help to achieve project goals more successfully (Brady & Davies, 2004). Preserving knowledge is challenging as the acquired knowledge is most likely tacit even within the same organization; therefore, it is more challenging to be exploited for future projects (Almeida & Soares, 2014). Drawing on an organization's past experiences can improve project performance by utilizing the accumulated knowledge, whether they are positive or negative, which increases the value of future projects. Learning in organizations refers to processes that result in a change in knowledge (Argote & Miron-Spektor, 2011).

PBOs strive to improve project performance to increase project values. One significant way to achieve this improvement involves acquiring knowledge through the analysis of past projects. By learning from previous experiences, organizations can identify innovative methods to avoid repeating the same mistakes and build on positive experiences, and subsequently convert this acquired information into actionable knowledge for upcoming projects (Caldas et al., 2009).

However, learning within PBOs is often challenging due to the complex and temporary nature of the projects performed within the organization (Chronéer & Backlund, 2015). The fact that team compositions are continuously changing in PBOs throughout the organization can result in an unstable environment for learning, as individuals from one project team are often dispersed into different teams for other projects within the same organization after project completion. Additionally, insufficient time will be allocated to gather knowledge (Boh, 2007) as employees are naturally inclined to move on to the next project and close the accomplished project. This makes learning more challenging in PBOs, impacting more in the construction industry, where new technologies and techniques are rapidly emerging and there is always room for improvement.

1.2. Problem Statement

Learning within PBOs is notably complex, particularly due to the frequent loss of acquired knowledge at the completion of projects and the limited resources for learning and reflection. This loss hinders the organization's ability to utilize this knowledge in future endeavours (Eken et al., 2020).

While PBOs seek to facilitate effective inter-project learning (IPL), challenges in knowledge exchange often impede the process. However, the project-centric structure of projects in PBOs results in unique challenges, underscoring the need for continual improvement in learning processes to enrich the organizational contexts and increase the possibility of having enhanced project performance in upcoming endeavours. In addition, the incentives to deliver projects on time enlarge the challenges of improving the process of knowledge sharing between projects. Moreover, the continuously changing team compositions within PBOs exert an impact on the effectiveness of the learning process, which makes PBOs more likely to encounter challenges when it comes to knowledge acquisition.

The majority of PBOs believe that the required level of improvement can be achieved by effectively implementing the knowledge acquired from successful projects, which can be enhanced by improving infrastructure project management methods (Yap et al., 2018). However, the practical implementation falls short due to poor utilization of effective learning methods. Past research indicates that many PBOs are still failing to effectively make use of these experiences, including attaining, storing, sharing, and transferring knowledge derived from completed projects to the organization (Swan et al., 2010). It remains unclear under which circumstances the process of learning can be enhanced. There are many barriers that hamper the learning processes in PBOs, and these barriers are difficult to identify comprehensively. Given these challenges, two main issues emerge:

1. Identifying and extracting relevant knowledge from completed projects remains a significant struggle for PBOs.
2. The knowledge acquired fails to be effectively applied in subsequent projects.

Given these challenges, it becomes crucial to explore these barriers and investigate potential mechanisms that could facilitate improved IPL within PBOs.

1.3. Scope of the Research

Since organizational learning is an extremely broad concept applicable across various industries, the scope of this study will be narrowed down to focus on the construction industry. The rationale for this focus is that the construction industry has its own complexities and a wide range of impacting factors (Barlow & Jashapara, 1998) that are different compared to other sectors where fewer complexities emerge. Furthermore, the construction industry is considered reluctant to adopt new management approaches (Opoku & Fortune, 2011), emphasizing the need for further research in this area. This implies that all empirical studies conducted in this study are relevant to this industry.

Moreover, the scope of this study is limited to the phenomena of organizational learning, inter-project learning (IPL), and project-based organizations (PBOs). IPL, a subset of organizational learning, concerns the sharing of knowledge between different projects within PBOs, which are known to face the most challenges in this regard. The focus on IPL is due to its unique complexities, including the need for effective knowledge exchange between different teams (Prencipe & Tell, 2001). This differs from intra-project learning, where knowledge exchange and learning are confined within the same project team. Another factor is the scarcity of research on IPL compared to other forms of project learning. The main distinction between intra-project learning and inter-project learning is that the second one aims to improve the performance of an organization rather than individual teams. As a result, IPL aims to ensure that knowledge is being shared within the entire organization, maximizing the benefits of learning and knowledge sharing. This thesis is concerned with the processes that facilitate effective IPL, excluding from its scope learning processes within individual projects or between different organizations.

1.4. Research Objectives

The main objective of this study is to improve inter-project learning (IPL) within project-based organizations (PBOs), with a focus on understanding the current status and examining the contributing factors that contribute to or hinder the process of learning in a PBO context. This involves an in-depth investigation of various barriers, facilitators, and all other impacting factors that affect the process of IPL. Furthermore, this study aims to develop a roadmap framework that guides project-based organizations on how to improve their IPL processes, thereby elevating organizational performance and subsequently increasing the values and benefits derived from their projects. The framework will be developed based on both theoretical and empirical studies, resulting in a more practical framework.

1.5. Research Questions

From the previous sections, the research question and corresponding sub-questions are formulated as follows:

Research question:

How can inter-project learning be improved within project-based organizations?

Sub-questions:

1. What is the current state of the art of inter-project learning?
2. How are the practical barriers and facilitators to successful inter-project learning characterized within project-based organizations?

3. What key factors are fundamental for successful inter-project learning within project-based organizations?

Research Question Explanation:

This question encapsulates the aim of the research: improving inter-project learning (IPL) within PBOs.

To answer this question, three sub-questions have been made. Each sub-question has its own contribution to the main question's resolution. The findings will culminate in a roadmap framework that helps PBOs to improve their IPL processes, presented in the conclusion chapter.

Sub-question 1 Explanation:

This question seeks to gain a comprehensive understanding of the current state of IPL phenomena within PBOs. The importance of this question lies in its role in exploring the status of IPL and it serves as a foundation to address the other sub-questions and the main research question.

To address this question, an extensive literature review is conducted to delve into the definitions, phases, processes, and key characteristics of PBOs. The findings of this investigation will be summarized in the conclusion chapter.

Sub-question 2 Explanation:

This question investigates the influential barriers and facilitators that impact the process of IPL within PBOs. It also explores the potential influencing factors that could be considered either barriers or facilitators, depending on the context. Additionally, this question explores the interrelatedness of these barriers and facilitators and their interconnections to explore how they are characterized within PBOs.

To answer this question, a mixed-method approach involving literature and case studies is employed. The findings will be shown as a list of factors impacting IPL with their interconnections.

Sub-question 3 Explanation:

This question aims to explore the fundamental factors pivotal to improving the process of IPL within project-based organizations. It involves a collective investigation into the critical factors that result in better project performance.

To answer this question, the results of the same case study conducted for the second sub-question are employed to uncover the critical determinants required for improved IPL and, consequently, better project performance of organizations. The findings of this question will be incorporated into the final framework as the critical dimensions of all influencing factors will be determined. This helps to provide organizations with an overview of the impacting factors and gives them a comprehensive analysis of the main characteristics of these factors.

1.6. Conceptual Framework

In order to establish the theoretical foundation that guides the improvement of IPL within PBOs, a conceptual framework has been developed. This framework outlines the key components that significantly influence IPL dynamics: barriers, facilitators, and influencing factors.

Firstly, barriers, are defined as the factors that hinder the IPL process and result in deficiencies in knowledge sharing and learning within organizations (Bartezzaghi et al., 1997). Secondly, facilitators are elements that positively impact the process of IPL by enhancing knowledge sharing and learning. Thirdly, influencing factors are elements that cannot be strictly classified as either barriers or facilitators, as their impact is context dependent. These three components together form the conceptual framework of this research. Additionally, the nature of PBOs has an important impact on the process. Therefore, this framework provides a pathway to answer the research question effectively. Figure 11 illustrates the conceptual framework model.
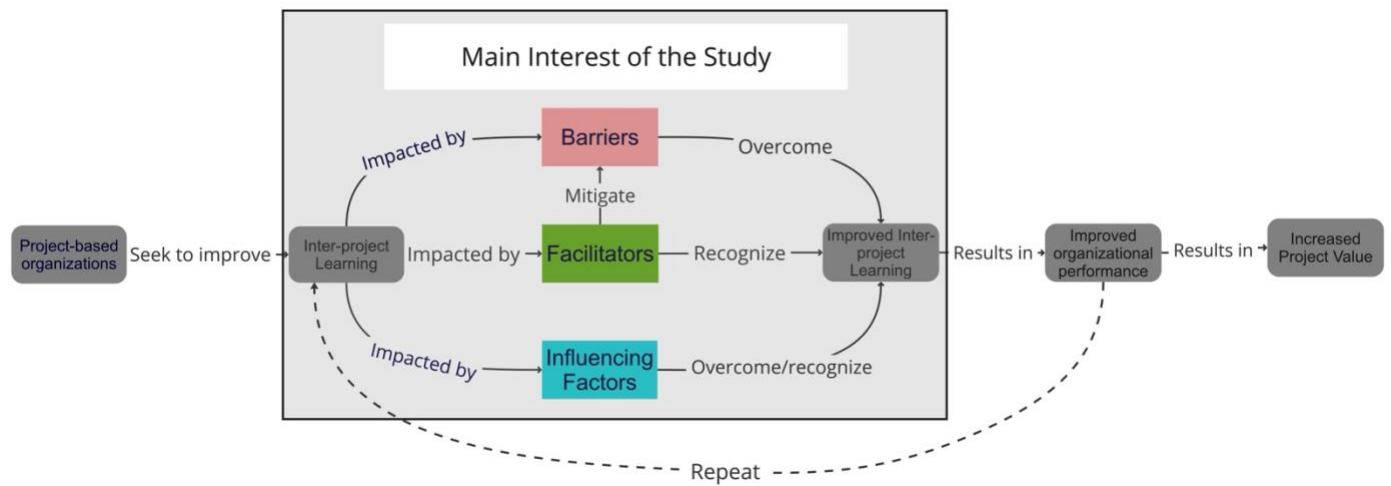
Figure 11 Conceptual framework: Improving Inter-project Learning within Project-Based Organizations (Author, 2023)

This figure demonstrates the iterative process of improving IPL within PBOs which is constantly seeking improvement. Hence, improving IPL is a significant approach. Improving IPL is impacted by three main factors: barriers, facilitators, and influencing factors that are context dependent. These influencing factors can take either the form of barriers or facilitators. Moreover, the framework shows that facilitators can be used in some cases to mitigate the barriers. As a result, improving IPL contributes to improved organizational performance and eventually an increased project value as learning across teams reduces the possibility of repeating the same mistakes and adapting faster to new challenges. Finally, the framework underscores that this is a repetitive process, as there is always room for improvement and PBOs are inherently focused on boosting performance. This conceptual framework illustrates one approach that organizations take to improve performance and increase project value.

1.7. Societal and Theoretical Relevance

1.7.1 Societal Relevance

This study seeks to bridge the critical knowledge gap by unravelling the intricate dynamics of inter-project learning (IPL) within project-Based Organizations (PBOs). By identifying the formidable barriers that impede IPL, recognizing the facilitators that can fuel its improvement, and proposing an actionable framework, this research aims to empower PBOs to harness their collective knowledge and experiences effectively.

The barriers and facilitators of IPL within PBOs present unique complexities compared to the other forms of organizations due to the additional challenges that result from this form of organization and its main characteristics. This thesis contributes significantly to existing knowledge by shedding light on the specific barriers and facilitators that shape IPL in this distinct context, offering innovative strategies based on the theoretical and empirical findings.

The societal relevance of this thesis extends beyond academia by providing a roadmap framework that organizations can utilize to improve their IPL process. The roadmap offers PBOs a tangible pathway to enhance their performance through continuous learning. This improvement in organizational learning not only increases project value but also cultivates a culture of ongoing improvement. Moreover, by promoting more effective knowledge transfer practices within organizations, this research contributes to sustainable knowledge sharing.

1.7.2 Theoretical Relevance

The importance of this thesis in terms of theoretical relevance stems from the exploration of barriers and facilitators to effective IPL in PBOs. The literature illustrates the fragmented state of learning between projects

and is characterized by numerous boundaries (Swan et al., 2010). This thesis introduces a novel approach to achieving successful inter-project organizational learning within PBOs in the construction industry. It delves into the development of a framework designed to identify the key factors impacting the process. This thesis will contribute to the current body of knowledge by providing a new perspective on how IPL can be addressed. The research fills the gap in the current theories about IPL within PBOs, as most current studies focus on all types of organizations meanwhile this thesis will investigate the IPL in PBOs and what kind of impacts the PBOs' nature will have on IPL. Furthermore, the combination of the literature and empirical studies presents a new approach that can be integrated into the existing body of knowledge, serving as a foundation for future studies.

1.8. Audience

The audience of this thesis are PBOs that aim to improve their performance by facilitating the learning process between projects and enhancing knowledge-sharing by overcoming emerging barriers and facilitating the impacting factors to a successful learning process. For the organization where the thesis has been conducted, the organization's policymakers are the actors who can utilize the findings of this thesis to implement the provided framework that will improve IPL processes. Additionally, all organization members can view the results of this study as a source that illustrates where the problem comes from. Beyond the organizational context, this study can be valuable in academia for researchers who are interested in organizational learning, inter-project learning, and project-based organizations.

1.9. Structure of the Thesis

The thesis report's structure is thoughtfully designed to guide readers through a logical progression of the research process. Phase 1, presented in Chapter 1, establishes the foundation for the research by introducing the research problem, articulating the thesis objectives, and outlining the conceptual framework. Phase 2 unfolds in Chapter 2, where an extensive exploration of relevant literature takes place, delving into theoretical underpinnings crucial for the study, including organizational learning, project-based organizations, and inter-project learning. Definitions, processes, and influential factors are covered, along with an outline of a hypothesis model derived from the literature study. Transitioning to the methodology of this research in Phase 3, Chapter 3 elucidates the research methodologies and provides an overview of the case study's unique attributes, essential for contextual understanding. Phase 4 takes place in Chapters 4 and 5, where an in-depth analysis of the case study's findings occurs, outlining the findings of the case study and comparing them with the findings of the literature study. Chapter 5 unveils the developed framework model and presents post-validation research outcomes. This chapter also offers insights into the impending validation phase, including details about the interview with the field expert. The final phase, phase 5, encompasses Chapters 6 and 7, navigating through the research findings, their broader implications, and delivering a comprehensive conclusion, offering conclusive answers to the research questions, and charting a course for future studies.

This structured progression ensures a methodical exploration of inter-project learning within project-based organizations, ultimately providing valuable insights and practical recommendations. Figure 12 provides a schematic overview of the thesis, illustrating its five distinct phases. Positioned to the right of this schematic are the research questions, colour-coded to align with their corresponding areas of focus within the thesis. This colour differentiation serves as a visual guide, making it clear where each question or sub-question is addressed throughout the thesis.
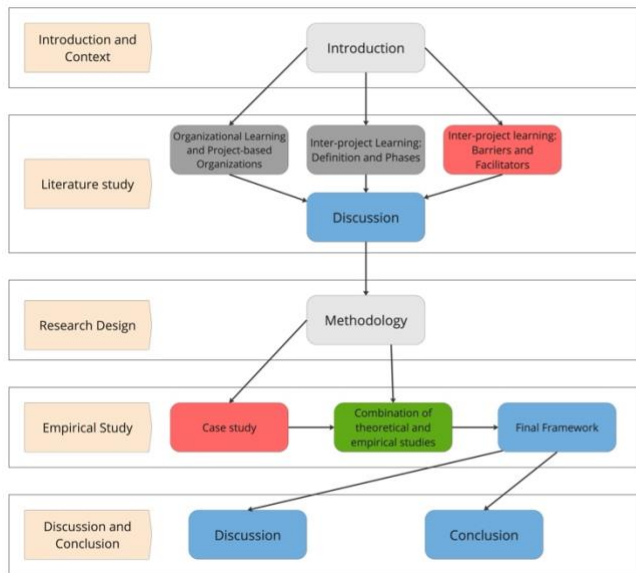
Figure 12 Schematic overview of the thesis (Author, 2023)
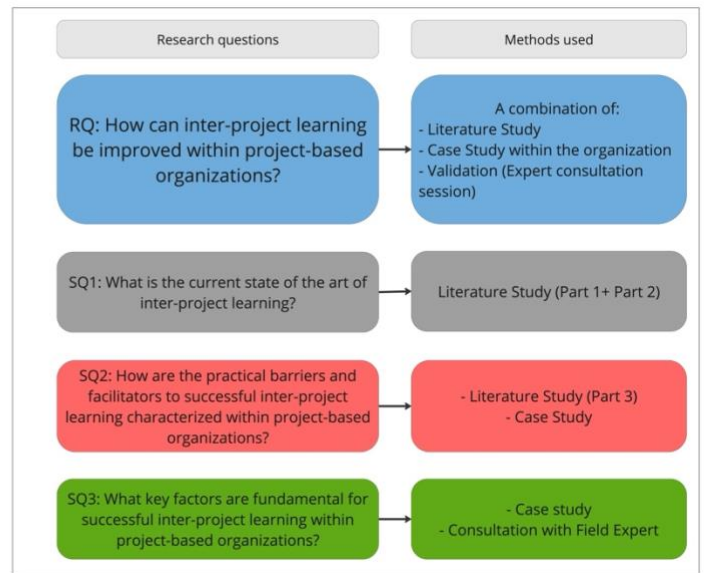
2 Literature Review

To be able to comprehensively understand the current status of inter-project learning (IPL) within project-based organizations (PBOs), it is essential to delve into both its conceptual underpinnings and mechanisms employed in practice. This involves investigating the various barriers and facilitators that impact its effectiveness within organizations. This study aims to achieve these objectives by investigating scientific papers and academic theses.

While investigating the current literature, it became apparent that the existing literature lacks a standardized and agreed-upon term to describe the phenomenon of inter-project learning. For the sake of clarity and consistency, this review will use the term "inter-project learning" to describe the phenomenon, which aligns with the keywords indicated in the abstract.

2.1 Introduction

The increased reliance of organizations on projects as a means of conducting their activities has affected the knowledge-capturing process of projects (Newell, 2004). This is primarily due to the natural inclination of organizations to move on to subsequent projects, often leading to the repetition of the same mistakes (Boh, 2007). Swan et al. (2010) highlight the ambivalent nature of learning in organizations by stating that projects still fail due to inadequate learning practices, despite the claim that projects are rich sites for learning. This study confronts the recurrent issue of "reinventing the wheel" in the context of project learning, which refers to repeating past errors and insufficient knowledge transfer to successive projects.

Over the last two decades, there has been a growing scholarly focus on IPL, driven by the intention to enhance project performance in construction and other industries. One approach that scholars have taken is to identify barriers and facilitators to effective learning between projects (Hartmann & Dorée, 2015).

This chapter is structured as follows: the current section (2.1) serves as an introduction and highlights the chapter's importance. Section 2.2 explores the fundamentals of organizational learning and PBOs. It aims to familiarize readers with the main characteristics of PBOs and investigate the relationship between organizational learning and the construction industry. Subsequently, in section 2.3, a detailed definition and the phases of IPL processes are provided, and the current status of IPL in project-based organizations is addressed. In the same section, the importance of IPL in the construction industry and its affecting factors are addressed. After that in section 2.4, the IPL barriers and facilitators are addressed to have a comprehensive overview of the impacting factors on IPL. In section 2.5, the discussion is centred around summarizing the identified barriers and facilitators in tabulated form. Additionally, this section introduces the hypothesis model derived from this chapter that will be used in the subsequent parts of the study.

2.2 Organizational Learning and Project-based Organizations

2.2.1 Organizational Learning

Organizational learning is the transformative process within an organization that results in changes in knowledge, behaviour, and optimized performance within the organization (Argote & Miron-Spektor, 2011). According to Snell & Chak (1998), organizational learning influences assumptions, processes, and structures of the organization by incorporating new approaches and techniques to enhance its effectiveness.

Within the organizational context, learning results in continuous development and knowledge sharing because of acquired experiences that permanently modify the behaviour of certain processes (Holmqvist, 2003).

Knowledge sharing is widely regarded as a main objective of organizational learning and can be defined as the process of transferring knowledge from one employee or group to others to improve organizational performance (Liebowitz & Megbolugbe, 2003). Nowadays, organizations value learning more than before due to the developing work nature and the complex organizational structure they operate within (Opoku & Fortune, 2011). Holmqvist (2003) suggests that organizational learning should be viewed as a process that is achievable through experience. Therefore, organizational learning is not only achieved through lessons and traditional learning methods. Instead, it can be acquired through tacit and explicit routines, regular operating procedures, programs, and other approaches that develop over time. Furthermore, the author also highlighted the assumption by other scholars that organizational learning is essentially a social phenomenon, emphasizing the importance of individual learning within social contexts and group settings.

Snell & Chak (1998) identified four levels of learning applicable to organizational learning. These levels are as follows:

1. **Not Learning level:**
   - The main characteristic of this level is fragmentation, as the linkage between mental models is missing and there is no learning process. This level will not be considered in subsequent phases because there is no learning occurs.

2. **Single Loop Learning level:**
   - The main characteristic of this level is consolidation, as organizations focus on increasing their knowledge using established policies without significant changes. This level is considered to be the simplest form of learning as there are no major changes being made to the current policies.

3. **Double Loop Learning level:**
   - The main characteristic of this level is transforming. Organizations aim to reframe problems collectively, which will increase the organization's knowledge and develop new paradigms and the existing policies will be extensively changed.

4. **Triple Loop Learning level:**
   - The main characteristic of this level is co-invention, where firms aim to collectively alter their current policies and paradigms to develop new learning strategies and structures.

In many organizations, the learning process takes place at the single-loop level in most cases (Wong et al., 2009). However, learning in organizations still encounters challenges due to the nature of these organizations, such as the increased complexity, temporary nature of projects, and the need for the other two levels of learning.

Gardner (2022) differentiates between the single-loop, double-loop, and triple-loop levels in Figure 13. The author distinguished between single- and double-loop learning levels where the reframing of problems happens with no radical changes. In contrast, the triple loop involves new principles and a collective transformation, often referred to as the digital transformation in the article.
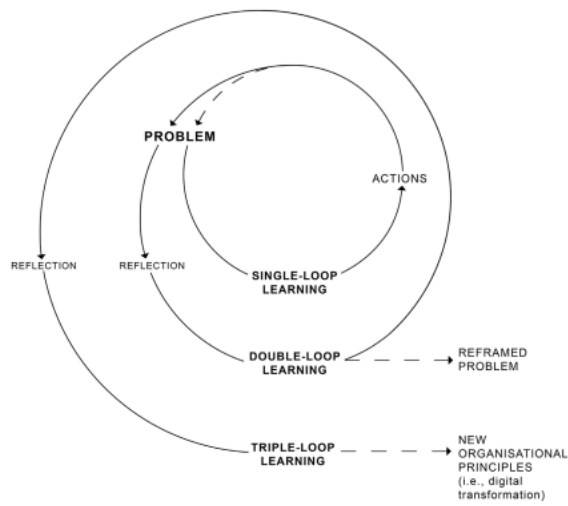
Figure 13 Organizational Learning Loop Levels Distinctions (Gardner, 2022)

These learning levels are essential for gaining a comprehensive understanding of organizational learning, which is indispensable for organizations. Moreover, without an organizational learning process in place, inter-project learning cannot occur, as it is a subset of organizational learning. The various levels of learning indicate that organizations have various avenues for facilitating organizational learning. Consequently, each level has its own set of implications that affect both the organizational structure and the learning processes involved.

2.2.2 Organizational Learning in the Construction Industry

Over the past two decades, there has been a growing interest in organizational learning within the construction industry (Opoku & Fortune, 2011), largely due to the industry's volatile economic climate and uncertainties. Organizational learning has become a pivotal factor for firms to flourish and improve in the construction industry. The growing emphasis is reflected in the arising number of scholarly articles on the subject (Ying Liu & Pheng Low, 2009). In the realm of construction, companies tend to embrace a pragmatic problem-solving approach (Barlow & Jashapara, 1998), characterized by a reactive mindset that responds to unexpected events if they arise. However, this approach may limit the capacity to learn from past experiences. Consequently, it becomes imperative to adopt a proactive approach that fosters organizational learning. Opoku & Fortune (2011) emphasize that organizational learning is the primary driver of prosperity within the construction industry. Sev (2009) underscores the importance of the construction industry for sustainable development due to its considerable social and environmental impact which requires an elevated level of organizational learning.

To facilitate organizational learning, it is crucial to establish a supportive organizational context that integrates individuals, processes, content, culture, and technology (Ying Liu & Pheng Low, 2009). Other studies have outlined that organizational learning still encounters challenges like the study by Flyvbjerg et al. (2004) that indicates the challenges related to an effective implementation of the learning. The authors observed an absence of effective learning processes concerning cost escalation, noting that it has not been reduced over the past 90 years in infrastructure projects. The same observation holds true for the construction industry itself (Flyvbjerg et al., 2002) which explains why organizational learning within the construction industry requires more attention.

2.2.3 Project-based Organizations Definition

Project-based organization (PBO) was previously defined as an organizational form where a project is the essential unit for innovation and production (Hobday, 2000). The importance of PBOs arises from their widespread presence in the construction industry, stemming from their capability to address specialized and

customized industry requirements (Sydow et al., 2004). The main distinguishing feature of PBOs is that the teams are composed differently for each project, which makes learning in these forms of organizations more challenging owing to the continuous changes and adjustments in team composition. This creates a scenario where knowledge sharing between projects becomes more fortuitous in nature.

Scarbrough et al. (2004) have defined project-based learning as the conceptualization process of knowledge creation and acquisition and transferring this created and acquired knowledge to the organization and other projects. Bartsch et al. (2013) have defined learning in PBOs as the process of integrating knowledge of the project into organizations where the knowledge is accumulated. However, despite having these simple definitions, learning in organizations still lacks improvement in terms of the effectiveness of the knowledge-acquiring and knowledge-implementation phases as knowledge is extremely exposed to be lost at the end of the projects. Chronéer & Backlund (2015) have also addressed the difficulty of spreading knowledge across projects in large organizations. This is particularly important because different units and disciplines independently function within the organization. Therefore, learning in PBOs should be facilitated on the organizational level since the individual level is insufficient.

2.2.4 Project-based Organizations Characteristics

Grasping the distinct traits of PBOs is vital to delving into how IPL transpires. As mentioned in the introduction chapter, the scope of this study has been narrowed to exclusively examine PBOs and the specific characteristics that significantly impact the processes of learning and knowledge transfer. Several studies have probed into the distinct features of PBOs and their implications on learning and knowledge transfer, as opposed to other forms of organizations.

The study by Wiewiora et al. (2009) investigated the differences between functional organizations and project-based organizations across various industrial sectors. The key characteristics of PBOs are:
- Projects are the main organizational units.
- Project managers exercise more control, acting as the connecting actors between projects and organizations.
- Project activities are prioritized over the activities related to knowledge transfer.
- Projects are time-oriented, meaning that the allocated time is often insufficient to cover all project aspects. This results in less focus on evaluation and knowledge transfer activities.
- Weak process coordination as each project is independent of the other.
- Organization members are less motivated and don't have sufficient time to reflect on the accomplished projects.
- Social communication is reduced due to project geographical dispersion which impacts inter-project knowledge sharing.

Another study conducted by Ajmal & Koskinen (2008) delineated the impact of a project-based nature on the knowledge transfer process. This is particularly relevant since project teams often consist of employees with diverse backgrounds who may have never worked together before, increasing the complexity of knowledge sharing. The study has also touched upon the challenges posed by limited resources in PBOs and its ramifications for learning and knowledge sharing. Building on this line of inquiry, the study by Hobday, (2000) underscored the lack of incentive for project managers to facilitate learning across and within projects, as it does not offer immediate benefits at the individual level. From the definitions and characteristics of projects, it has been widely discussed in the academic literature that project learning needs a more contextualized approach to learning is essential. This approach has to be tailored to align with the unique characteristics of PBOs. These characteristics result in unique challenges and opportunities when it comes to IPL within PBOs, which this study aims to thoroughly explore in depth in order to answer the research questions.

2.3 Inter-project Learning Definition and Phases

2.3.1 Definition and Phases of Inter-project Learning

Inter-project learning (IPL) can be defined as the process of knowledge accumulation and the exchange of experiences among different projects over time (Bartezzaghi et al., 1997; Prencipe & Tell, 2001). This phenomenon has been captured under various terminologies. For instance, Brady & Davies (2004) refer to it as "project-to-project learning", and Julian (2008) who encapsulates it under the term "cross-project learning". The primary objective of IPL is to enhance an organization's capability in executing projects (Kotnour, 1999). The IPL process consists of four main phases, as described by Bartezzaghi et al. (1997):

1. **Abstraction and generalization:**
   - In this phase, knowledge is abstracted from its original context and transformed into a theoretical concept that can be applied in other contexts.
2. **Learning embodiment:**
   - During this phase, the abstracted knowledge from the project is institutionalized. It is worth noting that a time gap exists between the abstraction of knowledge and its subsequent application to improve future project performance. Therefore, capturing knowledge is an essential step for successful IPL, as knowledge is prone to be lost over time.
3. **Learning dissemination:**
   - In this phase, knowledge is diffused and transferred to other teams for utilization in different projects.
4. **Learning application:**
   - In this phase, the knowledge is exploited and transformed into a specific contextual model for practical implementation.

Understanding these phases is important for providing a conceptual understanding of the IPL learning process, outlining the necessary steps for achieving successful outcomes. However, it is worth mentioning that despite the apparent organization of these phases, the IPL process still encounters challenges within the construction industry. This emphasizes the importance of investigating the barriers to IPL and exploring strategies to overcome them.

2.3.2 Inter-project Learning in Project-based Organizations

Within the context of PBOs, IPL takes on different forms. An approach by Nobeoka (1995) identifies two types of IPL. The first type is known as the **concurrent design transfer**, where knowledge is exchanged between two parallel projects through interactions and communications while the base project is still in progress (Zhao et al., 2015). The second type is the **sequential design transfer**, where knowledge is transferred to a new project from a completed base project that can utilize similar techniques (Nobeoka, 1995). The second strategy is considered by Nobeoka (1995) as an ineffective strategy since it lacks direct interactions between the two projects. Knowledge is extracted from finished projects and then transferred to new projects, increasing the chance of knowledge loss. Moreover, Zhao et al. (2015) point out challenges in the effectiveness of the second type. Since the acquired knowledge is derived from various base projects, communicating with individuals who worked on those projects becomes more complicated, especially if they have left the organization or are no longer accessible.

2.3.3 Importance of Inter-project Learning in the Construction Industry

The importance of IPL lies in its capability to facilitate the transfer and codification of knowledge for future projects, aiming to enhance their organizational performance (Prencipe & Tell, 2001). A distinctive feature of IPL is that knowledge is exchanged between different project teams, which can not only enrich employees' backgrounds and increase their expertise but also augment their performance in subsequent projects. In the construction industry, the fragmented and complex character of projects and the historical reluctance to adopt innovation illustrate the importance of exchanging knowledge to improve organizational performance (Rotimi et al., 2022). The industry has been criticized for its poor learning processes compared to other industries. Knowledge exchange encompasses various types of learning, with IPL being a primary type that streamlines the transfer of knowledge between projects, minimizing the chance of repeating the same mistakes in later ventures. Additionally, IPL plays a vital role in cultivating the competitiveness of institutions within the organization, as it creates opportunities for different project teams to improve their performance (Zhou et al., 2023).

2.3.4 Inter-project Processes and Affecting Factors

Prencipe & Tell (2001) distinguished three sequential processes of IPL: experience accumulation, knowledge articulation, and knowledge codification.

1. **Experience accumulation:**
   - In this process, IPL is based on routines and experiences. Experience-based learning can be defined as a process of learning by doing and using. However, this process seems to have limitations due to the heavy reliance on routines and the possibility of capability traps and myopia being high in the long term. Additionally, Bakker et al. (2011) emphasized that in PBOs, the assembled knowledge may be lost when the project team disperses.

2. **Knowledge articulation:**
   - In this process, justification and deliberation are the main elements of inter-project learning. The primary typology of this process suggests that learning in organizations can be achieved by thinking, reflecting, discussing, and confronting.

3. **Knowledge codification:**
   - This process builds upon the knowledge articulation process, and it involves the possibility of codifying acquired knowledge, as mentioned in the second process. In addition, it encompasses knowledge codification to generate generic knowledge that can be used in similar situations. Codification serves two primary functions: knowledge storage and transfer over time, and the ability to reorganize symbols to transform knowledge. This process is important not only for the transfer phase. Instead, it facilitates the whole evolution knowledge system within organizations (Zollo & Winter, 2002).

In addition to these processes, other scholars have introduced several factors that influence inter-project processes and play a significant role in achieving success. One of these factors is "dynamic capabilities", which refers to the ability of an organization to integrate its skills to address rapidly changing environments (Zollo & Winter, 2002). The dynamic capabilities approach offers a comprehensive framework that integrates both empirical and conceptual knowledge and therefore, emphasizes the strategic management role (Teece & Pisano, 1994; Zaidi & Othman, 2012). The dynamic capabilities approach is crucial for organizations to convert these three mechanisms into routines that are spontaneously implemented within organizations.

Shapiro (1999) has provided another factor that can influence the knowledge transfer process between project teams which is "redundancy". The study defined redundancy in IPL as the process of duplication of knowledge between projects within the same organization. The importance of redundancy in IPL arises from the fact that

it facilitates the process of tacit knowledge transfer and strengthens trust among the organization's members, as it ensures that the implications of the hierarchy are mitigated. Additionally, it ensures equal access to information for all members of the organization.

These processes of inter-project learning are crucial for gaining a comprehensive understanding of how IPL can be performed. Moreover, the indicated influencing factors will have a significant impact on the process and will be integrated into the final framework at the end of this study.

2.4 Inter-project Learning Barriers and Facilitators

The preceding sections underscored the importance of inter-project learning (IPL) within project-based organizations (PBOs), particularly, in the context of the construction industry. However, the literature also highlights the existence of barriers to IPL that can restrict the full exploitation in future projects. Bartsch et al., (2013) highlight that organizations often develop remedies that help to overcome IPL barriers. Overcoming barriers to IPL will result in better project performance in organizations, as these barriers act as boundaries to the transfer of learning between projects, as defined by Scarbrough et al. (2004). Next to the barriers, there are facilitators that empower the process of IPL and make it more effective as was mentioned in the article by Newell, (2004). These facilitators are referred to as facilitators of successful IPL. The following sub-sections will explore both barriers and facilitators and provide some practical implications on the construction field.

2.4.1 Inter-project Learning Barriers

Scholars have made efforts to identify barriers to IPL. Newell et al. (2006) identified two key factors that help gain a better understanding of IPL: learning focus and learning type. The first reflects the level of involvement of the actors in the projects. The authors mentioned that the lack of involvement in projects can result in less effective learning and can affect the quality of the process of knowledge transfer. The second is related to a lack of ability to understand the distinction between process and product knowledge. The article outlines the difference between these two by mentioning that process knowledge is about the knowledge that was gained as a result of the processes that teams deployed to achieve their target while product knowledge is about the actual achievement of the stated objective. Some project actors assumed they gained a lot of knowledge that will help them in future projects whereas it appears that it belongs to the product knowledge and cannot be utilized for other projects.

Three affecting factors were identified by Gieskes & Ten Broeke (2000) in infrastructure projects. These can have a major impact on IPL and the process of continuous improvement, which refers to the ability of organizations to modify their techniques and approaches to adopt the industry's development. These factors can be viewed as barriers to successful IPL:

1. **The one-off projects' nature inorganization:**
   - The temporary nature of projects demotivates project teams to facilitate learning and put efforts into improvements and learning.
2. **The on-site project character:**
   - As communication is a key factor in IPL, the on-site nature of projects can affect effectiveness due to the shortages of communication in the long term and on the strategic level.
3. **Culture:**
   - The engineers' dominance of the infrastructure sector has resulted in a situation where the focus on the technical level is much higher than on the management level. This results in less structured IPL and negatively affects the continuous improvement of organizations.

Furthermore, the barriers to IPL have been classified differently in different studies. The classification depends mostly on the organization type. In Research and Development (R&D) projects, Von Zedtwitz (2002)

developed a framework where 8 barriers were identified, and they are classified into 4 groups as can be seen in Figure 14. By reviewing these barriers, it can be concluded that they are also applicable in the construction industry for PBOs. Each barrier has an influence on the IPL process, ultimately diminishing its impact.
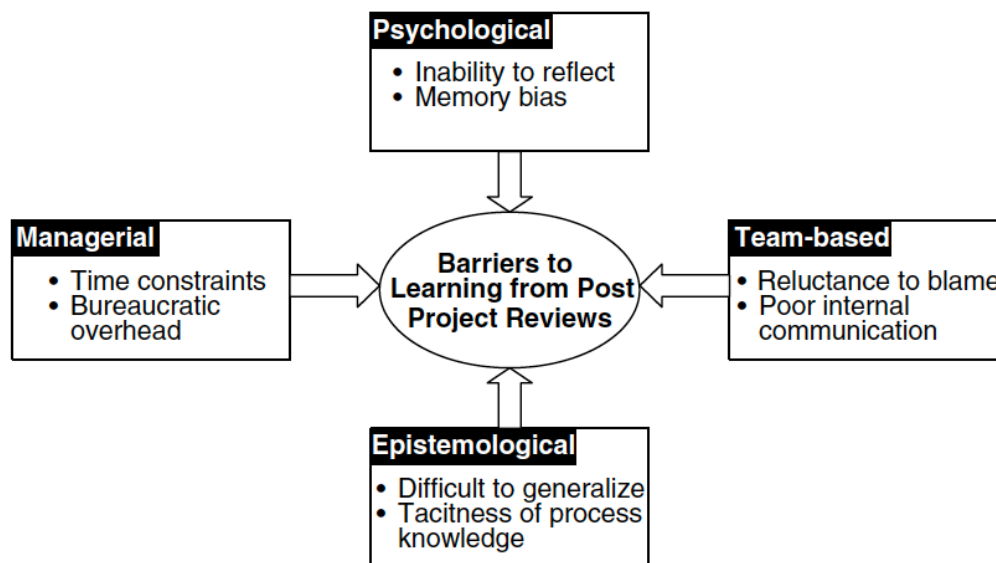
Figure 14 Barriers groups for R&D organizations (Von Zedtwitz, 2002)

Santos et al. (2012) performed an empirical study to explore the knowledge-sharing barriers (KSB) in R&D and complex projects. The found barriers related to IPL can be found in Table 1 with a brief description.

Table 1 Knowledge sharing barriers results (Santos et al., 2012)

Barrier	Brief description
Codification process difficulties	The problem of transferring the knowledge in suitable format and the differences in formats
Lack of trust	Lack trust between project teams leads to an introverted work environment during knowledge sharing
Lack of initiative by the employees	Laziness of project teams and the poor knowledge sharing culture in the environment results in less initiatives by these project teams.
Lack of time and resources	Knowledge sharing and learning are not given sufficient time and budget as a result of the underestimating of learning importance
Unawareness of the work performed by others	The lack of background information of project teams of other teams' projects makes it more difficult to share knowledge
Competitive environment	People feel reluctant to share information as they consider it as a source of power
Inefficient information technology	Used tools to share knowledge are inefficient which makes the individuals more reluctant to make use of them.

Other scholars have classified the barriers of IPL in different ways. Wiewiora et al. (2009) classified the IPL barriers into three categories. These are:

1. **Social communication barriers:**
   - Similar to what was mentioned in Gieskes & Ten Broeke (2000), the poor level of communication between construction firms is the reason why social communication is viewed as a barrier. Challenges

such as the dispersed nature of projects, the time constraints, and the unwilling behaviour to share bad experiences made it extra challenging for organizations to have successful communication which does restrict knowledge sharing and IPL. The results of the article emphasized that social communication is the most important manner to achieve the required level of knowledge and information sharing (Wiewiora, Trigunarsyah, Murphy, & Liang, 2009).

2. **Documented lessons learned transfer barriers:**
- The ambivalent approach to documenting the lessons learned and the fragmented knowledge did enlarge the big when it comes to IPL. Other barriers such as the lack of effort made on the repository of the lessons learned and the time shortage to produce these lessons, and the exclusion of lessons learned from the scope of new projects.

3. **Project manager-related barriers:**
- The natural inclination of project managers to prioritize delivering projects on time is the main cause of the barrier. Additionally, the article addressed the overconfidence of the project managers as a cause for the barrier. Next to these causes, the natural willingness of project managers to control the knowledge and the unwillingness to be criticized are also important causes of ineffective IPL.

Almeida & Soares (2014) addressed the problem of knowledge sharing by labelling it as "Informational limbo". They identified unstructured information and the rapid generation of information as the underlying causes of having an ineffective knowledge-sharing environment which in turn acts as a barrier to IPL as discussed above.

The study by Solli-Sæther et al. (2015) identified three challenges that impact the process of knowledge sharing in project networks. These challenges can also be used as barriers to IPL. The challenges and their corresponding barriers are as follows:
- **Cultural differences:** these encompass the variation in national culture in case there are multiple nationalities involved in the organization. Language differences can also be a barrier to learning as it can affect communication.
- **Strategic misalignment:** The different perspectives and definitions of success criteria can also limit the learning process.
- **Knowledge protection:** the fear of exposing confidential information about the projects can be a disincentive for the project teams to share knowledge across projects.

This section has addressed the barriers affecting the process of IPL in literature. All of the barriers are emerging in PBOs that strive to overcome them. More barriers will be explored in the empirical study in the upcoming chapters as there are other practical barriers that exist in practice and not exist in the literature. Furthermore, all of these barriers can be found in the construction industry due to the complex nature of this industry as mentioned previously.

2.4.2 Inter-project Learning Facilitators

The study by Boh (2007) has presented two dimensions of methods in project-based organizations. These dimensions are important to determine the appropriate approach to facilitate the IPL process. These dimensions are:

Codification vs Personalization:
1. This dimension, introduced by Hansen et al. (1999) distinguishes between codification and personalization methods in knowledge management for IPL. The codification method can be applied by using the acquired and shared knowledge explicitly and can be applied by establishing a database that contains the acquired knowledge and can be used by all employees in the organization. Meanwhile, personalization relies on the interactions of the experts in the field. This method can be applied in organizations by implementing direct contact between persons. Personalization helps to

have a strong communicative environment in organizations because it uses individuals to transfer knowledge.

Institutionalization vs Individualization:

2. The institutionalization dimension refers to formal at the collective level when it comes to information sharing with the organization's employees. On the other hand, individualization refers to formal at the individual level when it comes to information sharing with the organization's employees. The article has indicated that both tactics can be used. However, the Individualization method has a limited reach level compared to the Institutionalization method because the former focuses on sharing knowledge between a small number of individuals whereas the latter focuses on sharing knowledge with many individuals which can be achieved by integrating the knowledge into the daily routine and the structure of the organization.

Considering these two dimensions and their methods, organizations can choose the most suitable approaches to facilitate the process of IPL.

The study by Julian (2008) examined the tactics employed by project managers to facilitate learning between projects and overcome barriers. The article conducted a case study by interviewing project managers from different departments and it came up with various facilitators that are already implemented in the field. These facilitators include:

- Creating practice connection between individuals and managers help to share knowledge by organizing workshops.
- Establishing processes that are applicable in other projects to enhance the chance to successfully transfer lessons learned for future projects.
- Using templates and forms that can be documented and stored in order to not lose the acquired knowledge and implement it in future projects.
- Coordinating boundary encounters to solve issues in other projects and continuously improve performance.
- Reflective practice and training sessions are crucial to facilitate learning and knowledge sharing for future projects.
- Having more experienced/senior project managers is also an option that many interviewees agreed on.

Nevis et al. (1998) addressed various facilitating factors that have an influence on the process of learning. Since not all of them belong to IPL, Table 2 has an overview of these actors with a brief description.

Table 2 Facilitating factors for inter-project learning (Nevis et al., 1998)

Facilitating Factor	Brief Description
Performance Gap indicator	By identifying the gap between the targeted outcomes and actual performance, new insights can be introduced.
Concern for Measurement	Utilizing metrics by organizations can support learning due to their ability to track its effectiveness.
Climate of openness	Openness climate in organizations improves the information flow process as it facilitates informal learning and focuses on sharing the errors.
Continuous education	This can help to foster the commitment to learning at all levels for a long time by creating a culture that encourages knowledge sharing among all organization's members.
Multiple advocates	By having more than one individual or actor to facilitate learning, the knowledge will be more effectively widespread.
Involved leadership	Leadership at all levels is important to remove hierarchical layers between management layers as these leaders from diverse levels will be more emphasized to gather data and improve coordination throughout the organization.

2.5 Discussion

The literature study addresses organizational learning in project-based organizations (PBOs) and outlined the key characteristics and challenges of the learning process in these organizations. In addition to organizational learning, the inter-project learning (IPL) phenomenon has been addressed to understand its definition, processes, phases, barriers, and facilitators. The literature identifies two main challenges hampering the process of IPL. These are the knowledge exchange process between projects challenge and the learning process within an organization challenge.

The literature study shows that while barriers to IPL and knowledge transfer have been already investigated in various industries, there has been comparatively less focus on exploring the facilitators. This can be attributed to the relative ease of identifying and studying barriers compared to identifying facilitators. Furthermore, it is important to note that not all studies specifically examined the construction industry. However, all these identified barriers and facilitators are encountered in the construction industry and therefore, they remain within the scope of this study. Tables 4 and 5 provide a comprehensive overview of the barriers and facilitators identified in the literature, categorized according to their types. In addition, the industry type and the reference have been mentioned to indicate where these barriers or facilitators were encountered. Each barrier or facilitator falls within one of three distinct dimensions: learning infrastructure, knowledge accessibility, and organizational culture. Each category represents a specific dimension of the IPL process, and each dimension is illustrated in Table 3. The organizations have the possibility to work on improving each dimension independently by addressing the challenges and leveraging the facilitating factors within that dimension.

However, it is significant to note that there is interconnectedness between these dimensions that can be addressed to foster the process since improving one dimension may indirectly influence another dimension. Therefore, while addressing one dimension individually, organizations should be mindful of the potential synergy that is created among them.

Table 3 Inter-project Learning Dimensions Definitions

Dimension	Definition
Learning infrastructure	This dimension focuses on all factors attributed to the essential tools that underpin effective inter-project learning and knowledge transfer.
Knowledge accessibility	This dimension focuses on factors attributed to the process of knowledge retrieval and accessibility.
Organizational culture	This dimension focuses on factors attributed to the natural interactions, collaborations, and cultivating environment where learning is championed.

In order to come up with an answer to the second and third sub-questions of this research, it was chosen to develop a hypothesis model that hypothesizes these three dimensions and their interconnections. The empirical research will gather practical perspectives from field experts to investigate the following:

- The most emerging barriers and facilitators in practice within the industry.
- The linkage between these three dimensions.
- The interconnections of these barriers and facilitators.

Table 4 Barriers to Successful Inter-project Learning Based on the Found Literature

Dimension	Barrier	Industry	Reference
Learning Infrastructure	Knowledge Loss	All industries	(Bakker et al., 2011; Bartezzaghi et al., 1997)
	Time shortage for lessons learned	Construction	(Wiewiora, Trigunarsyah, Murphy, & Liang, 2009)
	Fragmented lessons learned	Construction	(Wiewiora, Trigunarsyah, Murphy, & Liang, 2009)

Knowledge Accessibility	Lack of Initiative and Strategy by the Workers	Research and Development	(Santos et al., 2012)
	Codification Process difficulties	Research and Development	(Santos et al., 2012; Von Zedtwitz, 2002)
	Single-loop level learning	All industries	(Snell & Chak, 1998)
	The on-site project characters	Construction	(Gieskes & Ten Broeke, 2000)
	Fragmentation	Construction	(Rotimi et al., 2022; Wiewiora, Trigunarsyah, Murphy, & Liang, 2009)
	Lack of Interactions	Product development	(Nobeoka, 1995)
	Lack of Trust	Research and Development	(Santos et al., 2012)
	Unawareness of Other People's Work	Research and Development	(Santos et al., 2012)
	Tacit Knowledge Transfer	Product development, Research and Development	(Shapiro, 1999; Von Zedtwitz, 2002)
	Inefficient information technology	Research and Development	(Santos et al., 2012)
	Cultural differences	Shipbuilding	(Solli-Sæther et al., 2015)
	Knowledge protection	Shipbuilding	(Solli-Sæther et al., 2015)
	Project Uniqueness	Construction	(Gieskes & Ten Broeke, 2000)
	Unstructured information	Research and Development	(Almeida & Soares, 2014)
Organizational Culture	Unwillingness to be criticized	Construction, Research and Development	(Von Zedtwitz, 2002; Wiewiora, Trigunarsyah, Murphy, & Liang, 2009)
	Neglecting the importance of lessons learned	Construction	(Wiewiora, Trigunarsyah, Murphy, & Liang, 2009)
	Poor internal communication	Research and Development	(Von Zedtwitz, 2002)
	Reluctance to share expertise	Construction	(Wiewiora, Trigunarsyah, Murphy, & Liang, 2009)
	Discouragement of sharing bad news	Construction, Research and Development	(Von Zedtwitz, 2002; Wiewiora, Trigunarsyah, Murphy, & Liang, 2009)
	Exclusion of lessons learned process from scope and budget	Construction, Research and Development	(Von Zedtwitz, 2002; Wiewiora, Trigunarsyah, Murphy, & Liang, 2009)
	Temporary Nature of Projects	Project-based Industries with Frequent Turnover	(Wong et al., 2009)
	Competitive Environment	Research and Development, Shipbuilding	(Santos et al., 2012; Zhou et al., 2023)
	Strategic misalignment	Shipbuilding	(Solli-Sæther et al., 2015)
	Knowledge implementation inefficiency	Construction	(Flyvbjerg et al., 2002)

Table 5 Facilitators to Successful Inter-project Learning Based on the Found Literature

Dimension	facilitator	Industry	Reference
Learning Infrastructure	Continuous education	All industries	(Nevis et al., 1998)
	Training sessions and workshops	Various industries	(Julian, 2008)
	Reflective Learning practices	Various industries	(Julian, 2008)
	Performance gap indicator	All industries	(Nevis et al., 1998)
	Knowledge documentation templates	Various industries	(Julian, 2008)
	Double/triple loop learning level	All industries	(Snell & Chak, 1998)
	Increase project managers experience	Various industries	(Julian, 2008)
Knowledge Accessibility	Cross-project coordination	Research and Consulting	(Boh, 2007)
	Concern for measurement	All industries	(Nevis et al., 1998)
	Knowledge transfer processes establishment	Various industries	(Julian, 2008)
Organizational Culture	Multiple advocates	All industries	(Nevis et al., 1998)
	Climate of openness	All industries	(Nevis et al., 1998)
	Involved leadership	All industries	(Nevis et al., 1998)
	Boundary encounters stimulation	Various industries	(Julian, 2008)

To address the research question, as well as the second and third sub-questions, a hypothesis model has been formulated, as shown in Figure 15. This hypothesis model is constructed by utilizing the findings from the literature on the dimensions of IPL barriers and facilitators. It will be subjected to empirical testing using a research methodology. The hypothesis is illustrated in a model depicting the dimensions of these barriers and facilitators on the IPL process in PBOs. Furthermore, the model highlights that factors like redundancy and dynamic capabilities can exert influence on the IPL process. This model will be used as a hypothesis for the subsequent phase of this thesis, involving a case study to empirically test and refine the hypothesis by incorporating insights from practitioners in the industry. The hypothesis model offers an overview of the dimensions that warrant consideration for improving the process of IPL from a scientific standpoint. The

findings of the case study will enrich the model by integrating the practical perspectives derived from the study's results.
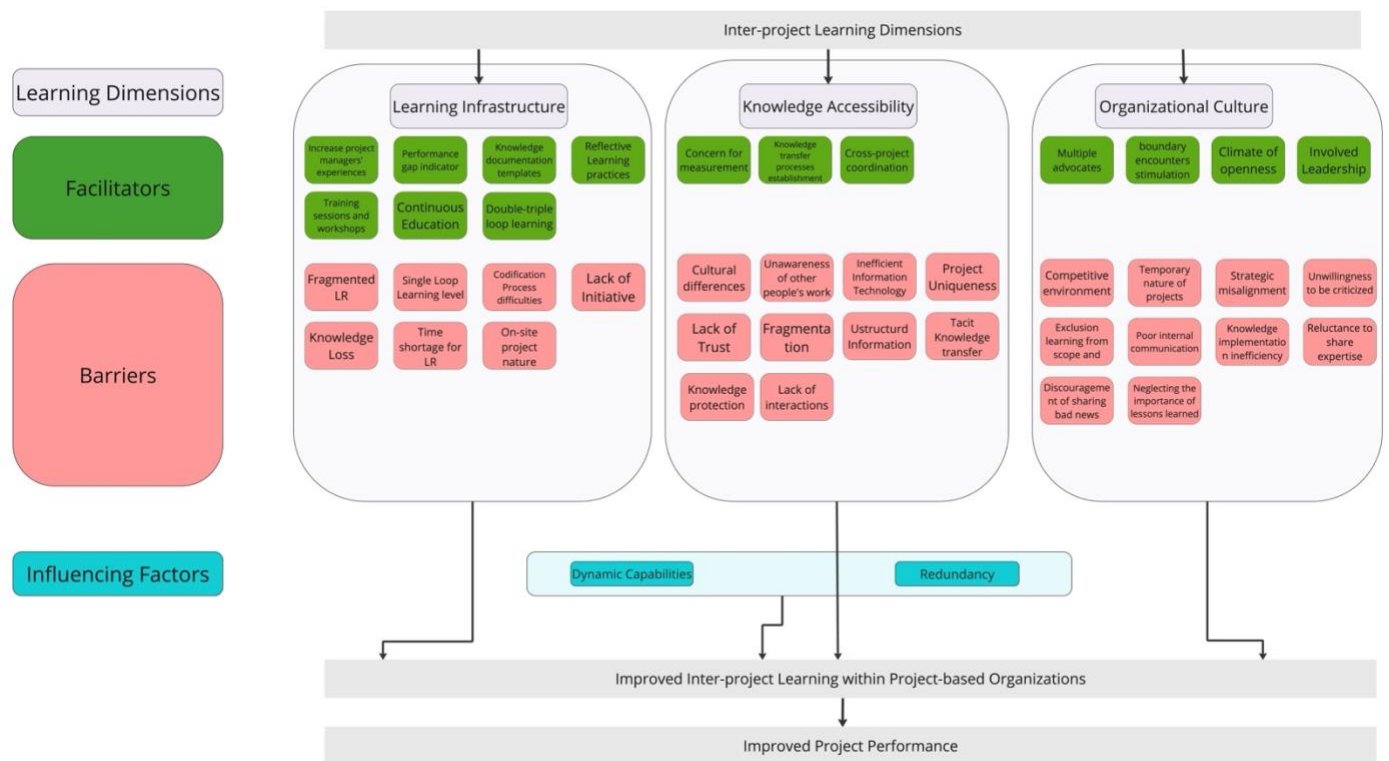
Figure 15 Inter-project Learning Hypothesis model based on the Literature (Author, 2023)

3. Research Methodology

This chapter discusses the methodological approach utilized in conducting this research. It outlines the research design, approach, data collection method, and sampling strategy employed for empirical research. Additionally, it introduces the research operationalization table, translating theoretical concepts into measurable variables. Furthermore, this chapter elaborates on the data analysis methodology and addresses aspects such as validity, reliability, ethical considerations, and limitations inherent in this empirical research.

3.1 Research Design and Approach

The main goal of this thesis is to improve inter-project learning (IPL) within project-based organizations (PBOs), leading to strengthened organizational learning, improved project performance, and reduced repetition of past mistakes in future projects. The literature review has extensively covered the current status of organizational learning, PBOs, and factors affecting IPL, including influencing factors, barriers, and facilitators. This review is summarized in Tables 4 and 5, which provide an overview of these barriers and facilitators, respectively.

Sweco, a standard project-based organization specializing in the construction industry, serves as the chosen case study. The case study method was preferred for this research particularly because it allows for a contextual and in-depth analysis of complex factors affecting IPL within PBOs, which resonates with the research's main objective. The case study research method is deemed highly suitable for this investigation due to its ability to explore barriers and facilitators, their interconnections, and insights from field experts in practice. Additionally, the method enables the testing of the provided hypothesis model. Findings from the case study will underpin the development of the framework and will propose solutions to enhance the organization's internal learning processes, thereby refining IPL.

The case study consists of two distinct parts. The first part investigates the available information on the process of IPL within the organization to understand how it is being done and to get an idea of the current approach before conducting the interviews. The insights gained from the first part of the case study are significant to refine the interview questions guide that will be used in the second part and will ensure the reliability and relevance of the questions related to the organization's current approach. The second part is accomplished by conducting semi-structured interviews with project managers who work in the organization. This interview format facilitates the emergence of discernible patterns, as it allows the interviewer to follow a standardized format of questions (Verschuren et al., 2010). Furthermore, it facilitates the exploration of new learning barriers and facilitators that may not have been previously addressed in the literature review.
Semi-structured interviews were chosen due to their ability to facilitate an in-depth exploration of new concepts that add high value to the hypothesis model. Semi-structured interviews provide the required balance between the structure of the interview but also give more flexibility which enables a comparable and nuanced data collection. Additionally, these interviews offer the possibility to gather new insights regarding the impacting factors on the process as they provide the interviewees more space to express their thoughts. These interviews will constitute primary data, as they will elicit tacit knowledge and insights directly from the interviewees.

Furthermore, project managers have been chosen as they have a very important role in improving knowledge transfer within PBOs (Wiewiora, Trigunarsyah, Murphy, Gable, et al., 2009) and they are primarily responsible for overseeing projects. Focusing on project managers for the interviews is strategic due to the fact that they are the most capable actors in information flow in PBOs and their insights are essential to understand the challenges in implementing IPL. Additionally, project managers are the key figures with

numerous interconnections with other employees from different disciplines (Wiewiora, Trigunarsyah, Murphy, Gable, et al., 2009) as they are the connecting actors between the team managers and project members. Subsequently, the collected data will then undergo analysis to extract explicit information, helping answer the research questions. To ensure that the results are applicable to all different types of projects within PBOs, the chosen project managers have been selected from various disciplines ensuring the applicability of the results.

Moreover, to validate the final results, a semi-structured interview is conducted with an expert in the field. This process aims to gain feedback about the roadmap and the framework to be improved and to validate the ultimate findings. The importance of the validation phase is that it will ensure the applicability of the research findings. A semi-structured interview has been chosen to develop a more focused assessment of the framework's effectiveness and to gather insights that can improve the final roadmap framework.

The research will adopt a qualitative approach, as its objective is to delve into deeper insights and propose solutions that might not be easily quantifiable. The qualitative approach allows for more generalizable conclusions, aligning with the overarching goal of improving IPL within PBOs as a whole, rather than solely focusing on the specific organization being examined. The quantitative approach was avoided as it lacks the required depth to investigate the IPL dynamics.

The organization where the case study is conducted, Sweco, is a project-based organization that encompasses various departments catering to diverse projects and expertise domains. Specializing in engineering and consulting services, the organization is committed to fostering enduring relationships with its clients. Similar to other organizations, Sweco is committed to an ongoing trajectory of improvement. Recognizing the pivotal role of knowledge sharing and IPL in fulfilling this objective. Sweco expressed enthusiastic support for this research by providing the possibility of conducting interviews with employees from different departments and providing a workspace at their Rotterdam office. This ensures their full willingness to foster a culture of continuous learning.

3.2 Data Collection

The data collection occurred in two phases. The first phase involved observing the organization's existing approach to gain insights into the process and to be able to formulate a precise interview questions guide. The second phase involved conducting the semi-structured interviews. The interviews were recorded using Microsoft Teams, with participants' consent, to ensure accurate data collection. The semi-structured interviews were conducted with project managers who are actively engaged in the organization.

The central component of the case study is the semi-structured interviews, which provide a comprehensive understanding of the problem and potential solutions to address these challenges. Through the results of these interviews, the most influential barriers and facilitators are investigated, regardless of whether they are found in the literature or are derived from the interviews. The semi-structured format ensures focused interviews on the topic while permitting the interviewees to express their insights and thoughts on how effective IPL can be achieved by answering open-ended questions. For this study, the interview sample size is set at a maximum of 15, aimed at gathering enough information to formulate statements that will be used to develop the final framework. Another criterion for determining the number of interviews is information saturation, which implies that further interviews are unnecessary when the same information is repeatedly obtained.

Given the focus on IPL, it's essential to approach the study from an organizational perspective. Investigating individual projects in isolation would not sufficiently capture the overarching issue. As a result, instead of focusing on one or multiple project-specific approaches, the case study emphasized an organization-wide

viewpoint. Nevertheless, project phases related to IPL and knowledge exchange were explored to understand the organization's policies that facilitate a learning and knowledge-sharing environment.

The semi-structured interview with an expert in the field was conducted to validate the final model developed based on the insights gained from the case study. By including the expert's perspective, the findings could be validated as methodological triangulation will be employed by comparing insights from different perspectives. More information about the structured interview to be provided in the validation section.

To increase the effectiveness and consistency of the interviews, interview guides have been prepared. Appendix A contains the interview guide for the semi-structured interviews, while Appendix B includes the interview guide for the validation interview. To ensure data anonymity, interviewees' personal information is anonymized throughout the research process. This approach safeguards confidentiality and minimizes biases.

3.3 Sampling Strategy and Participants

Sweco is a large and diverse organization that encompasses many departments, divisions, experts, and employees with a wide range of backgrounds and positions. Therefore, selecting an appropriate sampling strategy is crucial to avoid biases and to ensure an effective collection of relevant and valuable data. The importance of sampling lies in guiding the selection of individuals that are best suited to address the interview questions that can help to develop the framework and validation of the framework. A mix of purposive sampling and snowballing sampling methods have been chosen to identify suitable participants for the semi-structured interviews, while purposive sampling has been chosen for the validation part. Both of these sampling methods were chosen in order to leverage their strengths: purposive sampling for its accuracy and snowball sampling for its ability to uncover potential valuable contributors that may not have been found in purposive sampling. Purposive sampling is defined as a sampling type in which the searched unit is selected based on the judgment of the researcher ensuring the most appropriate candidates are selected (Babbie, 2016). Meanwhile, snowballing sampling is a method that relies on interviewees' suggestions to identify individuals who possess valuable insights and knowledge related to the research problem (Babbie, 2016).

Regarding the semi-structured interviews, project managers with a minimum of one year's experience in the organization have been chosen for the semi-structured interviews. This selection criterion ensures their adequate familiarity with the IPL process within the organization. Furthermore, their longevity within the organization lends credence to the collected data due to their experience and participation in the organization's learning processes. The reason is that project managers are the ones responsible for project evaluation where the knowledge is being accumulated in the form of lessons learned and knowledge transfer between projects. For each discipline, the plan was to interview one project manager at least (purposive sampling) to obtain a comprehensive overview. The total sample size is determined by the need for discipline variety and the point at which data saturation is reached. At this point, no new insights will emerge from the additional interviews and there is no need to conduct more. During these interviews, the interviewees will be invited to suggest other project managers who they think are interested in the topic (snowballing sampling). However, this can also depend on the availability of the project managers and their willingness to be a participant in the interviews.

On the other hand, the validation interview encompasses interviewing one field expert to validate the developed framework and the roadmap from diverse perspectives. The field expert was chosen for their expertise in the field and considered a different perspective than the case study's participants. This approach ensures the framework's applicability to all departments within the construction industry's PBOs.

3.4 Research Operationalization

To make it possible to transfer to empirical research, table 6 has been made to make the indicated variables in the literature review measurable through their conceptual definitions, dimensions, and indicators using the guidelines by (Arias Gonzales, 2012). The operationalization table offers a structured way of translating the theoretical concepts into measurable variables for empirical research. This table serves as a bridge between the theoretical findings and the actual data collection process. This table is essential to set up the questions guide of the semi-structured interviews as this table serves as a tool to fill in the gaps in the data collection process, ensuring a more robust research design.

Table 6 Operationalization of variables (Author, 2023)

Variable	Conceptual definition	Dimensions	Indicators	Measurement scale
Organizational learning	Transformative process results in knowledge change which optimize performance (Argote & Miron-Spektor, 2011)	Learning levels	Single-level, double-level, and triple-level	Nominal
Project-based organizations	Organizational form where projects are the essential units of innovation and production (Hobday, 2000)	Influence on organizational learning	Effect on the project-based organization on the process of learning and knowledge sharing across projects	Ordinal
Inter-project learning	Process of knowledge accumulation and exchanging experiences among different projects over time (Bartezzaghi et al., 1997)	Types of inter-project learning	Concurrent design transfer and sequential design transfer for knowledge sharing	Nominal, Ordinal
		Integration learning culture between projects in organization's routines	Dynamic capability's role in inter-project learning	Ordinal
		Knowledge duplication strategies	Redundancy's role in inter-project learning	Ordinal
Barriers to inter-project learning	Boundaries affecting the transfer of learning between projects (Scarbrough et al., 2004)	Most influential barriers	Compilation of barriers	Nominal, Ordinal
Facilitators to inter-project learning	Factors that facilitate the process of inter-project learning and increase its effectiveness (Newell, 2004)	Most influential facilitators	Compilation of facilitators	Nominal, Ordinal

3.5 Data Analysis

The data collected from the case study was acquired through two previously mentioned methods. Firstly, the organization's current learning approach was examined by reviewing the project management framework, with a specific focus on the learning phase. Secondly, the semi-structured interviews were conducted with the project managers. These interviews were conducted online via Microsoft Teams. To ensure accurate analysis of the interview materials, verbal permission will be obtained prior to recording the interviews. The aim of recording these interviews is to obtain accurate transcriptions, mitigate the risk of missing information and ensure unbiased representation of the interviewees' responses. Additionally, most interviews were conducted in Dutch and were translated into English observing that the participants felt more comfortable speaking Dutch therefore, transcribing these interviews will allow the interviewer to focus on the interview contents.

The transcription feature of Microsoft Teams eliminated the requirement for additional software, streamlining the process of transcribing recorded interviews and boosting productivity.

The qualitative data analysis software ATLAS.ti was used to analyze these interviews. It is widely used software by researchers to analyze qualitative data. This software helps in the systematic assignments of codes

to specific parts of the interviews, facilitating the identification of barriers and facilitators, which in turn contribute to addressing the second sub-question and the overarching research question. Furthermore, the software's ability to assign codes to the quotations simplifies the study of interview answers, allowing for a thorough assessment of the interviewees' responses.

Before commencing the actual data analysis, the interview transcripts were analysed to gain an initial understanding of the potential themes. The objective was to determine the text segments that are informative for the research's main topic about IPL within PBOs. After the preliminary reading, a list of codes was generated. These codes are derived from the findings of the literature review and the recurring themes and topics that emerged during the data analysis phase. The coding process is continuous as there are always new themes and concepts emerge. The coding process encompasses three phases: open coding, axial coding, and selective coding (Verschuren et al., 2010). During the open coding phase, the interview transcript texts underwent meticulous analysis which involved labelling and classifying the key segments within the text. Codes representing significant statements, barriers, and facilitators are established, serving as a foundation for the subsequent axial coding phase. In axial coding, the focus shifts to discerning connections and relationships among previously created codes, resulting in the formation of categories with shared patterns and associations. The third phase, selective coding, results in the identification of the core theme of the case study conclusion, addressing research sub-questions and main research questions (Verschuren et al., 2010). The outcomes of the coding process were integrated into the hypothesis model in Section 2.5 of the report, expanding dimensions and providing a detailed and practical framework for enhancing IPL within PBOs. To validate that there are no codes missed, a second pass through the transcripts was conducted where extra codes can be added from the emerging themes.

3.6 Validity and Reliability

The selected case study stands as an essential instrument to answer the questions of this thesis, and as such, ensuring reliability is of utmost importance. It ensures the accuracy and reliability of the acquired results within the field of study (Fitzner, 2007). Conducting interviews with individuals from diverse departments mitigates the potential for biased results. Furthermore, including a field expert in the semi-structured interview within the organization ensures the addition of additional perspective, contributing to the reliability of the results.

Regarding validity, it pertains to the accuracy of the findings. In this context, validity may differ slightly from reliability, as all interviews were conducted within the same organization. This setup could potentially affect external validity, limiting the applicability of the results to other organizations. The validation interview was conducted and analyzed in the same approach as the semi-structured interviews in the case study. Additionally, by including various questions about IPL in a broad context, the study boosts the potential for achieving robust external validity. Moreover, using interview transcriptions and the Atlas.ti software reinforces the validity of the findings and ensures a detailed representation of perspectives.

Incorporating the case study, the validation interview with the field expert, and insights from the literature review allow for methodological triangulation, further enhancing the reliability of the study.

3.7 Ethics

It was fundamental to maintain the confidentiality of the participant's personal information. Consequently, a decision was made to not disclose the names of the interviewees. Furthermore, it is imperative that responses are analyzed without any content modification to uphold ethical standards during data analysis. An additional

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measure to ensure ethical data collection involved seeking permission from each interviewee prior to conducting the interview, stating that it was recorded for transcription purposes. Furthermore, once the transcriptions were successfully obtained, the recorded videos were promptly deleted. All participants were asked for their consent prior to the interview where the purpose, procedures, risks, and benefits were outlined. The interview data was stored on a secure server to get the transcripts that were anonymized right after the interview.

3.8 Limitations

Throughout the case study, certain limitations arose. The busy schedules of project and team managers leaded to late response by them which resulted in extra time to conduct the case study. Additionally, the findings of the case study encountered limitations in terms of external validity since all interviewees are from the same organization. Moreover, the time limitations inherent in conducting lengthy interviews might impacted the thoroughness of responses, as interviewees could face challenges in fully addressing all questions.

The fact that the sample size was limited to the employees from a single organization could also lead to selection bias which limited the possibility of generalizing the findings that can be applicable for all PBOs. However, the questions asked in the interviews and the validation interview minimized this limitation and increased the applicability of the findings of this research.

4. Data analysis

4.1 Introduction

The previous chapters of this study laid a solid theoretical foundation for understanding organizational and inter-project learning within project-based organizations. The necessity for the empirical study has been justified, highlighting its capability to shed light on unexplored challenges and factors in the existing literature. Moreover, the data analysis methodology has been in detail explained in Chapter 3. The findings from the case study specifically help to address the second and third sub-questions of this thesis. These insights culminate in the formulation of the roadmap framework to improve inter-project learning in order to answer the main research question. This chapter provides a comprehensive data analysis of the case study conducted within the project-based organization.

This chapter proceeds as follows: This section provides an overview of what this chapter is about. Then, an examination of the current approaches to learning and knowledge-sharing within the chosen organization is provided. Next, background information on the case study participants, including their disciplines and years of experience, is presented. Subsequently, the emerging factors from the interview results are addressed, including highlighting of their interrelationships, the domain where they lie, and the correlations with the literature findings. Then, the empirical classification of the factors is outlined. After that, the impact of influencing factors, i.e., Dynamic Capabilities and Redundancy, is outlined, along with their integration into the final results. After that, the interconnections between factors are addressed. Finally, in the conclusion section, the empirical study findings are summarized and presented.

4.2 Organization Current Approach

The analysis begins with a close examination of Sweco's current project evaluation framework. Sweco operates as a project-based organization, making projects the primary units for production and innovation as indicated in the literature. The organization uses a standardized framework that covers all project phases, from initial planning to project closure. This framework is continuously updated to incorporate new developments that can enhance project performance. One key feature of this framework is the use of internal evaluation forms filled out at the end of the project cycle. These forms are collected in the organization's database, and the information gathered can be utilized in future projects.

The evaluation forms serve as tools for project managers to review project outcomes and assess several aspects:

- Effectiveness of executed activities and the context in which they succeeded.
- Identification of potentially better alternatives.
- Compilation of lessons learned for future projects.

While this approach does promote some reflection and gathering related to projects, it has notable limitations. Firstly, the framework allocates insufficient resources for learning and knowledge-sharing, which is crucial for a project-based organization like Sweco. Secondly, the data captured through these forms often remains tacit and therefore, it is not easily transferable to future projects, as previously noted in the literature. Thirdly, the data captured through these forms is often archived in a database and remains unused and rarely consulted for future projects. Another limitation, also emerged in the literature, is the heavy reliance on sequential design transfer of knowledge, which presents additional challenges for learning as no direct connection is possible. The shortcomings of the framework have tangible consequences: they lead to repeated mistakes due to inefficient learning and knowledge exchange processes.

Moreover, the framework's lack of mechanisms for cross-project learning is another limitation of the current approach. Without processes in place for knowledge exchange across teams, the utility of evaluation forms is significantly undermined. The current framework does not consider the process of inter-project learning and knowledge sharing within the organization in an effective way and the focus remains on providing only basic information on the accomplished projects, such as what aspects were successful, what challenges were faced, and what recommendations could be considered for future projects. This highlights the limitations in the existing approach and indicates that there is room for improvement in both general learning and inter-project learning specifically.

4.3 Participant experience levels and backgrounds

The participants of the semi-structured interviews, as described in the methodology chapter, are project managers who have been working for Sweco for at least one year, as previously described in the methodology chapter. They come from diverse backgrounds specialize in various disciplines within the construction industry and have various experiences ranging from 14 to 34 years. This ensured a wide range of perspectives due to their differing tenures and specialities. The interviews were recorded via Microsoft Teams to export the transcript after ensuring the interviewees' consent. In total, ten interviews were conducted, enriching the data pool. Table 7 provides a list of participants, detailing their disciplines and experience years in the industry.

Table 7 List of Participants Interviewed for the Semi-structured Interviews

Interviewee number	Discipline	Experience in the industry
1	Urban projects	+25 years
2	Urban projects	18 years
3	Transportation and Mobility	27 years
4	Architecture and Building management	15 years
5	Rail and Infrastructure	17 years
6	Transportation and Mobility	15 years
7	Engineering and consultancy.	34 years
8	Architecture and Building management	14 Years
9	Infrastructure	22 years
10	Technique	31 years

All interviewees showed a high level of enthusiasm to share their insights on the topic, offering a multitude of perspectives due to their diverse fields of expertise and experience. This diversity enriches the depth of insights into IPL, contributing to a framework that can be applied to all PBOs, not only Sweco.

After each interview, the initial impression of the interviewer has been documented in a notebook which can be found in Appendix C. The reason for that is to ensure capturing the initial insights and spontaneous reaction. A common agreement among interviewees highlighted a substantial scope for enhancement in IPL. All were keen to share their experiences and suggest possible solutions.

4.4 Factors Analysis: Mapping the Structural Landscape

This section aims to provide an overview of the processes followed to come up with the factors and structural domains drawn from the empirical research. Using a three-tiered coding framework, which includes open, axial, and selective coding processes, this study provides a comprehensive analysis of the critical elements

affecting the process of IPL within PBOs. In the initial stage of data analysis, it was observed that multiple open codes coalesce to form singular axial codes, which serve as impacting factors in the realm of IPL. Subsequently, clusters of axial codes were condensed into selective codes, highlighting various structural domains crucial for enhancing IPL. The selective codes were generated by synthesizing the multiple factors identified in the empirical research. In total, 26 factors (axial codes) were identified. Each factor comprises multiple open codes. The selective codes were derived through a meticulous process of pattern recognition and analysis, effectively distilling the essence of these factors into broader structural domains. These structural domains provide a systemic framework for understanding the areas where the factors are impacting, ensuring a holistic and informed approach to achieve the main objective of the research. Table 8 shows the co-occurrence of factors in interviews. This table depicts the co-occurrence of factors found through the interviews' data analysis process. Rows and columns contain the factors, and the values within the table indicate the frequency of the factors that were mentioned in the same interview. This table is crucial for displaying the frequency of each factor in the empirical study, as shown in the orange diagonal. It can be observed that the majority of the factors did emerge in many interviews. This can be reasoned by the fact that each factor consists of several open codes that emerged in many interviews. Furthermore, this table has an important role in unravelling the intricate web of relationships between factors, which also helps to determine the interconnections between the factors and show how the majority of these factors emerged in many interviews, indicating their importance.

Table 8 Co-occurrence of Factors in Interviews

Factor	Communication with the client	Environment Competitiveness	Fragmentation Level	Location Differences	Project Uniqueness Level	Project-based Nature	Resource Allocation for Learning	Specialization	Tacit Knowledge Exchange	Collaborative culture Adoption	Experience Impact	Learning Process Continuity	Learning workshops	Roles and Responsibilities	Safety of environment for learning	Time Availability for Learning	Attitude towards sharing failure	Cross-team interactions	Individual Culture	Informal Learning Mechanisms	Initiative taking Propensity	Internal Communication	Verbal Communication	Digital Platform Utilization	Open AI systems	Remote work
Communication with the client	5	5	4	5	3	4	3	4	5	4	2	4	3	5	3	5	3	3	3	4	4	3	2	5	2	3
Environment Competitiveness	5	9	5	8	6	7	5	7	9	8	3	7	6	9	5	8	4	5	5	5	6	5	4	9	5	4
Fragmentation Level	4	5	6	6	4	5	2	4	5	4	1	5	4	6	3	6	2	4	3	4	5	4	4	6	4	4
Location Differences	5	8	6	9	7	7	4	7	8	7	3	8	6	9	5	9	4	6	4	5	6	5	5	9	5	6
Project Uniqueness Level	3	6	4	7	7	5	3	5	6	5	2	7	6	7	5	7	3	6	3	4	5	5	5	7	5	5
Project-based Nature	4	7	5	7	5	7	3	5	7	6	3	6	5	7	5	7	4	3	4	5	5	4	4	7	4	4
Resource Allocation for Learning	3	5	2	4	3	3	5	3	5	4	2	4	3	5	2	4	2	1	3	3	4	3	1	5	2	2
Specialization	4	7	4	7	5	5	3	8	7	6	2	6	6	8	3	7	1	5	3	3	4	5	4	8	5	4
Tacit Knowledge Exchange	5	9	5	8	6	7	5	7	9	7	3	7	6	9	5	8	4	5	5	5	6	5	4	9	5	4
Collaborative culture Adoption	4	8	4	7	5	6	4	6	7	8	3	7	7	8	5	7	4	6	5	5	7	6	5	8	6	5
Experience Impact	2	3	1	3	2	3	2	2	3	3	3	3	2	3	3	3	3	2	2	2	2	1	1	3	1	1
Learning Process Continuity	4	7	5	8	7	6	4	6	7	7	3	8	6	8	5	8	4	6	4	5	6	5	5	8	5	5
Learning workshops	3	6	4	6	6	5	3	6	6	7	2	6	7	7	4	6	3	6	4	3	6	6	5	7	6	5
Roles and Responsibilities	5	9	6	9	7	7	5	8	9	8	3	8	7	10	5	9	4	6	5	5	7	6	5	10	6	5
Safety of environment for learning	3	5	3	5	5	5	2	3	5	4	3	5	4	5	5	5	4	4	3	3	3	4	3	5	3	3
Time Availability for Learning	5	8	6	9	7	7	4	7	8	7	3	8	6	9	5	9	4	6	4	5	6	5	5	9	5	5
Attitude towards sharing failure	3	4	2	4	3	4	2	1	4	4	3	4	3	4	4	4	4	3	3	3	3	2	2	4	2	2
Cross-team interactions	3	5	4	6	6	5	1	5	5	6	2	6	6	6	4	6	3	6	3	4	5	5	5	6	5	5
Individual Culture	3	5	4	4	3	4	3	3	5	5	2	5	4	5	3	4	3	3	6	4	4	4	2	5	3	3
Informal Learning Mechanisms	4	5	4	5	4	5	3	3	5	5	2	5	3	5	3	5	3	4	5	5	4	3	3	5	3	4
Initiative taking Propensity	4	6	5	6	5	5	4	4	6	7	2	6	6	7	3	6	3	5	4	5	7	4	4	7	5	5
Internal Communication	3	5	4	5	5	4	3	5	5	6	1	5	6	6	3	5	2	5	4	4	4	6	4	6	5	5
Verbal Communication	2	4	4	5	5	4	1	4	4	5	1	5	5	5	3	5	2	5	2	3	4	4	5	5	5	4
Digital Platform Utilization	5	9	6	9	7	7	5	8	9	8	3	8	7	10	5	9	4	6	5	5	7	6	5	10	6	5
Open AI systems	2	5	4	5	5	4	2	5	5	6	1	5	6	6	3	5	2	5	3	3	5	5	5	6	6	4
Remote work	3	4	4	5	5	4	2	4	4	5	1	5	5	5	3	5	2	5	3	4	5	5	4	5	4	5

At the conclusion of this coding process, four main structural domains were identified, each associated with a range of impacting factors, with some domains containing from 3 to 9 factors. Moreover, certain factors overlap across structural domains, lying in more than one domain in specific instances. This section discusses each domain and its associated factors.

Figure 16 displays the structural domains (selective codes) through Atlas.ti software. To comprehend IPL dynamics within PBOs, it is necessary to delve into these structural domains, as they have a significant impact on the multifaceted process. These domains are not only interconnected but also crucial in devising effective solutions to the problem identified in this study. Each domain encompasses various factors representing the empirical study's findings (axial codes). Within each factor, there are several codes (open codes) concluded from the interview transcripts as explained in the third chapter.
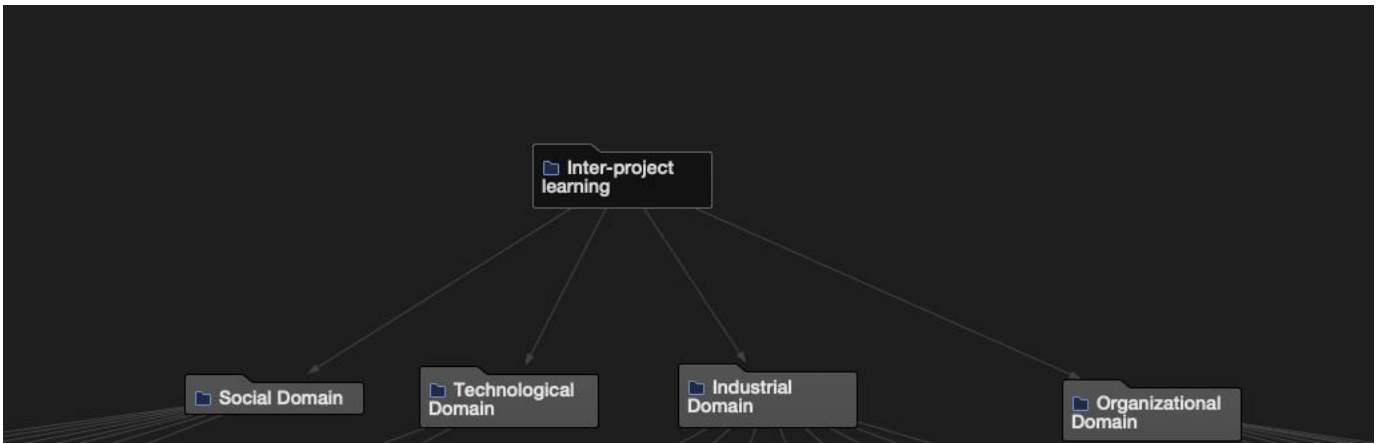
Figure 16 Structural Domains Found in the Empirical Study (Selective codes)

4.5 Emerging Themes and Factors

This section's main objective is to analyse the themes and patterns that emerged during the empirical investigation into inter-project learning (IPL) within project-based organizations (PBOs).

By pinpointing the primary structural domains of the empirical study factors, a comparison with the literature-based hypothesis model can be made. The results of this analysis help to have the full answer to the second sub-question and identify all practical impacting factors. Additionally, the findings of this section help to answer the third sub-question as it determines the interconnections and the potential impact of these factors on the process which helps to answer the main research question.

In the upcoming subsections, each domain is outlined to understand its characters. Within each domain subsection, the factors are also discussed and references from the case study are used to show how and under which context were these factors addressed in the case study.

4.5.1 Technological Domain

In the construction industry, technology has a significant role in fostering knowledge sharing across project teams and learning. Technology acts as a cornerstone for seamless IPL. It automates processes to improve learning and reduce human error, fostering the learning process. Under this domain, digital tools and practices that influence the IPL process and increase the possibility of spreading knowledge among the different teams and project members are outlined. An important example includes the use of digital platforms for this purpose. Additionally, within this domain, the impact of the recent open AI systems revolution is outlined and reviewed to assess its potential benefits in facilitating organizational learning. Furthermore, the discussion includes the impact of remote work on fostering the IPL process. Figure 17 shows the factors within this domain and the codes found for each factor using Atlas.ti software. Moreover, Table 9 presents a comprehensive overview of the frequency of each open code within this domain by indicating the number of times each open code was mentioned in the interviews.

Figure 17 Technological Domain and its Factors

Table 9 Technological Domain Factors Frequency

Axial Code	Digital Platform Utilization		Open AI systems		Remote work	
Open Code	digital platforms to facilitate communication	3	Codification Process difficulties	4	Lack of Interactions due to the remote work	3
Open Code	digital platforms to facilitate learning	7	Using AI to generate platforms that help to exchange knowkledge	5	Unawareness of other people's work	2
Open Code	Evaluation form ineffectiveness	6			Working from home impact	5
Open Code	Increase the attractivensess of evaluation	1				
Open Code	Inefficient information technology	12				
Open Code	infomation power embracement	2				
Open Code	Codification Process difficulties	4				
Total		31		10		10

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4.5.1.1 Digital Platforms Utilization

One impacting factor that has been found in the empirical study is the impact of digital platforms on the IPL process. The significance of these platforms increases in the realm of IPL due to their ability to easily transfer knowledge across projects through the utilized platforms of the organization. Many interviewees agreed that there is always space for improvement when it comes to the platforms used in organizations. The gathered knowledge in the evaluation phase can be presented in a better way to the employees to ensure that everyone can easily be up to date on the mistakes made so that they can learn from them. Many participants have pointed out that having many projects in the organization makes it very difficult for them to check the evaluation forms of all projects. Therefore, presenting these evaluation forms in a better shape can increase the effectiveness of the knowledge exchange process. This factor has correlation with the two barriers "Codification Process Difficulties" and "Inefficient Information Technology" and facilitator "Knowledge Documentation Templates" found in the literature. The correlation can be seen in Figure 30 in Appendix D.

4.5.1.2 Open AI Systems

Another finding from the empirical study is attributed to the recent advancements in open AI systems. Many participants emphasized that integrating open AI systems into the organization's platforms can significantly impact knowledge accessibility as it provides the required information in the shortest time if it is used properly. The organization has already been working to develop its own version of (Chat GPT) which is designed exclusively for its employees (Sweco GPT) in order to make it easier to gain the information they are looking for. This intra-organization chat can only be used internally by the organization's employees and can be utilized as an interactive database. Many participants have suggested using this system to facilitate IPL and knowledge sharing across projects. The main benefit of this system is that it filters the required information for the employees and removes any irrelevant information for efficiency.

One participant has quoted:

"*I was really impressed by the introduced Chat GPT version of our company. It makes it much easier to exchange knowledge across teams in any location or country*."

Furthermore, it was also suggested to integrate these evaluation forms into the system to deal with the issue of tacit knowledge transfer and convert it to explicit and implementable knowledge in other projects. This can be an alternative way to codify the knowledge acquired due to the ability of the organization's version of open AI systems to make knowledge implementable and the possibility of continuously improving over time and having more accurate data.

4.5.1.3 Remote Work

Remote work has significantly shaped organizational landscapes in the post-COVID era (Adekoya et al., 2022). Organizations have recognized their economic advantages and have made remote work a permanent option for employees in many cases. However, this shift has notable implications for communication within project teams and eventually on the IPL process. As many participants noted, remote work affects spontaneous interactions among project and team members, making it more challenging to share knowledge. One participant articulated this, saying, "*I'm a bit frustrated by the current prevalence of remote work. In the office, we had a dedicated project room, facilitating quick collaboration. As a project manager, I could easily check everyone's progress. But now, with people working from home, it's harder to monitor and learn from each other*".

Although the issue appears closely tied to intra-project learning, participants argued that remote work also affects IPL. This limitation primarily emerges from the loss of informal communication opportunities, such as coffee breaks or lunches, where employees from different teams can engage in casual conversations and learn about the activities of other teams. These informal interactions not only build interpersonal relationships but also serve as platforms for knowledge-sharing and trust-building. The factor can also be attributed to the social domain as remote connection can also be part of it.

4.5.2 Social Domain

In the realm of PBOs, the impact of social domain behaviour plays a pivotal role in IPL. The social domain consists of a wide range of natural reactions to share knowledge among employees and learn from them. These reactions can also be attributed to the organization's culture and play a crucial role in ensuring a successful IPL process and overcoming its challenges. Within this theme, there are various factors that have different impacts on the process and are created due to several causes.

Figure 18 shows the factors within this domain and the codes found for each factor using Atlas.ti software. Furthermore, Table 10 presents a comprehensive overview of the frequency of each open code within this domain by indicating the number of times each open code was mentioned in the interviews.
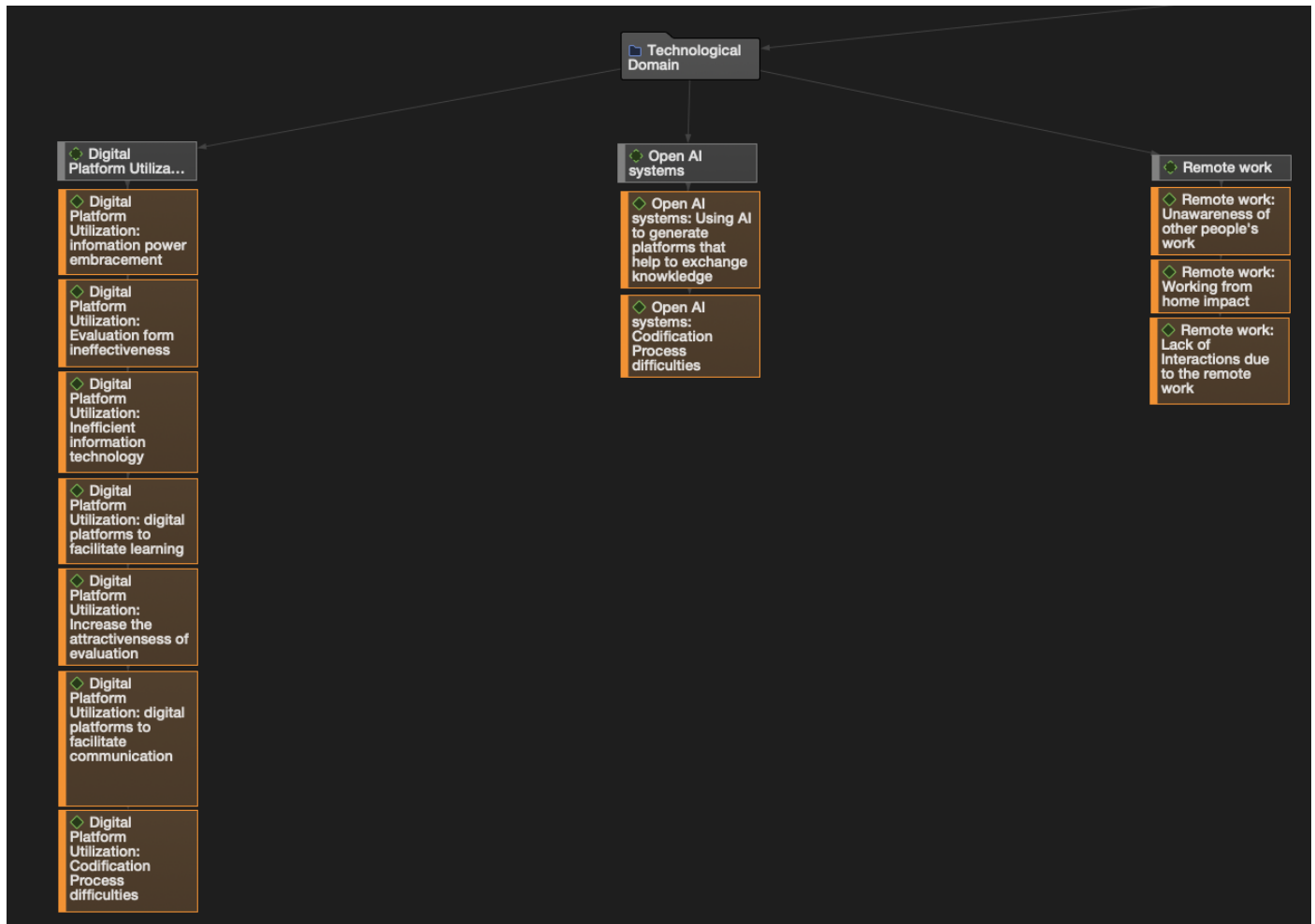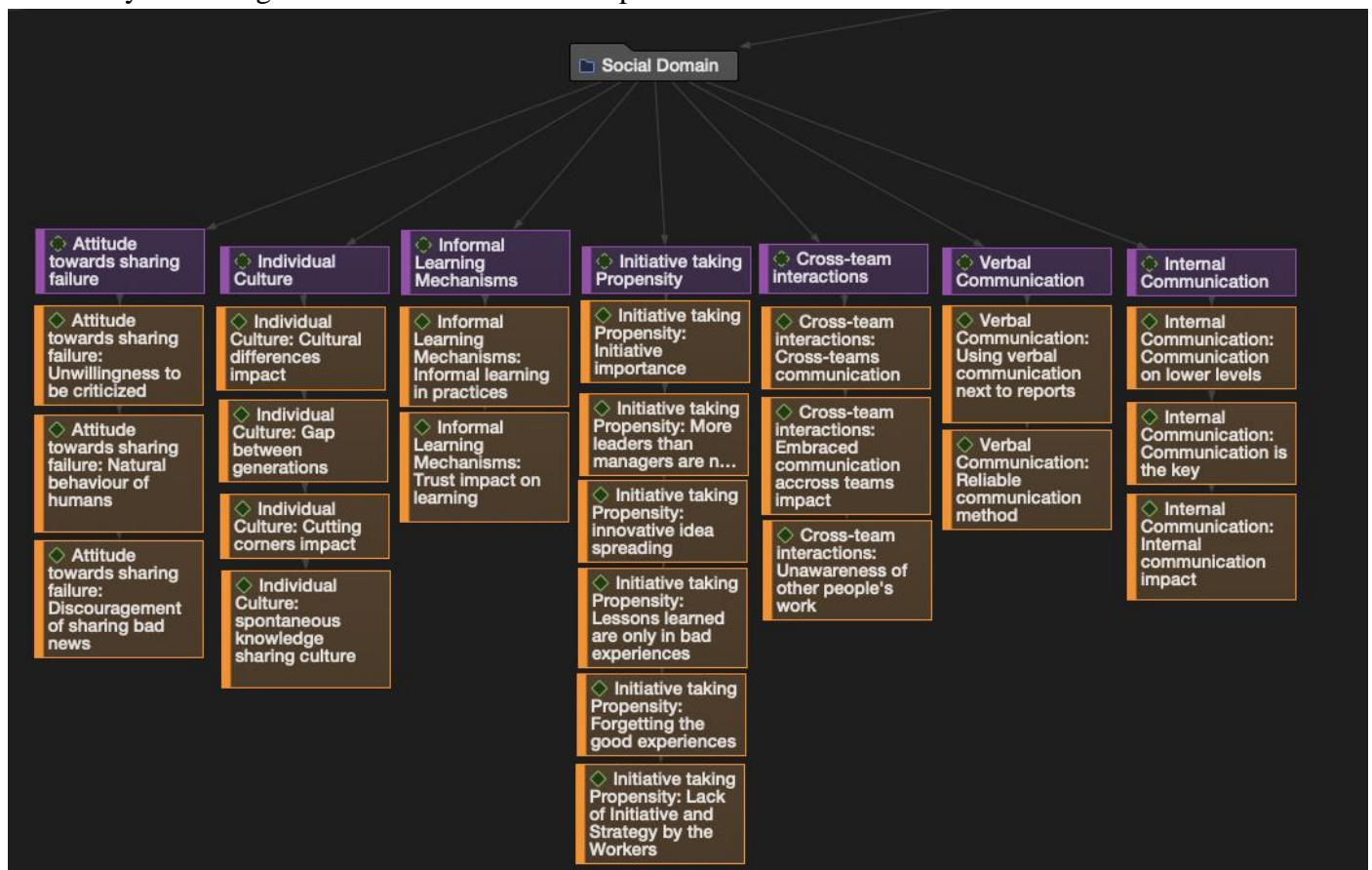

Figure 18 Social Domain and its Factors

Table 10 Social Domain Factors Frequency

Axial Code	Attitude towards sharing failure		Individual Culture		Informal Learning Mechanisms		Initiative taking Propensity		Cross-team interactions		Verbal Communication		Internal Communication	
Open Code	Discouragement of sharing bad news	6	Cultural differences impact	5	Informal learning in practices	10	Forgetting the good experiences	1	Cross-teams communication	11	Reliable communication method	2	Communication is the key	2
Open Code	Natural behaviour of humans	1	Cutting corners impact	1	Trust impact on learning	1	Initiative importance	6	Embraced communication accross teams impact	7	Using verbal communication next to reports	4	Communication on lower levels	2
Open Code	Unwillingness to be criticized	7	Gap between generations	1			innovative idea spreading	1	Unawareness of other people's work	2			Internal communication impact	7
Open Code			spontaneous knowledge sharing culture	2			Lack of Initiative and Strategy by the Workers	7						
Open Code							Lessons learned are only in bad experiences	1						
Open Code							More leaders than managers are needed	1						
Total		14		9		11		17		18		6		11

4.5.2.1 Attitude towards Sharing Failure

Within the literature review, barriers to sharing failures have been outlined, most notably the "Unwillingness to be criticized" and "Discouragement of sharing bad news". However, when transitioning from theory to practice in the empirical study, these barriers coalesced into a singular overarching factor: the attitude towards sharing failure. Employees' reluctance to disclose failures is often rooted in a desire to evade criticism, reflecting a deeply ingrained human instinct to avoid negative feedback. The majority of interviewees agreed that it is a natural human behaviour that organizations cannot easily mitigate, apart from providing a safe environment that reassuringly encourages employees to share their failures. A participant has quoted:

"Things that didn't go well are very difficult to share, that you just say, well, I didn't do that well, because I hadn't prepared it properly. Or I didn't do the check properly. It is something that is not related to the organization, it is more related to humans' nature."

Building on this sentiment, another interviewee added:

"But no one is going to flaunt themselves. Oh, guys, I failed here. We talk about this and that, because sometimes there are quite financial consequences."

The unanimous consensus among participants was that fostering a safe environment is the best approach is one that provides room for failure and mistakes. Moreover, while evaluation forms present an avenue to share failures, the current design restricts their usage to project managers, inhibiting broader organizational learning from failures. Figure 31 in Appendix D shows the correlation between this factor and the barriers mentioned.

4.5.2.2 Individual Culture

The inherent diversity in PBOs, characterized by employees from varying backgrounds, disciplines, and nationalities, inevitably influences their attitude towards learning and knowledge sharing. One interviewee provided a poignant illustration of this impact:

"In a multinational project, we engaged employees from several countries, the differences in their approaches to knowledge exchanging, learning, and interacting were palpable.".

This example underscores the profound influence of an individual's culture on their learning activities. This factor correlates with the "Cultural differences" barrier found, as detailed in Figure 32 in Appendix D.

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Yet, the cultural impact is complex and multifaceted. For example, a recurring theme from the interviews highlighted a perceived divide between employees of differing experience levels and positions. Some interviewees noted that less experienced employees, or those in junior roles, might hesitate to share insights, fearing it might be perceived as out of place or inappropriate. This applies to all organizations in the industry, not only the organization where the case study was conducted. This dynamic is often rooted in cultural norms, which vary among the different countries and generations. An interviewee remarked, "*For the younger generation, it is more challenging to actually point out possible mistakes to older people, which is quickly seen as inappropriate action.*"

4.5.2.3 Informal Learning Mechanisms

In PBOs, informal and spontaneous interactions, like learning from a colleague's mistake or chatting during coffee breaks, often play a crucial role in learning. These interactions are significant not only because of their ability to facilitate knowledge sharing and promote learning. In addition, they help to establish a level of trust between team members resulting in a more open and safer environment. An interviewee eloquently captured this sentiment, stating: "*I see a lot of added value in spontaneous meetings and informal knowledge transfer between different teams.*"

Informal contact with employees from different disciplines fosters trust, encouraging a collaborative culture. When employees are well-informed about the activities of others, it can also help to overcome many barriers to successful IPL within PBOs. This factor can specifically help to overcome the barriers "lack of trust" and "Lack of interaction," as shown in Figure 33 in Appendix D. The empirical research underscores the role of informal communication in creating an atmosphere conducive to relationship-building and trust solidification among employees.

4.5.2.4 Initiative Taking Propensity

All of the case study's participants agreed that improving IPL is a process that requires mutual effort from both the organization and the project members. While arranging training and organizational support are crucial, it is the individual's proactive approach that can facilitate the learning process. The organization can provide all the techniques and maximize efforts to achieve the best IPL practices. However, without the initiative of the employees, this is unachievable. Each employee should have the responsibility to exchange knowledge with employees from other teams and projects. It is a symbiotic relationship, where the organization's aim to facilitate learning meets the individual's eagerness, which can foster a collaborative environment for learning. The organization has the duty to motivate its employees to take the initiative by providing a safe environment to learn from made mistakes and to not be afraid of that. Moreover, to incentivize initiative, two participants have suggested that organizations could propose a recognition system where employees are encouraged to take charge of knowledge exchanging and teaching other employees about things that they learned. By recognition system, employees can be formally acknowledged and rewarded for being active in sharing knowledge and interacting with other employees. Additionally, feedback loops can also be a solution, allowing employees to voice their suggestions and insights across the organization.

One participant stated regarding that:

"*As an organization, you must offer that opportunity and then personally take initiative to facilitate the learning process.*"

Figure 34 in Appendix D shows the correlations between this factor and the barrier found in the literature "Lack of initiative". This factor can also be attributed to the organizational domain due to the organization's role in fostering initiative.

4.5.2.5 Cross-team Interactions

Since the main goal of this study is improving IPL, the cross-team interactions factor is crucial in achieving this aim. All interviewees agreed that interaction and communication on different team levels have room for

improvement, necessitating strategic measures to improve knowledge sharing across teams and optimize the utilization of expertise across various disciplines. One interviewee remarked:

"I notice that employees of different teams are not sufficiently communicating to make use of the potential expertise and experience of each other".

The interviewees also stressed that the size of project teams complicates the situation by making knowledge sharing and learning more challenging since most interactions remain within individual teams. Another participant added:

"The interaction between departments, disciplines, and project teams is very limited and it needs to be empowered".

This factor can be attributed to the two barriers "lack of interactions" and "Unawareness of other people's work" as it heightened the interaction level across teams and can increase other employees' awareness of the other projects conducted by other teams. Figure 35 in Appendix D shows the correlations between the factors found in the literature and empirical studies.

Another important component of interactions across teams is the effective communication between team managers of teams from different disciplines. It can also play a pivotal role in facilitating knowledge sharing and learning across different projects. This comes due to the team manager's task to facilitate learning and exchange knowledge with other team managers. Additionally, in PBOs, the team manager is often the primary actor who has the responsibility to establish connections with other teams, emphasizing their crucial role in cross-team learning and knowledge sharing.

4.5.2.6 Verbal Communication

In addition to the factors already identified as impacting IPL, the form of communication was also found to significantly influence its effectiveness. Four participants underscored the importance of verbal communication, suggesting that it can be more impactful than written communication in specific cases. They argued that verbal interactions offer smoother communication and the immediacy of necessary questions. Face-to-face interactions, inherent to verbal communication, provide the possibility for real-time feedback that can be more effective than written feedback and can also strengthen the retention of shared knowledge. Additionally, it was found that verbal communication can also result in better team collaboration, improving overall project performance. Furthermore, as digital platforms continue to evolve, organizations should find innovative ways to replicate the advantages of verbal communication. Consequently, the prevalence of remote work may inhibit effective verbal communication, as remote employees often resort to emails and reports for their communications. This factor correlates with the barrier "Lack of interactions" as shown in Figure 36 in Appendix D.

4.5.2.7 Internal Communication

Internal communication can be defined as all communication forms within one organization and is often synonymous with intra-organizational communication (Tkalac Verčič et al., 2012). It encompasses information exchange among the members of the organization. Having a solid internal communication system can ensure a seamless flow of information, resulting in better IPL. The respondents have emphasized the crucial role that communication between project members of different roles plays in facilitating learning and knowledge-sharing within the organization. Moreover, with the continuously developing project dynamics, it becomes essential to create open channels for exchanging knowledge and insights within the project teams. One participant illustrated this by stating, "*In my team, I can say that team managers don't sufficiently communicate with project leaders which means that the project leaders have limited chances to learn and share their knowledge with other project leaders*". This factor is correlates with the barrier "Poor internal communication" as shown in Figure 37 in Appendix D. This factor can also lie in the organizational domain as it can be empowered by the organization's mechanisms.

4.5.3 Organizational Domain

Within the context of PBOs, the structure of the organization appears to have a major impact on the process of IPL. It encompasses factors that result from the organization's formal design and mechanisms. Under this theme, there are many factors that influence the process that are attributed to the organizational domain. The main character of this domain is that all factors within it can be deliberately strategized by the organization's leadership to facilitate IPL. Additionally, organizations have to consider these factors from a more collective point of view as each factor requires a collective collaboration between all organization members.

Figure 19 shows the factors within this domain and the codes found for each factor using Atlas.ti software. Furthermore, Table 11 presents a comprehensive overview of the frequency of each open code within this domain by indicating the number of times each open code was mentioned in the interviews.
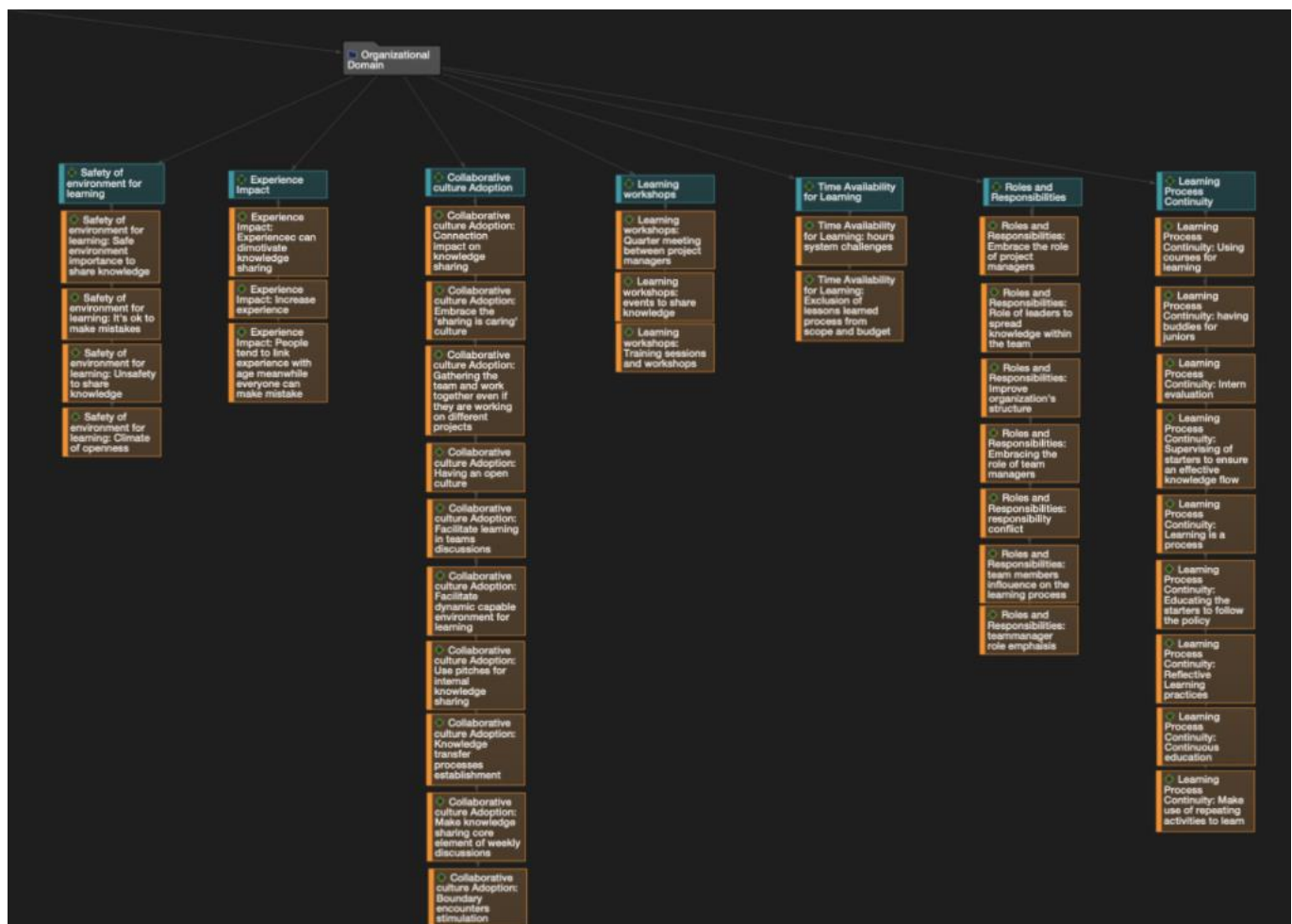
Figure 19 Organizational Domain and its Factors

Table 11 Organizational Domain Factors Frequency

Axial Code	Safety of environment for learning		Experience Impact		Collaborative culture Adoption		Learning workshops		Time Availability for Learning		Roles and Responsibilities		Learning Process Continuity	
Open Code	It's ok to make mistakes	2	Experiencec can dimotivate knowledge sharing	1	Connection impact on knowledge sharing	5	events to share knowledge	1	Exclusion of lessons learned process from scope and budget	11	Embrace the role of project managers	6	Continuous education	4
Open Code	Safe environment importance to share knowledge	13	Increase experience	2	Embrace the 'sharing is caring' culture	4	Quarter meeting between project managers	8	hours system challenges	7	Embracing the role of team managers	16	Educating the starters to follow the policy	8
Open Code	Unsafety to share knowledge	2	People tend to link experience with age meanwhile everyone can make mistake	2	Facilitate dynamic capable environment for learning	5	Training sessions and workshops	3			Improve organization's structure	4	having buddies for juniors	2
Open Code	climate of Opennes	3			Facilitate learning in teams discussions	3					responsibility conflict	1	Intern evaluation	3
Open Code					Gathering the team and work together even if they are working on different projects	1					Role of leaders to spread knowledge within the team	4	Learning is a process	1
Open Code					Having an open culture	2					influence on the learning	1	Make use of repeating activities to learn	1
Open Code					Knowledge transfer processes establishment	3					teammanager role emphaisis	7	Reflective Learning practices	1
Open Code					Make knowledge sharing core element of weekly discussions	2							Supervising of starters to ensure an effective knowledge flow	6
Open Code					Use pitches for internal knowledge sharing	1							Using courses for learning	1
Open Code					Boundary encounters stimulation	4								
Total	20				30		12		18		39		27	

4.5.3.1 Safety Environment of Learning

In the realm of IPL within PBOs, having a safe environment to exchange knowledge and announce the failures to avoid in the future is a key factor to have a successful learning process. A safe environment can encourage project members to be more transparent to express their opinions about the improving points and it can promote a culture of trust among the project members. When project and team members feel more secure in expressing their thoughts and experiences, the knowledge exchange process is more likely to be improved. Additionally, it can reduce the fear of committing mistakes and give the opportunity to think out of the box to come up with creative ideas. This factor correlates with the facilitator "Climate of openness" found in the literature as shown in Figure 38 in Appendix D All interviewees have emphasized that it is something that already exists in the organization. However, there is always room for improvement to foster continuous learning across projects and teams. Some interviewees have indicated that a safe environment can be mostly promoted by the team managers as quoted:

"*One important way to encourage team members to exchange knowledge can be achieved by offering a safe environment, and this is one important task of the team managers.*"

4.5.3.2 Experience Impact

In the literature study, experience appears to have a positive impact on learning as it increases expertise in the field by the experienced members aiding the junior employees to get new knowledge and learn from them. However, the empirical study revealed a contradictory perspective. An increased level of experience in the field can hamper the establishment of an open environment conducive to effective learning in some cases. A participant has stated regarding that:

"*Anyone can make mistakes, even if they are in the field for many years. Juniors should also not be reluctant to share knowledge with experienced colleagues and not expect them to know everything in the field.*" Figure 39 in Appendix D. shows the correlation between this factor and the facilitator "Increase project managers' experiences". This underscores the need for organizations to find a balance between their experienced and

junior employees. On one hand, it facilitates learning from the seniors' experience. On the other hand, it results in a situation where experience levels and positions do not pose a barrier to interacting with each other. Promoting a safe environment to open dialogue in the organization is a potential strategy to bridge disparities in experience levels.

4.5.3.3 Collaborative Culture Adoption

A collaborative culture in IPL within PBOs emphasizes fostering an environment conducive to knowledge exchange and experience transfer (Nugroho, 2018). The empirical study revealed that adopting a collaborative culture can be instrumental in achieving organizational goals. In addition to that, it encourages employees to feel more comfortable towards mutual learning and adopting a 'sharing is caring' mindset. This means that the focus is not solely on acquiring knowledge from others, but also on disseminating knowledge and experiences to inspire reciprocity.

A participant has stated regarding that:

"*As individuals, we are a part of the organization, and I believe that we should think about giving as much as we think about receiving".* In the literature study, the facilitator "knowledge transfer process establishment" is closely aligned with this factor as it also aims to create an environment where the organization's members are continuously collaborating to exchange knowledge. "Boundary encounters simulation" facilitator aligns with promoting a collaborative culture, leading to more fluid interactions during learning and knowledge exchange as everyone aims to learn from others and spread knowledge. Figure 40 in Appendix D shows the correlation between this factor and the facilitators mentioned already.

4.5.3.4 Learning Workshops

One activity that the organization undertakes is organizing periodic workshops for project managers across various disciplines and locations to discuss lessons learned and potential areas of improvement for both completed and ongoing projects. During this meeting, every project manager is encouraged to share knowledge from projects they were involved in to inform colleagues of insights that might be beneficial for their respective projects. All interviewees concurred on the value of these workshops for knowledge sharing with peers and gaining fresh insights on enhancing performance. However, it is still restricted to project managers only and it is not ultimately exploited. There's a need for organizations to conduct more inclusive workshops, which can be achieved by encompassing employees from diverse disciplines and roles, to enhance knowledge exchange and bolster IPL. This factor aligns with the facilitator "Training sessions and workshops" as shown in Figure 41 in Appendix D.

4.5.3.5 Time Availability for Learning

Time constraints present a significant challenge to effective IPL within PBOs. The inherent strict timelines of PBOs leave employees with limited opportunities for learning activities. The primary responsibility of project members of deliver projects on time and within budget, consequently leaving limited room for reflection, evaluation, exchange of knowledge, and learning processes. The time shortage can hinder the process of IPL in several manners. It forces the employees to dedicate time for knowledge sharing and learning as the project-specific tasks have the highest priorities over learning activities even though these activities can bring more value to the organization in the long run. The relationship between this factor and the barrier "time shortage for lessons learned" is depicted in Figure 42 in Appendix D. Many interviews mentioned that a lack of motivation to reflect on completed projects and an eagerness to initiate new ones. Additionally, it is one of the results of the working hours system and the fact that these learning hours can affect the employees' overall performance.

4.5.3.6 Roles and Responsibilities

This factor is attributed to the roles of individuals from different positions within the organization. This factor underscores the importance of team members' responsibilities towards learning and knowledge exchange across projects. Effective IPL requires full commitment from employees as each one has a distinct role in improving it. A clear comprehension of roles and responsibilities can enhance the process of IPL within the organization.

Conflict in responsibilities emerged as a primary challenge from the empirical study. Since all interviewed participants were project managers, some of them agreed that learning across projects and knowledge exchange processes are processes that lie in the team managers' responsibilities. On the one hand, they stated that their main objective is to deliver projects on time, within budget, and with the required level of quality. Facilitating learning across projects and overseeing knowledge exchange is not necessarily within their primary duties. On the other hand, as was mentioned in section '4.5.2.4 Initiative taking Propensity', all team members, including team managers, need to collaborate to foster IPL as it is a process that needs to be dealt with collectively. This creates a conflict between the responsibilities of different positions in the organization. Additionally, three participants agreed that there should be an ultimate commitment from employees of different positions such as project managers, team managers, and project leaders in order to have the most effective learning process. As one participant noted:

"Collaborative effort for effective learning should ideally involve not only team managers but also project leaders and project managers. It should not be perceived as a routine item on a manager's checklist, but rather as a shared commitment to a comprehensive approach".

4.5.3.7 Learning Process Continuity

Maintaining continuity in the learning process is pivotal for the success of IPL. This factor is correlated with the facilitators "Continuous education", "Reflective learning practices", and "Increase project managers' experiences" as shown in Figure 43 in Appendix D. The essence of this factor arises from the fact that learning and knowledge exchange processes are continuous processes, meaning that it is a closed loop as the room for improvement always exists. A continuous process of learning is a very significant process in the construction industry due to the non-stop development as indicated before. Moreover, this factor significantly enriches the IPL process by promoting a conducive learning environment, ensuring employees remain receptive to acquiring new knowledge and insights. As one interviewee expressed:

"You cannot assume that the learning process will come to the day where it has no added value. We always learn from experiences and gather new knowledge and insights that improve our performance.".

4.5.4 Industrial Domain

The empirical study highlights how the unique characteristics of the construction industry within PBOs profoundly influence the IPL process. This is attributed to the complex nature of construction projects, encompassing various stakeholders from diverse disciplines. Each stakeholder presents distinct challenges. Several factors, inherent to the industry, shape the IPL process. These factors, stemming from the industry's intricacy, may be unique and not prevalent in other sectors. Furthermore, since the complexity of construction projects is continuously increasing, the urgency for effective IPL becomes more important to improve performance. Several factors within this domain influence the IPL process. While some of these factors are recognized in the literature, others emerged from the empirical study. Figure 20 shows the factors within this domain and the codes found for each factor using Atlas.ti. Furthermore, Table 12 presents a comprehensive overview of the frequency of each open code within this domain by indicating the number of times each open code was mentioned in the interviews.

Figure 20 Industrial Domain and its Factors

Industrial Domain

- **Fragmentation Level**
  - Fragmentation Level: Emphasizing a mutual method of work
  - Fragmentation Level: Better classification of lessons learned
  - Fragmentation Level: Fragmentation information
  - Fragmentation Level: Ineffectiveness of reports
  - Fragmentation Level: Fragmented lessons learned
  - Fragmentation Level: Unstructured information
- **Project-based Nature**
  - Project-based Nature: Projects have mutual acitivities
  - Project-based Nature: Temporary Nature of Projects
  - Project-based Nature: PBOs ability to facilitate learning
  - Project-based Nature: project-based organizations's difficulty
  - Project-based Nature: Involved leadership
- **Location Differences**
  - Location Differences: Knowledge integration accross the organization
  - Location Differences: Knowledge sharing in different locations
  - Location Differences: The on-site project characters
- **Tacit Knowledge Exchange**
  - Tacit Knowledge Exchange: Project Uniqueness
  - Tacit Knowledge Exchange: Knowledge Loss
  - Tacit Knowledge Exchange: Getting the right information
  - Tacit Knowledge Exchange: Tacit Knowledge Transfer
- **Environment Competitiveness**
  - Environment Competitiveness: Time shortage for lessons learned
  - Environment Competitiveness: Competitive Environment
  - Environment Competitiveness: Strategic misalignment
  - Environment Competitiveness: Neglecting the importance of lessons learned
- **Resource Allocation for Learning**
  - Resource Allocation for Learning: Learning hourse are uninvoicable
  - Resource Allocation for Learning: unbeneficial activity
  - Resource Allocation for Learning: Numbers driven organization
  - Resource Allocation for Learning: Exclusion of lessons learned process from scope and budget
- **Specialization**
  - Specialization: Impact of the specialisation on the learning process
- **Project Uniqueness Level**
  - Project Uniqueness Level: Assigning someone to be responsible for data collection
  - Project Uniqueness Level: Project size impact
  - Project Uniqueness Level: Using hashtags to classify the knowledge
  - Project Uniqueness Level: Projects are human work
  - Project Uniqueness Level: Project Uniqueness
- **Communication with the client**
  - Communication with the client: Improve communication methods with clients
  - Communication with the client: Facilitate knowledge sharing with the clients
  - Communication with the client: Rely on client's feedback for improvement
  - Communication with the client: Use clients' experiences to improve performance
  - Communication with the client: Multiple advocates

Table 12 Industrial Domain Factors Frequency

Axial Code	Fragmentation Level		Project-based Nature		Location Differences		Tacit Knowledge Exchange		Environment Competitiveness		Resource Allocation for Learning		Specialization		Project Uniqueness Level		Communication with the client	
Open Code	Better classification of lessons learned	2	PBOs ability to facilitate learning	2	Knowledge integration across the organization	5	Getting the right information	5	Competitive Environment	4	Learning hourse are uninvoicable	4	Impact of the specialisation on the learning process	13	Assigning someone to be responsible for data collection	4	Facilitate knowledge sharing with the clients	1
Open Code	Emphasizing a mutual method of work	5	project-based organizations's difficulty	4	Knowledge sharing in different locations	12	Knowledge Loss	6	Neglecting the importance of lessons learned	7	Numbers driven organization	3			Project size impact	2	Improve communication methods with clients	3
Open Code	Fragmentation information	9	Projects have mutual acitivities	1	The on-site project characters	1	Project Uniqueness	1	Strategic misalignment	2	unbeneficial activity	2			Projects are human work	2	Rely on client's feedback for improvement	1
Open Code	Fragmented lessons learned	2	Temporary Nature of Projects	3			Tacit Knowledge Transfer	12	Time shortage for lessons learned	14	Exclusion of lessons learned process from scope and budget	11			Using hashtags to classify the knowledge	1	Use clients' experiences to improve performance	4
Open Code	Ineffectiveness of reports	4	Involved leadership	2											Project Uniqueness	4		
	Unstructured information	6																
Total		22		10		17		24		27		8		13		10		9

4.5.4.1 Fragmentation Level

Empirical research underscores the influence of fragmentation on the IPL process, particularly within the industrial domain. It highlights the disconnection between divisions within PBOs. The case study reveals that fragmentation hampers cross-project learning by causing teams to operate in isolation. Fragmentation can create silos, making it difficult for project members to have access to the right information at the right time. This leads to ineffective knowledge transfer and elevates the risk of failure in IPL. Furthermore, fragmentation can result in misunderstandings and reduce the chance of team synergy. One participant has stated:

"I just did a project where I had a structural engineer in office X, but another structural engineer is from office Y, which made the process more challenging as these two have to collaborate together on the same design".

Another participant commented on the challenges posed by varying specializations:

"While one constructor specializes in concrete the other in steel work. When collaboration and knowledge exchange are required between such diverse specializations, how can it be effectively achieved?"

These statements underscore the detrimental impacts of fragmentation on both learning and knowledge exchange processes among project teams. Figure 44 in Appendix D shows the correlation between this factor and the barriers "Fragmentation", "Fragmented lessons learned", and "Unstructured information".

4.5.4.2 Project-based Nature

In the case study, it was found that the project-based structure has significant implications for the process of IPL. The inherent diversity of projects and the ability to interact with numerous clients from different backgrounds, sizes, and industries boost the possibility for knowledge acquisition and expertise growth. Additionally, such a structure provides the opportunity to have a broader view of the market dynamics and brings valuable insights from various projects encounters. Consequently, the specialization within different disciplines can be effectively leveraged to facilitate deeper knowledge acquisition and harness the structural complexity to broaden the perspectives of organizational members. Every project can serve as a new chapter of learning and exchanging valuable knowledge that contributes to organizational performance. This dynamic interplay of diverse projects, client interactions, and specialization fosters a rich environment for continuous IPL and knowledge enrichment within the organization. This factor has correlations with one barrier and two facilitators found in the literature "Temporary nature of projects" and "Involved leadership" respectively as shown in Figure 45 in Appendix D.

4.5.4.3 Location Differences

Since the organization has offices in different locations across multiple countries, knowledge sharing between these locations emerged as a primary challenge in the case study's results. Differences in location and time zones can exacerbate communication barriers. The impact is similar to the impact of remote work. Engaging with project members based in various offices, especially in different countries, amplifies the challenges of disseminating knowledge and facilitating mutual learning. An interviewee has stated that regarding this issue: "*It is difficult for the organization to share the acquired knowledge across the different countries and multiple offices.*"

Furthermore, some interviewees have suggested that having a multi-location meeting can empower the knowledge-sharing process and IPL across teams with the same disciplines. Robust collaboration tools using technological developments can be crucial to overcome this barrier. Figure 46 in Appendix D shows the correlation between this factor and the barrier "On-site project nature".

4.5.4.4 Tacit Knowledge Exchange

In the context of IPL, tacit knowledge transfer is one crucial barrier in PBOs. Tacit knowledge often needs a conducive environment to be shared as it is mostly context specific. The literature has already identified this factor, noting that acquired knowledge often resides within the minds of employees. Therefore, it becomes more challenging to exchange knowledge and eventually learn from other project teams. The challenge with tacit knowledge can be attributed to various factors such as fragmentation, knowledge loss and project nature. The significance of tacit knowledge arises from its ability to improve IPL through informal learning practices as it can be shared through practices, like the verbal communication mentioned earlier. In the case study, all participants concurred that transferring of tacit knowledge poses a challenge in the industry. Furthermore, no specific technique or method has been suggested to overcome this barrier other than improving communication and embracing a collaborative culture. Figure 47 in Appendix D shows the correlation between this factor and the barriers "Tacit knowledge transfer" and "Knowledge loss".

4.5.4.5 Environment Competitiveness

In the construction industry, many PBOs have the same expertise level and each one aims to get as many as possible projects from the clients which creates a very high level of competitiveness. This competition can sometimes overshadow the value of long-term learning over the gains from short-term projects. This results in lower offered hours to execute the projects and therefore, learning, knowledge-sharing, and evaluation activities are barely given a very limited amount of time and the organization has no other alternative than

going with the market and not including the learning and evaluation hours in the process to have fewer hours needed. However, the participants underscored the importance of learning on the terms as it allows the organization to be better prepared to navigate challenges.

An interviewee stated:

"We often work in competition with other organizations, so if we have to offer a price, if we think of the average time needed for a project. Suppose the project is or you have a bandwidth between 800 and 1000 hours, but you are in a competitive environment, then you will always bid for 800 hours." Figure 48 in Appendix D shows the correlation between this factor and the barrier "Competitive environment".

4.5.4.6 Resource Allocation for Learning

The highly competitive environment of the industry is directly impacting the allocation of resources, specifically allocating time to reflect and learn. This factor is intrinsic to the nature of PBOs. It is directly attributed to the found barriers in the literature "exclusion of learning from scope and budget" and "neglecting the importance of lessons learned" as shown in Figure 49 in Appendix D. Achieving a balance between resource allocation for learning and doing the required work is a common struggle for PBOs. In PBOs, hours allocated to clients' projects are more significant because they contribute directly to billable hours. In contrast, time spent on learning and knowledge exchange is less quantifiable. A high billing ratio for an employee signifies their value to the organization, which, in turn, can lead to decreased motivation for investing time in learning and sharing knowledge with colleagues.

Furthermore, clients are primarily concerned with the outcomes of their specific projects and may allocate hours for learning if it benefits their project directly. This phenomenon can also be influenced by the competitive nature of the industry. To secure sufficient projects, organizations often need to minimize the allocated hours in the tender phase, leaving limited room for reflection and learning within the project scope. This leaves very little room for dedicated hours for learning and reduces the possibility of having the maximal exploitation of post-project evaluation. All interviews have emphasized the impact of not including the learning activities in the project's scope and budget. One implication mentioned in the interviews is that learning hours are often sacrificed when additional activities arise. This highlights how learning processes are given the least priority by both the client and the organization.

Furthermore, to address this issue, it was suggested that meaningful change could come only from adjusting the organization's current policy to prioritize learning, even if it may reduce short-term profits term. One participant stated:

"When other things require priority, knowledge sharing and learning are often the first items on the bill that will be sacrificed". The participants concurred that organizations should consider the long-term benefits that continuous learning can offer. This can be achieved by incorporating learning activities into regular working hours.

4.5.4.7 Specialization

This factor was not found in the literature, but it has been underscored by the majority of the interviews of the empirical study. It was found that the variety of disciplines in PBOs has a pivotal role in IPL. The impact of specialization can be classified as multifaceted. On the one hand, each discipline's specific specialization enhances efficiency in learning between team projects. It allows the project members to learn about new disciplines and increase their expertise.

On the other hand, it can lead to a high level of fragmentation and an ineffective knowledge-sharing environment as project members are more focused on their specific domains. This can hinder the process of IPL as knowledge sharing becomes less prevalent and project members may feel less motivated to interact with members from different disciplines. In the realm of IPL, specialization essence often functions as a two-edged sword. While diversity in PBOs can foster creativity and innovation, it can create silos that restrict

seamless knowledge exchange. Bridging the gap between the specializations and facilitating a collaborative culture is key to exploiting the benefits of specialization.

One interviewee has stated:

"The challenge of learning across teams is due to the fact that each discipline always has a slightly different approach, and therefore, it becomes more difficult to work together."

Some interviewees suggested setting specific dates for employees from different disciplines to work together, regardless of their specialization. This can also help project members to be more familiar with what others do and exchange knowledge with them.

4.5.4.8 Project Uniqueness Level

Project uniqueness is a characteristic that significantly influences the process of IPL within PBOs. Each project has its own distinct complexities, activities, challenges, and requirements. This uniqueness makes knowledge acquisition extremely challenging, as the knowledge acquired from one project may not be applicable to others. This factor has emerged in the literature as the barrier "Project Uniqueness" and barrier "knowledge implementation inefficiency" as shown in Figure 50 in Appendix D. Four participants believe that the influence of this factor can be partially overcome by designating someone to convert acquired knowledge into actionable insights for future projects. They noted that the current 'lessons learned' evaluations focus more on assessment than learning. One of these participants has quoted: *"There should be a designated person responsible for extracting knowledge from the evaluation forms to ensure its relevance and active engagement with team members."*

However, two participants argued that the unique nature of projects should not be viewed solely as a barrier. Instead, it should be embraced to open new horizons to foster a continuous learning culture among the project teams and motivate them to improve their expertise and better deal with complex projects. To further support this perspective, PBOs can establish a centralized platform that can store unique learnings from projects, making them actionable for future endeavours.

4.5.4.9 Communication with Client

In PBOs, the relationship with the client is not merely essential for ensuring a steady stream of new projects but it is also a valuable source of learning to improve performance. Five interviewees underscored the importance of leveraging client input as a mechanism for IPL. Transparent and deep communication with the client results in more realizing of the performance as the client will assess the process as an external party and their experience might be also exploited to gain knowledge that will affect IPL and make project teams more open to learn from each other and to exchange knowledge. However, the interviews show that there is an over-reliance on the client to gather feedback and the client gives feedback only in case there is something going in a not good way which hampers the ability to learn from the good experience and build on them for the future project and exchange the acquired knowledge with other project teams. One participant has stated:

"I can confirm that the process of learning from positive experiences is compromised due to the reliance on feedback from only unsatisfied clients.". This factor correlates to the facilitator "Multiple advocates" shown in Figure 51 in Appendix D. The facilitator helps to consider multiple perspectives from actors in different positions.

4.5 Barriers and Facilitators

The structural domains and factors outlined in the previous section identified the key factors influencing the process of IPL within PBOs. Additionally, the section showed the distinction between the literature and the empirical findings. In the literature, the majority of the factors appear as barriers or facilitators. Some of them may hamper others, while some can positively influence others and foster the process. A significant observation that can be taken from the empirical study compared to the literature is that the factors impacting

the process can be classified in a more practical manner. All factors impacting the process can be posed as a barrier or a facilitator influencing the process. It's entirely depending on the context in which they are utilized. Therefore, a significant deviation from the hypothesis model in Chapter 2 is that there is no distinction between barriers and facilitators when it comes to the empirical findings. This can be reasoned by the fact that organizations consider the process of improving inter-project learning by utilizing all potential tools and techniques and view them as facilitators although they can emerge in the field as barriers in many cases. Thus, the findings from the empirical study can be seen as factors that, depending on their utilization, can either facilitate or hinder the process. However, they can act as a barrier if the organization fails to utilize them.

4.6 Influencing Factors

In the literature study, there were two pivotal factors identified that influence the process of IPL within PBOs. These factors were 'Dynamic Capabilities' and 'Redundancy'. These factors are unlike the identified barriers and facilitators found in the literature as their impact on the process was ambiguous. Their impact was found to vary significantly depending on the context, necessitating a deeper examination through the empirical study.

On the one hand, during the case study, empirical evidence has been gathered from the interviewees' insights. All respondents emphasized that creating a safe environment for the organization's employees can increase the likelihood of fostering a dynamically capable environment, thereby enhancing the processes of inter-project learning. In such an environment, organizations can be better equipped to refine, iterate, and evolve their current approaches, creating a cascading effect on the inter-project learning process across projects with diverse disciplines. For this factor, it can be shown from the results that it appears in two found factors "Safety of Learning Environment" and "Collaborative Culture Adoption" as these two result in a dynamic capable environment of learning when it comes to learning practices.

On the other hand, the role of 'Redundancy' emerged multifaceted as different approaches were introduced. Many interviewees agreed on the fact that spreading the same knowledge through different methods will ensure a better knowledge-exchanging environment and will enhance the chance of having successful inter-project learning. However, some interviewees indicated the potential implications of doing that as it can lead to information overload and dilute the focus of employees due to the extra time consumption without a guaranteed value in return, Furthermore, it could lead to employee skepticism or disengagement, potentially resulting in the opposite of the intended outcome. For this factor, the factors found in the case study "Open AI systems" and "Digital platforms" are the factors that can replace this factor as these two aim for effective knowledge reach by employees without the need to consume extra time to duplicate the same information.

4.7 Impact on Organizations

The findings from the empirical study suggest that the impact of factors impacting IPL within PBOs is multifaceted. The empirical data reveal a holistic and interconnected landscape where each factor can influence other factors and not only have multiple impact types. As a result, many factors are multi-dimensional in nature, collectively affecting the effectiveness of organizational learning.

A practical example can be given from one factor that was found in both literature and empirical studies is the factor "Attitude towards sharing failure" or the barriers found in the literature study "Discouragement to share failure" and "Unwillingness to be criticized". The empirical study shows that it has an impact on the entire process of inter-project learning. The emergent view is that influencing factors are interconnected to shape the inter-project learning process. Many factors are interconnected and affect each other and eventually impact

the collective process. Therefore, the framework will illustrate the interconnections between factors to provide a more comprehensive understanding of how these various factors collectively impact the process.

4.8 Factors interconnections

The initial premise of the research was to dissect the impacting factors into distinctive elements and categorize them based on their dimensions. However, the empirical study's findings have shifted this approach towards a more practical approach that focuses on recognizing the web of intricate relationships among various factors. The case study found that many factors influence other factors. This influence can either foster or hamper other factors. Table 13 in Appendix E illustrates the various relationships between the different factors with a brief explanation. It shows the interconnections between factors, and it can help to develop the roadmap as it shows how different factors can impact others. The interconnections of these factors contribute to the study by providing organizations with an accurate analysis of what type of impact factors can have. Additionally, it shows how the factors are characterized within PBOs.

4.9 Conclusion

The empirical study aimed to investigate the IPL facets within PBOs in practice by exploring the challenges and the possibilities to improve the process. The most important finding is the fact that the impacting factors, barriers, or facilitators can be better classified in the practice as each one can emerge in both shapes. Therefore, organizations should consider these factors in a way that allows them to get the positive side of each factor. Additionally, it was found that the hypothesis classification of factors into three dimensions is appropriate as proven in practice. Each dimension represents components that constitute the learning infrastructure mechanisms, knowledge accessibility, or organizational culture. Furthermore, empirical research has found that these factors can be categorized according to their structural domains as each domain covers a specific aspect of the process. The structural domains are technological, social, industrial, and organizational domains. Each structural domain represents various aspects of the process that impact the IPL's dynamics.

Organizations can make use of the classifications to have a better understanding of the road they need to follow to improve IPL. Additionally, these domains will be utilized to develop the roadmap framework of this study as they help to break down the processes into actionable processes for the organization.

5.   Results and Validation

5.1 Introduction

The primary objective of this chapter is threefold. First, it presents the results of the study, outlining the key elements that PBOs need to consider in improving the inter-project learning (IPL) process and presenting the final framework. Second, it incorporates a validation phase to corroborate these findings, thereby ensuring both reliability and applicability. Third, the post-validation section. This chapter culminates in the presentation of the final roadmap framework. This framework synthesizes the validated data and provides a validated roadmap. This roadmap provides the steps that project-based organizations (PBOs) need to undertake to improve their IPL, thereby fulfilling the main objective of this study.

5.2 Results

In this section, a brief introduction and a recap of the methodology are provided. Then, the main findings of the thesis are presented. After that in the third section, the IPL improvement roadmap for organizations is presented as it will be validated in the validation part.

5.2.1 Introduction and Methodological Recap

The research has been conducted using both theoretical and empirical methods. In the theoretical study, an intensive literature study on three main concepts has been conducted. These concepts are organizational learning, project-based organization, and inter-project learning. Based on the results of the literature study, a hypothesis model has been developed. This model classifies the factors impacting the process of IPL into three categories, barriers for factors with negative impact, facilitators for factors with positive impact, and influencing factors for factors that their impacts cannot be identified whether it is positive or negative. Additionally, it clustered the barriers and facilitators into three main dimensions. Each dimension represents different facets of the process. After that, the empirical study took place. A case study within a project-based organization has been conducted using two steps. The first step was to understand the current approach and method of IPL to gain a comprehensive understanding of the process within the organizations and set up the questions guide for the second step. In this step, semi-structured interviews with ten project managers have been conducted. In the data analysis chapter, the results of the case study have been addressed.

The results of the study are organized to be presented into distinct subsections: key findings, a comparison between theoretical and empirical findings, and a roadmap for improvement.

5.2.2 Synthesis of Key Findings: Bridging Theoretical and Empirical Insights

The research embarked on the task of exploring the landscape of IPL within PBOs. Therefore, several key findings from both the theoretical and empirical studies have emerged. These key findings are:

- **Commonality across studies:** The majority of the factors identified based on the literature study have emerged in the empirical study.
- **Discrepancies:** Although there was alignment between both theoretical and empirical studies, some factors identified from the literature study have not emerged in the empirical study. Moreover, some other factors were explored in the empirical study for the first time.
- **Impact type:** by reviewing both studies, it can be concluded that each factor is impacting one or more structural dimensions of the process, resulting in an impact on the overall performance of IPL.
- **Contradictory factors:** Some factors have emerged in both studies. However, they appear to have a contradiction. A significant example is the experience impact on the process factor. This factor has

emerged in the literature study as a facilitator that can enhance the process of the IPL process. Meanwhile, the empirical study shows that it can pose an extra challenge to have a collaborative culture as it can demotivate some employees to share knowledge with the experienced one which hampers the overall process.

- **Interconnections:** most of the identified factors appear to have interconnections with other factors meaning that exploiting one factor can result in fostering other factors.
- **Influence:** the empirical study shows that in practice, the factors are classified according to their structural dimensions. Each structural dimension has its own characteristics and can be addressed from different perspectives. In total, there were 4 domains identified. These domains are technological, social, organizational, and industrial domains. The next subsection will address these domains in more detail and will outline their positions in the final framework with the three dimensions identified in the literature review.

5.2.3 Main Findings

The previous chapter has presented the results from an in-depth study conducted within a specific PBO. The main objective was to uncover the practical dynamics influencing IPL within such organizations and to elucidate the interconnections among these factors. The findings indicated that these influencing factors can be more appropriately categorized into four structural domains: technological, organizational, social, and industrial. This multifaceted classification diverges from the proposed hypothesis based on the literature study, which essentially focused on categorizing the factors as barriers, facilitators, and influencing factors that were not classified as barriers or facilitators.

Notwithstanding the discrepancy, the empirical study has substantiated the majority of factors found initially hypothesized based on the literature study which can be reasoned by the fact that these factors in the hypothesis model are gathered from scientific papers. However, not all factors aligned with the proposed hypothesis model. Some of the factors were uncovered during the empirical study and were not found in the literature and vice versa. Additionally, some factors did show up in both literature and empirical studies but were identified in a contradictory way. One significant example that can be given here is the impact of the experience as it was presented as a facilitator in the literature study meanwhile it emerges as a potentially hampering factor to IPL as it creates a gap between employees with different experience levels. Moreover, the remote work factor was not explored in the literature study, which can be reasoned by the fact that the phenomenon is considered to be new as it emerged as a post-covid consequence and there are not a lot of scientific papers yet about it.

In addition to this factor, the factor regarding open AI systems is also considered to be new due to the fact that AI has been integrated into individuals' routines very recently. Furthermore, the specialization impact on the process has been derived as a result of the various disciplines chosen for the case study since approaches from different perspectives have been proposed regarding its impact. The same applies to the factor related to roles and responsibilities. This factor is more related to organization structure as it depends on the way organizations assign responsibilities and how they assign roles. These four identified factors can be considered as the main uncovered factors that did not emerge in the literature. The factors that were identified in the literature but did not emerge in the empirical study are mainly due to two reasons. The first reason is due to the fact that the case study focused on the practical factors, unlike the literature study that focused on theoretical and practical factors. The second reason is due to the fact that only project managers were interviewed which hindered the possibility to have a more collective overview and outline the possibility of shifting between the learning levels. The Venn diagram includes quotes taken from the interview to have a better understanding of each factor and to outline how they exactly emerge in the case study.

The Venn diagram also reveals instances where numerous factors identified in the literature do not align with the findings of the empirical study. These factors have been found in the literature and have received validation within the scientific community. This divergence suggests two possibilities: 1) these factors might not be actively utilized within the organization, indicating the need for their inclusion in the roadmap framework, and 2) the limited sample size, given that only project managers were interviewed, could have contributed to this discrepancy. Hence, the decision was made to incorporate these factors into the final framework, allowing organizations the flexibility to choose whether to utilize them based on their specific requirements. Organizations are not obliged to adhere to all the steps of the roadmap framework, providing them with the autonomy to adapt as needed.

Figure 21 depicts a Venn diagram illustrating which factors were identified exclusively in the literature review, solely in the empirical research, or were common to both studies.
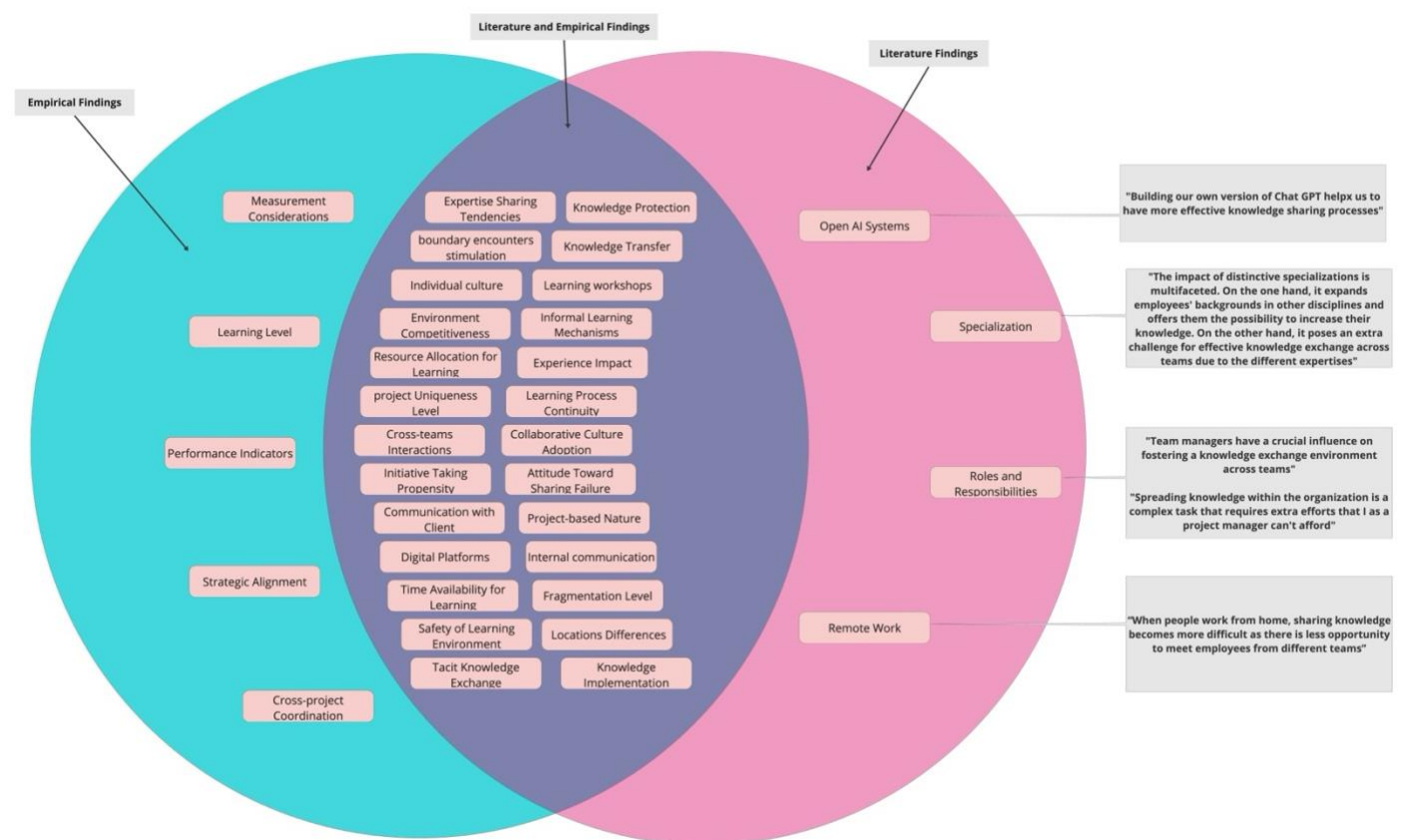
Figure 21 Venn Diagram Comparing Factors Influencing Inter-Project Learning as Identified in Literature Review and Empirical Study (Author, 2023)

Moreover, the results of the empirical study have revealed the relationships between the identified factors, as depicted in section 4.8. Figure 22 provides a visual representation of these interconnections among the factors. The factors that were not identified in the empirical study have been excluded from this interconnection diagram since it was not feasible to determine their relationships, given their absence in the empirical study.
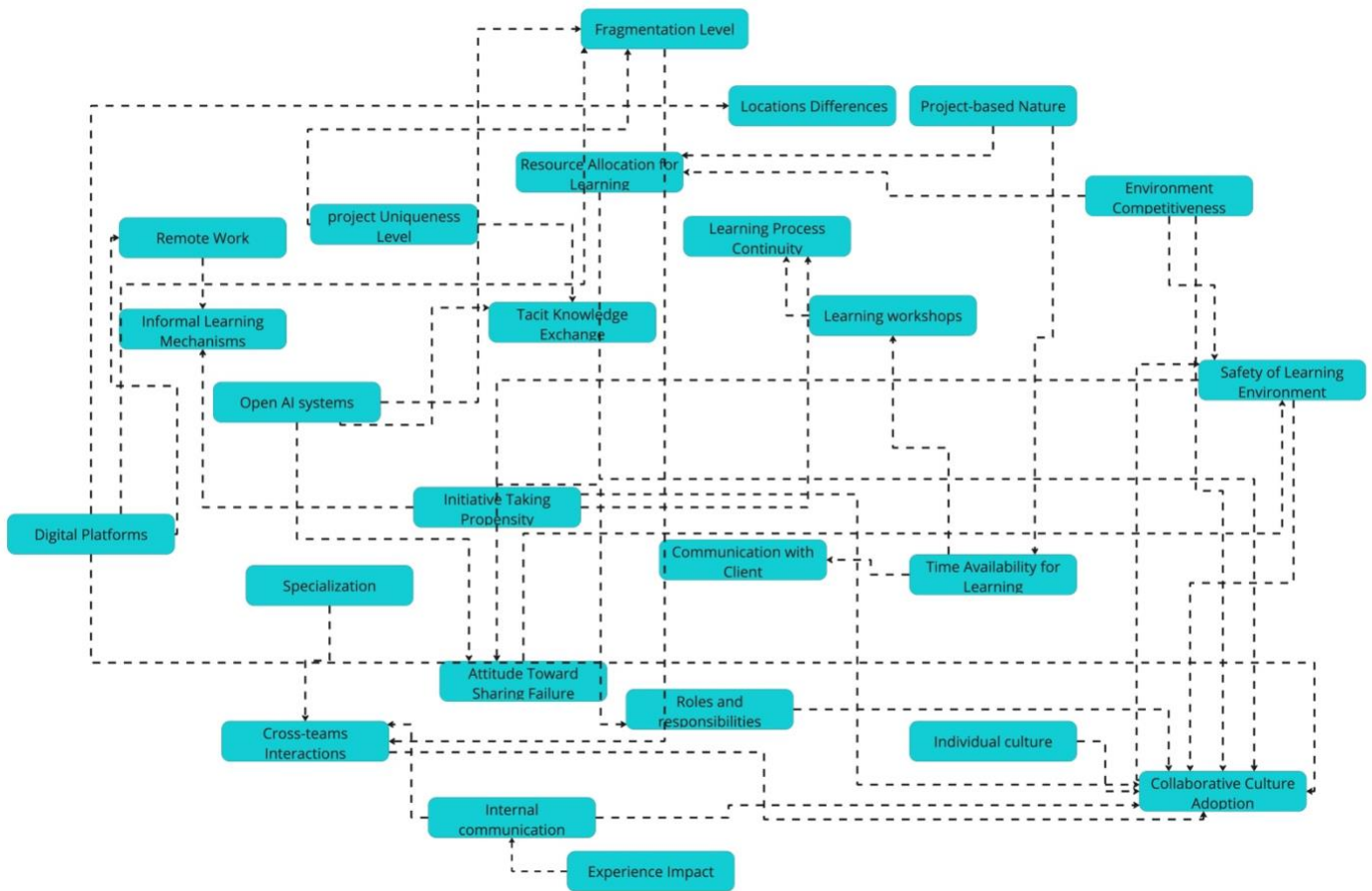
Figure 22 Interconnections between Found Factors from the Empirical Study (Author, 2023)

5.2.4 Dimensions and Domains Importance

The findings of the case study have shown that the factors impacting IPL are shaped into four distinctive structural domains. Each domain represents various factors that organizations can consider improving their performance. The structural domains represent the areas that influence IPL. Each domain focuses on one aspect of the process. The importance of these structural domains arises from the fact that they provide organizations with the possibility to understand the dynamics of IPL within PBOs and how they can help organizations approach the improvement of the process. These domains are Technological, social, organizational, and industrial domains. Each domain has its own sets, practices, and required measures to be improved.

Furthermore, it was found that some factors fall into multiple domains as they can be approached from more than one dimension. Figure 23 illustrates the positions of the factors within the structural domains and their dimensions. This figure is crucial for the roadmap improvement due to its ability to distinguish the factors based on the structural domains indicating the specific aspect to which they belong. The structural domains show where the factors come into action for organizations in order to improve the IPL process. Additionally, this figure shows the dimensions of these factors in order to provide a holistic overview that organizations need to consider. The dimensions provide the possibility to dissect the IPL process.
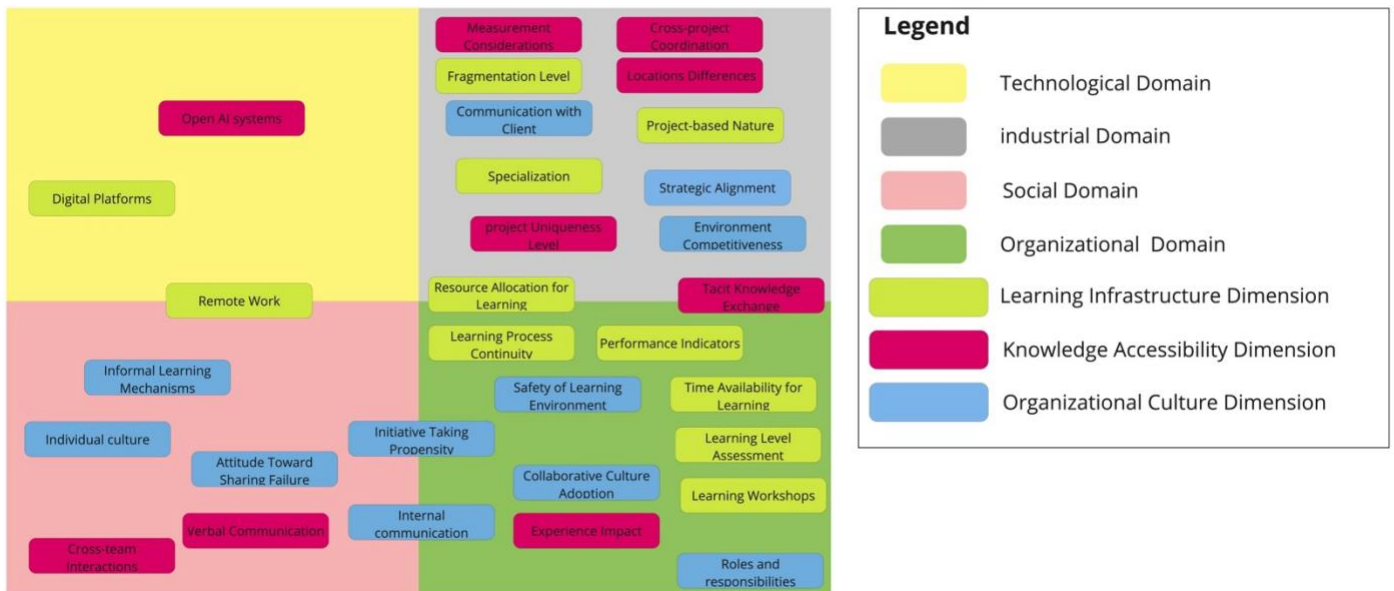
Figure 23 Structural Domains and Associated Factors for IPL in PBOs (Author, 2023)

5.2.5 Roadmap for Improvement

This section provides a comprehensive roadmap for inter-project learning (IPL) improvement within PBOs. This can be done by drawing from the insights gleaned from results derived from a combination of both literature and empirical studies. The roadmap serves as an actionable guide for PBOs, formulated from the key findings, dimensions, and structural domains addressed in the previous sections.

The roadmap framework has the following objectives:

- To identify the actionable steps that can be implemented by PBOs to enhance IPL.
- To present a contextual framework that aligns with the dimensions and structural domains identified.
- To provide practical recommendations that are explored in both theoretical and empirical data.

This roadmap framework will be used to provide an answer to the main research question as it will provide a comprehensive guideline on how PBOs can improve the IPL process.

The following paragraph demonstrates the steps of the roadmap. These steps will be integrated into the framework that will be used for the validation part. After the validation part, minor refinements can be done based on the expert's input to come up with the final framework.

The roadmap consists of 22 steps in total, with each step consisting of two phases that highlight the core points of each step. The aim of these steps is to provide organizations with an overview of what they need to do to improve the process of IPL. The order of the steps follows the dimensions and structural domains. The steps in the learning infrastructure dimension are the basic steps that organizations need to work on before the other two dimensions because they are foundational for the other two dimensions. Ensuring the basic infrastructure solidness is important to maximize the impact of IPL processes. These steps are according to their dimensions:

Learning Infrastructure

1. **Digital Platforms Efficiency:** This step lies in the technological domain, and it aims to evaluate the efficiency of the current digital platforms in terms of the processes of knowledge sharing. In this step, a collective exploration is conducted to identify all gaps and uncover the potential for improvement.
2. **Remote Work Capabilities:** This step lies in both technological and social domains as it is attributed to technological and social infrastructure. Organizations can conduct a comprehensive analysis of their current remote work facilities and gather feedback from employees. After that, organizations can introduce the new developments of the current system based on the assessment phase and ensure that all the new features are efficiently utilized.
3. **Workshop Development:** The step lies in the organizational domain, and its importance arises from the fact that it can strengthen the interconnections among project teams in addition to its primary

objective of sharing knowledge and insights with employees This step can be achieved by developing progressive training paths for employees to ensure that they are continuously updated with the latest methods and tools in the organization.

4. **Learning Level Assessment:** This step lies in the organizational domain. It plays a crucial role in identifying the appropriate learning level required for each improvement within the IPL process. Its significance lies in guiding organizations toward the most suitable learning approach for their specific needs to improve IPL.

5. **Performance Indicators:** This step lies in the organizational domain, and it aims to establish standards to facilitate long-term progress measurement. It proposes the implementation of specific indicators that enable organizations to assess the progress of IPL improvement and quantify its benefits to the organization.

6. **Knowledge Development Tracks:** This step lies in the organizational domain, and it is attributed to the second-level learning loop. The step dictates that organizations need to continuously review and refine their policies to have an improved information exchange and more effective learning practices. It also encompasses the process of feedback collection to ensure that all perspectives are considered to optimize the refinements.

7. **Resource Allocation:** This step lies in the industrial domain, and addresses time shortage issues and lack of resources. The framework suggests allocating a fixed amount of time for learning and reflection to ensure a consistent level of learning. Additionally, it proposes to make knowledge sharing part a core part of daily activities such as regularly scheduled meetings.

8. **Learning Strategy and Repository:** This step also lies in the industrial domain, and it can be followed by empowering a standardized strategy of learning that clarifies how effective learning can be achieved. Additionally, this step suggests establishing a repository that provides clear guidance on how project teams can learn and exchange knowledge.

9. **Industry Experts Contact:** This step lies in the industrial domain, and it suggests keeping up to date with the industry developments and maintaining regular contact with experts in the industry such as contractors to utilize the expertise and spread the acquired knowledge across the teams.

Knowledge Accessibility

10. **AI Systems:** This step, lying in the technological domain, aims to exploit recent developments in internal open AI Systems. This can be done by integrating the current knowledge into an internal open AI chat so that employees have quick and easy access to all knowledge that can be beneficial to all project activities. Additionally, it suggests utilizing the ability of AI tools to convert tacit knowledge into explicit and implementable knowledge. Using the organization version of Chat GPT will help employees to have more efficient knowledge accessibility.

11. **Collaboration and Interactions:** This step, which lies in the social domain, aims to foster a collaborative environment across teams by providing cross-team activities to build relationships, exchange knowledge, and learn from each other. The step also suggests promoting regular events to boost the interaction level across teams which will result in an enhanced knowledge exchange level.

12. **Mentorships and Field Experiences:** This step lies in the organizational domain. It aims to improve the current mentorship programs to include all needed techniques and methods that can result in a more effective learning process. In addition to the mentorship programs, this step suggests maximizing the experience utilization process by offering sessions for juniors and experienced employees to share their experiences and learn from each other.

13. **Cross-regional Collaboration:** This step lies in the industrial domain. It suggests taking interaction and collaboration levels to another level by incorporating cross-regional events in order to create more connections and make use of the various disciplines. Additionally, it suggests organizing activities that

encompass teams from different disciplines in order to open new oppurtunities for learning and increase the expertise of employees.

14. **Measurement Considerations:** This step lies in the industrial domain. It focuses on the strategic implementation of metrics within organizations to bolster the learning process. This step suggests setting standards to measure the effectiveness of IPL. Additionally, this step aims to set an agreed definition of success for the organization to align with the specific industry trends.

15. **Cross-project Coordination:** This step lies in the industrial domain. It aims to enhance collaboration among project leaders and managers across multiple projects, each with distinct specialities. This collaborative approach fosters a more robust knowledge exchange, contributing to the comprehensive IPL process.

Organizational Culture

16. **Cultural Awareness:** This step lies in the social domain. It aims to mitigate the impact of cultural differences on the employees when it comes to IPL. Various measures can be taken by the organization, such as creating an organization-specific culture that applies to all employees regardless of their backgrounds. Moreover, this step aims to promote an organizational culture where mistakes are viewed as learning opportunities which boost the

17. **Safe Environment:** This step lies also in the social domain. It aims to overcome barriers related to sharing failures. It can be achieved by enhancing the current knowledge exchange framework without referring to the one who made the mistake. Furthermore, organizations can also establish a safe space where employees can feel safe to share knowledge even if it is about bad experiences.

18. **Initiative Encouragement:** This step lies in both the social and organizational domains. It proposes to integrate a reward system for employees who take the initiative to promote IPL and who are active in knowledge exchange processes. It also aims to create an environment where employees effectively communicate and collaborate to foster learning processes. Moreover, this step also suggests allocating more resources to educate employees on how to give constructive feedback so that knowledge exchange and learning processes become smoother within the organization.

19. **Roles and Responsibilities:** This step lies in the organizational domain. It aims to provide clearer role descriptions related to the process of knowledge exchange. Additionally, it also suggests continuously reviewing the responsibilities based on the feedback provided by employees to ensure that learning practices are being followed by someone in the organization.

20. **Feedback Mechanisms:** This step lies in the organizational domain. It aims to strengthen the channels between employees to have more productive feedback-sharing mechanisms. Additionally, it suggests having a better understanding of project trends to anticipate the challenges that can be encountered by employees.

21. **Client Input:** This step lies in the industrial domain. It aims to increase the sources of knowledge by utilizing client feedback. The client's input helps to uncover new perspectives on learning and knowledge exchange processes. It suggests offering enhanced communication with clients and receiving their positive and negative feedback to build upon. Additionally, the step also suggests optimizing the current systems to allow an improved knowledge flow from the client.

22. **Learning Integration:** This step lies in the industrial domain. It recommends that organizations stay up to date with the latest industry developments to ensure that the organization remains at the forefront. Additionally, it suggests shifting the current way of resource allocation by integrating learning practices into the regular activities in projects to ensure that the industry challenges are overcome and to ensure continuous learning practices.

Figure 24 displays the inter-project learning improvement framework. The figure shows the concentric circles, each representing one dimension. It also illustrates how each circle is divided into four segments, each representing a structural domain. As mentioned earlier, some factors may belong to multiple domains.

Learning Infrastructure		
1	Digital Platforms Efficiency	- Evaluate the efficiency of current digital platforms. - Identify gaps and prioritize platform improvements.
2	Remote Work Capabilities	- Evaluate the current state of remote working. - Organize sessions on effective remote communication.
3	Workshop Development	- Offer workshops to foster learning. - Develop progressive training paths for employees.
4	Learning Level Assessment	- Regularly review learning methods. - Empower all team members for change.
5	Performance Indicators	- Establish a shared definition of success in IPL. - Create a precise methodology for evaluating IPL performance.
6	Knowledge Development Tracks	- Refine policies for better information exchange. - Provide more room for feedback to optimize learning methods.
7	Resource Allocation	- Allocate fixed amount of time for learning activities. - Make knowledge sharing part of the daily activities (e.g. weekly meetings).
8	Learning Strategy and Repository	- Develop a standardized learning strategy for each specialization. - Establish a repository of knowledge for team learning.
9	Industry Experts Contact	- Stay updated on industry developments. - Maintain contact with industry experts.

Knowledge Accessibility		
10	AI Systems	- Integrate AI for optimized knowledge access. - Utilize AI tools to convert tacit knowledge to explicit.
11	Collaboration and Interactions	- Foster cross-teams activities for knowledge exchange and learning. - Promote events for higher interaction level.
12	Mentorships and Field Experiences	- Implement mentorship programs for learning and knowledge transfer. - Utilize field experiences for educating juniors.
13	Cross-regional Collaboration	- Organize events for cross-regional collaboration. - Foster activities that span multiple disciplines.
14	Measurement Considerations	- Implement strategic metrics to enhance the learning process. - Define success criteria aligned with industry trends.
15	Cross-project Coordination	- Assemble teams comprising individuals from diverse disciplines. - Prioritize multi-disciplinary project initiatives.

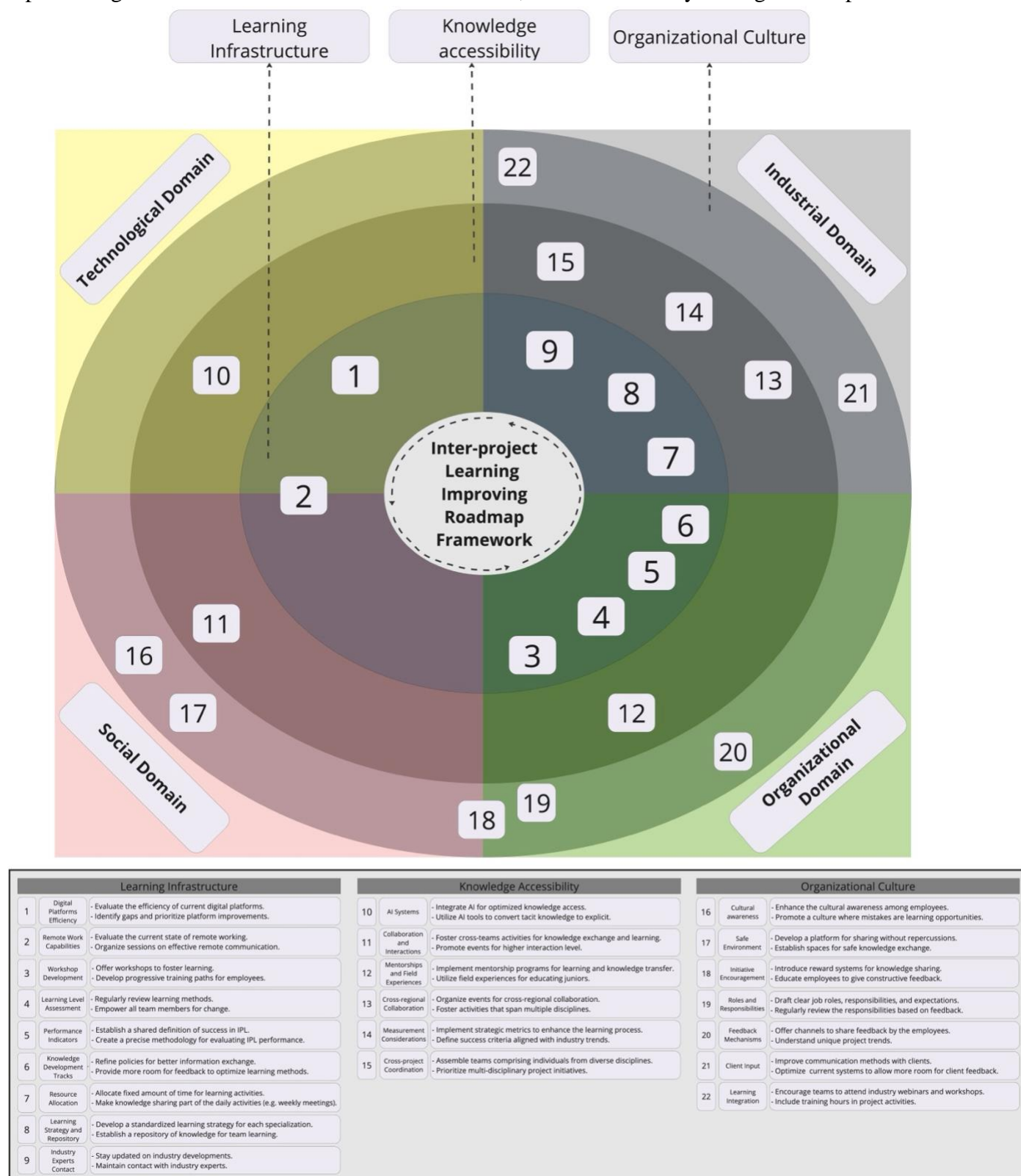| Organizational Culture		
16	Cultural awareness	- Enhance the cultural awareness among employees. - Promote a culture where mistakes are learning opportunities.
17	Safe Environment	- Develop a platform for sharing without repercussions. - Establish spaces for safe knowledge exchange.
18	Initiative Encouragement	- Introduce reward systems for knowledge sharing. - Educate employees to give constructive feedback.
19	Roles and Responsibilities	- Draft clear job roles, responsibilities, and expectations. - Regularly review the responsibilities based on feedback.
20	Feedback Mechanisms	- Offer channels to share feedback by the employees. - Understand unique project trends.
21	Client input	- Improve communication methods with clients. - Optimize current systems to allow more room for client feedback.
22	Learning Integration	- Encourage teams to attend industry webinars and workshops. - Include training hours in project activities.

Figure 24 Preliminary Inter-project Learning Roadmap Framework (Author, 2023)

The next section will address the validation phase, where the framework's applicability and accuracy will be tested. After validation, the roadmap framework will be refined to incorporate the expert's perspective, resulting in the final framework for this study.

5.3 Validation

5.3.1 Introduction

The purpose of this section is to validate the findings of the results through an expert feedback session. An industry expert with over a decade of experience as a team manager, well-versed in IPL mechanisms and techniques, was consulted to add another perspective from the field. This approach aimed to validate the practicality, applicability, comprehensiveness, and relevancy of the roadmap framework model. This process has been conducted by having a semi-structured interview as indicated in the methodology chapter as it allows for asking context questions and also open dialogue to secure sufficient validation of the framework's applicability in the field.

The triangulation approach of this study integrates insights from the literature study, the case study, and the expert perspective. The interview questions were about the roadmap framework model where each dimension and structural domain have been discussed in detail. Appendix B provides the interview guide, detailing the specific questions posed during the session.

5.3.2 Findings

The semi-structured interview was with the field expert who has around one decade of experience in managing teams and being responsible for many teams in the organization. The interview resulted in several noteworthy observations.

General Observations

The expert highlighted the framework's innovative approach, especially in classifications of dimensions and structural domains. The expert expressed that this classification would help the organization to have a comprehensive understanding of the factors impacting inter-project learning and the steps that need to be followed to achieve successful inter-project learning.

Technological Domain

The interviewee emphasized the importance of efficient digital platforms. The interviewee highlighted that these platforms must be continuously reviewed to incorporate new developments and enhance the knowledge exchange process. Additionally, the interviewee noted the significant impact of remote work, stating that many organizations now have employees working from home on certain days, which can hamper effective communication. Therefore, organizations need to adapt to this new norm by developing communication platforms to enhance cross-team interactions.

Social Domain

The interviewee stressed the value of informal communication in fostering a collaborative organizational culture. The expert acknowledged the influence of cultural differences, noting that employees from diverse backgrounds might have varying comfort levels in voicing opinions and exchanging knowledge. However, the team manager emphasized the organization's role in shaping an inclusive culture, ensuring that employees engage and contribute irrespective of their individual backgrounds and experience levels.

Organizational Domain

The field expert agrees that workshops and multi-team training can have a multifaceted influence on the process of inter-project learning. On the one hand, training sessions allow employees to acquire knowledge useful for future projects. The expert emphasized that multi-team training sessions promote interactions among employees, fostering unity among employees from different teams. On the other hand, the expert strongly disagreed that learning processes should be the role of one position. Learning and knowledge sharing

should be a shared responsibility, as they involve continuous processes that require collaboration from all members of the organization.

Industrial Domain

The team manager agreed that the client's feedback is an essential tool for continuous improvement and disseminating knowledge across teams. The interviewee emphasized its value, particularly from successfully completed projects, as it offers insights for enhancing future project performance. When clients suggest improvements, the feedback can be shared within the organization to prevent other teams from repeating the same mistakes.

The Framework Applicability

The field expert conveyed that the roadmap framework can be taken as a starting point for the organization to improve IPL. However, it cannot be directly implemented by the organization's employees since most steps are in the inner circle (learning infrastructure), which can be improved by the organization's development team. Therefore, the interviewee recommended presenting it to this team, as they oversee the policies and frameworks utilized by the employees.

5.3.3 Interpretation

The findings from the validation process largely validate the framework's foundations. The findings offered deep insights into the relevance, strengths, and applicability of the framework. Moreover, the expert's recognition of the framework's innovative approach reinforces its originality and increases the possibility of contribution to the practical domains of IPL. However, some observations regarding domains have been denoted by the expert which will have an influence on the framework steps.

Technological Domain:

The emphasis on the crucial role of digital platforms and adapting to the changing norms of remote work circumstances highlights the importance of the technological domain in the process of IPL. The framework emphasizes these factors and suggests that organizations prioritize improving digital platforms and make more use of the open AI system.

Social Domain

The importance of informal communication practices and being aware of cultural differences emphasizes the high impact of the social domain on the process. The framework highlights the importance of having a safe environment for the organization's employees to exchange knowledge and feel safe to share failures. The framework also highlights the need for collaboration from each employee to achieve the required level of effective IPL.

Organizational Domain

The validation affirms the importance of multi-team training sessions for their multi-faceted benefits. However, the validation shows that learning and exchanging knowledge is everyone's responsibility as each individual plays a role, negating the need for specific positions dedicated to learning processes.

Industrial Domain

The emphasis on the importance of client feedback affirms the need for this domain in achieving successful IPL. Additionally, the significance of integrating learning activities into the daily routines also affirms the need to include training hours in project activities. The expert also highlighted the importance of being up to

date on the new developments within the industry to be able to stay strong in the market but also get sufficient resources for learning and reflection.

Framework applicability
The validation process affirms the framework can serve as a starting point for organizations to improve IPL processes. It shows that the implementation of this framework relies on the development team within the organization, suggesting that a collective approach can be developed that can be more applicable to all disciplines.

Conclusion
The findings of the validation process have reinforced the robustness of the framework. Step 19 (roles and responsibilities) needs adjustments to emphasize everyone's role in learning and knowledge sharing across teams. The validation process provided a triangulation to this study by including a third perspective: the view of the field expert.

5.4 Conclusion

This study presents a roadmap framework for inter-project learning that helps organizations to elevate performance and increase project value.
After the intensive exploration into the inter-project learning realm, the results of this study have culminated in the formulation of the framework that will be used to provide an answer to the main research question. The objective of this framework is to provide organizations with a roadmap of various steps in different structural domains. This roadmap aims to foster knowledge sharing and learning between projects, thereby improving organizational performance and ultimately increasing project value.

Several takeaways can be taken from the results of this study and will influence the roadmap framework:
- **Holistic Approach:** This framework combines both theoretical and practical insights to ensure a balanced approach that meets the needs of organizations to improve IPL and fills the gap in academia.
- **Importance of Validation:** The interview with the field expert brought two benefits to this study. First, it validated the final findings by including a third perspective. Second, it provided some refinements to the framework to increase the applicability of the framework.
- **The Applicability and Adaptation:** While this framework provides a structured approach, it is still crucial for organizations to adapt it based on their current policy and needs. However, domain classification is still applicable to all project-based organizations in the industry.

The framework elements are the same elements concluded in section "5.2.5 Roadmap for improvement" with only one adjustment in step 19 as a result of the validation phase. The alteration in this step is due to the expert's feedback as they pointed out that emphasizing collective responsibility had a more powerful impact than the initially proposed step.
This step has been modified as follows:

19. Roles and Responsibilities: Create an environment in the organizations that emphasizes the collective responsibilities of learning and knowledge exchange process by all employees. This can be done by providing the possibility to share knowledge on different occasions so that all employees become aware of their responsibility towards learning across teams.

Therefore, the final version of the framework that organizations need to utilize to have improved IPL processes is shown in Figure 25.
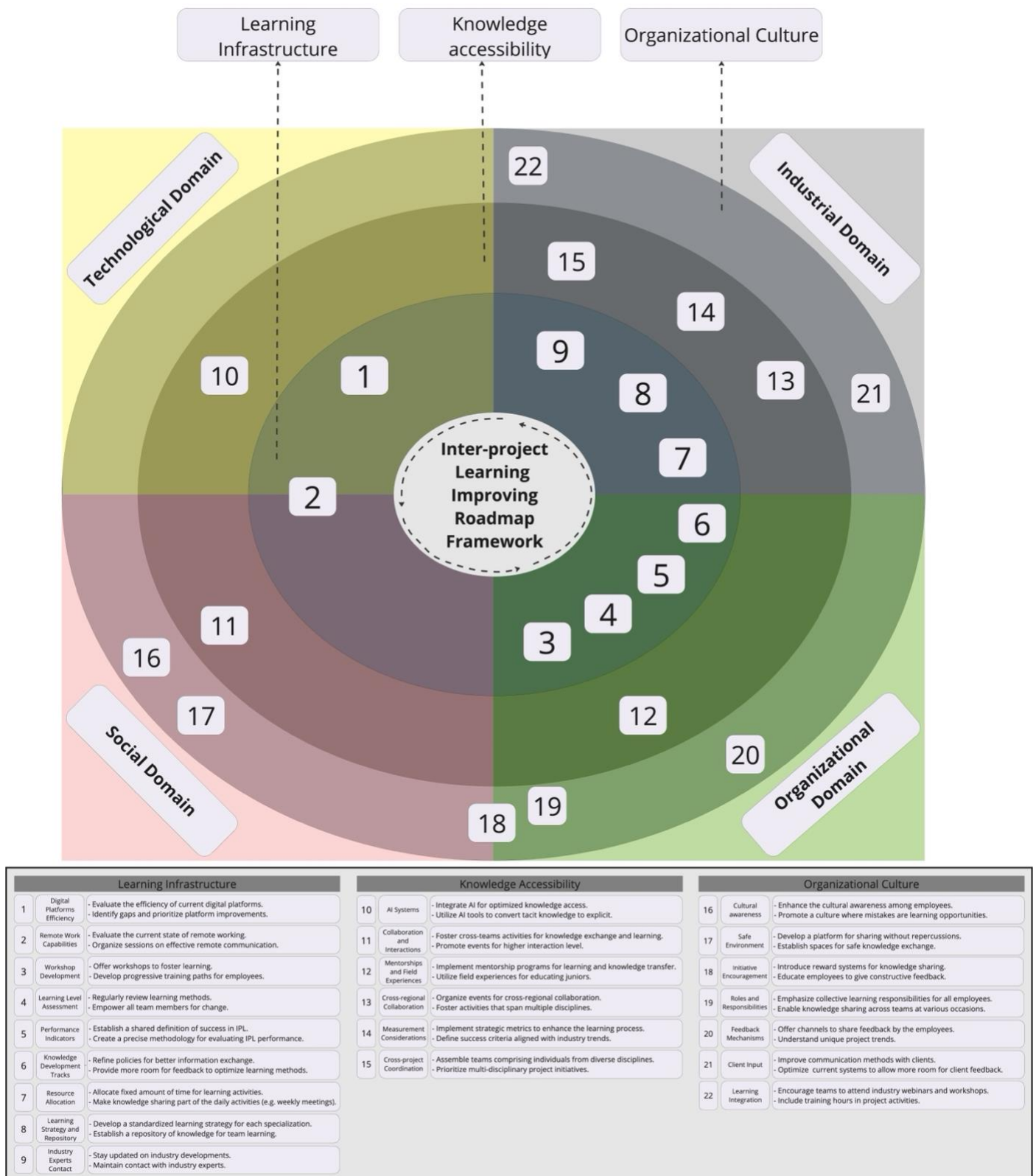
Figure 25 Improving Inter-project Learning Roadmap Framework (Author, 2023)

Learning Infrastructure		
1	Digital Platforms Efficiency	- Evaluate the efficiency of current digital platforms. - Identify gaps and prioritize platform improvements.
2	Remote Work Capabilities	- Evaluate the current state of remote working. - Organize sessions on effective remote communication.
3	Workshop Development	- Offer workshops to foster learning. - Develop progressive training paths for employees.
4	Learning Level Assessment	- Regularly review learning methods. - Empower all team members for change.
5	Performance Indicators	- Establish a shared definition of success in IPL. - Create a precise methodology for evaluating IPL performance.
6	Knowledge Development Tracks	- Refine policies for better information exchange. - Provide more room for feedback to optimize learning methods.
7	Resource Allocation	- Allocate fixed amount of time for learning activities. - Make knowledge sharing part of the daily activities (e.g. weekly meetings).
8	Learning Strategy and Repository	- Develop a standardized learning strategy for each specialization. - Establish a repository of knowledge for team learning.
9	Industry Experts Contact	- Stay updated on industry developments. - Maintain contact with industry experts.

Knowledge Accessibility		
10	AI Systems	- Integrate AI for optimized knowledge access. - Utilize AI tools to convert tacit knowledge to explicit.
11	Collaboration and Interactions	- Foster cross-teams activities for knowledge exchange and learning. - Promote events for higher interaction level.
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13	Cross-regional Collaboration	- Organize events for cross-regional collaboration. - Foster activities that span multiple disciplines.
14	Measurement Considerations	- Implement strategic metrics to enhance the learning process. - Define success criteria aligned with industry trends.
15	Cross-project Coordination	- Assemble teams comprising individuals from diverse disciplines. - Prioritize multi-disciplinary project initiatives.

Organizational Culture		
16	Cultural awareness	- Enhance the cultural awareness among employees. - Promote a culture where mistakes are learning opportunities.
17	Safe Environment	- Develop a platform for sharing without repercussions. - Establish spaces for safe knowledge exchange.
18	Initiative Encouragement	- Introduce reward systems for knowledge sharing. - Educate employees to give constructive feedback.
19	Roles and Responsibilities	- Emphasize collective learning responsibilities for all employees. - Enable knowledge sharing across teams at various occasions.
20	Feedback Mechanisms	- Offer channels to share feedback by the employees. - Understand unique project trends.
21	Client Input	- Improve communication methods with clients. - Optimize current systems to allow more room for client feedback.
22	Learning Integration	- Encourage teams to attend industry webinars and workshops. - Include training hours in project activities.

The framework consists of concentric circles, all centred on improving IPL. The inner circle represents the factors that lie in the learning infrastructure dimension. The middle circle represents the factors that lie in the knowledge accessibility dimension. The outer circle represents the organizational culture dimension.

Furthermore, each structural domain is represented by a segment in the framework. The yellow segment represents the technological domain, the pink segment represents the social domain, the green segment represents the organizational domain, and the grey segment represents the industrial domain.

The steps are located on both the right and left sides of the concentric circles. Each step is briefly explained to provide a basic understanding of the steps.

6.   Discussion

The intricate dynamics of project-based organizations (PBOs) result in complex and unique challenges when it comes to inter-project learning (IPL). By discussing the key findings of this study, an in-depth understanding is provided, assisting organizations in realizing the full potential of setting up IPL. In this chapter, the findings from the previous chapter are discussed in section 6.1. Additionally, the interpretations and implications of this study are outlined in section 6.2. Furthermore, the limitations are addressed in section 6.3.

6.1 Discussion of the research results

In this study, factors, including barriers and facilitators, in the existing literature that have a major impact on IPL within PBOs were uncovered and classified into three main dimensions as shown in the hypothesis model (see Figure 15). The hypothesis model indicated a certain level of complexity in identifying the implications of these barriers and determining the interconnections between these factors and what organizations need to do to enhance their IPL processes. Therefore, the choice went to the empirical study to uncover new potential factors, understand how these factors are interconnected, and develop a roadmap that organizations can utilize as a guideline for improvement. The results of the empirical research showed that all impacting factors on IPL should be examined more closely in order to have a more effective performance of IPL. Instead of viewing them as barriers, facilitators, or influencing factors, they could be viewed as factors that organizations can utilize as tools to improve the process. Furthermore, it was found that the impact of the factors is multifaceted. One factor can impact many factors and vice versa. This shows the complexity of determining the impact of each factor on the process.

Furthermore, during the empirical study, it was found that the factors can be classified according to their dimension as was found in the literature study. However, it was also found that they can be categorized according to their structural domains. Each structural domain represents various aspects of the process that influence the IPL's dynamics within organizations. These domains offer a comprehensive understanding of how the different components interact to influence the IPL and the knowledge exchange processes. Recognizing these domains offers the organization the possibility to pinpoint areas of strengths and weaknesses, which enables them to refine and efficiently implement their learning initiatives. This multi-dimensional approach provides a more collective view of the landscape of IPL. Section 2.5 discussed the dimensions and provided an overview of what factors belong to them. Section 4.5 has discussed all domains and factors lying under them.

This study sought to bridge the gap between the theoretical frameworks and the practical perspectives. In this study, most of the findings in the literature study have emerged in the case study and validation. On the one hand, there are factors that did not emerge in the literature and emerged in the empirical study. These factors are shown in the Venn diagram in Figure 21: Open AI systems, specialization, roles and responsibilities, and remote work. The first one is related to the recent development of Open AI systems and the other three can be the most attributed to the organization's nature and dynamics. Specialization often refers to the impact of different disciplines of the teams and the increased level of difficulty in exchanging knowledge. The roles and responsibilities factor is mostly attributed to the role's descriptions and responsibilities within the organization which differs from one organization to another. Finally, the remote work factor, which refers to increased reliance on working from a distance is one of the post-COVID consequences. This indicates why these factors did not emerge in the literature.

On the other hand, there are factors that emerged in the literature but did not emerge in empirical study. The Venn diagram in Figure 21 also shows these factors. It can also be observed that all these factors are attributed to the nature of organizations and could not emerge due to the fact that the empirical study focused on only one organization. this shows the significance of diversifying research settings and samples to come up with a more comprehensive approach to the factors impacting IPL.

Furthermore, the facilitator "Increase project managers" was found in the study Julian (2008). In the empirical study, this facilitator emerged as "experience impact" factor. It was found that despite the fact that experience can foster IPL, it can cause a limit for junior employees to exchange knowledge with experienced employees as they may think it is inappropriate. However, this divergence can be reasoned by the fact that the chosen participants for the case study are all experienced and have been working in the industry for decades, which implies a possibility for a biased response regarding this factor.

In conclusion, the study juxtaposes the theoretical and empirical studies on the process of IPL within PBOs. The alignments and the discrepancies outlined in this study emphasize the developing dynamics of IPL and show the importance of diverse research settings in a holistic approach.

6.2 Interpretations and Implications

In the previous section of this chapter, the results were discussed and a comparison between the theoretical and empirical findings was presented. This section is paramount to describe the interpretations of various aspects of this study. The importance of this section arises from the fact that it translates the findings of this study into insights that are meaningful and applicable to practice.

The literature study provided an overview of all factors attributed to the IPL process and highlighted the impact on organizations that each factor can pose. The main distinction between this study and the previous studies is that it focused on PBOs. Additionally, all findings from both literature and empirical studies are applicable within the construction industry which is considered to be reluctant to develop as indicated in the introduction chapter. The dimension classification can be an effective approach for organizations to identify the critical dimension related to their circumstances and provide them with a guideline by the roadmap proposed in Chapter 5.

Alternatively, organizations can make use of the structural domain classification that introduces a new perspective on how organizations should consider the process of improving IPL. This also helps organizations to prioritize and allocate the appropriate resources for the improvement process. Organizations may choose to not follow the exact order of the roadmap presented in Chapter 5. Instead, they can isolate one domain and go through each step if they are capable of a comprehensive improvement.

This approach is helpful as the literature study has illustrated the complexity of the improvement process of IPL within PBOs. The results of this study aim to streamline the path for organizations and minimize the complexity level by providing the roadmap framework and by providing the key impacting factors on the process.

Furthermore, the factors exclusively identified in the literature suggest that organizations have further opportunities for progress in enhancing their IPL processes. Exploring these theoretical dimensions outlined in the literature provides organizations with a valuable avenue to amplify their endeavors towards improving IPL. By delving into these theoretical insights, organizations can unlock additional strategies and perspectives that contribute to a more refined and effective IPL environment.

Additionally, organizations can leverage performance indicators to monitor the progress of their improvement initiatives. These indicators may be formulated based on the frequency of repeated mistakes over time, serving as benchmarks to gauge and measure the ongoing progress. By incorporating performance indicators, organizations gain a quantitative and measurable framework, allowing for a systematic evaluation of the effectiveness of their efforts in improving IPL.

In the broader scope, improving IPL within PBOs will increase the potential to revolutionize the construction industry. Building upon the findings and conducting future research on each aspect of the process of IPL, the organizations will be more capable of fostering a culture of continuous learning and improvement to optimize the process of IPL. This will contribute not only to the performance of future projects. Additionally, it will contribute to the industry's resilience and sustainability to learn from errors and not repeat them. By utilizing the knowledge acquired, the industry can have a more accurate prediction of potential future challenges and ultimately improve performance.

6.3 Limitations

While this study offers valuable insights into the complexities of improving inter-project learning within PBOs, there were some limitations encountered that are worth acknowledging as they shaped the results of the research. These limitations are:

- **Single organization focus:** This study was conducted solely within one project-based organization. While every effort was made to extract generalizable conclusions applicable to a broader range of PBOs, the specificity of the organizational context may have influenced the results, potentially leaving certain perspectives or factors unexplored.
- **One case study limitation:** The research is further constrained by being based on just one case study within that organization. This raises questions about the generalizability of the results across multiple projects or departments even within the same organization.
- **Lack of empirical validation:** Due to time restrictions, the roadmap framework was not validated in real organizational settings. This leaves the reliability of the framework untested which requires empirical validation to be imported to organizations.
- **Non-response bias:** Since participation in the case study was completely voluntary, the sample taken from the empirical study could be biased as only interested individuals were involved in this study and the reliability of the results can be affected.
- **Homogeneity of Interviewees:** The fact that this study relied exclusively on project managers for the interviews in the case study, the generalizability of the results can be impacted as other perspectives from employees with other perspective were not considered. This happened due to the challenge of interviewing other samples of participants due to the time restrictions.
- **Temporal constraints:** Due to the fact that this study has been conducted in a limited timeframe, it was not allowed to analyse how inter-project learning can evolve over time and how the measures can be changed.
- **Analysis depth:** The scope and time constraints did pose extra challenges to delve into the components and elements of the dimensions and the structural domains in results which creates room for further research.

7. Conclusion and Recommendations

7.1 Answering the Sub-Questions

7.1.1 What is the current state of the art of inter-project learning?

Understanding the current state of the art of inter-project learning (IPL) has a significant impact on the organization's success since knowledge is paramount for organizations. IPL was defined in the study as the process of knowledge accumulation and experience exchange among different projects over time. The study has investigated the current state of the art of IPL by uncovering various aspects of the process.

The literature did outline the phases of the knowledge transfer journey. It starts with knowledge abstraction and generalization to extract knowledge from its original context and convert it into a theoretical concept. Then the abstracted knowledge will be institutionalized in the organization so that it can be applicable to other teams. After that, the knowledge will be disseminated to other project teams for utilization. Finally, in the final phase, the disseminated knowledge can be implemented in practice.

Other studies have distinguished between two forms of IPL, both are primarily for learning and knowledge exchange. The first is termed 'concurrent design transfer', which refers to the exchange of knowledge between two active projects. The second, known as 'sequential design transfer', indicates the knowledge transfer between an active and a completed project. Furthermore, the literature outlined that the second type is more challenging due to the difficulty of communication among the project teams.

Moreover, it was found that IPL undergoes three processes in organizations. Each process represents a different method that knowledge undergoes. The first process is when experience is accumulated which occurs by practical application. The second process is when the knowledge is articulated and deliberated through the organization's actors. The third process is when knowledge is codified to be utilized in future projects and endeavours.

Beyond these processes, the study has explored the factors that are classified into barriers, facilitators, and influencing factors impacting the process. Each one has its contribution to the process. The main characteristic observed for the process is the chaos in the process as was shown in the hypothesis model. A lot of interactions and complex relationships were observed in this study on the process, and many of these complexities arise as a result of process ramifications. The factors impacting the process of IPL were classified into three main dimensions. The learning infrastructure dimension encompasses factors that are attributed to the essential tools that are needed to boost learning within the organization regardless of its type. The knowledge accessibility dimension includes all factors attributed to knowledge dissemination and accessibility. The organizational culture dimension includes all organizational factors that can be directly organized by the organization.

In summary, the current IPL still encounters many challenges regarding complexities. However, there is a growing interest in improving it by diagnosing the factors that impact the process and increase its effectiveness. These insights into IPL shed light on its current complexities and highlight its importance in improving performance.

7.1.2 How are the practical barriers and facilitators to successful inter-project learning characterized within project-based organizations?

The literature and empirical studies have investigated all distinct factors that impact the process of IPL. The literature study has presented a list of barriers, facilitators, and influencing factors that have unknown impacts on the process.

These factors were all classified into different dimensions. The classification focuses on the fundamental characteristics that serve as a foundation for IPL. Each dimension represents a unique aspect of IPL and encompasses distinct elements that contribute to a comprehensive understanding of the learning processes in PBOs. Three dimensions were identified:

- **Learning Infrastructure:** This dimension focuses on factors attributed to the essential tools that underpin effective IPL processes. It covers all factors that are attributed to the frameworks that influence learning activities such as the digital platforms used by organizations, workshops allocated to facilitate learning, and available resources.
- **Knowledge accessibility:** This dimension focuses on factors attributed to the process of knowledge retrieval and accessibility. This encompasses all processes attributed to the ease of access to knowledge and all utilized methods and techniques.
- **Organizational culture:** This dimension focuses on factors attributed to the natural interactions, collaborations, and cultivating environment where learning is championed. This encompasses all factors related to human interactions, individual culture impacts and all human-related factors.

The empirical study aimed to explore the practical implications of these barriers and facilitators. Interestingly, the findings suggest a shift in perspective. Rather than strictly classifying these factors as barriers or facilitators, it's more pragmatic to view them as factors with the potential to be harnessed as facilitators. Depending on the context in which they are applied, a single factor can either hinder or enhance IPL. In response to this question, the practical barriers and facilitators to successful IPL within PBOs can be characterized by considering them as potentials for improvement rather than mere barriers to overcome or facilitators to encourage. This approach helps to maximize the benefits of these factors and implement them to function as fostering factors in the process of IPL. Figure 26 illustrates the key factors integral to IPL in PBOs that need to be considered to achieve a successful IPL. The figure shows that these factors are categorized according to the dimensions where they belong. This classification helps organizations strategically address and prioritize improvement areas. By understanding the domain in which each factor lies, organizations can tailor their interventions to improve IPL. This approach ensures a holistic development of the IPL within PBOs.
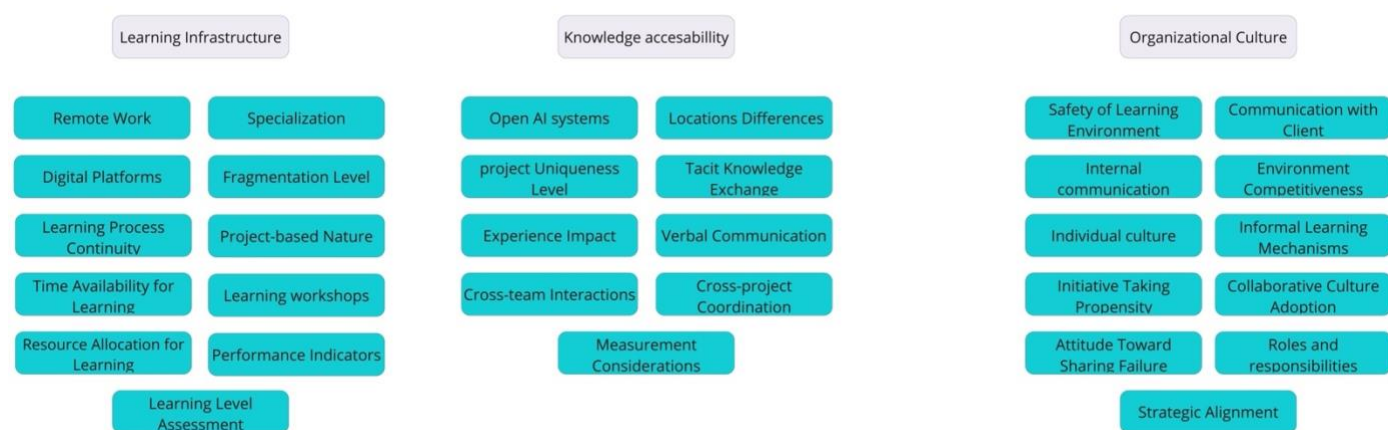

Figure 26 Factors Influencing Inter-Project Learning in Project-Based Organizations (Author, 2023)

Furthermore, based on the empirical findings, the interconnections of these factors are depicted in Figure 27. These interconnections offer organizations insights into how these factors can influence one another, which is crucial for fostering effective strategy development and enhanced decision-making. Understanding and navigating the factors impacting IPL paves the pathway for more adaptive PBOs.

The figure shows that the factor "Collaborative culture adoption" is the factor that is mostly influenced by other factors which indicates their interdependence on the success of this factor.
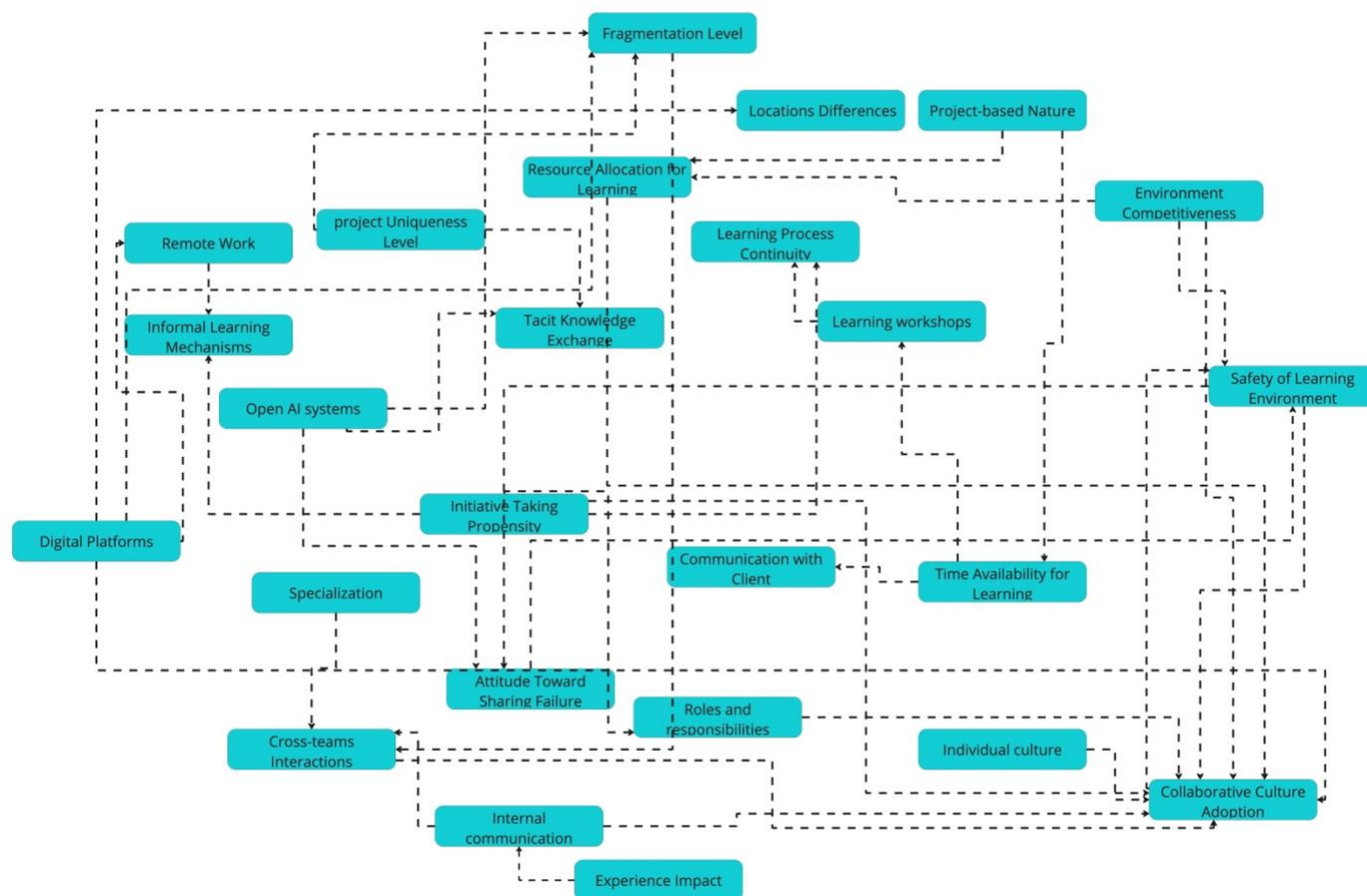
Figure 27 Interconnections between Factors (Author, 2023)

7.1.3 What key factors are fundamental for successful inter-project learning within project-based organizations?

The IPL process within PBOs depends on various interconnected and complex factors. The answer to the second question illustrated how factors can be categorized into three dimensions. Furthermore, a deeper layer of categorization is imperative to show organizations the fundamental factors to achieve successful IPL. Therefore, based on the results of empirical research, a new perspective of classification is integrated into the process. This perspective classified factors into structural domains. Each domain represents an area within PBOs where specific measures can be taken, and strategies can be formulated to fortify the IPL process. These domains help organizations to break down the broader dimension into specialized subsets, to provide clarity to organizations on critical areas requiring intervention. The domains found in this study are technological, social, organizational, and industrial.

- **Technological Domain:** This domain emphasizes the significant role technology can foster in the process of IPL. Technology can help to automate repetitive processes resulting in a reduction of resources and avoidance of human errors. In this domain, the critical factors found are the inclusion of open AI systems that can be internally used in the organization for stronger knowledge sharing mechanisms and the effective utilization of digital platforms due to their roles in facilitating the knowledge sharing process and eventually improving IPL.

- **Social Domain:** This domain plays a pivotal role as it encompasses all factors attributed to human natural interactions. Additionally, this domain has a crucial role in overcoming the barriers resulting from cultural differences. In this domain, the critical factors found are the attitude of sharing failure mechanisms and the initiative taking propensity as these two result in a situation where the organization's members are more encouraged to share knowledge and learn.
- **Organizational Domain:** This domain emphasizes the role of the organization in adopting effective policies and regulations for enhancing IPL processes. This encompasses all factors attributed directly to the organizations. In this domain, the critical factors found are the learning workshops factor, the safety of the environment, time availability for learning, and experience impact. Each factor has its unique contribution to the process, but all of them share the feature of the ability to foster IPL processes.
- **Industrial Domain:** This domain has a crucial role in addressing external factors that influence the processes of IPL and encapsulates industry standards and the competitive environment of the industry. This encompasses all factors directly attributed to the industrial environment in which PBOs operate. In this domain, the critical factors found are the resource allocation for learning and communication with clients. The first one aims to integrate learning activities into the daily activities of the organization's members, which will ensure that sufficient resources are allocated for effective learning practices. The second one is attributed to the importance of the clients' input to reflect and learn as their input can bring valuable knowledge to the organization if it is effectively spread across the teams to learn from made mistakes and build upon successful experiences.

For a deep understanding of the implications of these domains for IPL within PBOs, it is essential that they do not exist in silos. Instead, they are interrelated as many factors lie in multiple domains. Figure 28 shows the structural domains and the factors that lie in each one of them. It can be observed how the two levels classification can provide organizations more contextual understanding of how they can approach and when to start.
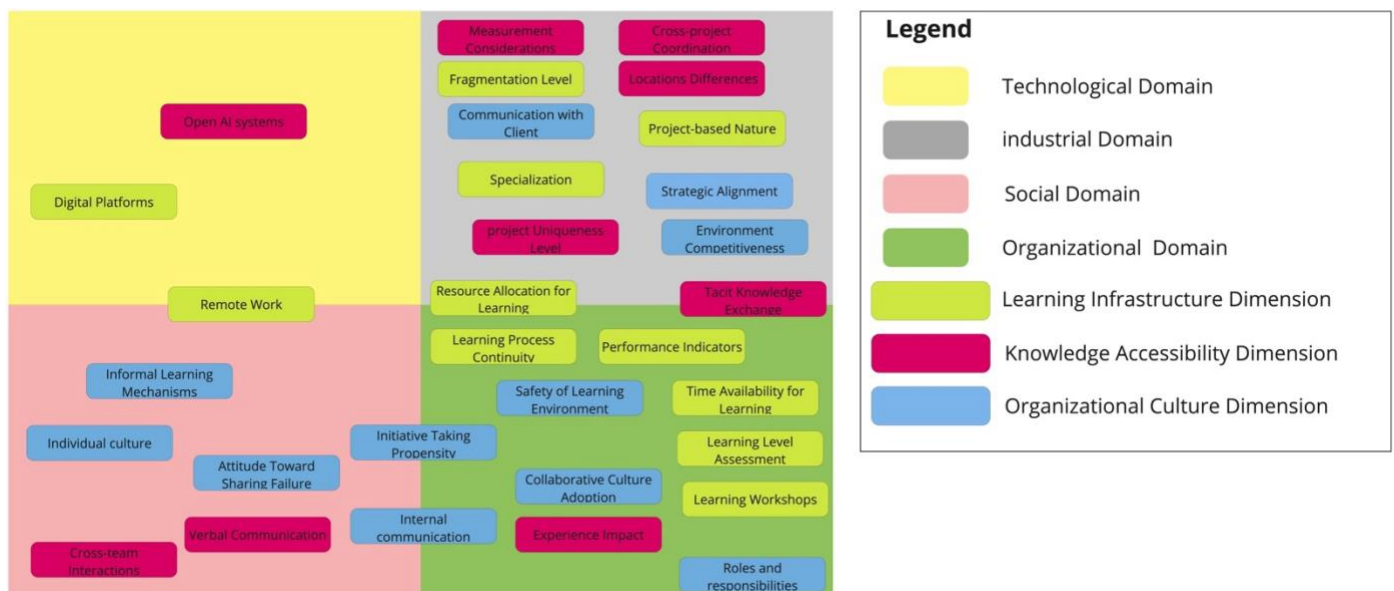

Figure 28 Structural Domains and Associated Factors for IPL in PBOs (Author, 2023)

By understanding these structural domains and their interdependences, PBOs can approach IPL holistically, ensuring a high level of effectiveness. Integrating the domains with the dimensions provides a more nuanced overview for organizations aiming for successful IPL. Additionally, it offers a multi-faceted perspective on IPL since domains highlight the intervention areas and dimensions offer a broader context in which these interventions function.

7.2 Answering the Research Question

This thesis, consisting of an extensive literature study, case study, expert validation, and roadmap framework are used to address the following research question:

How can inter-project learning be improved within project-based organizations?

The study reveals that inter-project learning (IPL) is an ongoing process that project-based organizations (PBOs) need to continuously adopt a multifaceted approach for improvement. The approach encompasses various interventions from PBOs, each contributing to one critical aspect of the improvement process. To provide organizations with comprehensive and detailed guidelines on what measures they need to undertake, a roadmap framework was developed. The framework consists of 22 steps that are divided into three dimensions and four structural domains. The importance of the dimensions arises from the fact that they offer organizations the possibility to understand what steps are achieved and how. Structural domains are important as they provide organizations with the possibility to understand in which organization aspects these steps occur and to whom they should be attributed. Figure 29 shows the roadmap framework with dimensions represented in circles and domains in different colors. It also outlines the steps that the framework recommends for organizations to undertake, accompanied by a brief description of each step.
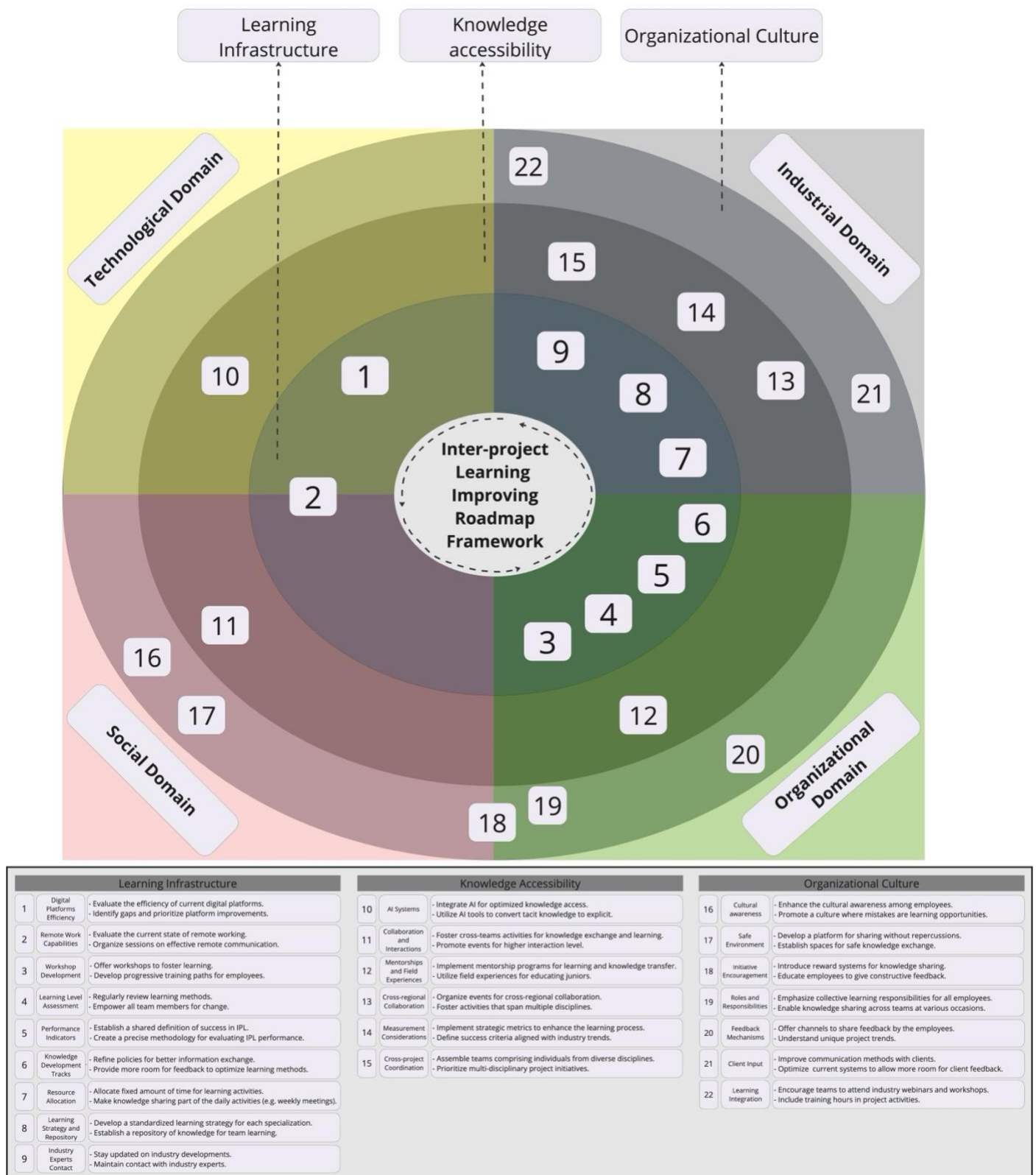
Figure 29 Inter-project Learning Improving Framework (Author, 2023)

Learning Infrastructure		
1	Digital Platforms Efficiency	- Evaluate the efficiency of current digital platforms. - Identify gaps and prioritize platform improvements.
2	Remote Work Capabilities	- Evaluate the current state of remote working. - Organize sessions on effective remote communication.
3	Workshop Development	- Offer workshops to foster learning. - Develop progressive training paths for employees.
4	Learning Level Assessment	- Regularly review learning methods. - Empower all team members for change.
5	Performance Indicators	- Establish a shared definition of success in IPL. - Create a precise methodology for evaluating IPL performance.
6	Knowledge Development Tracks	- Refine policies for better information exchange. - Provide more room for feedback to optimize learning methods.
7	Resource Allocation	- Allocate fixed amount of time for learning activities. - Make knowledge sharing part of the daily activities (e.g. weekly meetings).
8	Learning Strategy and Repository	- Develop a standardized learning strategy for each specialization. - Establish a repository of knowledge for team learning.
9	Industry Experts Contact	- Stay updated on industry developments. - Maintain contact with industry experts.

Knowledge Accessibility		
10	AI Systems	- Integrate AI for optimized knowledge access. - Utilize AI tools to convert tacit knowledge to explicit.
11	Collaboration and Interactions	- Foster cross-teams activities for knowledge exchange and learning. - Promote events for higher interaction level.
12	Mentorships and Field Experiences	- Implement mentorship programs for learning and knowledge transfer. - Utilize field experiences for educating juniors.
13	Cross-regional Collaboration	- Organize events for cross-regional collaboration. - Foster activities that span multiple disciplines.
14	Measurement Considerations	- Implement strategic metrics to enhance the learning process. - Define success criteria aligned with industry trends.
15	Cross-project Coordination	- Assemble teams comprising individuals from diverse disciplines. - Prioritize multi-disciplinary project initiatives.

Organizational Culture		
16	Cultural awareness	- Enhance the cultural awareness among employees. - Promote a culture where mistakes are learning opportunities.
17	Safe Environment	- Develop a platform for sharing without repercussions. - Establish spaces for safe knowledge exchange.
18	Initiative Encouragement	- Introduce reward systems for knowledge sharing. - Educate employees to give constructive feedback.
19	Roles and Responsibilities	- Emphasize collective learning responsibilities for all employees. - Enable knowledge sharing across teams at various occasions.
20	Feedback Mechanisms	- Offer channels to share feedback by the employees. - Understand unique project trends.
21	Client Input	- Improve communication methods with clients. - Optimize current systems to allow more room for client feedback.
22	Learning Integration	- Encourage teams to attend industry webinars and workshops. - Include training hours in project activities.

The figure shows how the steps are located in each dimension. The inner circle represents the learning infrastructure dimension, and it encompasses mechanisms that an organization can utilize to improve learning processes within the organization. The dimension is crucial because it reinforces the infrastructure of learning so that it is more capable of knowledge sharing and learning processes which indicates its location as a core for this framework.

Transitioning to the middle circle represents the knowledge accessibility dimension, and it encompasses all the steps that organizations need to undertake to improve their knowledge exchange methods. The importance of this circle arises from the fact it is the bridge between the foundational infrastructure and the cultural aspects

of an organization. It ensures that the knowledge can seamlessly flow through the foundation established in the inner circle.

Moving on to the outer circle represents the organizational culture dimension, and it encompasses the steps that the organization needs to undertake and are directly attributed to their organizational values and practices. The importance of this dimension arises from the fact efficient IPL process can only be achieved by refining the culture adopted in the organization. Additionally, this dimension stems from understanding the human aspect of learning and that the framework, tools, and mechanisms are insufficient without human incorporation.

Moreover, the structural domains are also contributing to the effective process of IPL. In the visual representation of the framework, the domains are color-coded. The technological domain, represented in the yellow segment, includes all the steps that can be taken by optimizing technological tools. The social domain, represented in the pink segment, includes all steps that can be taken by the employees. The organizational domain, represented in green, includes all the steps that organizations can directly take. These steps are mostly related to the organization's activities. Finally, the industrial domain, represented in grey, includes all the steps that are attributed to the industry's nature.

Furthermore, the steps included in this framework aim to provide organizations with an overview of the distinct approaches they can apply for more successful IPL. It is not necessarily required to follow these steps in order. Organizations have the choice to prioritize what they deem critical for the current time. The framework emphasizes the iterative nature of these steps as there is always room for improvement.

7.3 Recommendations for Practitioners

This section offers recommendations for practitioners aiming to improve their inter-project learning (IPL) processes. These recommendations can be taken based on what organizations need to prioritize their IPL processes. Derived from the findings of the theoretical and empirical studies, these insights can guide organizations in addressing the most pressing challenges.

Organizations can use the proposed roadmap framework as a starting point for improving IPL processes. Their foremost action should be to prioritize steps that align with their need, especially if they have already undertaken some of these steps. In this scenario, they can use the framework as a benchmark to ensure alignment with best practices. The roadmap framework allows organizations to explore new areas of development.

As highlighted in the roadmap framework, the improvement process is an ongoing process. Organizations should consistently explore new ways to streamline IPL and optimize knowledge exchange processes, as new improvement continually presents opportunities for advancement.

Furthermore, another important recommendation for organizations is to establish standards that demonstrate the long-term impact of improved IPL. This is primarily to quantify the benefits of enhanced IPL. Additionally, it can be used to emphasize the significance of the knowledge exchange process for employees, motivating them to remain proactive in their efforts for successful IPL. Utilizing performance indicators can be beneficial to observe the development and respond accordingly.

Additionally, it is vital for organizations to keep abreast of the latest industry advancements. By adopting the latest technologies and techniques, they can maintain competitiveness, improve learning activities, and

conserve resources. This proactive approach helps organizations to position themselves as a frontrunner in maximizing knowledge exchange and efficiency.

Lastly, organizations should stay involved in industry conferences and workshops to maintain an environment that enables organizations to strengthen relationships, and potentially make use of their experiences regarding improving IPL.

7.4 Recommendations for Future Research

This thesis has investigated the factors impacting on the process of IPL within PBOs. To achieve this objective, an improvement roadmap has been developed in this study that organizations can follow. The long-term development of the framework is an interesting topic for future studies, observing how the roadmap framework might change over time.

Furthermore, it was found that employees' experience can influence the process in different ways. Since the impact of this factor is still entirely unclear, more studies on the effect of experience on learning, especially its relationships with cultures, are warranted. This study can be useful in uncovering how experience can be ultimately utilized to improve the learning process within organizations.

Moreover, future studies can focus on the overarching impact of culture on IPL, as the results indicate how the social domain plays a pivotal role in improving IPL. Addressing cultural differences in learning can be a good approach to facilitate IPL. This study highlights how culture plays an important role in learning and knowledge exchange activities as it is directly attributed to the social domain factors and can pose a barrier if not addressed wisely. Therefore, a study on how to leverage cultural awareness can optimize the process of IPL.

Additionally, one recommendation can be to examine a wider range of organizations in different industries, offering a broader perspective on how PBOs are improving their IPL activities. This helps to yield data that is more generalizable, potentially leading to a framework suitable for all organizations. Such an approach will reveal challenges and opportunities in PBOs not identified in this study, given the fact that the main focus was on the construction industry.

Finally, expanding the study to focus solely on one structural domain can be another recommendation for future research. It was observed in this study that covering all structural domains provides an overview of IPL within PBOs. However, concentrating solely on one structural domain allows the researchers to delve deeper to explore new factors and provide a more in-depth understanding of IPL challenges.

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Appendix A Semi-Structured Interview Guide

A) Introduction

1. Introducing the interviewer and the interviewee:

Let me start by introducing myself to break the ice here. My name is Wael, I am a master's student, studying Construction Management and Engineering at TU Delft. As a part of my thesis, I am conducting my research on inter-project learning within Sweco, and I have to conduct interviews with experienced project managers to have their practical perspectives on how inter-project can be improved. I really appreciate that you agreed to have this interview with me. Can you tell me a little about yourself?

2. Interview Goal:

The goal of this interview is to have a better understanding of the inter-project learning process and the emerging barriers and the possible facilitators from a project/team manager perspective within Sweco. The aim of the thesis essentially is to improve the learning between projects and therefore have a better project performance.

3. Interview Structure

The interview will be semi-structured, which means that they will be predetermined questions, but I would really like to have an open discussion with you to have a good understanding of your perspectives. The interview's duration will be around 50-60 minutes.

4. Consent and Confidentiality

Before we start, I want to emphasize that all shared information will be treated with strict confidentially. Additionally, your identity will be anonymized, and the data will be safely stored. The interview recording will be used for transcription purposes and will not be used anywhere else. Do you give me your permission to start the recording?

5. Recording the Interview

The recording has started now. We can start now with the interview questions.

B) Interview Questions

I. Opening questions:
1. Can you tell me something about the project you working on?
2. How long have you been working in Sweco?

II. Organizational learning and inter-project learning-related questions:
3. How would you describe the learning process in Sweco, What is the current approach? What are the challenges?
4. How do you think it can be improved?
5. Why do you think learning can really bring impact to the organizations?

III. Project-based organizations related questions:
6. Since Sweco is a project-based organization, how do you think this project-based organization nature affects the learning process? What are the extra challenges encountered there?
7. What are the extra challenges encountered in your industry?

IV. Knowledge transfer-related questions
8. How would you describe the process of knowledge transfer between projects?
9. Can you tell me about a successful example where learning has been implemented?

10. What are the measures taken by Sweco to ensure effective knowledge transfer? Elaborate.

V.   **Influencing factors-related questions**
11. What are the impacts of factors like dynamic capabilities and redundancy on learning? Can you name other factors that could affect the process of learning?

VI.   **Closing questions:**
12. Is there anything that you would like to add before we finish this interview?
13. Are there any other project managers that you would propose to be interviewed?

Thank you very much for taking the time and for your collaboration to participate in this interview despite your busy schedule. Your answers will bring a significant contribution to my thesis.

Appendix B Validation Interview Guide

A) Introduction

1. **Introducing the interviewer and the interviewee:**

Let me start by introducing myself to break the ice here. My name is Wael, I am a master's student, studying Construction Management and Engineering at TU Delft. As a part of my thesis, I am conducting my research on inter-project learning within Sweco, and I have to conduct interviews with expert in the field of inter-project learning within project-based organizations to validate my final findings. I really appreciate that you agreed to have this interview with me. Can you tell me a little about yourself?

2. **Interview Goal:**

The goal of this interview is to validate my findings in regard to improving the inter-project learning process. The interview aims to test the applicability and comprehensively of the framework to see whether it can be implemented in organizations.

3. **Interview Structure**

The interview will be semi-structured, which means that they will be predetermined questions, but I would really like to have an open discussion with you to gather sufficient feedback and insights from your perspective as an expert in the field. The interview's duration will be around 60-90 minutes.

4. **Consent and Confidentiality**

Before we start, I want to emphasize that all shared information will be treated with strict confidentially. Additionally, your identity will be anonymized, and the data will be safely stored. The interview recording will be used for transcription purposes and will not be used anywhere else. Do you give me your permission to start the recording?

5. **Recording the Interview**

The recording has started now. We can start now with the interview questions.

B) Interview Questions

I. **Opening questions:**
   6. Can you briefly describe your role and experience in managing teams within PBOs?
   7. How would you describe the importance of inter-project learning?

II. **Introduction to the Framework:**

This model shows my final findings so far. Let me briefly explain to you how I came up with this framework. At first, I conducted a literature study to investigate the impacting factors and could conclude various factors that impact the process. These factors were classified into 3 dimensions. Each dimension serves a specific role in the inter-project learning realm. The first dimension is presented in the inner circle of this framework, and it is the learning infrastructure dimension. This dimension lays the foundation for all learning activities, and it is a core dimension for inter-project learning and that is why it is in the inner circle. It includes all the tools and platforms that organizations need to improve their inter-project learning activities. The bigger circle then represents the knowledge accessibility dimension which involves all mechanisms that foster the process of exchanging and accessing knowledge. The third dimension is represented in the biggest circle. This dimension represents the factors that result from the norms, values, and atmosphere of the organization.

Furthermore, I conducted a case study within a project-based organization to gather new insights and investigate new factors that impact the process from a practical perspective. The findings of the case study show that the factors impacting inter-project learning are divided into 4 structural domains. Each domain

represents a unique facet of the process of inter-project learning. The technological domain encompasses technological tools and platforms in organizations that can affect the process. Social domain that focuses on factors attributed to human behaviours and cultural impacts. Organizational domain that highlights the structure of the organization. Finally, the industrial domain focuses on the factors that are related to the industry in general.

8. What are your essential impressions of this framework?
9. What do you think about the categorization of structural domains and dimensions?

III. Technological Domain:

10. Do you agree that the optimization of digital platforms will have a significant impact on the inter-project learning process?
11. How do you think remote work circumstances can be optimized to come up with the most effective inter-project learning activities?

IV. Social Domain

12. How far do you agree that cross-team activities will facilitate knowledge sharing? Is this an effective process in practice?
13. Do you think that cultural differences play a vital role in the process?
14. How do you think a collaborative culture can increase the efficiency of the inter-project learning process?

V. Organizational Domain

15. Do you agree that learning processes can be facilitated by utilizing workshops and training sessions?
16. Do you agree that experience differences between employees could pose a limitation to effective communication?
17. Do you think learning and knowledge sharing processes responsibility can be assigned to specific roles?
18. How far do you agree that the discipline varieties can optimize the process?

VI. Industrial Domain

19. How far do you agree learning and knowledge-sharing activities can be incorporated into daily routines to deal with the lack of resources problem?
20. How far do you think attending webinars and workshops can solve the problem of environmental competitiveness?
21. Do you agree that the client's feedback can be exploited to learn from and improve performance?

VII. Validation and Recommendations

22. Are there any elements in the framework that you think are not effective in the practice?
23. What would you suggest adding or modifying in this framework?

VIII. Closing questions:

24. Before we finalize this discussion, how much applicability does this framework have?
25. Are there any other suggestions or insights you would like to share before we finish this interview?

Thank you very much for taking the time and for your collaboration to participate in this interview despite your busy schedule. Your answers will bring a significant contribution to my thesis.

Appendix C Post-Interviews Impressions by the Interviewer

Interview 1:

This interview took around 50 minutes. The main theme of this interview is that communication should be empowered within the teams in order to facilitate inter-project learning. The fragmented and tacit information makes the process even more difficult to learn and increase experience. By involving experienced leadership and making use of AI platforms, the efficiency of knowledge sharing can be improved, and a more dynamic learning environment can be created.

Interview 2:

This interview took around 53 minutes. The main theme of the interview is that communication is a key method for achieving successful learning. The interviewee also emphasized the important role of team managers in facilitating learning across projects and that division managers should also enrich the connections between the team managers to have better team interconnections. The interviewee also indicated that the leaders and the managers should interact more with other project members and make sure that everyone is familiar with the process and going according to the plan. Finally, the interviewee mentioned the impact of working from home and its potential impact on knowledge-sharing.

Interview 3:

This interview took around 45 minutes. The main theme of this interview is that communication is not the key part of improving learning. Instead, the interviewee has suggested motivating employees to take initiative as learning is something that you cannot enforce in an organization without individual motivation. The interviewee has also suggested that learning and knowledge sharing should be given more priority in the team's discussions.

Interview 4:

This interview took around 41 minutes. The main theme of this interview is that learning, and knowledge-sharing processes have to be integrated into employees' daily activities. The interviewee has also proposed that having a safe environment is a powerful tool to motivate employees to share their failures. The safe environment can only be achieved by empowering a collaborative culture where everyone feels comfortable to share mistakes.

Interview 5:

This interview took around 36 minutes. The main theme is that the interviewee has suggested integrating learning into the daily routine of the organization in order to keep improving. Generally, the interviewee gave the impression of satisfaction with the adopted learning method in the organization. The interviewee has indicated the fact that team managers have a very significant role in facilitating learning across projects and boosting a knowledge-sharing environment. Additionally, the interviewee has recommended improving communication on various levels to make sure that there are sufficient interactions between employees from different teams and projects.

Interview 6:

This interview took around 38 minutes. The main theme is that the interviewee believes that a safe environment is the most important tool to emphasize learning and knowledge-sharing culture across projects and teams. The interviewee mentioned that experience can hinder learning sometimes since organization members feel reluctant to share knowledge with employees with big experience. The interviewee also indicated that lessons learned should be discussed in all team meetings as a main element in the agenda to integrate it into the organization's daily routine.

Interview 7:

This interview took around 50 minutes. The main theme of this interview is the interviewee believes that effective communication is the key to successful cross-team collaboration. The interviewee emphasized that communication in all forms can help to have an effective process of knowledge exchange which helps employees learn from each other's mistakes. The interviewee believes that informal practices such as coffee pauses and informal chats are strong tools to foster an atmosphere where knowledge is exchanged in a smooth way.

Interview 8:

This interview took around 25 minutes. The main theme of this interview is that the interviewee indicated the inefficiency in the process of learning in general which comes due to the fact that there is no sufficient time allocated for reflection and learning as the focus is mostly on the upcoming projects. The interviewee thinks that organizations need to reassess the priorities of their activities based on which one will benefit in the long term.

Interview 9:

This interview took around 31 minutes. The interviewee has focused on the impact of billing ratio on learning practices as limited room is given for learning and reflection. Knowledge sharing and learning activities are generally made during meeting spontaneously. The unclear responsibility description results in a situation where it is unknown who is responsible for cross-project learning activities. Additionally, there is always a gap between knowledge collection and learning and implementation phases. No effective implementation of gained knowledge in practice has been observed.
Finally, the interviewee noted on the impact of organization focusing on numbers which result in less effective inter-project learning.

Interview 10:

This interview took around 42 minutes. The interviewee talked about the ineffectiveness of the current evaluation forms to reflect and learn and there is a serious need to optimize the current digital platforms to include the gathered knowledge in a way that ensures that each employee has an easy access on it. Additionally, the interviewee highlighted the need for more post-project reflective sessions. Finally, the interviewee has emphasized that learning is a continuous and iterative process, meaning that there is always room for improvement for both learning and knowledge exchange processes.

Appendix D Correlation Figures between Literature and Empirical Studies

Digital Platforms
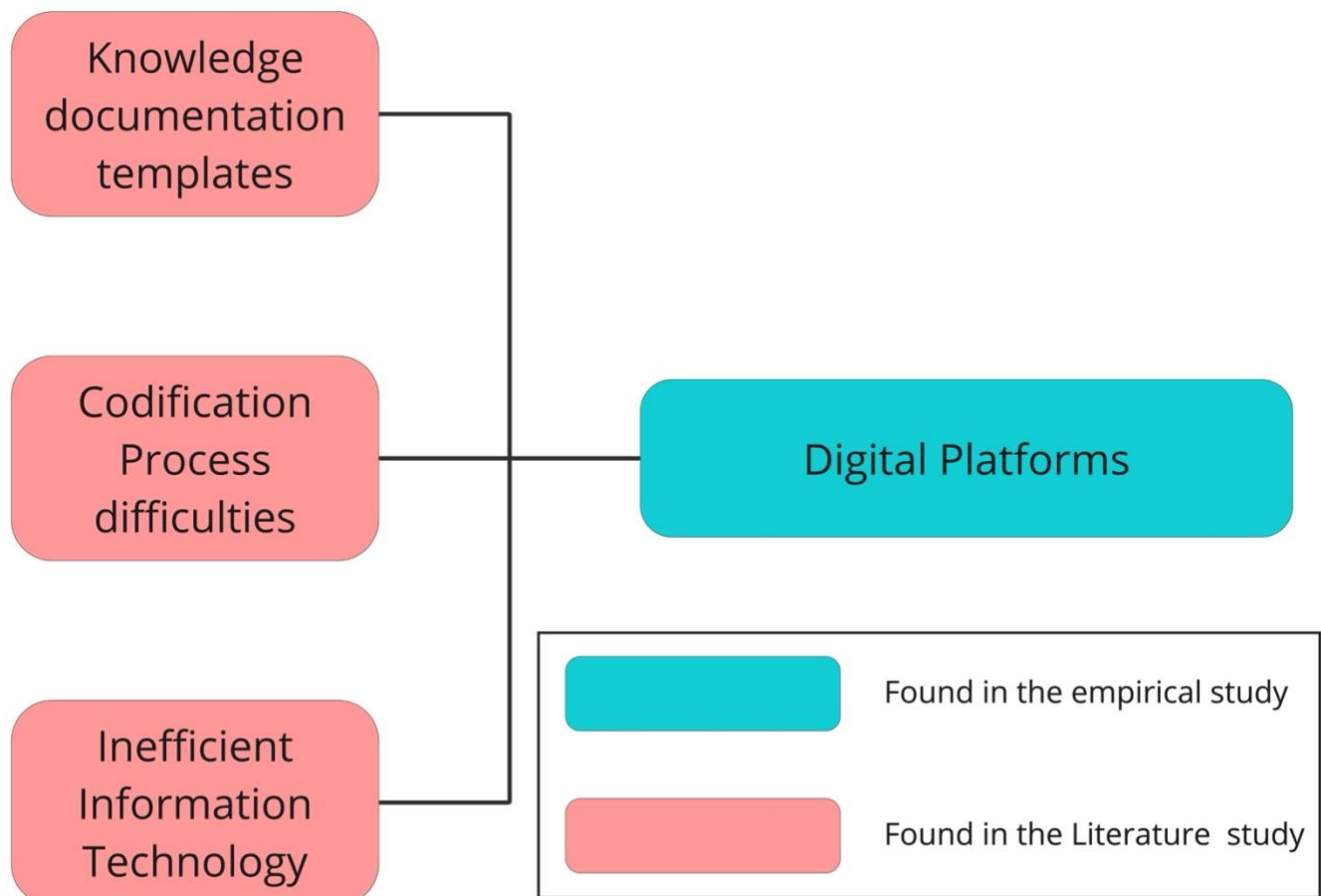
Figure 30 Correlation Between Digital Platform Factor and Literature Findings

Attitude toward Sharing Failure
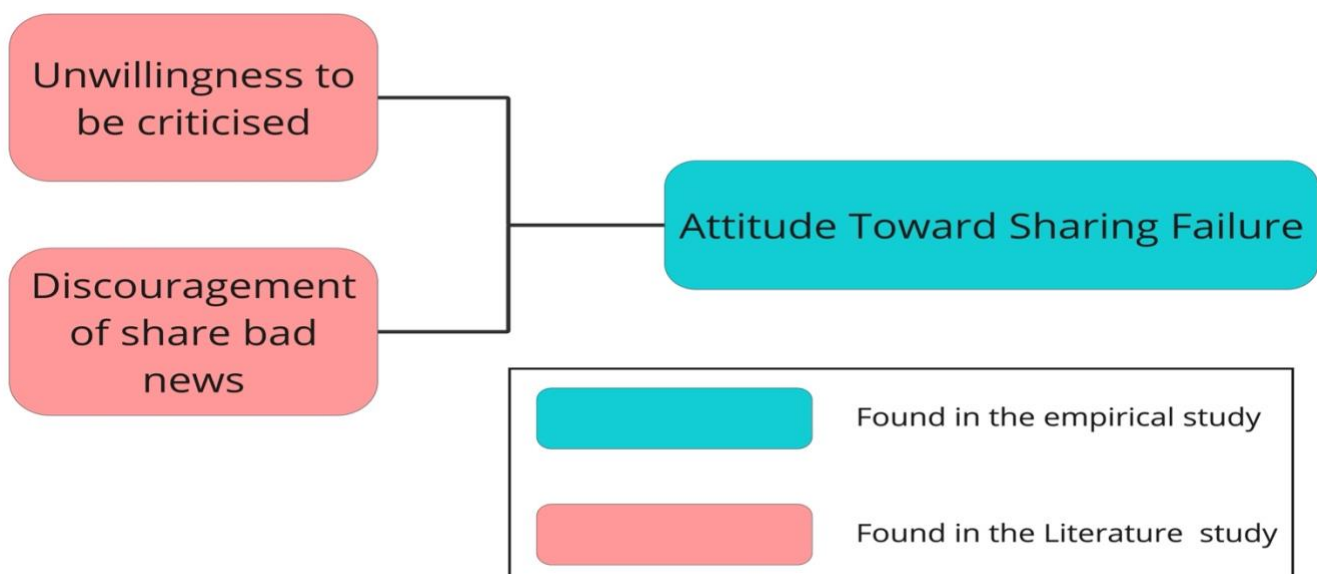
Figure 31 Correlation Between Attitude towards Sharing Failure Factor and Literature Findings

Individual Culture
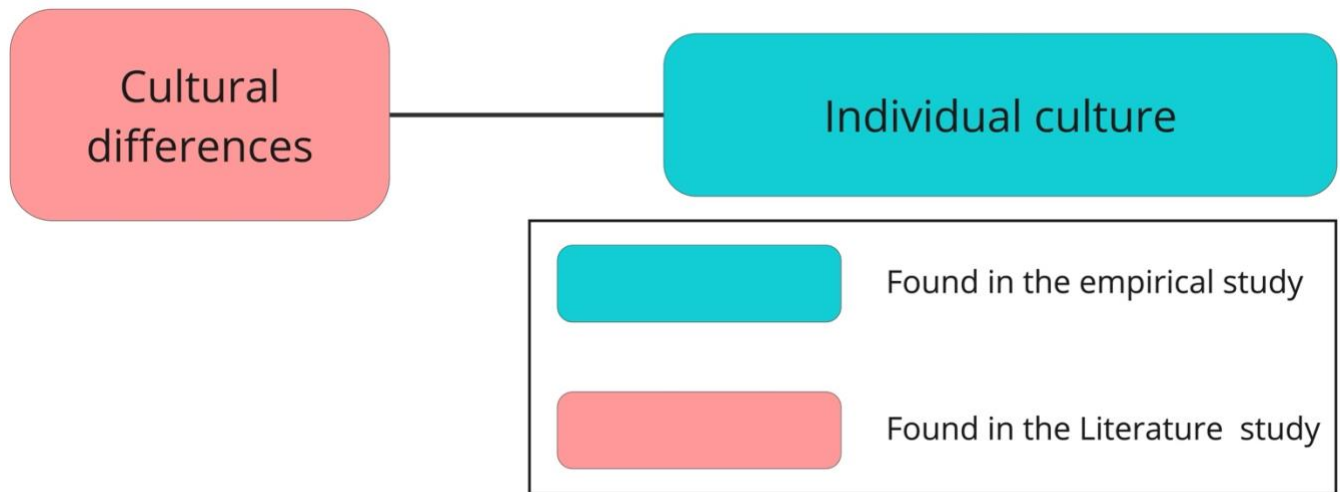
Figure 32 Correlation Between Individual Culture Factor and Literature Findings

Informal Learning Mechanisms
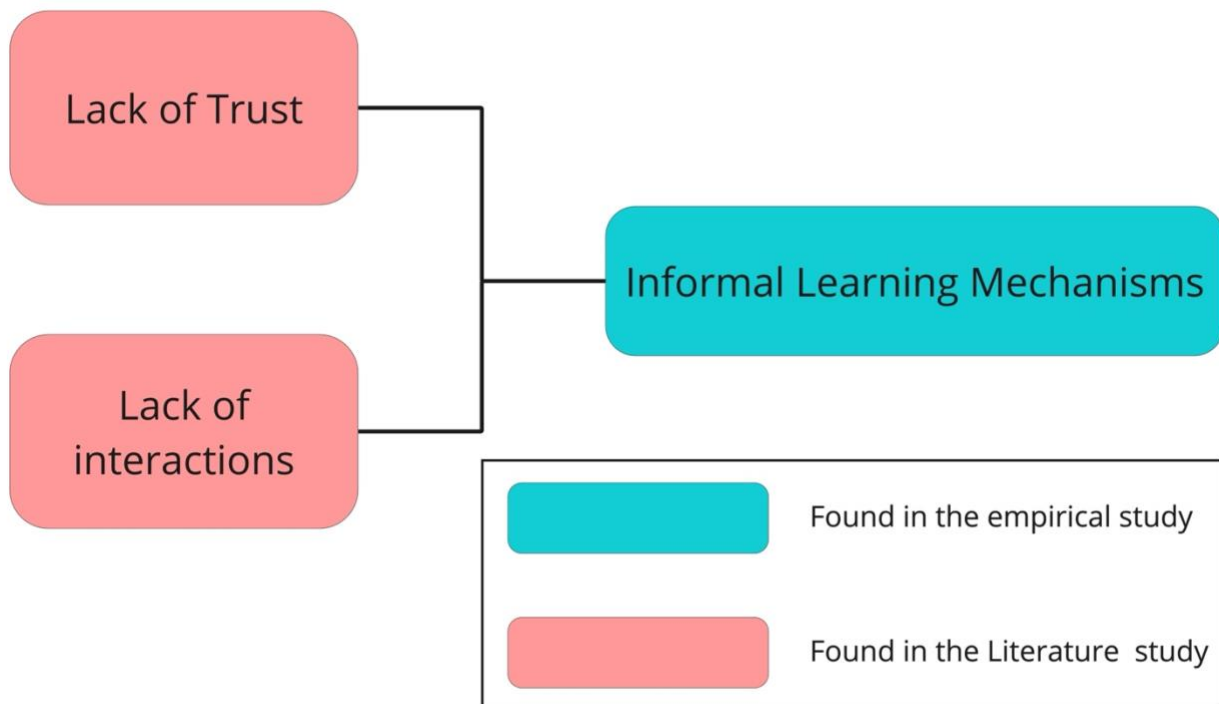
Figure 33 Correlation Between Informal Learning Mechanisms Factor and Literature Findings

Initiative Taking Propensity
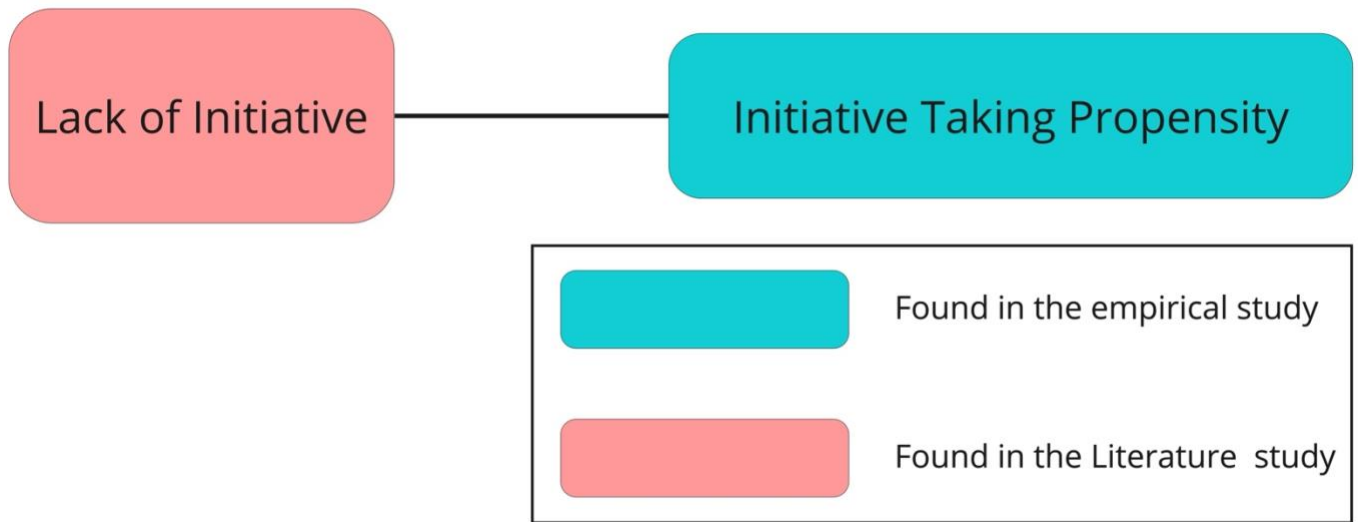
Figure 34 Correlation Between Initiative Taking Propensity Factor and Literature Findings

Cross-teams Interactions
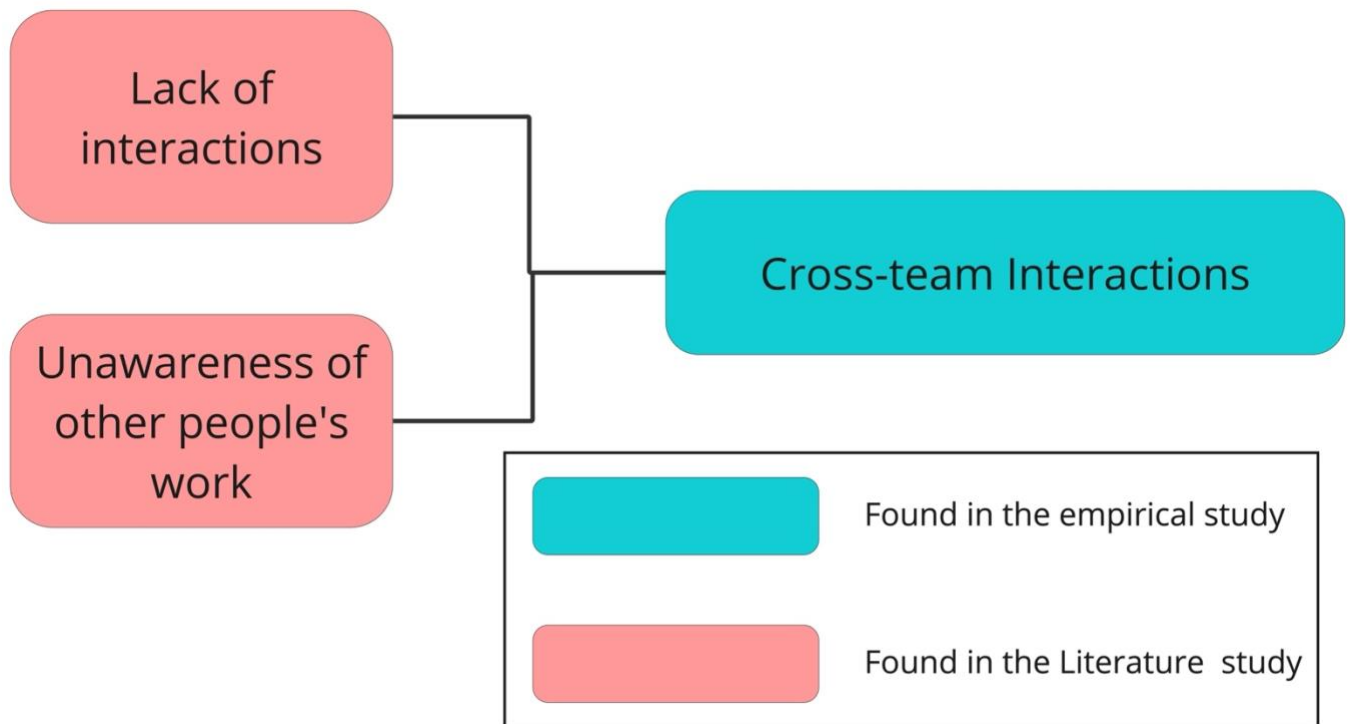
Figure 35 Correlation Between Cross-team Interactions Factor and Literature Findings

Verbal Communication
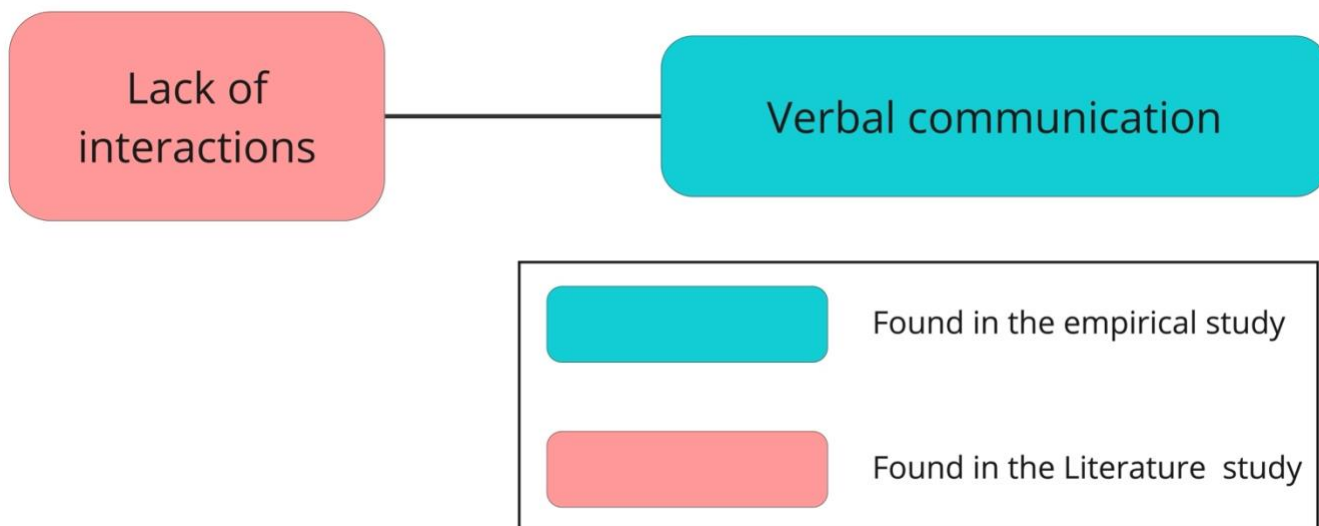
Figure 36 Correlation Between Verbal Communication Factor and Literature Findings

Internal Communication
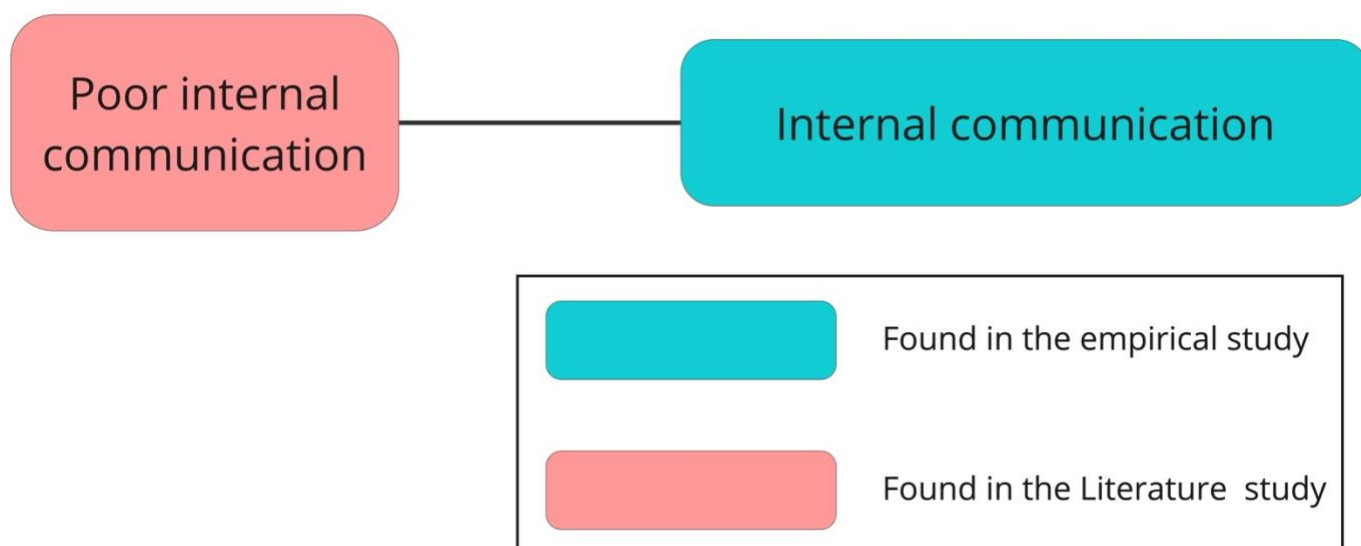
Figure 37 Correlation Between Internal Communication Factor and Literature Findings

Safety of Learning Environment
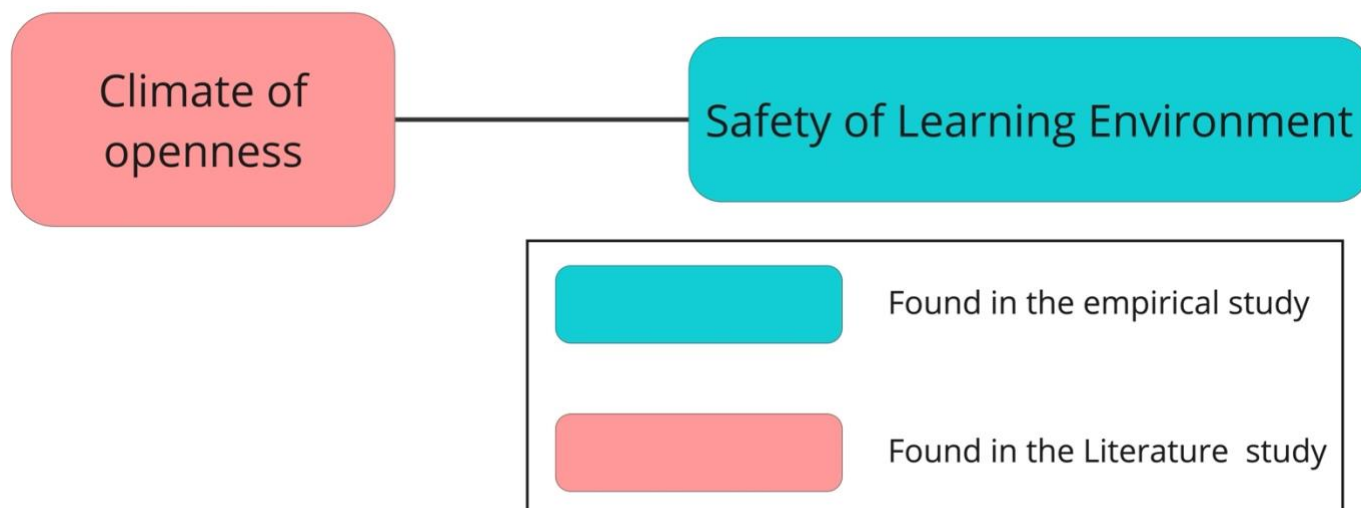
Figure 38 Correlation Between Safety of Learning Environment Factor and Literature Findings

Experience Impact
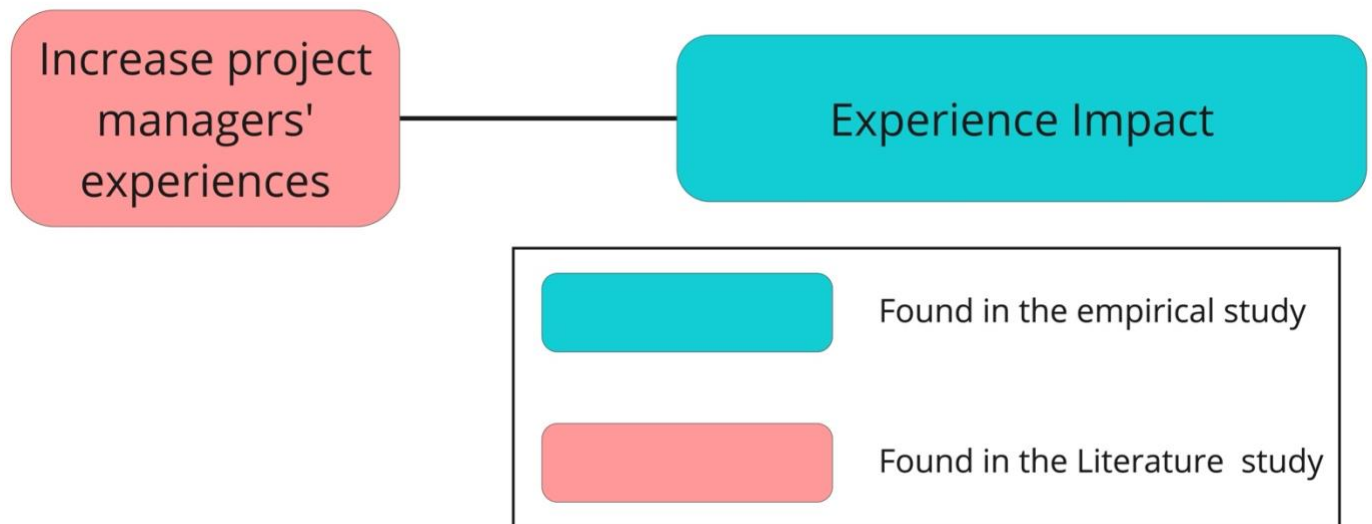
Figure 39 Correlation Between Experience Impact Factor and Literature Findings

Collaborative Culture Adoption
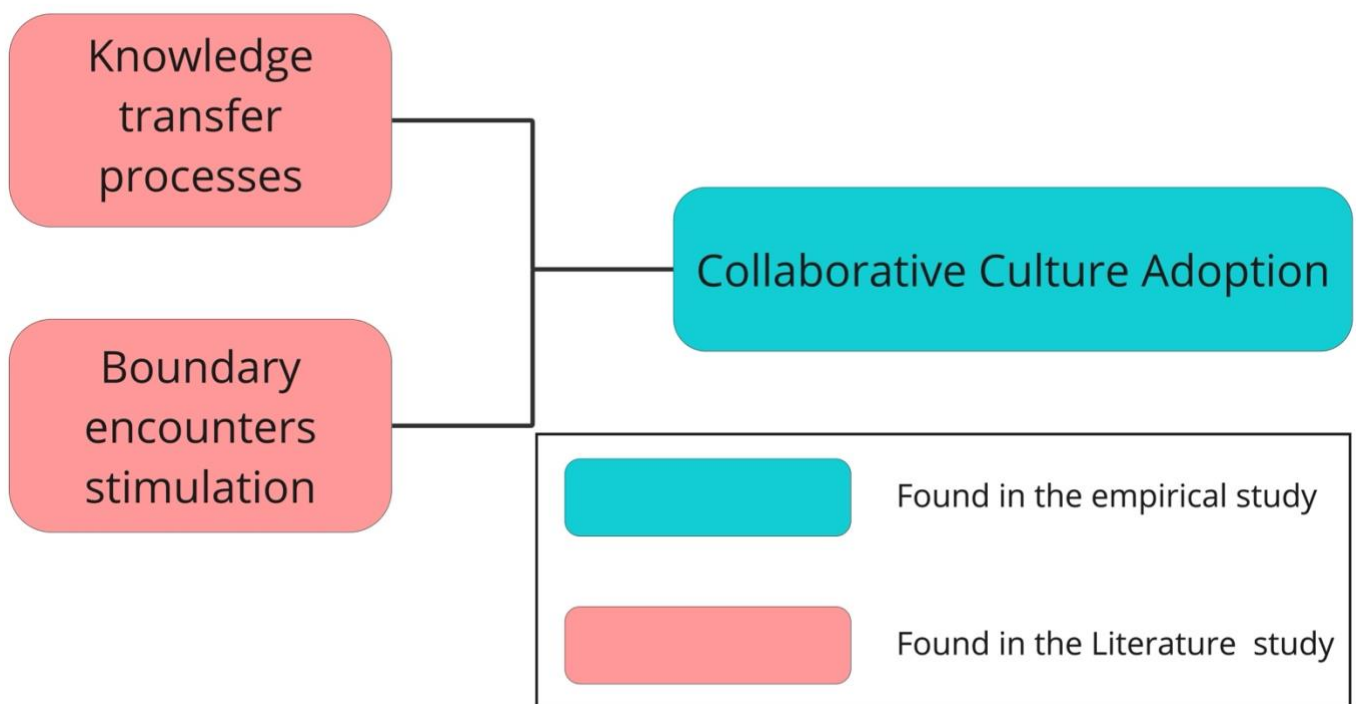
Figure 40 Correlation Between Collaborative Culture Adoption Factor and Literature Findings

Learning Workshops
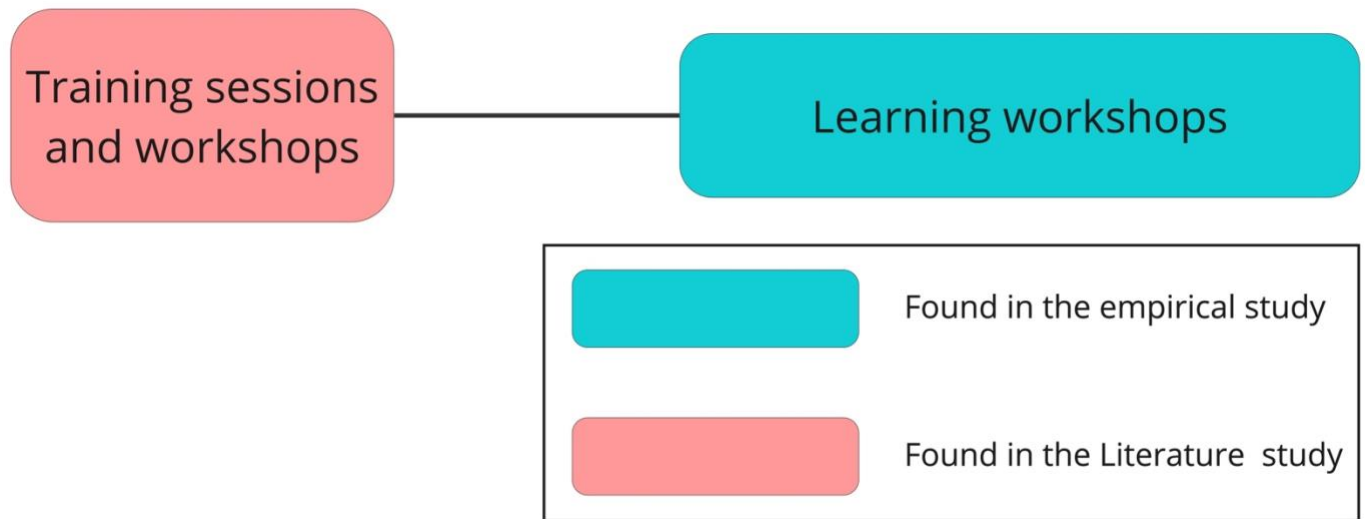
Figure 41 Correlation Between Learning Workshops Factor and Literature Findings

Time Availability for Learning
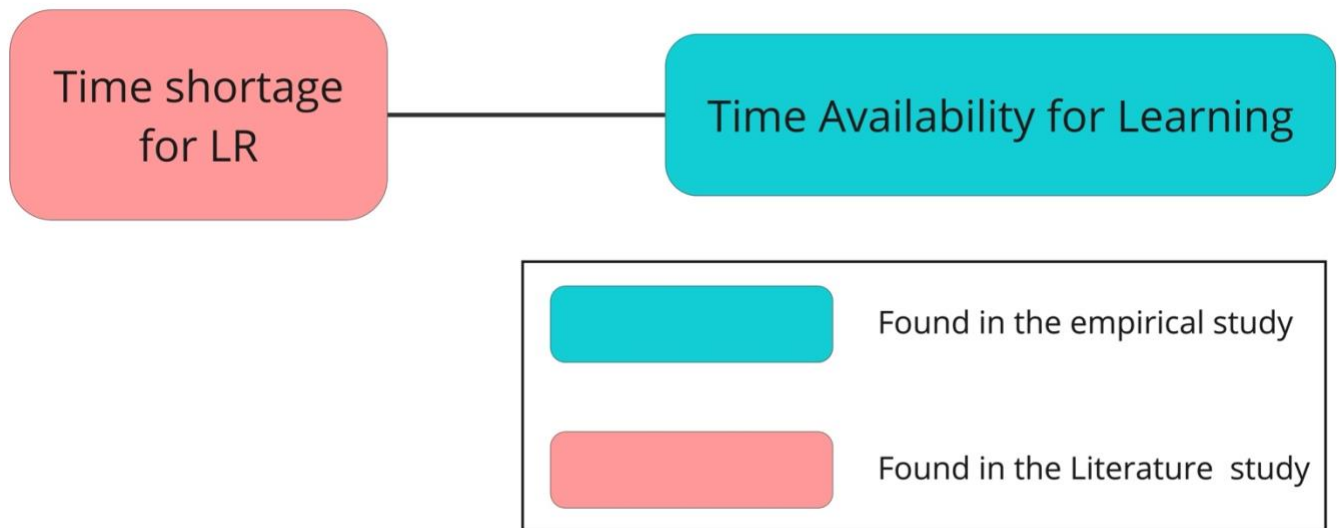
Figure 42 Correlation Between Time Availability for Learning Factor and Literature Findings

Learning Process Continuity
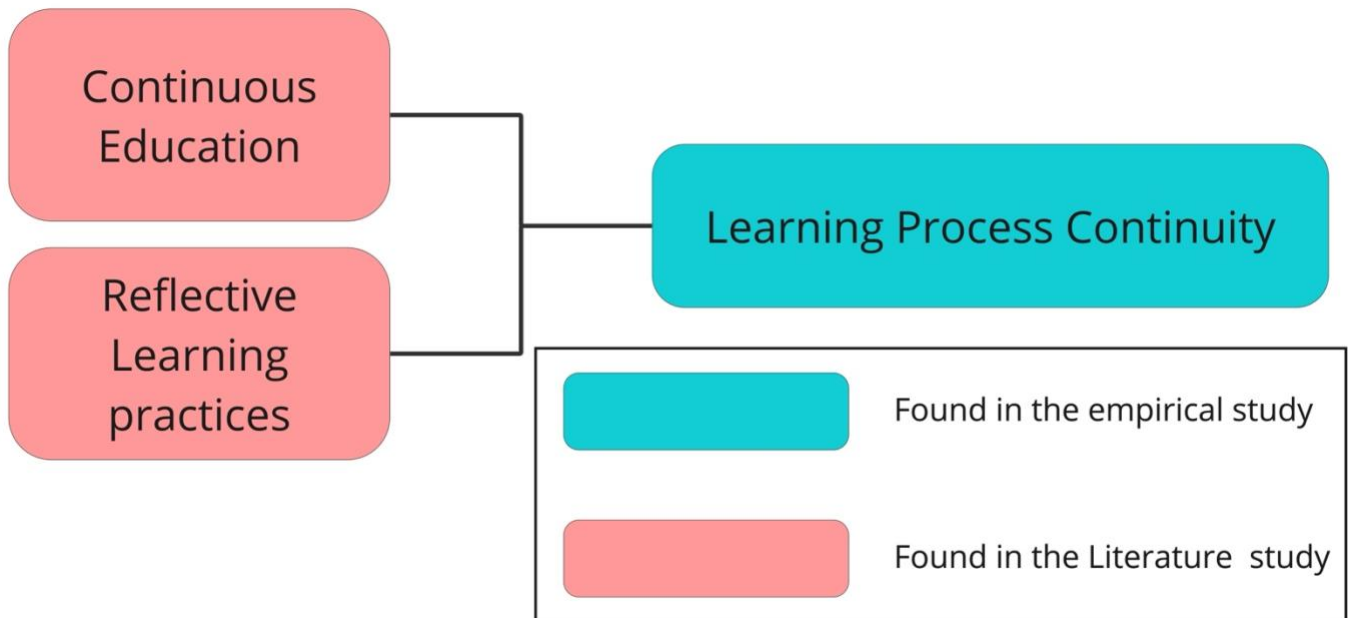
Figure 43 Correlation Between Learning Process Continuity Factor and Literature Findings

Fragmentation Level
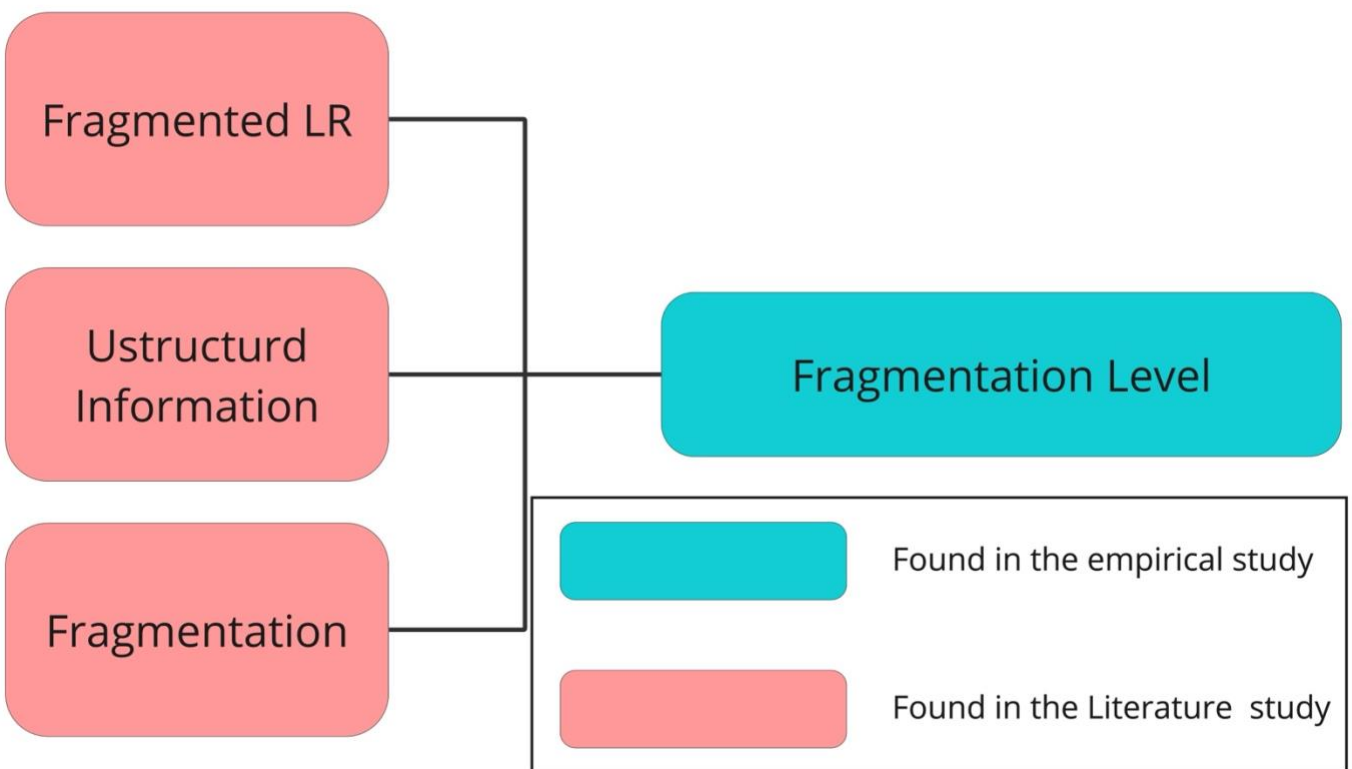
Figure 44 Correlation Between Fragmentation Level Factor and Literature Findings

Project-based Nature
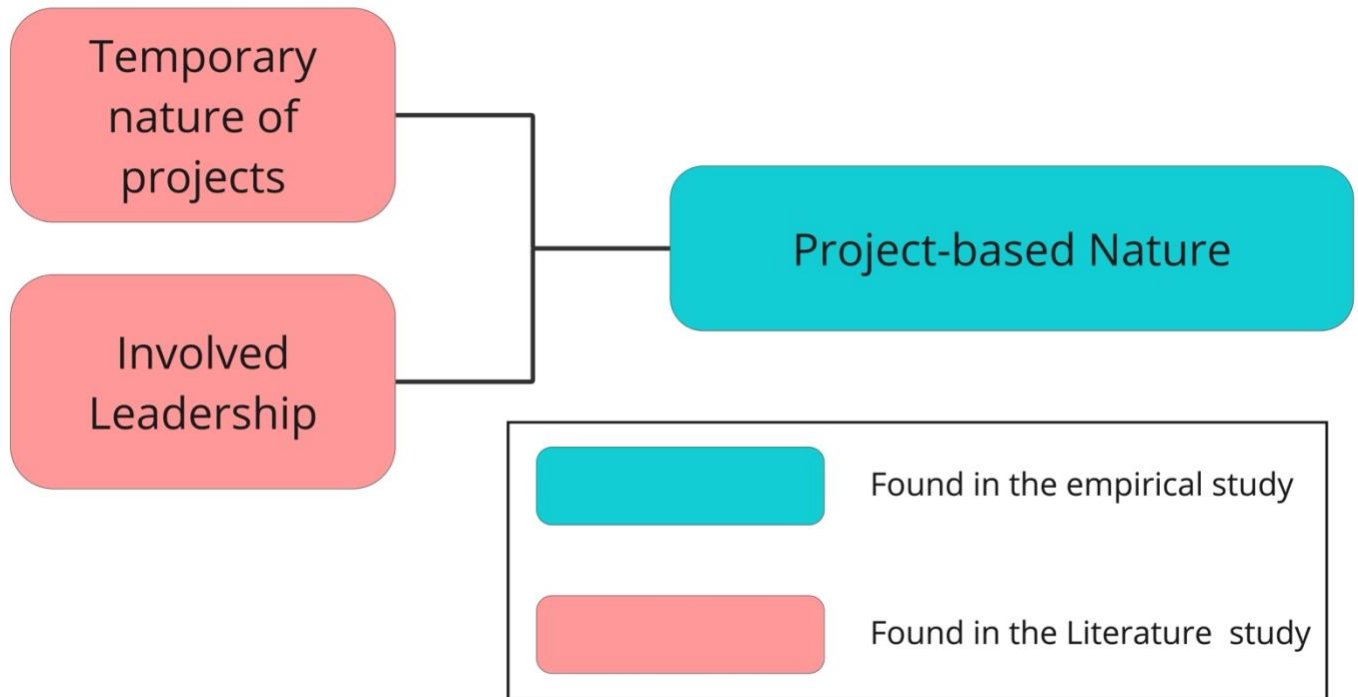
Figure 45 Correlation Between Project-based Nature Factor and Literature Findings

Location Differences
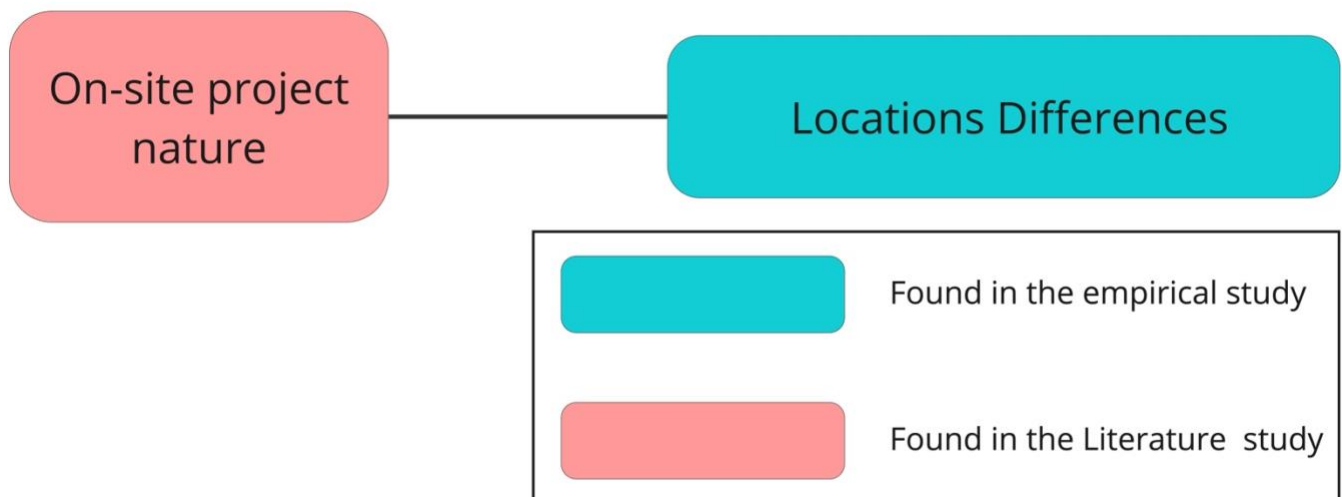
Figure 46 Correlation Between Location Differences Factor and Literature Findings
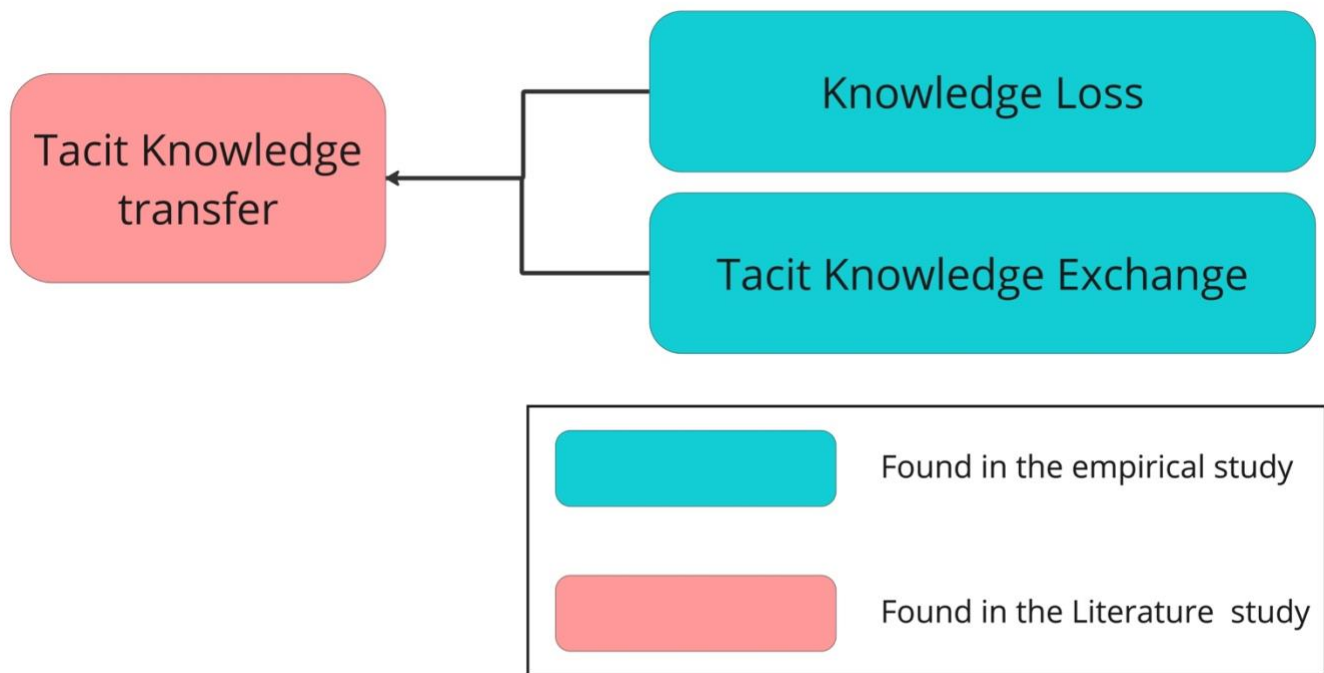
Tacit Knowledge Exchange

Figure 47 Correlation Between Tacit Knowledge Exchange Factor and Literature Findings
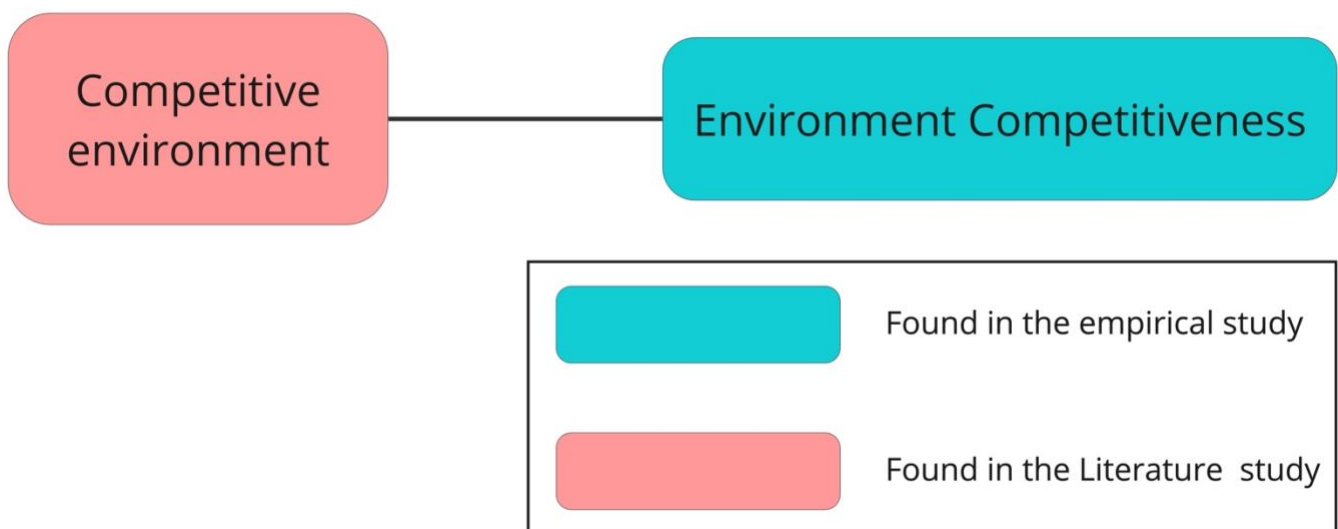
Environment Competitiveness

Figure 48 Correlation Between Environment Competitiveness Factor and Literature Findings

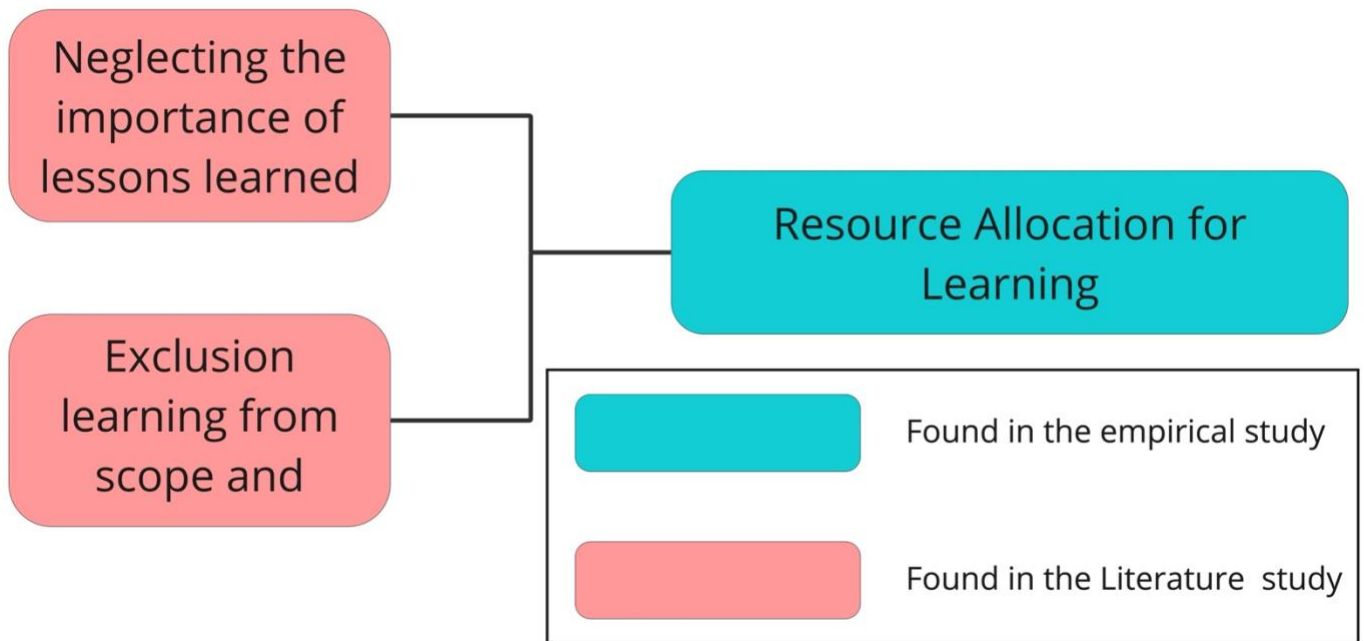**Resource Allocation for Learning**

Figure 49 Correlation Between Resource Allocation for Learning Factor and Literature Findings
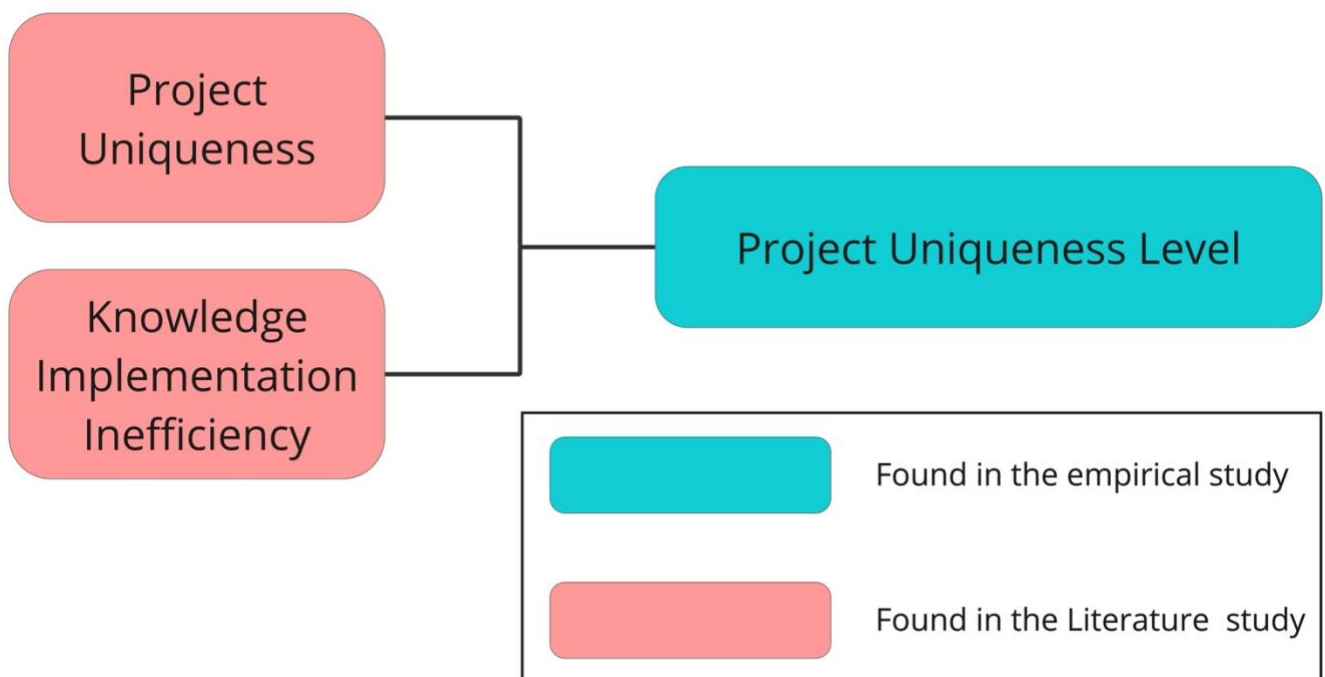
Project Uniqueness Level

Figure 50 Correlation Between Project Uniqueness Level factor and Literature Findings
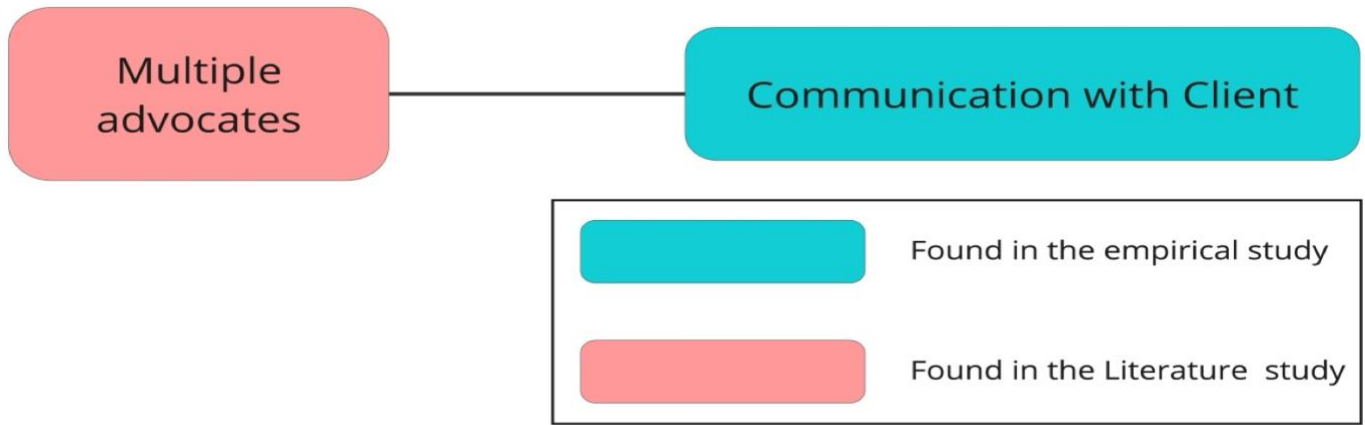
Communication with Client

Figure 51 Correlation Between Communication with Client Factor and Literature Findings

Appendix E Interconnections Table

Table 13 Factors Interconnections Explanation

Impacting Factor	Factors Impacted	Explanation
Fragmentation Level	Cross-team Interactions	A high level of fragmentation will pose an extra challenge to have a successful cross-team interactions
Open AI systems	Tacit Knowledge Exchange	Open AI systems can help to make the acquired knowledge more explicit and implementable in future projects
Open AI systems	Fragmentation Level	Open AI systems can gather data from different resources that can be merged to allow users to have an easy access to the required information
Open AI systems	Attitude Toward Sharing Failure	Open AI systems has the ability to anonymize, automate, analyse failure data which encourages sharing insights
Specialization	Cross-team Interactions	Specialization helps to improve discipline expertise and sharing valuable information
Digital Platforms	Remote Work	Digital platforms provide stronger accessibility to knowledge and facilitate effective communication
Digital Platforms	Fragmentation level	Digital platforms have the ability to centralize information and make it easier for an organization's teams to access it in a more organized manner.
Digital Platforms	Collaborative culture adoption	Communication channels in the digital platforms can boost collaboration on organization level
Digital Platforms	Location differences	The digital platforms mitigate the consequences of different locations as it facilitates remote collaboration
Environment Competitiveness	Safety of Learning Environment	Competitiveness increases the reluctance of employees to speak up due to the pressure resulted by it
Environment Competitiveness	Collaborative Culture Adoption	Competitiveness reduces the chance to have a collaborative as it will deprioritize collaboration on organization level
Environment Competitiveness	Resource Allocation for Learning	The competitiveness in the market forces organizations to allocate less resources on projects and deprioritize learning activities
Time Availability for Learning	Communication with Client	Time pressure for both client and organization's employees restrict the possibility of having productive communication process as employees focus on next projects and client has no interest
Time Availability for Learning	Learning workshops	Time shortage can reduce the chance of implementing periodic workshops for learning
Internal communication	Cross-team Interactions	Internal communication within the organization encourages cross-team interactions
Initiative Taking Propensity	Collaborative Culture Adoption	Taking initiative toward spreading knowledge and learning boost collaborative culture within organization
Initiative Taking Propensity	Learning Process Continuity	Taking initiative is an essential way to foster continuous learning process as it shows the importance of gaining new insights and knowledge

Initiative Taking Propensity	Roles and responsibility	Takin initiative results in more dynamic responsibilities of employees
Initiative Taking Propensity	Informal Learning Mechanisms	The proactive approach makes informal learning practices more effective
Collaborative Culture Adoption	Safety of Learning Environment	A collaborative culture within organization results in a safe environment for learning and sharing failures
Cross-team Interactions	Collaborative Culture Adoption	Activities across teams play a vital role in strengthen a collaborative culture due to its ability to break down silos.
Individual culture	Collaborative Culture Adoption	Individual culture can directly impact the collaborative culture within the organization
Project-based Nature	Resource Allocation for Learning	Project-based nature result in an extremely tightly allocated resource
Project-based Nature	Time Availability for Learning	Limited time and the temporarily projects limit the time available for learning activities
Attitude Toward Sharing Failure	Safety of Learning Environment	Comfortable attitude towards sharing failure will result in a safe environment where knowledge can be smoothly exchanged
Remote Work	Informal Learning Mechanisms	Remote work can hinder informal learning as it doesn't provide the face-to face interaction
Learning Workshops	Learning Process Continuity	
project Uniqueness Level	Tacit Knowledge Exchange	Unique projects lead to more challenges in exchanging tacit knowledge as it is more difficult to be transferred
project Uniqueness Level	Fragmentation Level	Unique project characteristics result in higher fragmentation level
Experience Impact	Internal Communication	Experience variation can create a gap for effective internal communication