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Project Managers soft skills influence in tacit and explicit knowledge sharing

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Master's in Computer Science and Business Management

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TECNOLOGIAS
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Department of Information Science and Technology

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Resumo

A evolução tecnológica permitiu um foco maior no desenvolvimento de projetos de software, porém, estes sempre apresentaram altas taxas de insucesso. Na última década, o papel do gestor de projeto tornou-se mais relevante. Vários estudos concluíram uma ligação positiva entre as habilidades dos gestores de projeto, como comunicação, liderança, e o sucesso do projeto. Com a evolução tecnológica e a crescente disponibilidade de informação e conhecimento, o papel da gestão do conhecimento no ambiente de projetos tornou-se crucial. Contudo, a falta de tempo ou resistência dos membros das equipas é considerada uma barreira na partilha de conhecimento. Considerando a influência comprovada entre as soft skills dos gestores de projetos e o sucesso dos projetos e tambem que a influência positiva da gestão do conhecimento no sucesso dos projetos pode melhorar, este estudo pretende analisar se as soft skills dos gestores de projetos influenciam a partilha de conhecimento. Foi realizada uma pesquisa com os membros de equipas do projeto. Os resultados obtidos concluiram que a liderança do gestor de projetos influencia positivamente a partilha de conhecimento dos membros da equipa em sistemas de informação. Concluiu-se também que a liderança do gestor influencia a partilha de conhecimento através de processos referentes à partilha de conhecimento tácito. Na relação entre a capacidade de resolver problemas do gestor e o ambiente de gestão de conhecimento, conclui-se que esta é reforçada quando existe uma cultura organizacional estruturada que favoreça esta partilha.

Palavras-chave: Gestor de projeto, Soft skills, Partilha de conhecimento, Cultura organizacional

Abstract

The technological evolution allowed a more significant focus on software development projects however, these always showed high failure rates. The project manager role has also gained increasing importance. In the last decade, several studies concluded a positive link between project managers' skills, such as communication, leadership and problem-solving skills, with project. With the technological evolution and the availability of information and increasing knowledge, the knowledge management role in project environment has become indispensable. However, employees' lack of time or resistance is considered a barrier to knowledge sharing. Considering the proven influence between project managers' soft skills and its success and considering that knowledge management positive influence on project success can be improved, this study aims to analyze whether project managers' soft skills influence knowledge sharing. A survey of project team members was carried out. The results obtained allowed us to conclude that the project manager's leadership positively influences team members' knowledge sharing in information systems. It was also concluded that project manager's leadership influences knowledge sharing through socialization processes and face-to-face conversations, which refers to tacit knowledge sharing. Regarding the moderation studied, it is concluded that the relationship between the project manager's problem-solving ability and knowledge management environment is reinforced as each moderator increases. This means that the relationship between the project manager's ability to solve problems and explicit knowledge sharing within the organization is reinforced in an organization where there is a structured organizational culture that favors knowledge sharing.

Keywords: Project Manager, Soft skills, Knowledge Sharing, Organizational Culture

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CHAPTER 1

Introduction

Motivation

The last few decades have seen profound structural changes at the business level. The rapid technological evolution has placed many organizations in fragile and competitive positions, creating the need for readjustment and a careful search for how to maintain or expand the response capacity to an increasingly technological and competitive world.

The focus on projects and their failure began to increase when their economic and strategic importance within organizations was understood. However, its high failure rates have always been and remain a significant cause for concern, leading the scientific community to large and intense research on the project's main success factors (Neves et al., 2017; Hidding & Nicholas, 2014).

The value given by organizations to the employee's skills, namely to project managers' skills, has also suffered significant changes in recent decades. For many years, technical skills were considered essential to develop as a project manager (Maqbool et al. 2017; Awan et al., 2015). Its effectiveness and efficiency were measured through the number of tangible results achieved, that is, through the produced planning documents, which tool was used to manage the budget, customer satisfaction, its ability to prioritize, among others. However, the search for project success factors revealed the importance of managers with more human and personal skills developed. Several studies conducted in the last decade found a positive link between skills such as communication, leadership and problem-solving skills with the project's success (Awan et al., 2015; Maqbool et al., 2017; Alvarenga et al., 2020). That is how a paradigm shift began, starting a growing appreciation of project managers soft skills.

The rapid technological evolution that has been experienced in recent decades has created significant business opportunities in Information Technology (IT) sector. More and more projects began to be developed, which became fundamental from the organization's economic and strategic point of view (Hassani & el Bouzekri El Idrissi, 2020). In addition to the increased available information enabled by technological evolution, the growing number of projects has also generated more knowledge. Documenting good practices, lessons learned and knowledge generated during the project's life cycle is an asset to the entire organization, allowing for the future reuse of this knowledge (Hanisch et al., 2009). Transference and knowledge sharing became fundamental processes to improve project development, allowing organizations to benefit from their positive results (Mahura & Birollo, 2021). However, various factors like employees' lack of time or resistance are considered barriers to sharing knowledge. This lack of success in knowledge managing within project environments led to the search for factors that can positively influence knowledge sharing within the organization. Among the

various factors, the company culture was considered one of the most important. Knowledge sharing and reuse will hardly exist if the company's culture and environment are not aligned with this sharing culture (Dinh et al., 2016).

Research questions and objectives

The present study was developed based on two research pillars: the first lies in the fundamental role that project managers' soft skills play in dimensions such as project success. The second is linked to the knowledge management potential development, concerning its positive link to the project's success. Therefore, the objective of this investigation was to study the impact of the Project Manager's soft skills in tacit and explicit knowledge sharing. In addition, since the project manager influence is framed in an organizational context, the present study aims to analyze whether organizational culture acts as a moderator in the relationship between the project manager's soft skills and knowledge sharing.

This study allows an understanding of whether a project manager's different soft skills impact knowledge sharing among projects and whether the organizational environment impacts the relationship between soft skills and knowledge sharing. It is intended to answer the following questions:

P1: Do the Project Manager's soft skills influence tacit knowledge sharing?

P2: Do the Project Manager's soft skills influence explicit knowledge sharing?

P3: Does the organizational environment impact the relationship between project manager soft skills and tacit and explicit knowledge sharing?

Methodological Approach

In the present work, a quantitative methodological approach was used to quantify and analyse the defined variables and then draw conclusions from the analysis carried out. It was conducted a cross-sectional survey that allowed fast and reliable data collection. It was used to investigate a target population.

Document Structure

This document is divided into six chapters. The first is the **Introduction**, where the motivation and objective of the study are presented, as well as the applied methodological approach. Then, **Literature Review** is where you can find all the research and literature review carried out to support the objectives of the work. The **Method** chapter is where the used methodological approach is analysed.

The participants are described, as well as the measures of analysis and the procedures that were carried out. Then, in the **Results** chapter, the results obtained through the analysis of the collected data are presented. In the **Discussion** chapter, the results obtained are discussed and it is compared what was expected with what was obtained. The **Conclusions, Limitations and future research** is the final chapter, where the conclusions drawn from the present study can be read. The main considerations of the study are presented, as well as the limitations found. There are also some suggestions for future research.

CHAPTER 2

Literature Review

2.1. Project management concepts

2.1.1 Project and project management

The project management field has been and continues to be widely researched between companies and research communities. The interest shown over the past decades led to several definitions for this concept. Munns and Bjeirmi (1996) defined the project as the execution of activities and tasks that consume resources to achieve a specific objective, with defined start and end dates. As written by Murali & Venkatesh (2019), a project is a set of synchronized and managed actions within a defined period, with stipulated resources and budget, to achieve the objectives, considering the defined requirements. The Project Management Institute (PMI) defined in the Project Management Body of Knowledge (PMBOK) the project as an effort taken during a limited duration to create a service or product and should be used to achieve the company's goals (PMI, 2021). For the present research, the project is considered a set of tasks/activities that occur within a defined period and with defined resources and budget and its objective must be aligned with the organization's ambition.

The exponential information technology evolution felt in the last decades has created a constantly changing environment. Thus, the companies need to adapt to keep growing without losing competitive advantages or decreasing productivity. Projects play an increasingly important role in the organizations contributing to their economic development. They have been the target of great concern as their low success rates show that adapting to this fast-changing environment has not been easy (Hassani &Bouzekri El Idrissi, 2020).

Considering that the market is full of companies specializing in IT projects, the difference often lies in fulfilling the estimated times, costs, and quality of the delivered project. Thus, it is easy to understand that companies have invested a lot in improving their project management, guaranteeing their competitive advantage compared to other companies (Fonseca et al., 2017).

Despite the solid attention given to the project management field in the last decades, this area can be traced back to the primordial times of human life. Several constructions have been built on top of well-planned and managed project, as the coliseum of Rome on the 70's. However, the project concept was different from what it is today. They were not as methodic, disciplined or well documented. However, it was still necessary to gather a group of people with different skills, each with designated tasks, to make the construction of such a monument possible. Even though they were still far from what is considered project management nowadays, there were still people who held a management position guaranteeing that everything went according to what was planned. Regarding the evolution of the concept, Henri Fayol was able to strengthen his position in project management subject when he wrote the five main tasks of management, which, accordingly to himself, were universal: planning, organizing, commanding, coordinating and controlling. Despite his efforts, his studies were not given enough emphasis until the 90's, motivated then by the industrial and technological evolution (Seymour & Hussein, 2014).

It was only at the beginning of the new century that concepts and definitions of project management (PM) started to surface, with great agreement between them. Accordingly, with Shahibi et al (2019), project management usually deals with initiating, planning, scheduling, monitoring and controlling all the project activities to achieve the desired goals. Munns & Bjeirmi (1996) also defined project management as the process of making choices and determining priorities, choosing the proper techniques and strategies to ensure that a project is carried out. These definitions align with the described in the PMBOK, which considers that PM is the use of tools, methodologies, knowledge, and skills to meet the defined requirements. Project management is also related to the elaboration of plans appropriate to the project needs and characteristics, performing control processes to ensure the harmonization of four main dimensions: scope, time, cost, and quality, ensuring the good performance of the project (PMI, 2021).

2.1.2 Project Management Office

To respond to the projects increasing number held inside companies, a business unit called Project Management Office (PMO) was created, to provide safety and helpful network to the project manager, thus playing a vital role in project success (Dinh et al., 2016; Pirotti et al., 2022). These needs evolved from the necessity of building a unit inside the organizations that allowed the information

centralization, the standardization and control of all the project-related processes. It is expected that this department is seen as the foundation for activities and metrics related to the projects and helps and guides the project managers in applying innovative and efficient methodologies to their management (Dinh et al., 2016). Some of the main functions of these units are related to maintaining PM standards and methods, maintaining project historical archives, helping, and supporting while consulting and mentoring topics related to project management (Dai & Wells, 2004; Pirotti et al., 2022).

As a centralized unit for managing projects and their processes, the PMO creation led to the agglomeration of information from the most varied sources. The members of these departments need to know about the company and its objectives, as they are aware of the best practices for implementing project management. It is also necessary to have depth knowledge about their project and team. Naturally, there was a need to manage this information, optimize it and make it available to all participants. In the beginning of the last decade, investigations emerged that demonstrated the advantages and benefits of efficient knowledge management (KM) regarding the success and effectiveness of the developed projects, as will be presented in the following chapters (Dinh et al., 2016).

2.1.3 Project Management influence on Project Success

Organizational concern about projects high failure rate is not recent. In the 90s, articles were already developed that studied this high rate of failure, trying to find possible justifications, as is the case of the article developed by Robert Agunga (1992). The search for project success factors that could help organizations obtain better results and improve their competitive advantages is not recent.

In the 1960s, a graphic demonstration of a triangle was created, representing the main criteria by which the success of the project was measured. This triangle, which was given the name of Iron triangle, gained a lot of popularity in organizations and was for many years a standard by which teams were guided to evaluate the project performance (Pollack et al., 2018). This graphic representation shows three project constraints: cost, scope and time and the project quality reside in the center of the triangle. That means that, to guarantee a good final result, it must be ensured that the cost, scope and time are not exceeded. The most common causes of failure projects are typically connected to overreached budget, projects delivered after the defined date or large changes to the defined scope. These metrics are very aligned with the three parameters stated on the iron triangle, determining that they are indeed crucial to project management success (Hidding & Nicholas, 2014; Neves et al., 2017).

When a range of concepts started being introduced on the project management area, such as knowledge management, the iron triangle stop being enough to measure project success. Projects

began introducing complex concepts and irregularities that the iron triangle did not consider. It was realized that the idea of success depends on each person perspective so defining project success was no longer as easy and linear. As a result, the search for more robust metrics for project success began intensifying (Shahibi et al., 2019).

As mentioned earlier, project management involves plan elaboration, use of tools and methodologies to achieve the intended objectives, whose main function is improving project performance. According to the PMBOK, a greater and more conscious use of project management suggests that applying the correct knowledge, tools and techniques can impact the project's success (PMI, 2021).

The search for factors of success or failure of projects has remained a very important research topic and several studies developed over the years point to good project management as a crucial factor for project success. Studies from Fortune et al. (2011) and Joslin and Mulle (2015) showed that limited or inefficiently conducted project management are detrimental factors for project success. A study carried out in 2016 concluded that project management practices such as the use of a communication plan and time plan are critical to the success of projects (Badewi, 2016).

The conclusions drawn from the studies mentioned above are in accordance with what is described in the PMBOK and mentioned above, suggesting in fact the existence of a relationship between project management and their success. Considering the importance of effective project management, the organizations focus shifted to improving this segment and also in helping those who coordinate and are responsible for such management activities. The project manager came to be seen as a role of high importance.

2.2. Project Manager

The project manager role surfaced from the growing importance given to projects. These came to be seen as an organization great asset, creating the need for someone responsible for its management.

According to PMI, project manager responsibilities, together with the team, customers, sponsors, are related to setting objectives and using their capabilities to ensure that the project is delivered within stipulated requirements (PMI, 2021). The project managers main function is to lead a team so that the project objectives are achieved, and this must consider the needs, concerns, and expectations of everyone involved, ensuring project success.

Project Manager must have technical skills (also called hard skills) as well as non-technical (soft skills). Hard skills are the ones aligned with knowledge and technical skills. Using them often involves creating diverse and tangible deliverables according to the area of expertise of each person. Competencies like work coordination, decision making as well as the ability to produce schedules, risk

plans among others. On the other hand, soft skills are more connected to the human side and do not depend on delivering something concrete. Example of these kind of skills are communication abilities, leadership, problem solving among others (Karlsen et al., 2020; Noor & Esa, 2021; PMI, 2021). One way to characterize and distinguish hard skills from soft skills is to consider that the first is linked to what we know and the second is more linked to who we are and our capabilities (Of et al., 2012; Awan et al., 2015)

Authors initially developed research to study the project manager role and its competencies, and they were mainly focused on technical skills and how they affect the business and project context. However, subjects such as leadership, motivation, culture and communication emerged, bringing more awareness to soft skills. With a better understanding of what was expected of a project manager, it started being clear that the project manager spends a great amount of time communicating with different stakeholders and with its team, solving conflicts and ensuring that the relation between team colleagues is healthy. Even though hard skills are essential, and their importance was already recognized, a shift toward soft skills happened (Maqbool et al., 2017; Awan et al., 2015).

To reduce project's low success rate, numerous research has been carried out, trying to understand which are the most crucial segments that lead to successful projects. The investigations conclusions allowed the scientific community and organizations to find determining factors for the project's success, enabling investment in it. When a very positive association between the project manager's skills and abilities and project success began to be found in different studies, the role of the project manager was again reviewed and analysed.

In 2018, Adzmi and Hassan (2018) conducted a study to identify critical success factors during the project planning phase that result in project success. They concluded that project management experience and involvement are critical success factors. Gheni et all (2017) conducted a literature review on Critical success factors for IT Projects and concluded that skilled project managers are one of the critical success factors. Also Gumay et all (2020) researched the same topic but applied it to a case in Indonesia and concluded that the project manager's capabilities and leadership are critical success factors in Information Technology projects.

2.3. Project Manager Soft Skills

A better understanding of what type of role do project manager plays in the project life cycle, together with a paradigm shift from hard skills to soft skills, with the latter having a fundamental role in human beings, triggered several investigations to understand the impact of the project manager's soft skills on the project's success

In 2015, to answer the question “what are the most relevant competencies in IT project managers’ development to achieve IT project success?”, Araújo & Pedron (2015) conducted sixteen interviews with Brazilian professionals from different business sectors and concluded that team management, business domain knowledge, communication, project management and people skills are the most relevant competencies. **Team management** skills are related to the ability to lead and manage the team and motivate and empower all the members. **Business domain knowledge** refers to the capacity that a project manager should have to understand the project context and its impact on the organization. **Communication** it is related to all the necessary tools to communicate efficiently and effectively with the different parties of a project. **Project management** includes all the necessary skills to ensure good project management. **People skill and communication** are linked to the skills that allow an effective communication between the project manager and all the people involved in the project and the skills to create a good relationship, to be a good negotiator and conflict manager, among others. They also concluded that technical skills (hard skills) are less relevant when compared with the soft skills analysed on that research. In the same year was published a study to identify and measure the impact of the soft skill on the project success, focusing on communication, team building and delegation, problem finding, analysing, and solving, interpersonal and coordination skills. The conclusions drawn from this study confirmed that each of the studied soft skill has a significant positive relationship with project success (Awan et al., 2015).

In 2017, 107 Pakistani construction firms were studied to measure the impact of construction project managers emotional intelligence, transformational leadership style and managerial competencies like communication and teamwork. They concluded that “project managers with high emotional intelligence who bear the desired competencies and exhibit transformational leadership behavior are effective leaders and ensure higher success in projects” (Maqbool et al., 2017). Another study conducted to assess project manager skills impact on project success concluded that to improve the chances of project success in the public sector, investments should be made in project manager interpersonal skills as well as project management awareness, among others (Irfan et al., 2021). In the study developed by Iriarte and Bayona Orè (2018), a systematic literature review was conducted with a focus on the soft skills that impact the project's success. It was also possible to observe that all studies agree on the importance of soft skills regarding project success. The most mentioned soft skills were communication, leadership and conflict management. Moura et al (2021) developed a recent study to bring more information to the discussion about factors that influence Information Systems project team members, with regard their high performance. They concluded that the human-centered dimensions are of greater importance when compared to the technical dimensions. They also stated that soft factors as communication, conflicts and trust are the ones that mainly impact project members performance.

In addition to studies focusing more on the direct connection between project manager skills and project success, numerous studies mention several essential characteristics for a project manager in what concerns factors like project performance or even the project manager performance itself, to improve the project context and increase its success changes. Thi & Swierczek (2010) concluded that the ability to coordinate, make decisions, negotiate, delegate authority, and perceive role and responsibility were important competencies to a project manager. Almost seven years before, Dainty, Cheng & Moore (2003) had already concluded that competencies like team building, leadership, and communication, among others could be considered performance criteria factors to consider to identify individual performance goals that promote project success. Deborah et al. (2010) made a researched in IT project management preferred competencies and identified six critical core competencies, like leadership, communication, ability to deal with change among others. Also, Maxwell Chipulu et al. (2013) explored the skills that employees consider most important for a project manager. Of the different dimensions reflected on that study, one referred to positive personality traits, including attitude, attention to detail, and career motivation. These last two references were analysed in a systematic literature review conducted by Iriarte & Bayona Orè (2018), that presented a list of twenty-eight soft skills that impact the project success. The eleven references in which they based their study to analyze the soft skills mentioned in the literature and withdraw their conclusions were also analysed in this study and considered in the table 2.1.

To analyse the skills mentioned and create a summary table, leadership was considered as a cluster of references found in the systematic literature review conducted by Iriarte & Bayona Orè (2018), together with the reference found in the article that analyses explicitly transformational leadership (Maqbool et al., 2017).

Regarding soft skills teamwork/team building, the different references mentioned a common subject: the way the team works, the project manager's ability to help build team spirit and work and for this reason the four references were analysed together.

People skills are a combination of several concepts that have been mentioned in different articles. For example, Maqbool et al (2017) studied attentiveness, considering it as the ability to deal with others, the attention given to the other. Araujo & Pedron (2015) studied people skills considering these skills to be the ability to maintain a good relationship with others (team members). Sandhu did not specify the emotional intelligence definition used, but it was aggregated in people skills considering these skills as the capability to interpret and respond to the emotions of others (Sandhu, 2018).

The following table reflects the frequency with which these soft skills were mentioned in the articles examined and highlighted above, regarding their influence on the project's success.

Table 2.1 - Soft skills mentioned in the literature, regarding their influence on Project Success

Soft skill	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Communication	✓		✓	✓	✓	✓	✓	✓	✓	✓				
Conflict Management	✓		✓			✓		✓	✓					
Leadership		✓	✓				✓	✓						
Team building	✓		✓		✓	✓								
People skills			✓	✓		✓								
Problem solving	✓				✓			✓						
Interpersonal skills	✓			✓										
Business domain knowledge				✓										
Coordination	✓													
Motivation		✓												
Self-awareness		✓												
Emotional Resilience		✓												
Intuitiveness		✓												
Interpersonal sensitivity		✓												
Influence		✓												
Conscientiousness		✓												
Innovativeness								✓						
Negotiation								✓						
Ability to get along								✓						
Respectful								✓						
Honest								✓						
Trusting								✓						
Change orientation							✓							
Drive											✓			
Attitude							✓				✓			
Adaptability											✓			
Attention to detail											✓			
Independent											✓			
Career motivation											✓			
Thinking												✓		
Extroversion												✓		
Judgement												✓		
Operating within a multicultural environment														✓

1 - (Awan et al., 2015) 2 - (Müller et al., 2012) 3 - (Maqbool et al., 2017)
4 - (Araújo & Pedron, 2015) 5 - (Tahir, 2020) 6 - (Sandhu, 2018) 7 - (Stevenson & Starkweather, 2010) 8 - (Skulmoski & Hartman, 2008) 9 - (Creasy & Anantatmula, 2008)
10 - (Frese & Sauter, 2014) 11 - (Chipulu et al., 2013) 12 - (André et al., 2011) 13 - (Keil et al., 2013) 14 - (Alias et al., 2014)

The table analysis allowed us to understand which soft skills are mainly mentioned in the analysed literature. Maintaining good communication with all project participants stands out from other soft skills, with the highest literature mentions. It is also possible to observe that several soft skills have only one mention in the analysed literature. On the other hand, we can observe that several soft skills

are usually analysed together, such as communication, conflict management, leadership, team building, people skills, and problem-solving.

2.4 Knowledge Management

2.4.1. DIKW

The Knowledge definition as a concept has been developed by several authors and includes concepts like data and information. When writing the Knowledge Nirvana – Achieving The Competitive Advantage Through Enterprise Content Management and Optimizing Team Collaboration, Juris Kelly (2002) said, "for knowledge itself happens only when human experience and insight is applied to data and information". This is aligned with what Nacy M. Dixon (2000) wrote in Common Knowledge – How Companies Thrive by Sharing What They Know, saying that knowledge "is defined as the meaningful links people make in their minds between information and its application in action in a specific setting". It is possible to understand that data, information, and knowledge are different concepts linked between themselves.

Besides the three concepts mentioned, it is usual in the scientific community to also mention the wisdom notion. To better explain and create a visual representation of the connections between these four concepts, the DIKW pyramid was developed (van Meter, 2020). Although many representations were developed, they all have the same principle: a pyramid with four layers, where bottom top we have data, information, knowledge, and wisdom. This validates the connection between concepts and the idea that there is an evolutionary path among them, where one is transformed into another.

Despite the link between all the concepts, it is essential to understand what each means. Data can describe events or context but with no meaning or interpretation. It is just the unprocessed facts being presented in their most natural state. Considering a website, if we pick the visitors registration, this can be considered data that do not provide any significant outcome. When data is complemented with reflections, interpretations, and beliefs, it becomes information. If we pick the data before mentioned and get numbers like from this total number, 70% are women, and 70% of the visits occur between 11 AM and 4 PM, this is already data that has a meaning. The transition from information to knowledge happens through dialogues or interactions, so when someone uses their skills, beliefs, or experience to process the information, the transformation to knowledge occurs. The knowledge dimension is related to finding an answer to the "How" question (van Meter, 2020). Picking the previous example, if the team tries to understand how do women's use the website, this is a transition to knowledge. At the top of the DIKW pyramid, wisdom can be defined as the knowledge applied in action and is more related to the "Why" question. When someone thinks about the best approach, why should we do this

instead of that, that is wisdom (Mahura & Birollo, 2021; Control et al., 2008). The figure below illustrates the DIKW pyramid, where the four concepts are represented.

One of the most adopted definitions of knowledge belongs to Nonaka and Tareuchi (1995), that defined knowledge as the "justified true belief". This is aligned with Platos said years before, when defended that knowledge is a combination of what is true and what is believed. These definitions have three conditions that some authors call the tripartite account of knowledge (Neta & Pritchard, 2009): the truth condition, the belief condition, and the justification condition. The first one is related to the fact that if someone knows a proposition, then that must be true. This condition is what makes the difference between knowledge and opinion. The second one defends that if someone knows something, he believes in that, and last, the justification condition says that there must be a way to justify that the person's belief is true (Bolisani & Bratianu, 2018).

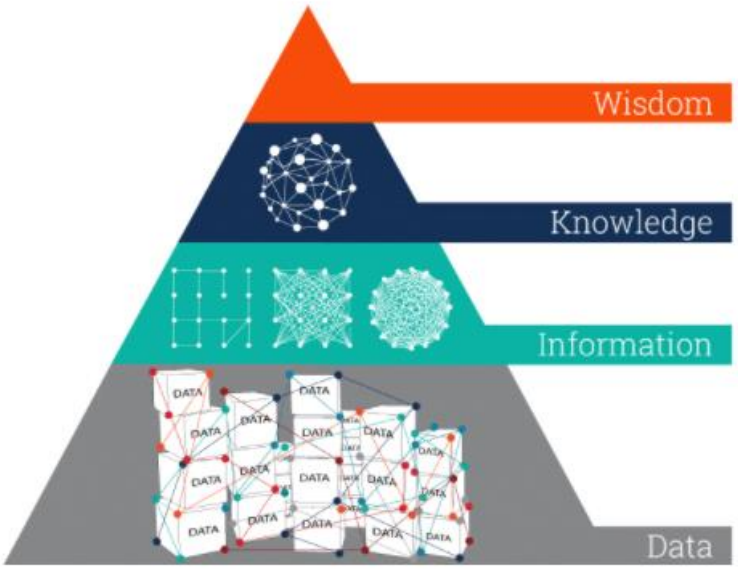

Figure 2.1 - DIKW pyramid representation, (What Is the Data, Information, Knowledge, Wisdom (DIKW) Pyramid?)

2.4.2. Explicit Knowledge VS Tacit Knowledge

Tacit knowledge concept was enabled when Michael Polanyi said that "we can know more than we can say", suggesting that there is in each one of us knowledge that it is not possible to articulate and transmit verbally in an adequate way (Nickols, 2003; Machin, 2018). However, it was in 1995 that Nonaka and Takeuchi, two very popular authors in the area, called the scientific community attention when they stated that knowledge should be categorized into tacit and explicit knowledge. Explicit knowledge is structured knowledge, which can be externalized and/or documented in tangible forms

with images, words, videos, or images that can be represented in mathematical formulas, rules or procedures. Unlike explicit knowledge, tacit knowledge is not easily transmitted because it is difficult to express. Tacit knowledge is gained from the individuals' experience, and it is more difficult to define and transfer (Stevens, 2010). This knowledge can also refer to perceptions, feelings, and intuitions. It is considered personal knowledge, which is based on the context and experience of each one of us. Thus, it is possible to understand that something considered tacit for one person may be explicit knowledge for another. Another way to explain the difference between both types of knowledge is through the association with the creation of a product, considering that explicit knowledge is the final product. In contrast, tacit knowledge is the entire process necessary to produce it (Dinh et al., 2016; Hanisch et al., 2009).

Although it is possible to explain the meaning of each type of knowledge individually, it is essential to understand that they are not separate and opposite concepts. They constitute each other, and although tacit knowledge is difficult to articulate and share, part of this knowledge can be considered explicit, allowing its sharing (Hanisch et al., 2009).

Considering the easiness with which explicit knowledge can be structured, documented, and therefore shared, the great interest of the scientific community lies in sharing tacit knowledge. It is common for highly experienced and highly qualified individuals to have much tacit knowledge but difficulties articulating it. At the same time, people with less experience and who are initially very much governed by rules or defined processes find it easier to verbalize their actions and knowledge because it does not have a tacit characteristic (Dalkir, 2005). So, the challenge that companies face today lies in this point: how can they ensure that the tacit knowledge present in each of their employees is shared and used as an asset for the organization itself?

Although Michael Polanyi has stated that even after trying to codify and abstract tacit knowledge, a large part of it remains on the one that have it, as it derives from the experiences, beliefs, practices, and values of each one of us, it is known that there is a part of the knowledge that can somehow be shared. In 1995 Nonaka released a model that explains the mobilization of tacit knowledge through the interaction between both types of knowledge. This interaction is called knowledge conversion, which facilitates the transformation of knowledge and has four processes: socialization, externalization, combination, and internalization, and it is characterized by its spiral metaphor, which characterizes an evolutionary process. Other authors also used this evolutionary path regarding knowledge evolution when they suggested other knowledge management process conceptualizations. For example, in 1998 Davenport and Prusak mentioned that if an organization wants to execute good management of knowledge, three processes need to occur: generation, codification, and transfer of knowledge, which also had at their core an evolutionary process of knowledge, in which knowledge was first generated and then codified so that it could ultimately be transferred. The main difference

between both lines of thought is that, for Nonaka and Takeuchi, tacit knowledge is the main driver of knowledge creation within organizations. In contrast, for Davenport and Prusak, the definition of organizational knowledge and its management is more pragmatic and organizational, focusing on how organizations can capture, codify, and transfer knowledge (Choo, 2013; Nickols, 2003; Masrek & Zainol, 2015).

The following figure represents the SECI model (Socialization, Externalization, Combination, and Internalization), developed by Nonaka and Takeuchi. This model characterizes the spiral metaphor mentioned above, demonstrating the knowledge management evolutionary process.

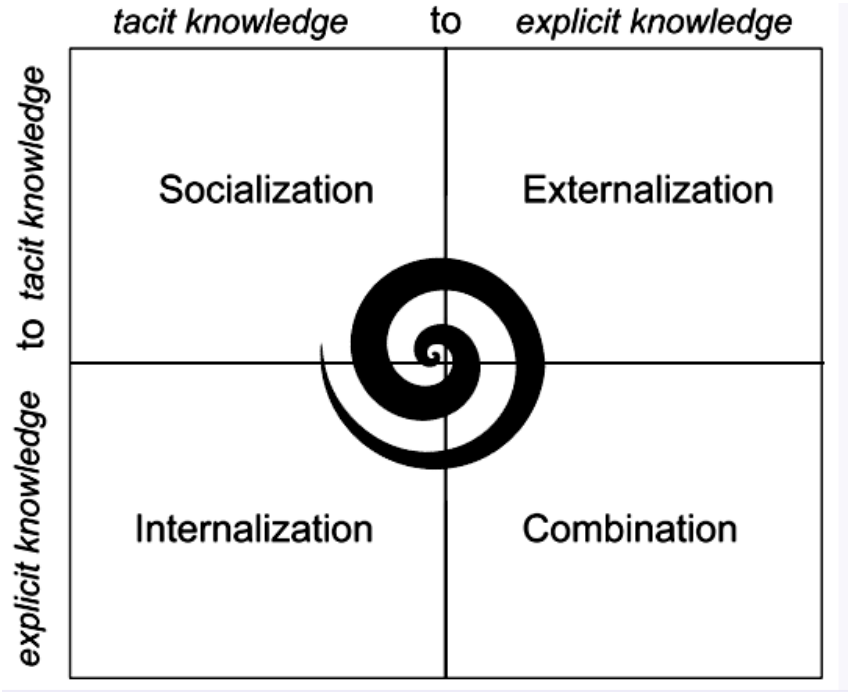

Figure 2.2- Four modes of knowledge conversion, (Kaur)

- ***Socialization*** *– Socialization involves tacit knowledge transfer between two individuals through social interactions. Nonaka argues that this process presupposes observation, imitation and finally, practice.*

- ***Externalization*** *- Transforms tacit knowledge into explicit knowledge by creating documents and content production. Making tacit knowledge explicit allows it to be shared; in the future, it will be the basis for new knowledge. The name given to the process is because an externalization of tacit knowledge is necessary, for example, through ideas transformation into words, analogies, or reasoning. This process is very common in dialogues and conversations, as people tend to share their experiences, improving how we express ourselves and articulate our ideas and thoughts, culminating then in a better sharing (and externalizing) of what is our tacit knowledge.*

- ***Combination*** *– The process of combining transformed explicit knowledge into explicit knowledge, that is, the joining of multiple explicit knowledge that exist or bringing together distinct pieces of explicit knowledge to create new explicit knowledge. New explicit knowledge can therefore be disseminated through meetings, presentations, creation of new hypotheses or processes.*

- ***Internalization*** *– The name given to this process comes from explicit knowledge internalization, that is when we transform it into tacit knowledge. This happens when the individual understands and absorbs explicit knowledge, allowing the transformation between knowledge (Creation et al., 1997; Masrek & Zainol, 2015).*

2.4.3. Knowledge Management processes

Based on the models created over the years, several authors have identified different knowledge management processes that allow organizations to manage external and internal knowledge more efficiently. According to Parikh, Knowledge acquisition is related to Knowledge-based resources used to find and acquire knowledge. Therefore, organizations must consciously seek and define the relevant knowledge and its sources. Knowledge Organization is related to refining, organizing, and storing the knowledge that has been collected. Dissemination is related to the perception of who receives what knowledge and how they receive it. Finally, knowledge application involves putting knowledge into practice in a real scenario (Parikh, 2001).

Hortwitch & Armacost (2002) defined the knowledge management processes in five stages: creation, which is linked to the creation of knowledge formally or informally, and capture, in which, according to the authors, knowledge must be captured to be shared. The third phase is knowledge organization. Since knowledge cannot be used if it is not found, so it must be organized. The next phase is the transfer phase, in which it is understood how individuals obtain knowledge and how knowledge contributors share it. Finally, the use phase is the actual application of Knowledge.

To Gold et al. (2001), knowledge management comprises 4 processes: acquisition, which refers to the accumulation of knowledge; conversion, which is related to existing processes to make existing knowledge useful; application phase, which implies the actual use of knowledge and finally, protection, which refers to the processes that must exist within the organization to ensure that existing knowledge is not stolen or inappropriately dared.

The following table represents the above models, developed over the years by various authors.

Table 2.2 - Knowledge Processes by different authors

REFERENCE	***KNOWLEDGE PROCESS***
(PARIKH, 2001)	*Acquisition, Organization, Dissemination and Application*
(HORWITCH & ARMACOST, 2002)	*Create, Capture, Organize, Transfer, Use*
(LAWSON, 2003)	*Creation, Capture, Organization, Storage, Dissemination, Application*
(GOLD ET AL., 2001)	*Acquisition, Conversion, Application and Protection*

Although the presented models have some differences, they have many similarities. For the development of the present work, it was considered the model presented by Lawson, which proves to be the most complete. For example, Parikh uses only one initial phase (acquisition) to define what Lawson defines in the creation and capture phases. Compared with the models developed by Hortwitch and Armacost (2002) the main difference lies in the chosen model containing the storage and dissemination phases, while Hortwitch and Armacost (2002) defined only the transfer phase. The use and application phases as the final ones of both models are identical phases, although with different nomenclatures. The model defined by Gold et al. l (2001) is the one that most distinguishes itself from the rest, especially for having a process dedicated exclusively to protecting knowledge. Regarding the model chosen, according to Lawson (2003), Knowledge management processes are defined as follows:

- ***Knowledge Creation*** – *Organizations define knowledge as relevant not only within the organization but also in the external environment. The knowledge creation process occurs through procedures such as discovering a new way to solve a problem.*

- ***Knowledge Capture*** *– New knowledge is identified as valuable not only for current but future needs as well. It must be represented in such a way that it is easily accessed and extracted.*

- ***Knowledge Organization*** *– New knowledge is organized through filtering processes and placed in practical contexts.*

- ***Knowledge Storage -*** *Coded knowledge must be stored in a format that allows other people to access it.*

- ***Knowledge Dissemination*** *–The dissemination phase is related to personalizing knowledge and distributing it so that it matches the users' needs. A language accessible by all users must be used, tools must be developed, and appropriate moments should be created for this dissemination.*

- ***Knowledge Application*** *– The application of knowledge presupposes its actual use. Once knowledge has been captured and converted, it must be used. The purpose of creating, converting, and sharing knowledge is that it can fill a gap or need that before all this process was not fulfilled (Lawson, 2003).*

2.4.4. Knowledge Management Definition

The general interest that has emerged in recent decades regarding knowledge management has led to several definitions of this concept. This variety is due above all to the multidisciplinary nature of knowledge management, as this is not a static field since it has evolved over the last few years and continues to evolve, creating new perspectives on it. This definitions diversity may also be the result of the existing three distinct perspectives in this area: Knowledge management from the business perspective, knowledge management from the cognitive science perspective, or definitions that come from the intellectual or knowledge asset perspective. Knowledge management from the business perspective is more focused on organizations and on creating the link between explicit and tacit knowledge and the company's positive results. Knowledge management from the cognitive science perspective already considers the human and cognitive aspects. This perspective defends that knowledge is the tool that allows us to function intelligently, not undervaluing other factors that positively contribute to personal and organizational behavior. Finally, the perspective linked to technology and processes argues that knowledge management is a concept that defines and explains how information is transformed into knowledge, allowing other people to use it *(Dalkir, 2005).*

Knowledge transfer can occur in several ways, depending on the type of knowledge or vehicle is used for the purpose. Technology has been a great driver in knowledge management and continues to

be a great tool regarding some types of communication and in information and knowledge storage and management. However, when compared to technology forms, face-to-face communication it is the most suitable option for tacit knowledge sharing, as this is the only way to capture the entire essence of human behavior, such as reactions, feelings and discomforts (Hanisch et al., 2009). Thus, the type of vehicle used for knowledge transfer must be adequate depending on the type of knowledge intended to be transferred, prioritizing face-to-face communication and social interactions for the transfer of tacit knowledge and using more technological methods for the transfer of explicit knowledge. In the last years, the emphasis given to Knowledge Management has been growing, having been the target of multiple investigations (Masic et al., 2017).

The technological expansion has been one of the main drivers of the breakthrough of knowledge and its management, mainly inside technological companies. Nevertheless, its presence in human life takes us back to completely different times from what we have today. Even though the terminology only started being mentioned in the 70s, knowledge management concept was already applied to human life in its purer state. From the beginning of life, every generation needed to know how to hunt, how to childbirth and how to survive. This knowledge had to be shared between generations in a simple way, making every person a living repository of information that was gained mostly through experience (Masic et al., 2017).

Despite the concept of knowledge management having already been defined and applied several decades ago, as far as the beginning of the human form, there was a time when people realized that the tasks, they were performing led to a necessity for knowledge management. This moment complemented the historical time that rapid technological advances first appeared. There is a strong connection between both since technological advances lead to higher and more complex information which in turn would need to be stored in some centralized and systematized way so that people could consult and improve them whenever needed *(*Masic et al., 2017).

2.5. Knowledge Management in Project Environment

The knowledge management area recognition as a great asset in organizational terms, along with companies' realization that projects complexity was a risk factor for their success, created a great organizational interest in understanding how knowledge management could be beneficial to the project environment. As a result, knowledge transfer has been in the spotlight recently since efficient knowledge management and transfer can improve project results and put organizations in a more favourable strategic position. This transfer can occur through formal and informal practices, which are very important to ensure an efficient knowledge management approach and that knowledge is not lost between projects (Mahura & Birollo, 2021).

The production and sharing of documents, use of intranets or collaborative tools or even reports made at the end of a project can be considered formal knowledge sharing practices. Another practice often mentioned in the literature is the sharing of lessons learned. Documenting how to overcome a specific obstacle or the lessons learned while developing a project can be a very beneficial habit for the entire organization. Project teams can reflect on the problems and resolutions found by another team and later revisit and be inspired by these documents. This practice allows the generated knowledge reuse and can help teams to avoid making the same mistakes or investing much time in solving similar problems (Mahura & Birollo, 2021; Ranf & Herman,2018 ; Control et al., 2008).

As mentioned, the documents production phase during project development is crucial for a good and efficient transfer of explicit knowledge. However, according to Hanisch et al. (2009), one of the knowledge managements more substantial challenges in a project environment is the lack of documentation produced by project members and sharing and administration of this knowledge. The project cycle involves generating much knowledge about good practices and technical and even procedural knowledge (Purvis & McCray, 1999; Carrillo et al., 2014).

Considering project failure rate is extremely important there is an organizational effort to transfer knowledge generated in projects to try to overcome the difficulties experienced during the project development. However, it has been observed that the nature of the project concerning its well-defined time and the different tasks that are necessary to carry out during its development means that project members do not have time to document knowledge acquired or even participate in knowledge sharing activities (Hanisch et al., 2009).

Regarding informal knowledge transfer practices, we can consider peer coaching sessions and mentoring sessions, in which a more senior member of the organization is considered a mentor. This type of practices should promote tacit knowledge transfer and networking, allowing employees to have a space for informal discussions. In addition, the creation of practical communities is also one of the informal practices of knowledge sharing, enhancing gatherings between people from the same field of interest and sharing good practices, knowledge, ideas and experiences (Control et al., 2008; Mahura & Birollo, 2021).

When tacit knowledge concept became more widely used by the community and studies around it began to be developed, it was understood that its sharing was only effective in face-to-face conversations. These interactions are the only way to receive and interpret important meanings of tacit knowledge, such as emotions, beliefs, and reactions. This is very aligned with the informal knowledge practices mentioned above because they are all based on meetings, gatherings or face-to-face exchange of ideas. Although the knowledge transfer is more likely to happen when people meet in person, the companies and managers cannot gather everyone in the same room and wait for this knowledge transfer to happen. Sharing tacit knowledge requires trust and the relationships created

between people, which explains the difficulty in sharing knowledge during the life cycle of a project since this tends to be of short duration, not being enough to create trusting relationships that enable sharing (Mahura & Birollo, 2021; Hanisch et al., 2009). A conducted literature review on knowledge management concluded that organizations focus continues to be on sharing knowledge with resources to IT systems, not paying attention to sharing and transferring knowledge through human interactions, revealing a gap that needed to be addressed in organizations to improve above all tacit knowledge management (Hanisch et al., 2009).

Some authors investigated knowledge management in organizations and created theoretical frameworks to try to solve knowledge management difficulties. A model mentioned on Yeong & Lim (2011) research was developed and focused on the socialization of tacit knowledge. They were able to conclude that guarantying how and when knowledge is shared in all their forms is crucial for increasing project success. Owen (2008) developed a framework since knowledge management will positively influence project management maturity. She concluded that continuous learning is essential to the project's success. These conclusions are aligned with what was written by Dinh et al (2016), when referred the study *The role of knowledge sharing practice in enhancing project success*, developed by Ismail et al. They concluded that sharing project knowledge among project management members is vital to project success.

The project manager role in modern organizations has become vital in achieving the company's goals and ensuring effective knowledge management. In fact, by the beginning of this new century, it was already mentioned that project manager's value perception in the knowledge management environment was limited, since few studies had yet been carried out to verify this role in knowledge management area (Egbu, 2001).

Considering that knowledge is viewed as a great organizational asset, it is crucial that project manager can create and develop an environment in which knowledge is recognized as something valuable that must be created and shared, helping to achieve the teams and organization's goals. Project managers need to recognize that knowledge management processes can create obstacles. It is important that they do not let these obstacles impede the creation, transferring and knowledge sharing among team members to ensure a better chance of project success. It is crucial that managers can identify knowledge management elements within the organization, as to find problems that might jeopardize knowledge sharing (Dinh et al., 2016; Egbu, 2001; Reich et al., 2012).

Alavi, Kayworth and Leidner (2005) conducted a study to investigate the organization's cultural influence on what concerns knowledge management practices. They concluded that knowledge management leaders have a decisive role in the process. It was also mentioned the top management critical role has in empowering and legitimizing leaders. This study also concluded that incentives creation for knowledge sharing is not as impactful as the leadership of the members responsible for

promoting this sharing. Therefore, providing appropriate tools to knowledge management leaders is more important and influential than encouraging employees to share through incentives and bonuses. One of the suggestions for future research these authors gave was related to finding KM leaders' main effective characteristics.

Sharing knowledge can be challenging and the projects complex and volatile environment increases the difficulty in managing and enhancing this sharing. The techniques and initiatives used by project managers to foster knowledge sharing were proving inefficient, as they did not maximize it (Dinh et al., 2016; Hanisch et al., 2009).

Considering the project manager fundamental role in project life cycle and its success and also considering the need to improve results concerning tacit and explicit knowledge sharing, two hypothesis was created, that intends to study the impact that each soft skills may have in tacit and explicit knowledge sharing.

H1: Project Manager soft skills impact explicit knowledge sharing.

H2: Project Manager soft skills impact tacit knowledge sharing.

2.6. Organizational Culture

In the last decades, the association between organizational environment and knowledge management has increased, becoming the target to the academic and research world. The competitive and rapidly changing market that we live in today made organizations start to value more strategies related to knowledge management so that knowledge of both the external and internal environment could be used to achieve organization goals and purposes more efficiently (Ranf & Herman, 2018). A literature review on knowledge management in organizations concludes that KM is not only considered one of the main factors in achieving and maintaining the organization's competitiveness, but it can also help develop and improve its business strategy (Si Xue, 2017).

As stated before, the high number of projects generates a lot of knowledge about good practices, overcoming barriers, managing a specific type of project adequately, or overcoming technical challenges. In addition to knowledge generated in the project life cycle, the knowledge that belongs to project members, that is, all tacit knowledge that every one of them has, must also be considered. Therefore, organizations and managers start to understand the need not only to manage the existing knowledge but also to optimize it, potentiating its sharing and thus increasing the existing knowledge within the company (Hanisch et al., 2009; Dinh et al., 2016).

A study developed to analyse the relationship between organizational culture and knowledge sharing practices in project environments concluded that organizational culture is significantly correlated with knowledge sharing in project environments. They also conclude that project managers

play an important role in this relationship, since they should “harmonize knowledge sharing practices with organization culture” (Ajmal et al., 2009).

A knowledge infrastructure must exist within organizations to ensure that the learning process takes place naturally and optimally, allowing it to achieve its goals. When considering the architecture of knowledge infrastructure, three dimensions are mentioned: management, organization, and technology. The first dimension is focused on creating organizational memory. Considering the knowledge management approach, the organization wants to ensure that data, information, and knowledge that employees have and acquired during their journey within the organization are accumulated and remain in the organization, creating organizational memory. Furthermore, the organization dimension needs to ensure that the members are motivated to share and learn within and between organizational units. The last dimension is related to the tools and systems supporting the organization's goals (Dinh et al., 2016).

The lack of successful results of knowledge management within project environments led to deep research on the success factors of knowledge management. Among these factors, top management, bureaucratic processes, infrastructures, strategies applied, and the company's culture were critical, with the last being the most important. Even if an organization works to achieve reliable infrastructure and efficient processes, knowledge sharing and reuse will hardly exist if the company's environment is not aligned with a knowledge sharing culture (Dinh et al., 2016).

Despite needing guidelines to occur in a structured way, knowledge management cannot be based only on processes. Therefore, it is necessary to ensure that the entire dimension of knowledge and its sharing is based on the organization's principles and culture, which is expected to encourage the acceptance and adoption of activities that promote effective knowledge sharing and management. Considering the fundamental role that the organization and its culture have in knowledge sharing, the following hypothesis was created:

H3: Knowledge management processes moderate the relationship between each soft skill and knowledge sharing, with the relationship between soft skill and knowledge sharing being more pronounced in organizations with policies that encourage knowledge creation and capture.

CHAPTER 3

Method

The method chosen should be selected to ensure that the data collected is consistent and useful for further analysis and drawing appropriate conclusions.

Regarding methods, these can vary between deductive or inductive approaches. An inductive approach builds its premise from specific and limited observations, generalizing them and creating its theory. In contrast, the deductive approach starts from a general theory, in which hypotheses or theories are formulated and tries to reach a more specific and logical conclusion through experiments (Gabriel, 2013; Streefkerk, 2019). In this research, a deductive approach was used. The following figure shows the deductive investigation steps.

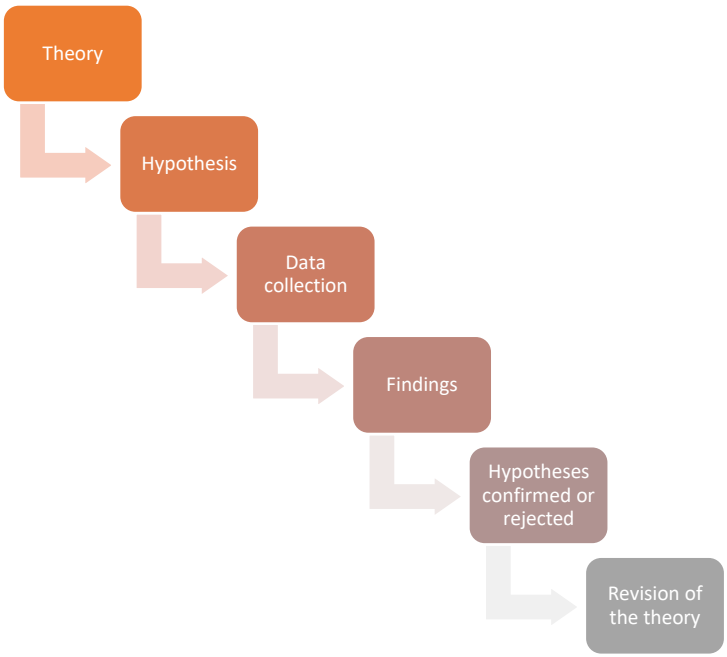

Figure 3.1 - Process of deduction

Theory - *The first step in quantitative research is related to theory, in which literature review is carried out to build and support the segments analysed throughout the theoretically work. In the previous chapter, the literature review was carried out to support the concepts that were analysed in the current work: project management, the project manager and knowledge management.*

Hypothesis - *After the research of theories is finished, hypotheses are built. Also, in the previous chapter, hypotheses were created during the theoretical research carried out. In this research, we confront the project manager's soft skills with knowledge sharing and analyse the moderating role that the organization plays in the relationship between the project manager's soft skills and knowledge sharing. In the present research, three hypothesis were created:* ***H1:*** *Project Manager soft skills impact explicit knowledge sharing.* ***H2:*** *Project Manager soft skills impact tacit knowledge sharing.* ***H3:*** *Knowledge management processes moderate the relationship between each soft skill and knowledge sharing, with the relationship between soft skill and knowledge sharing being more pronounced in organizations with policies that encourage knowledge creation and capture. The created hypotheses are represented in the research model, figure 3.2.*

Data Collection - *The data collection step presupposes the collection of data, which will be used to study the hypotheses created in the previous step. In the present work, a quantitative method was used to collect data. A questionnaire was developed based on previously created and validated scales and distributed to a target population. The details of the data collection carried out in the present work are specified in sub-chapter Procedures.*

Findings - *It is in the findings step that the data collected is analysed. The Results chapter will include all the findings and conclusions drawn from the analysis of the collected data. Statistical software, in this case, SPSS, was used to conducted data analysis.*

Hypotheses confirmed or rejected *- The data analysis will allow you to confirm or reject the hypotheses.*

Revision of the theory *- The last step of the current research was the theory review. After the hypotheses were supported or not, the theory can be revised, a process that usually starts a new investigation.*

After carried out the necessary literature review and to complete the proposed objectives and hypotheses, the research model represented in the following figure was developed and tested.

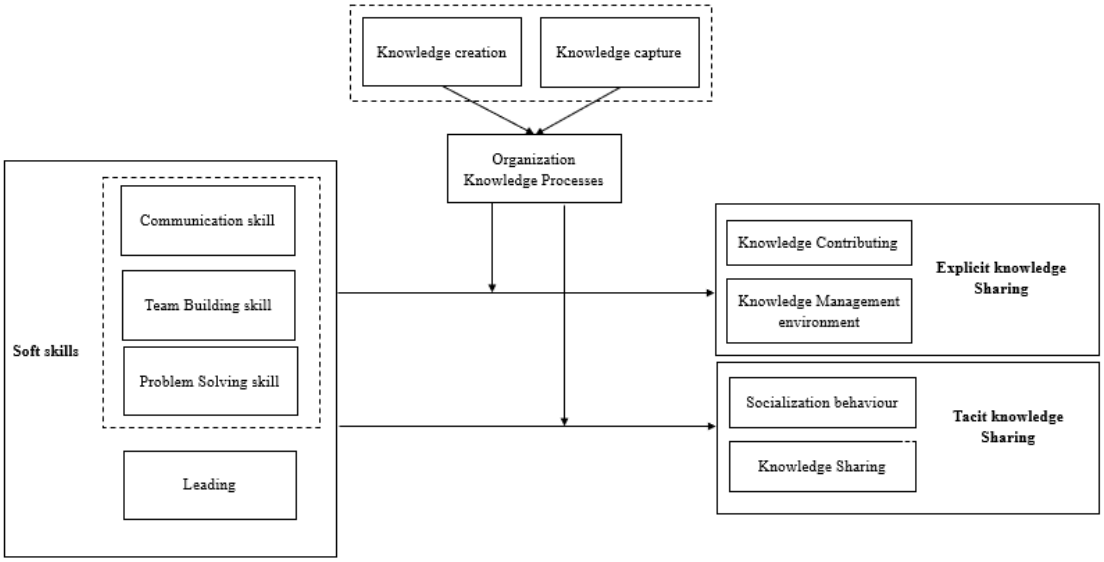

Figure 3.2 - Proposed research model

The first three soft skills presented in the research model are found together because their scales were taken from the same study, while the leading soft skill scale was taken from a different study. The four dimensions make up our soft skill concept, which is why they were grouped together in the model. knowledge contributing and knowledge management environment were the dimensions used to measure explicit knowledge sharing concept, while socialization behavior and knowledge sharing were the two dimensions taken from the literature used to measure tacit knowledge sharing concept. All measures will be explained in the next chapter. The arrows reflect the direction of the relationships between the different concepts.

3.1. Participants

Most of the participants were male (55.7%), aged between 18 and 58 years old (*M* = 31.05, *SD* = 8.36). The majority had up to five years of experience (4.8%). The geographic distribution showed that almost half of the respondents work in Portugal (46.8%), 12.9% worked in the Netherlands, 6.5% in Brazil. The remaining 33.8% were distributed by countries such as Denmark, Scotland, Germany, among others. The developed graphs that represent the participants profile can be seen below.

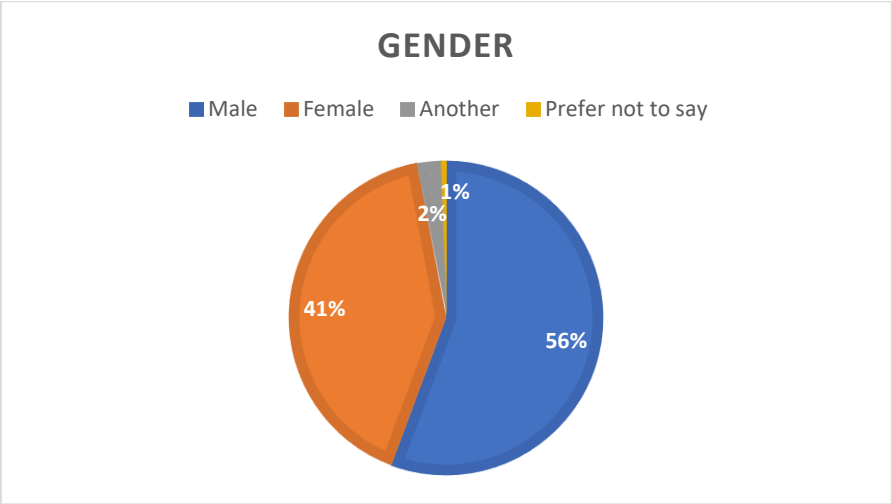

Figure 3.3 – Participants profile - age

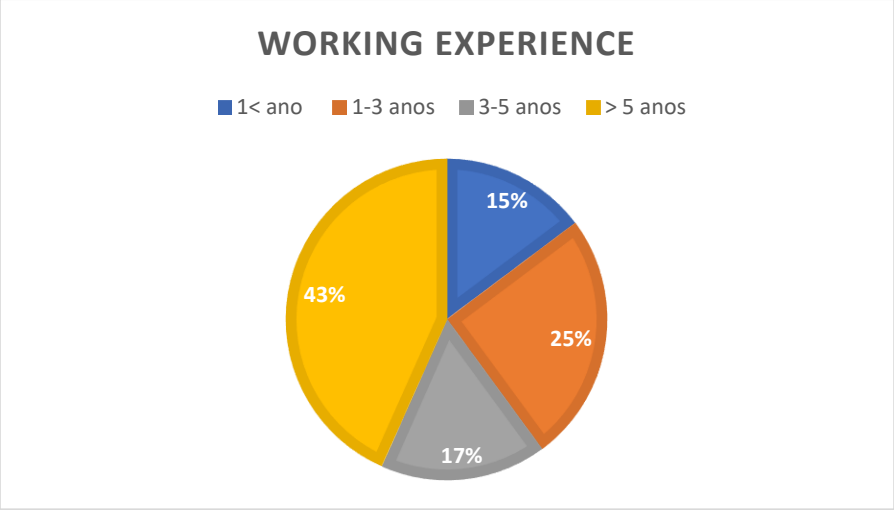

Figure 3.4 – Participants profile – working experience

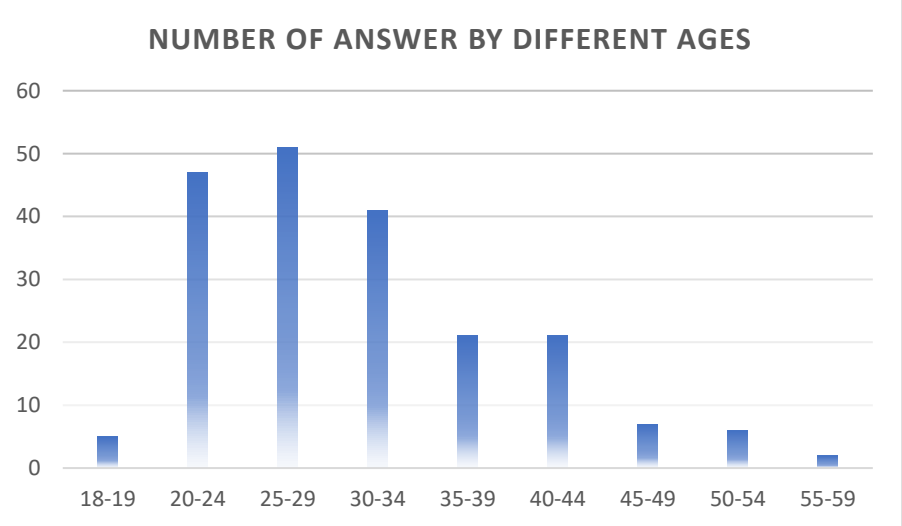

Figure 3.5 – Participants profile – age

3.2. Measures

Soft Skills

The soft skills concept was built on five dimensions: Communication skills, Conflict management skills, Team Building skills, Problem solving skills and Leading. The first four were measure through ten items that uses a 5-point Likert scale, ranging from 1 (very good) to 5 (very bad). The items were created by Shi & Chen (2006) who conducted interviews and based on the responses obtained, designed a questionnaire in which one of the parties intended to study leadership skills.

Communication skills was originally the author's name and has been kept in this study. Three items were used to measure this dimension such as “How are the written communication skills of your project Leader?” and “How are the comprehensive skills of your project leader”. Conflict Management skills was a changed designation, with the original being Coordination skills. Two of the three items were used, that refers to the ability to deal with conflict (“How are the skills of you project leader in dealing with conflict") and the ability to create good relationships (“How are the skills of your project leader in building harmonious relationships to achieve project goals”). Team building skills was the third dimension used. For its authors the designation was “Team building and delegation skills”, however, the item that specifically mentions delegation was removed from the analysis and that is why a change was made to the designation. As item examples, we can consider “How are the team structuring skills of your project leader”. About Problem solving skills, the original designation was “Problem-finding, analysing, and solving skills” however, the items that referred to problem finding and analysing were removed, leaving only two items: ”How are the problem-solving skills of your project leader” and “How are the judging and decision-making skills of your project leader”.

The last dimension, Leading, was measured through items included in the Project Manager Competency Development Framework (PMI Standards Committee, 2007). Project management institute developed this framework to be able to define and, in the future, develop the most important competencies for a Project Manager. Thus, this framework was used to assess the project manager's competencies with the greatest impact on project success Of the 25 items created to measure six leadership project manager personal competencies, five were used to measure leadership competence. Items were measured on a 5-point Likert scale that ranged from 1 (strongly disagree) to 5 (strongly agree). As items example we have: “My project leader uses skills influencing when required Leading” or “My project leader motivates and mentors project team members”.

A principal component analysis (PCA) was applied. Before that, the factorability of the data was verified. A Kaiser-Meyer-Olkin (KMO) of .92 was obtained and according to Hair et al. (2019) is considered a meritorious value. The correlations between the items were significant (χ^2 (45) = 1545.36, p < .001). PCA solution supported by Kaiser’s criteria showed one component. Since the original

authors (Shi & Chen, 2006) of the scale analysed the dimensions separately, a principal component analysis was performed with a fixed number of factors (five components). The analysis of the results led us to exclude the conflict management dimension. A principal components analysis was again applied without the removed dimension. The values obtained after a varimax rotation were satisfactory (with loadings ranged between .69 and .84), allowing us to proceed with the analysis. The Cronbach's Alpha was .93, revealing an excellent reliability Kline (2016).

Regarding Leading dimension, the matrix factorability was also supported with a KMO of .89 and the items were significantly correlated (χ^2 (10) = 703.62 , $p < .001$). An PCA was once again applied and as expected one component was extracted, with an excellent reliability (α = .92, Kline, 2016).

Explicit Knowledge sharing

As previously discussed, explicit knowledge, which is structured, that can be documented and/or represented through words or images. Sharing this knowledge during project lifecycle is related, for example, to lessons learned, best work practices or useful documentation for future projects. This type of sharing initiatives had already been revealed in past studies as an obstacle that must be overcome to improve the success of the project (Hanisch et al., 2009).

To measure this concept items from two different scales were used, one developed by Simon Cleveland (2014) and by another developed by Jay Liebowitza and Isaac Megbolugbeb (2003). The first four items, belonging to Simon Cleveland scale, were originally used by Van den Hooff and Hendrix (2004), who based on previous research, gathered a list of items that were related to knowledge sharing and added new items to that list. The final Van den Hooff and Hendrix items scale mediated the concepts of Knowledge donating and knowledge collecting. The knowledge donating and collecting concepts were related to the fact that the knowledge sharing process always has a component in which we bring knowledge (donate) and we receive knowledge (collect). Later, De Vries, Van den Hooff, and Ridder (2006) modified the scale, delineating a clear separation between knowledge seeking (related to collecting knowledge) and knowledge contribution (related to donating knowledge). In De Vries et al research (2006), Cronbach's alpha was .75 for knowledge seeking and .84 for knowledge contributing, with intercorrelation of the scales of .69 ($p < .01$). In 2014, Simon Cleveland modified the De Vries et al scale, now using a 7-point instrument instead of a 5-point one and changed the wording of the items to include the ICT dimension (Cleveland, 2014). In the present study, explicit knowledge sharing concept aims to measure knowledge sharing systems usage by respondents, that contribute with their knowledge, reporting acquired knowledge, lessons learned and best practices. For this reason, the scale that was changed and submitted to validation processes by Simon Cleveland (2014) was chosen, since it aims to study the behavior of respondents regarding the use of ICT systems. The four items used are measured on a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly

agree). In the current research, the data factorability was verified, showing a KMO of .76, a middling value, according to Hair et al. (2019). The correlations between the items were significant (χ^2 (6) = 347.12, p < .001). A PCA was conducted, and one component was extracted using Kaiser's criterion. Cronbach's alpha was .83, revealing a very good value (Kline, 2016).

To measure knowledge sharing effectiveness three items were chosen from a scale developed by Liebowitz and Chen (2003). The scale consists of 25 items. The chosen ones belong to the section related to the Knowledge Management Environment. The three chosen items represent individuals' behavior regarding knowledge sharing in information repositories, since they assess the existence of repositories and communities' ideas for knowledge sharing within the organization. The items were measured on a 5-point scale that ranges from 1 (strongly agree) to 5 (strongly disagree).

A PCA was applied and through the Kaiser criterion, one component was extracted. Before that, the factorability of the data was verified (KMO = .70, χ^2 (3) = 145.75, p < .001). Cronbach's alpha was .76.

Tacit knowledge sharing

Tacit knowledge is linked to individual experiences and context, considering the intuitions and feelings of each one of us. Sharing this knowledge is more associated with face-to-face conversations and informal contexts, such as mentoring sessions or communities of practice. Regarding the scope of projects, the sharing of tacit knowledge needs a good basis of trust between individuals, so that they feel encouraged to share their knowledge. This environment of trust and sharing is difficult to obtain when we consider, for example, short-term projects, or teams that work remotely or geographically apart.

Tacit knowledge sharing concept was measured through two scales. The first four items were taken from the study developed by Juanru Wang and Jin Yang (2017), who measured knowledge socialization behaviors through items adapted from other authors, responsible for their creation and testing. As previously discussed, knowledge socialization is the process in which there is a transfer of tacit knowledge between two individuals through social interactions. Since the object of study is the respondents' behavior regarding face-to-face conversations and social interactions, the selected items proved to be adequate. The items were measured on 5-point Likert scale ranged from 1 (Strongly disagree) to 5 (Strongly Agree). As items examples "I often talk about my job experience or know-how with other members" and "I actively exchange ideas with colleagues". The data factorability of the data was verified (KMO = .76, χ^2 (6) = 355.73, p < .001). An PCA was applied, and one component was extracted through Kaiser's criterion, and very good reliable measure was obtained (α = .84).

The remaining items were taken from a study by Chunjiang Yang and Aobo Chen (2014), who in turn adopted items from Bock and Kim's (Breaking the Myths of Rewards: An Exploratory Study of

Attitudes about Knowledge Sharing), that intend to study knowledge sharing behavior. These items were used to study tacit knowledge sharing, as they are related to knowledge sharing through face-to-face interactions. Items were measured on a 7-point scale (1 – strongly disagree to 7 – strongly agree). As items examples, "I keep my work and never share it out with other easily" or "In workplace, I take out my knowledge to share with more people". After supported the factorability of the data (KMO = .70, χ^2 (10) = 319.28, $p < .001$), a PCA was performed, and two components were obtained. Since the author analysed all items together, another PCA was performed with only one-factor with a good reliability ($\alpha = .75$).

Knowledge Capture and Creation

The knowledge creation and capture measures were taken from a study conducted by Juanru Wang and Jin Yang, (2017) that developed the Knowledge Management Assessment Instrument. These researchers analysed the processes defined by other authors and created the cycle that they thought made the most sense, consisting in six phases: knowledge creation, knowledge capture, knowledge organization, knowledge storage, knowledge dissemination, and knowledge application. Capture and creation were the processes chosen to be analysed in the present research, each containing four items, measured on a five-point Likert scale ranging from 1 (strongly agree) to 5 (strongly disagree). Since the authors analysed both processes separately, the statistical analyses were also done separately. The factorability of the data was supported (KMO =.80, χ^2 (6) = 361.49, $p < .001$ and KMO = .83, χ^2 (6) = 390.26, $p < .001$, for creation and capture respectively). PCA solutions exhibited one reliable component ($\alpha = .85$ and $\alpha = .87$, for creation and capture respectively).

The developed questionnaire included 44 with the following distribution: 15 items for soft skills, 16 items for tacit and explicit knowledge and 8 items for knowledge management processes. The remaining 5 questions were focused on characterising the participants, namely, sex, age, country of residence.

3.3. Procedures

A pre-test was carried out and delivered to 12 participants of different nationalities. The collected feedback did not reveal any common difficulty in understanding and analysing the items. After reviewing the pre-test results, the questionnaire was closed, and a new link to the final questionnaire was created to separate the pre-test responses from the final answers.

For the present study, the target population was members of software development teams who can answer the questionnaire about their current or past project manager and the organization in question. A snowball approach was used, where the participants with whom the questionnaire was

shared were challenged to share it with their contact network within the area. The questionnaire was also shared on LinkedIn and in software development groups.

The questionnaire was available to collect responses from the 15th of February to the 30th of March and it is attached in appendix N. The final sample included two hundred and one answers.

3.4. Data analysis

The data analysis process involved data compilation and data screening. The descriptive analysis was performed based on mean, standard deviation, and correlations between the variables under study. The Statistical Package for Social Sciences-software was used.

To test Hypothesis 1, four multiple linear regressions were performed, all with the same predictors: Communication, Team Building, Problem Solving and Leading, changing only the dependent variable. The dependent variables were Knowledge Contributing, Knowledge Management environment, Socialization behavior, Knowledge Sharing. Moderation analysis was performed using PROCESS v.4 SPSS macro developed by Hayes (2020).

CHAPTER 4

Results

The following table showed the descriptive statistics (mean and standard deviation) and the bivariate correlation between the study variables.

Table 4.1 - Descriptive statistics, reliability, and correlation of study variables

		Mean	SD	1	2	3	4	5	6	7	8
1.	Communication	2.34	1.06	(.89)	.75**	.74**	-.28**	-.02	.26**	-.03	.03
2	Team building	2.43	.92	.75**	(.83)	.76**	-.20*	.04	.29**	.03	.08
3	Problem solving	2.33	1.08	.74**	.76**	(.86)	-.20*	.06	.30**	.01	.06
4	Leading	5.02	1.41	-.28**	-.20*	-.20*	(.92)	.34**	-.08	.24**	.22**
5	K. contributing	4.91	1.41	- .02	.04	.06	.34**	(.83)	-.07	.32**	.35**
6	K. man. environ.	2.75	.96	.26**	.29**	.30***	-.08	-.07	(.75)	.05	.05
7	Socialization behavior	3.67	.89	-.03	.03	.01	.24**	.32**	.05	(.84)	.22**
8	Knowledge sharing	4.18	.77	.03	.08	.06	-.22**	-.35**	.05	.22**	(.75)

Notes. N = 201. K. contributing = Knowledge contributing. K. man. environ. = Knowledge management environment. Cronbach alpha is reported in parenthesis.

* $p < .05$ ** $p < .001$ *** $p < .001$.

The first three soft skills present a higher correlation with the Knowledge Management Environment outcome. According to Cohen (1992), the three correlations were medium. The Leading soft skill, in turn, presented its highest correlations in the remaining three outcomes, also with medium effect size. The highest correlation between predictors and outcomes was the correlation between leading and knowledge contributing (r = .34).

The first hypothesis aimed to study the impact of each of the soft skills analysed on each of the outcomes of the research model: Knowledge Contributing, Knowledge Management environment, Socialization behavior, and Knowledge Sharing. Therefore, four multiple linear regression models were tested, each with one of the mentioned outcomes.

4.1. Knowledge Contributing

Considering knowledge contributing, four hypotheses were defined, one for each soft skills analysed, as follows:

H1.1) *Project Manager Communication skills have a positive impact on Knowledge Contributing*

H1.2) *Project Manager team building skills have a positive impact on Knowledge Contributing.*

H1.3) *Project Manager Problem Solving skills have a positive impact on Knowledge Contributing*

H1.4) *Project Manager Leading skills have a positive impact on Knowledge Contributing*

Table 4.2 shows the results from a multiple linear regression to explain the variation of knowledge contributing. The linear model with communication, team building, problem solving and leading as predictors explained 11.7% ($R^2a = 0.117$) of the knowledge contributing variation and was significant (F (4, 198) = 7.63, $p < .001$). Leading showed a significant and positive effect on knowledge contributing (Beta = 0.36, $t = 5.20$, $p < .000$). Thus, the obtained results only confirmed the hypothesis for the leading effect (H1.4).

Table 4.2 –Regression results for Knowledge contributing

	Knowledge contributing		
	Beta	*t*	*p*
Communication	-0.07	-0.58	ns
Team building	0.05	0.44	ns
Problem solving	0.14	1.27	ns
Leading	0.36	5.20	< .000
R^2a =	0.12		
F (4, 198) =	7.63		< .000

Note. N = 201. ns – non-significant.

4.2. Knowledge Management environment

Considering knowledge management environment, four hypotheses were considered, one for each soft skills analysed:

H1.5) Project Manager Communication skills have a positive impact on Knowledge Management environment

H1.6) Project Manager team building skills have a positive impact on Knowledge Management environment

H1.7) Project Manager Problem Solving skills have a positive impact on Knowledge Management environment

H1.8) Project Manager Leading skills have a positive impact on Knowledge Management environment

A linear regression was performed, with knowledge management environment as the dependent variable. The achieved results are shown in the following table.

Table 4.3 - Regression results for Knowledge Management environment

	Knowledge management environment		
	Beta	*t*	*p*
Communication	0.02	0.20	ns
Team building	0.14	1.21	ns
Problem solving	0.17	1.51	ns
Leading	-0.01	-0.09	ns
R^2a =	0.08		
F (4, 198) =	5.35		< .000

Note. N = 201. ns – non-significant.

The linear model with communication, team building, problem solving and leading as predictors explained 8.0% (R^2a = 0.080) of the knowledge management environment variation and was significant (*F* (4, 198) = 5.35, *p* < .001). However, none of the predictors showed a significant effect on knowledge management environment, and consequently the hypotheses were not validated (H1.5, H1.6, H1.7 and H1.8).

4.3. Socialization behavior

In the context of the concept of sharing tacit knowledge the first outcome, socialization behavior, was analysed. Four hypotheses were defined, one for each soft skills analysed, as follows:

H1.9) Project Manager Communication skills have a positive impact on Socialization behavior

H1.10) Project Manager team building skills have a positive impact on Socialization behavior

H1.11) Project Manager Problem Solving skills have a positive impact on Socialization behavior

H1.12) Project Manager Leading skills have a positive impact on Socialization behavior.

The predictors communication, team building, problem solving and leading explained 4.2% (R^2a = 0.042) of socialization behavior variation and the linear model was significant (*F* (4, 198) = 3.22, *p* < .001, Table 4.4). Leading showed a significant effect on socialization behavior, and it was positive (Beta = 0.25, *t* = 3.40, *p* < .000). Thus, the results only sustained hypothesis H1.12.

Table 4.4 - Regression results for Socialization behavior

	Socialization Behavior		
	Beta	*t*	*p*
Communication	-0.04	-0.33	ns
Team building	0.09	0.79	ns
Problem solving	0.02	0.15	ns
Leading	0.25	3.41	< .000
R^2a =	0.04		
F (4, 198) =	3.22		< .000

Note. N = 201. ns – non-significant.

4.4. Knowledge Sharing

The last outcome analysed was Knowledge Sharing, which is part of the concept of sharing tacit knowledge. Again, four hypotheses were considered, one for each soft skills analysed:

H1.13) Project Manager Communication skills have a positive impact on Knowledge Sharing

H1.14) Project Manager team building skills have a positive impact on Knowledge Sharing

H1.15) Project Manager Problem Solving skills have a positive impact on Knowledge Sharing

H1.16) Project Manager Leading skills have a positive impact in Knowledge Sharing.

Table 4.5 showed that communication, team building, problem solving and leading explained 5.0% (R^2a = 0.050) of the variation of the Knowledge Sharing and the linear model was significant (*F* (4, 198) = 3.65, *p* < .001). Only leading showed a significant effect on Knowledge Sharing, and it was positive (Beta = 0.25, *t* = 3.53, *p* < .000), confirming hypothesis H1.16 that investigates leading effect.

Table 4.5 - Regression results for Knowledge sharing

	Knowledge Sharing		
	Beta	*t*	*p*
Communication	0.01	0.10	ns
Team building	0.10	0.89	ns
Problem solving	0.03	0.29	ns
Leading	0.25	3.53	< .000
R^2a =	0.05		
F (4, 198) =	3.65		< .000

Note. N = 201. ns – non-significant.

4.5. Knowledge creation and capture as a moderator

The second hypothesis assumed the moderating effect of the creation and capture of knowledge, in the relationship between the project manager's soft skills and tacit and explicit knowledge sharing. The interaction effect between problem solving skill and knowledge creation significantly affect knowledge management environment (B = 0.14, *t* = 3.01, *p* = .003, Table 4.6).

The relationship between problem solving skill and knowledge management environment was not significant for low knowledge creation (simple slope = -0.02, *t* = -0.25, *p* > .05, see also Figure 4.1). This relationship was positive and significant for higher knowledge creation (simple slope = .26, *t* = 4.21, *p* < 0.001). Thus, the moderator knowledge creation reinforced the relationship between problem solving skill and knowledge management environment (Figure 4.1).

Table 4.6- Regression results for moderation

					R^2
	Outcome: Knowledge management environment				.34
	Coeff.	*SE*	*t*	*p*	
Problem solving skill	0.12	0.06	2.22	.028	
Knowledge creation	0.48	0.06	8.22	< .001	
Problem solving skill x Knowledge creation	0.14	0.05	3.01	.003	
	Outcome: Knowledge management environment				.30
	Coeff.	SE	*t*	*p*	
Problem solving skill	0.14	0.06	2.50	.013	
Knowledge capture	0.44	0.06	7.35	< .001	
Problem solving skill x Knowledge capture	0.16	0.05	3.15	.002	

N = 201. Unstandardized regression coefficients are reported.

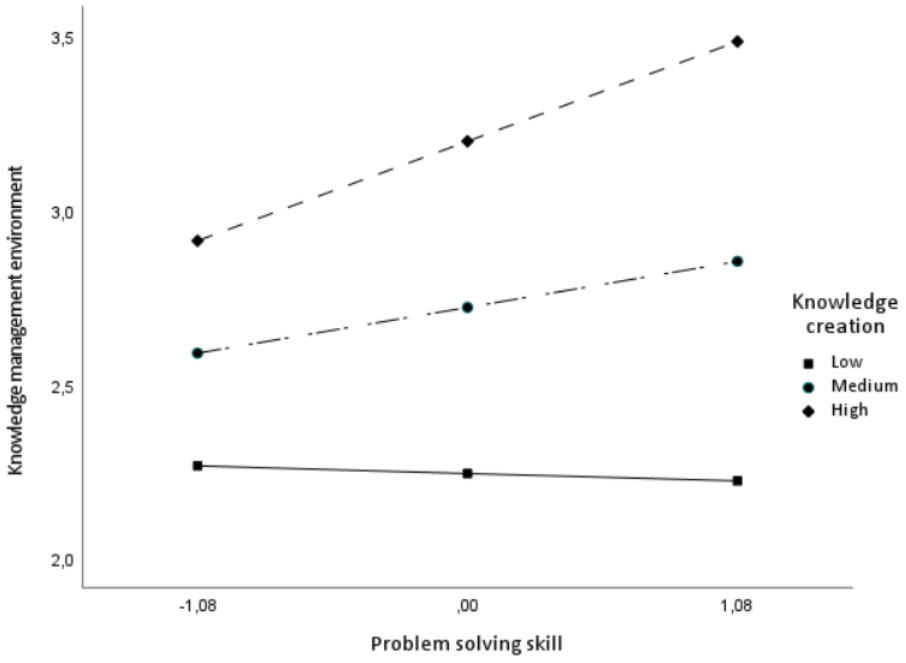

Figure 4.1 - The moderating effect of knowledge creation on the relationship between problem solving skill and knowledge management environment

Knowledge capture also had a significant moderating effect on the relationship between problem solving skill and knowledge management environment (B = 0.16, *t* = 3.15, *p* = .002).

The relationship between problem solving skill and knowledge management environment is not significant for low knowledge capture (simple slope = -0.02, t = -0.21, p > .05, Figure 4.2). This relationship is positive and significant for higher knowledge capture (simple slope = .30, t = 4.45, p < 0.001). Thus, as the moderator increases, the relationship between problem-solving ability and the knowledge management environment was reinforced (Figure 4.2).

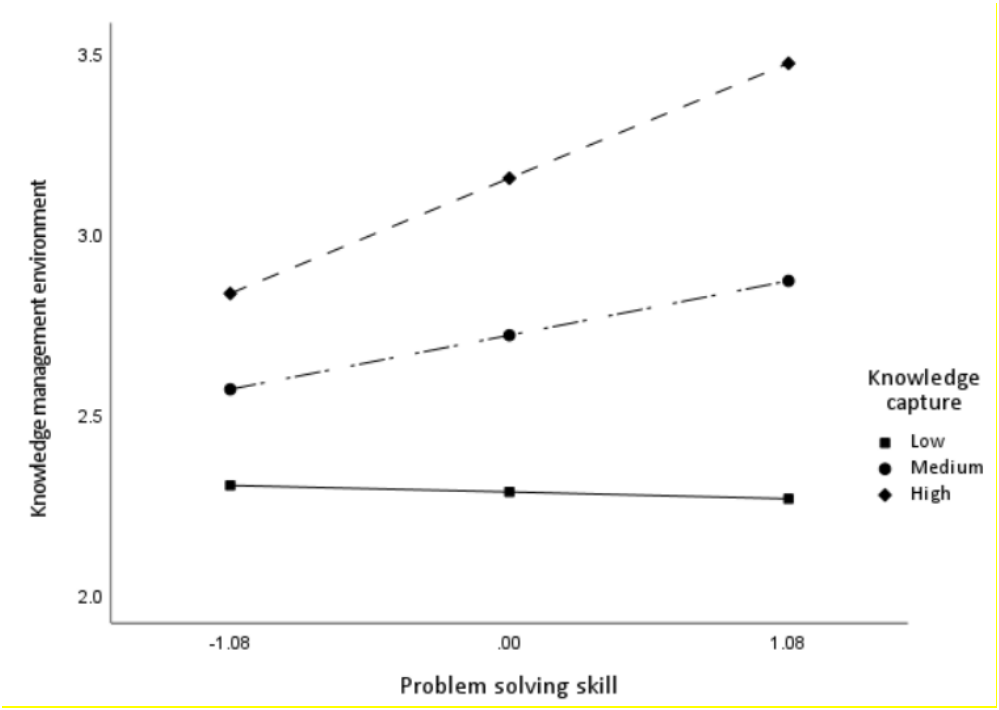

Figure 4.2 - The moderating effect of knowledge capture on the relationship between problem solving skill and knowledge management environment

CHAPTER 5

Discussion

This research aims to study the influence that project managers' soft skills have on tacit and explicit knowledge sharing, as well as validate if the organizational environment impact the relationship between project manager soft skills and tacit and explicit knowledge sharing. First, a research model was created based on the conducted literature review. This research model represents the relationship studied between the soft skills under analysis and each of the outcomes: knowledge contributing, knowledge management environment, socialization behavior and knowledge sharing. The first two are used to measure the explicit knowledge sharing concept and the last two are used to measure the tacit

knowledge sharing concept. It was also represented in the research model the knowledge creation and capture moderating effect in the relationship between soft skills and knowledge sharing.

The following figure illustrates the hypothesis analysis summary results. The detailed discussion of each of the results is carried out below, however it is possible to observe in the following figure that leadership obtained positive and significant results in three of the four outcomes under study and the remaining soft skills obtained non-significant results. Knowledge Contributing and knowledge management environment were the chosen variables to define explicit knowledge sharing concept and socialization behavior and knowledge sharing the variables that measure tacit knowledge sharing concept. Regarding the moderating effect, that is not represented in the following table, it proved to be positive and significant in the relationship between knowledge management environment and problem solving soft skill.

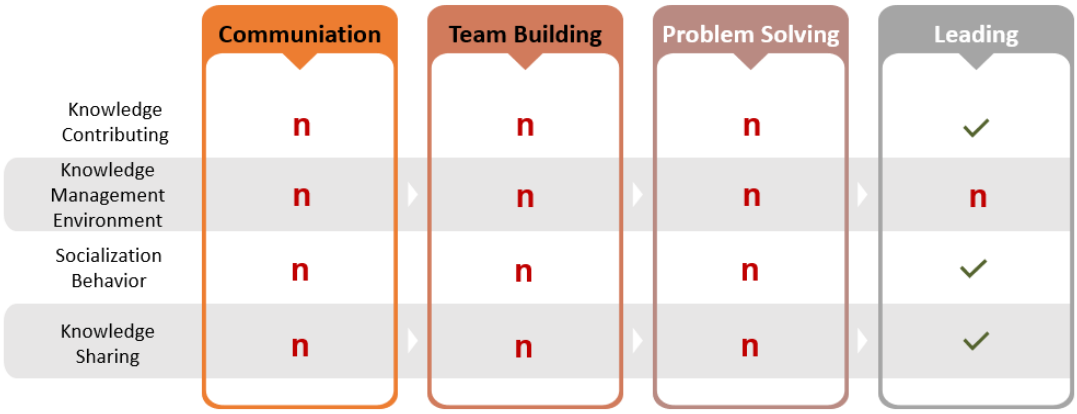

Figure 5.1 - Summary table representing the results for the first two hypothesis created

(1) Project Manager soft skills impact explicit knowledge sharing.

(2) Project Manager soft skills impact tacit knowledge sharing.

The initial assumptions were that the soft skills under analysis would impact explicit and tacit knowledge sharing, having been proven that soft skill leading does indeed have an impact on knowledge sharing. The leading variable had a positive and significant impact on three of the four outcomes: Knowledge Contributing (H1.4), Socialization behavior (H1.12) and Knowledge Sharing (H1.16). This means that this soft skill had an impact on both scales that were used to study tacit knowledge sharing concept and on one of the two used to study explicit knowledge sharing concept.

Regarding the three linear models in which this significant and positive relationship was obtained, the first (with knowledge contributing as the dependent variable) showed the greatest predictor impact. This reveals that project manager's leadership has a greater impact on team member's knowledge contribution in information systems (related to explicit knowledge) when compared to the

impact it has on socialization behaviors and knowledge sharing outcomes (related to tacit knowledge). The obtained results for the remaining hypotheses on the other three linear models, were not significant, that is, no significant relationship was found between the soft skills analysed (communication, team building, problem solving) and the outcomes used to measure explicit and tacit knowledge sharing.

The second linear model performed, which had the Knowledge Management Environment as a dependent variable, did not had any significant correlation between the predictors and the outcome.

Regarding the conducted study for the moderation effect that knowledge creation and capture may have in the relationship between soft skills and knowledge sharing, the results obtained show that the relationship between the manager's problem-solving ability and the variable knowledge management environment is reinforced as each moderator increases. This means that the relationship between the project manager's problem-solving ability and explicit knowledge sharing is reinforced in an organization with a structured organizational culture that favours knowledge sharing.

The variables analysis concerning moderation effect were knowledge creation and capture process. The first is linked to the ability to discover new ways of solving problems. This process depends not only on the ability of each of us to have new and innovative ideas, but also on the exchange of ideas, which can generate new knowledge and lead to the creation of new ideas. The second is linked to the ability to represent this knowledge in a way that can be easily accessed and captured by others. Therefore, the results obtained in the moderation study show the importance of having an organizational culture that incorporates the practices of creating and capturing knowledge, since this will increase the positive impact of one of the project manager's soft skills on explicit knowledge sharing.

The insights of the present study made it possible to understand that organizational culture, namely the processes of creating and capturing knowledge, influences the project's success since knowledge management and sharing are processes that positively influence the project and its success. This is in line with the conclusions drawn in the study developed by Owen. He stated that continuous learning (based on knowledge management) is essential for the project's success (Owen, 2008). Also, Ismail et al. concluded that sharing knowledge among project management members is vital to project success (Dinh et al., 2016).

The research conducted by Ajmal et al. (2009) carried out to study how organizational culture could help in knowledge sharing activities within the project, mentioned the crucial role of managers in encouraging behaviors such as exploration and experimentation, also referring to the positive influence of communication in the success of knowledge sharing practices. Considering the increasingly crucial role that communication plays nowadays, it was expected to obtain results that would confirm the impact of this soft skill in some of the knowledge sharing variables, in what concerns

or in the moderator's study. However, the obtained results only showed a positive influence of the leading soft skill, while the remaining results obtained, including the study of the influence of communication, were non-significant. This may be due to the reduced number of respondents.

CHAPTER 6

Conclusions, Limitations and future research

The present research allowed a deeper understanding of knowledge sharing and the factors that influence it, addressing topics such as project managers' soft skills, knowledge sharing and organizational culture, suggesting a relationship between the mentioned elements.

The literature review development allowed finding the project manager soft skills that are most mentioned in the literature regarding their impact on project success. These soft skills were chosen for analysis. It was also possible to understand that the knowledge management area still needs more scientific research, to understand how it can positively influence project success. Thus, the main objective was to verify if the project manager's soft skills have an impact in tacit and explicit knowledge sharing. It was also analysed whether organizational culture has a moderating role in this relationship, more specifically through the study of knowledge creation and capture.

Three research hypotheses were created - H1: Project Manager soft skills impact explicit knowledge sharing; H2: Project Manager soft skills impact tacit knowledge sharing; H3: Knowledge management processes moderate the relationship between each soft skill and knowledge sharing, with the relationship between soft skill and knowledge sharing being more pronounced in organizations with policies that encourage knowledge creation and capture - and analysed with the data collected through the application of a questionnaire.

The obtained results in the analysed linear regressions showed a positive relationship between Leading soft skill and three of the four outcomes. Therefore, it was possible to conclude that a project manager with effective Leadership positively influences team members' knowledge sharing in information systems, reflecting explicit knowledge sharing, and knowledge sharing in face-to-face interactions, that is, tacit knowledge sharing. These results allowed us to answer the research question 1 (Do the Project Manager's soft skills influence tacit knowledge sharing?) and research question 2 (Do the Project Manager's soft skills influence explicit knowledge sharing?). For both, the answer depends on the analysed soft skill. Considering leadership, the answer to both questions is affirmative, since there is in fact a positive and significant influence between these soft skills and tacit and explicit knowledge sharing. Regarding the remaining soft skills, the answer is neither affirmative nor negative, since the results obtained were not significant.

The study carried out about knowledge creation and knowledge capture as moderators allowed us to answer the research question 3 (Does the organizational environment impact the relationship between project manager soft skills and knowledge sharing). It was concluded that knowledge creation and capture (used to measure organizational environment) have a moderator effect in the relationship

between project manager problem solving skills and knowledge management environment, used to measure explicit knowledge concept.

The results related to leadership resulted in a significant positive impact in two of the concepts used to study tacit knowledge sharing and only in one of the concepts used to study explicit knowledge sharing. Thus, it is possible to conclude that project manager's leadership has more impact on team members' knowledge sharing through face-to-face interactions and socialization processes (measured through the variables Socialization behavior and Knowledge Sharing) than in knowledge sharing through information systems, measure through Knowledge Contributing and Knowledge Management environment variables.

The soft skills communication, team building and problem solving obtained non-significant results, so we rejected the hypothesis created for these soft skills. These results may be due to the number of respondents being lower than desirable to obtain more reliable and representative results. Although the questionnaire was based on other authors' already validated scales and also a pre-test was carried out and submitted to statistical validation, it is also possible that the respondents did not interpret the items in the desired way. To overcome this limitation, in a future study, content validation could be carried out with focus groups or interviews with experts.

Following the present research, analysis and reflection were conducted on the main points for improvement to complement the developed work and find solutions that mitigate the obstacles encountered, which are mentioned below, along with future research recommendations.

The non-significant results obtained may be because the respondents did not understand the chosen scale as being the dimension that we intended to study. Even though a pre-test was performed and no questions were raised about the understanding of the items, it is not possible to know whether the respondents understood the questions in the intended way. It is also possible that these results are due to the sample size, or the data collection method used. Thus, concerning this obstacle, it would be interesting to find a larger sample of respondents to understand whether obtaining non-significant results would be maintained or if different results would be obtained. The obtaining responses method could also be improved in a future study, raising awareness of different companies from different countries to respond to the questionnaire, which, with the timeline of the present study, was not possible.

Another aspect that may have been limiting regarding the response reliability lies in the scales used. The scales used came from different authors, resulting in different scales with different directions. In the pre-test performed, several respondents mentioned that changing the direction of the scales during the questionnaire caused some confusion. However, since the scales had not been created or altered and validated by the present study's authors, they remained unchanged, keeping items, scale, and direction of the original scale. In future research, it may be an asset to create new

scales that measure the concepts under study or to find different scales that maintain a little more uniformity during the questionnaire. It could also be a good approach to study the objectives of the present research but from the project manager perspective. The perception of the impact of soft skills that project managers have on knowledge sharing may differ, depending on the analysis perspective: team members or project manager.

As future research regarding the analysed moderating effect, it could be interesting measure the moderating effect of the remaining processes that make up the knowledge management processes since in the present study only two of them were considered. Another aspect of future analysis could be to understand whether the impact changes depending on the gender of the project manager.

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Appendix

Appendix A – Statistical analysis of communication, conflict management, team building, problem solving measures

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6,663	66,632	66,632	6,663	66,632	66,632
2	,616	6,156	72,789			
3	,507	5,069	77,858			
4	,487	4,868	82,726			
5	,411	4,113	86,839			
6	,381	3,810	90,648			
7	,288	2,880	93,528			
8	,257	2,574	96,102			
9	,214	2,143	98,245			
10	,175	1,755	100,000			

Extraction Method: Principal Component Analysis.

Figure 1 - Total variance explained for communication, conflict management, team building, problem solving

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6,663	66,632	66,632	6,663	66,632	66,632
2	,616	6,156	72,789	,616	6,156	72,789
3	,507	5,069	77,858	,507	5,069	77,858
4	,487	4,868	82,726	,487	4,868	82,726
5	,411	4,113	86,839			
6	,381	3,810	90,648			
7	,288	2,880	93,528			
8	,257	2,574	96,102			
9	,214	2,143	98,245			
10	,175	1,755	100,000			

Extraction Method: Principal Component Analysis.

Figure 2 - Total variance explained for communication, conflict management, team building, problem solving, with fixed value= 4

Rotated Component Matrix[a]

	Component			
	1	2	3	4
Predictor_Communication_1	.813	.221	.288	.279
Predictor_Communication_2	.800	.314	.333	.168
Predictor_Communication_3	.614	.418	.203	.446
Predictor_Conflict_1	.342	.629	.184	.495
Predictor_Conflict_2	.362	.358	.262	.736
Predictor_TeamBuilding_1	.286	.394	.677	.230
Predictor_TeamBuilding_2	.197	.154	.623	.641
Predictor_TeamBuilding_3	.349	.264	.730	.229
Predictor_ProbSolving_1	.331	.680	.519	.129
Predictor_ProbSolving_2	.276	.777	.303	.269

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.[a]

a. Rotation converged in 15 iterations.

Figure 3 – Rotated component matrix for communication, conflict management, team building and problem solving

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5,388	67,351	67,351	5,388	67,351	67,351
2	,615	7,693	75,044	,615	7,693	75,044
3	,479	5,993	81,036	,479	5,993	81,036
4	,409	5,114	86,151			
5	,398	4,980	91,131			
6	,295	3,693	94,824			
7	,227	2,832	97,656			
8	,188	2,344	100,000			

Extraction Method: Principal Component Analysis.

Figure 4 - Total variance explained for communication, team building and problem solving, with fixed value=3

Rotated Component Matrix[a]

	Component		
	1	2	3
Predictor_Communication_1	.842	.338	.211
Predictor_Communication_2	.811	.324	.315
Predictor_Communication_3	.686	.320	.446
Predictor_TeamBuilding_1	.312	.710	.359
Predictor_TeamBuilding_2	.283	.802	.247
Predictor_TeamBuilding_3	.357	.724	.293
Predictor_ProbSolving_1	.342	.462	.709
Predictor_ProbSolving_2	.324	.308	.844

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.[a]

a. Rotation converged in 5 iterations.

Figure 5 - Rotated component matrix for communication, team building and problem solving

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,916
Bartlett's Test of Sphericity	Approx. Chi-Square	1125,589
	df	28
	Sig.	,000

Figure 6 - KMO and Bartlett's Test for communication, team building and problem solving,

Reliability Statistics

Cronbach's Alpha	N of Items
,931	8

Figure 7 - Cronbach's alpha for communication, team building and problem solving

Appendix B – Statistical analysis of leading measure

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,888
Bartlett's Test of Sphericity	Approx. Chi-Square	703,621
	df	10
	Sig.	,000

Figure 8 - KMO and Bartlett's Test for leading measure

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3,767	75,336	75,336	3,767	75,336	75,336
2	,439	8,784	84,120			
3	,325	6,505	90,625			
4	,252	5,038	95,662			
5	,217	4,338	100,000			

Extraction Method: Principal Component Analysis.

Figure 9 - Total variance explained for leading measure

Reliability Statistics

Cronbach's Alpha	N of Items
,917	5

Figure 10 - Cronbach's alpha for leading measure

Appendix C - Statistical analysis of knowledge contributing measure

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,760
Bartlett's Test of Sphericity	Approx. Chi-Square	347,124
	df	6
	Sig.	,000

Figure 11 - KMO and Bartlett's Test for knowledge contributing measure

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2,690	67,253	67,253	2,690	67,253	67,253
2	,673	16,836	84,089			
3	,382	9,556	93,644			
4	,254	6,356	100,000			

Extraction Method: Principal Component Analysis.

Figure 12 - Total variance explained for knowledge contributing measure

Reliability Statistics

Cronbach's Alpha	N of Items
,831	4

Figure 13 - Cronbach's alpha for knowledge contributing measure

Appendix D - Statistical analysis of knowledge management environment measure

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,695
Bartlett's Test of Sphericity	Approx. Chi-Square	145,752
	df	3
	Sig.	,000

Figure 14 - KMO and Bartlett's Test for knowledge management environment measure

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2,022	67,405	67,405	2,022	67,405	67,405
2	,506	16,869	84,273			
3	,472	15,727	100,000			

Extraction Method: Principal Component Analysis.

Figure 15 - Total variance explained for knowledge management environment measure

Reliability Statistics

Cronbach's Alpha	N of Items
,756	3

Figure 16 - Cronbach's alpha for knowledge management environment measure

Appendix E - Statistical analysis of socialization behavior measure

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,757
Bartlett's Test of Sphericity	Approx. Chi-Square	355,733
	df	6
	Sig.	,000

Figure 17 - KMO and Bartlett's Test for socialization behavior measure

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2,710	67,742	67,742	2,710	67,742	67,742
2	,672	16,796	84,538			
3	,364	9,103	93,641			
4	,254	6,359	100,000			

Extraction Method: Principal Component Analysis.

Figure 18 - Total variance explained for socialization behavior measure

Reliability Statistics

Cronbach's Alpha	N of Items
,838	4

Figure 19 - Cronbach's alpha for socialization behavior measure

Appendix F – Statistical analysis of knowledge sharing measure

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2,590	51,800	51,800	2,590	51,800	51,800
2	1,199	23,978	75,777	1,199	23,978	75,777
3	,469	9,375	85,152			
4	,408	8,162	93,314			
5	,334	6,686	100,000			

Extraction Method: Principal Component Analysis.

Figure 20 - Total variance explained for knowledge sharing

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2,590	51,800	51,800	2,590	51,800	51,800
2	1,199	23,978	75,777			
3	,469	9,375	85,152			
4	,408	8,162	93,314			
5	,334	6,686	100,000			

Extraction Method: Principal Component Analysis.

Figure 21 - Total variance explained for knowledge sharing, with fix value= 1

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,703
Bartlett's Test of Sphericity	Approx. Chi-Square	319,283
	df	10
	Sig.	,000

Figure 22 - KMO and Bartlett's Test for knowledge sharing measure

Reliability Statistics

Cronbach's Alpha	N of Items
,753	5

Figure 23 - Cronbach's alpha for knowledge sharing measure

Appendix G – Statistical analysis of knowledge creation

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,803
Bartlett's Test of Sphericity	Approx. Chi-Square	361,485
	df	6
	Sig.	,000

Figure 24 - KMO and Bartlett's Test for knowledge creation measure

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2,775	69,365	69,365	2,775	69,365	69,365
2	,599	14,975	84,341			
3	,349	8,731	93,071			
4	,277	6,929	100,000			

Extraction Method: Principal Component Analysis.

Figure 25 - Total variance explained for knowledge creation

Reliability Statistics

Cronbach's Alpha	N of Items
,850	4

Figure 26 - Cronbach's alpha for knowledge creation measure

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,826
Bartlett's Test of Sphericity	Approx. Chi-Square	390,264
	df	6
	Sig.	,000

Figure 27 - KMO and Bartlett's Test for knowledge capture measure

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2,894	72,343	72,343	2,894	72,343	72,343
2	,456	11,397	83,740			
3	,343	8,581	92,321			
4	,307	7,679	100,000			

Extraction Method: Principal Component Analysis.

Figure 28 - Total variance explained for knowledge capture

Reliability Statistics

Cronbach's Alpha	N of Items
,870	4

Figure 29 - Cronbach's alpha for knowledge capture measure

Appendix I – Knowledge contributing linear regression

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,367[a]	,135	,117	1,32747

a. Predictors: (Constant), Leading, TeamBuilding, Communication, ProblemSolving

b. Dependent Variable: KnowledgeContributing

Figure 30 - Knowledge contributing linear regression- Model summary

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	53,767	4	13,442	7,628	,000[b]
	Residual	345,388	196	1,762		
	Total	399,155	200			

a. Dependent Variable: KnowledgeContributing

b. Predictors: (Constant), Leading, TeamBuilding, Communication, ProblemSolving

Figure 31 - Knowledge contributing linear regression - ANOVA table

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	2,673	,488		5,478	,000					
	Communication	-,087	,149	-,065	-,582	,561	-,024	-,042	-,039	,356	2,807
	TeamBuilding	,076	,174	,049	,438	,662	,040	,031	,029	,345	2,897
	ProblemSolving	,187	,147	,143	1,269	,206	,061	,090	,084	,349	2,862
	Leading	,362	,070	,360	5,196	,000	,340	,348	,345	,919	1,088

a. Dependent Variable: KnowledgeContributing

Figure 32 - Coefficients table for evaluating the effect of predictors on Knowledge Contributing

Appendix J - Knowledge Management Environment linear regression

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,314[a]	,098	,080	,92431

a. Predictors: (Constant), Leading, TeamBuilding, Communication, ProblemSolving

b. Dependent Variable: KnowledgeMEnvironment

Figure 33 - Knowledge management environment linear regression- Model summary

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	18,278	4	4,570	5,349	,000[b]
	Residual	167,451	196	,854		
	Total	185,729	200			

a. Dependent Variable: KnowledgeMEnvironment

b. Predictors: (Constant), Leading, TeamBuilding, Communication, ProblemSolving

Figure 34 - Knowledge management environment linear regression - ANOVA table

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Correlations			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	2,006	,340		5,906	,000					
	Communication	,021	,104	,023	,203	,839	,258	,015	,014	,356	2,807
	TeamBuilding	,146	,121	,139	1,205	,230	,290	,086	,082	,345	2,897
	ProblemSolving	,155	,103	,173	1,511	,132	,298	,107	,102	,349	2,862
	Leading	-,004	,049	-,006	-,091	,927	-,075	-,007	-,006	,919	1,088

a. Dependent Variable: KnowledgeMEnvironment

Figure 35 - Coefficients table for evaluating the effect of predictors on Knowledge management environment

Appendix L – Socialization behavior linear regression

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,248[a]	,062	,042	,87122

a. Predictors: (Constant), Leading, TeamBuilding, Communication, ProblemSolving

b. Dependent Variable: SocializationBehaviour

Figure 36 - Socialization behavior linear regression - Model summary

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9,774	4	2,443	3,219	,014[b]
	Residual	148,768	196	,759		
	Total	158,542	200			

a. Dependent Variable: SocializationBehaviour

b. Predictors: (Constant), Leading, TeamBuilding, Communication, ProblemSolving

Figure 37 - Socialization behavior linear regression- ANOVA table

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	2,706	,320		8,451	,000					
	Communication	-,032	,098	-,038	-,325	,746	-,025	-,023	-,022	,356	2,807
	TeamBuilding	,090	,114	,093	,788	,432	,030	,056	,055	,345	2,897
	ProblemSolving	,015	,097	,018	,150	,881	,011	,011	,010	,349	2,862
	Leading	,156	,046	,246	3,406	,001	,235	,236	,236	,919	1,088

a. Dependent Variable: SocializationBehaviour

Figure 38 - Coefficients table for evaluating the effect of predictors on Socialization behavior

Appendix M – Knowledge sharing linear regression

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,256[a]	,065	,046	,75249

a. Predictors: (Constant), Leading, TeamBuilding, Communication, ProblemSolving

b. Dependent Variable: KnowledgeSharing

Figure 39 - Knowledge sharing linear regression - Model summary

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7,753	4	1,938	3,423	,010[b]
	Residual	110,982	196	,566		
	Total	118,735	200			

a. Dependent Variable: KnowledgeSharing

b. Predictors: (Constant), Leading, TeamBuilding, Communication, ProblemSolving

Figure 40 - Knowledge sharing linear regression- ANOVA table

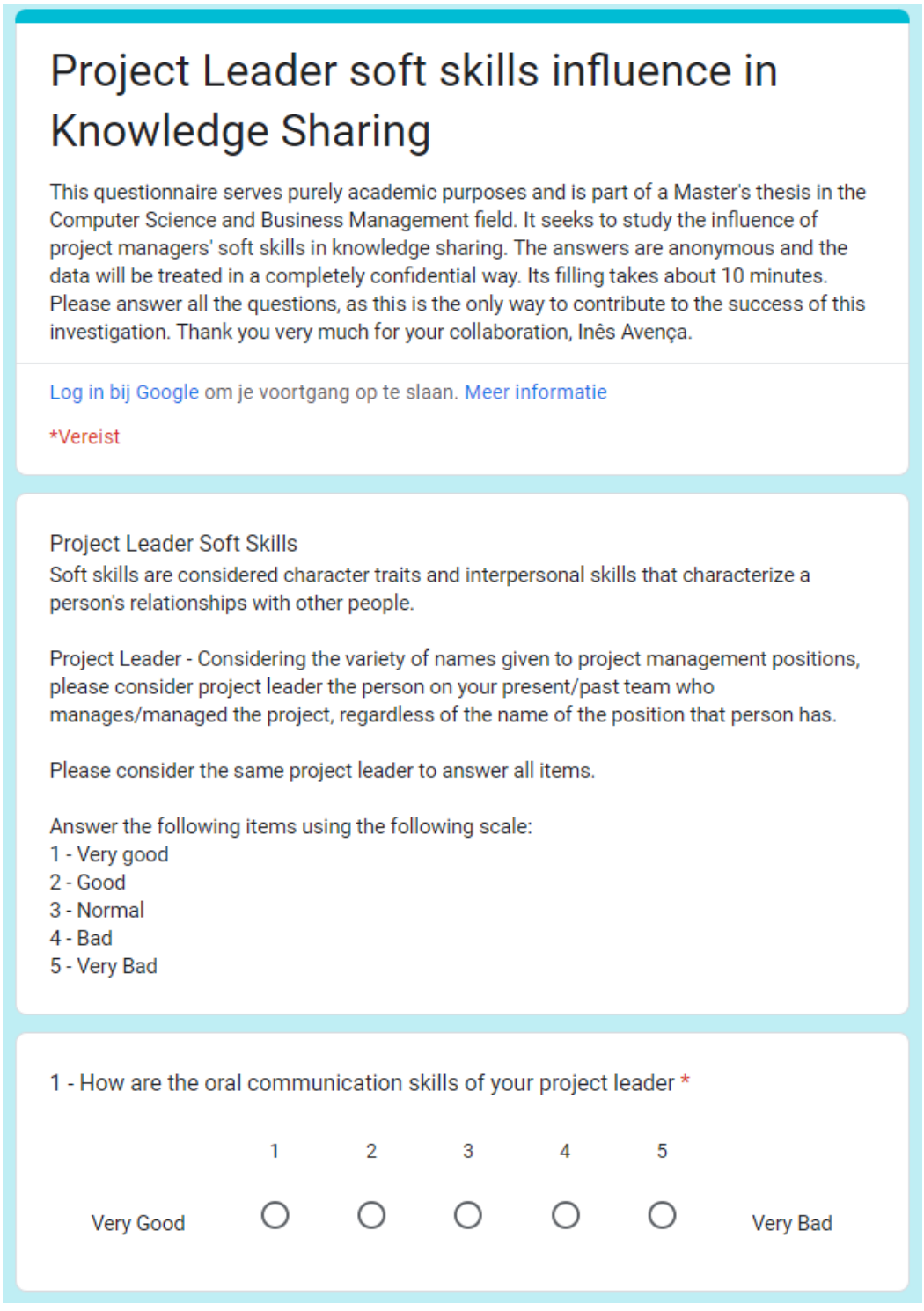
Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	3,226	,277		11,663	,000					
	Communication	,007	,084	,010	,085	,932	,033	,006	,006	,356	2,807
	TeamBuilding	,080	,098	,096	,816	,416	,077	,058	,056	,345	2,897
	ProblemSolving	,021	,083	,030	,254	,799	,060	,018	,018	,349	2,862
	Leading	,137	,039	,250	3,475	,001	,223	,241	,240	,919	1,088

a. Dependent Variable: KnowledgeSharing

Figure 41 - Coefficients table for evaluating the effect of predictors on Knowledge sharing

Appendix N – Survey



Project Leader soft skills influence in Knowledge Sharing

This questionnaire serves purely academic purposes and is part of a Master's thesis in the Computer Science and Business Management field. It seeks to study the influence of project managers' soft skills in knowledge sharing. The answers are anonymous and the data will be treated in a completely confidential way. Its filling takes about 10 minutes. Please answer all the questions, as this is the only way to contribute to the success of this investigation. Thank you very much for your collaboration, Inês Avença.

Log in bij Google om je voortgang op te slaan. Meer informatie

*Vereist

Project Leader Soft Skills

Soft skills are considered character traits and interpersonal skills that characterize a person's relationships with other people.

Project Leader - Considering the variety of names given to project management positions, please consider project leader the person on your present/past team who manages/managed the project, regardless of the name of the position that person has.

Please consider the same project leader to answer all items.

Answer the following items using the following scale:
1 - Very good
2 - Good
3 - Normal
4 - Bad
5 - Very Bad

1 - How are the oral communication skills of your project leader *

	1	2	3	4	5	
Very Good	○	○	○	○	○	Very Bad

Figure 42 – Survey, part 1/14

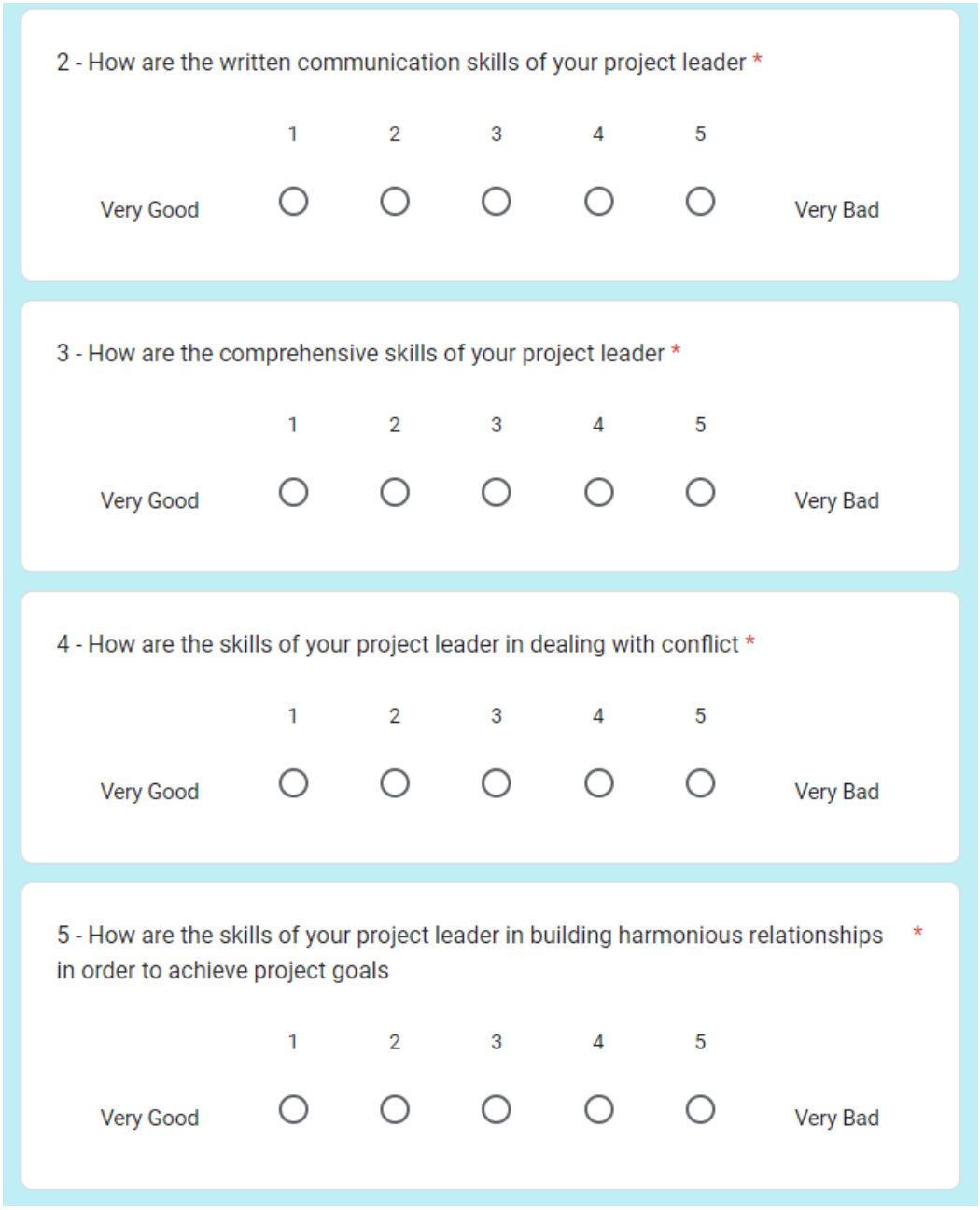


Figure 43 – Survey, part 2/14

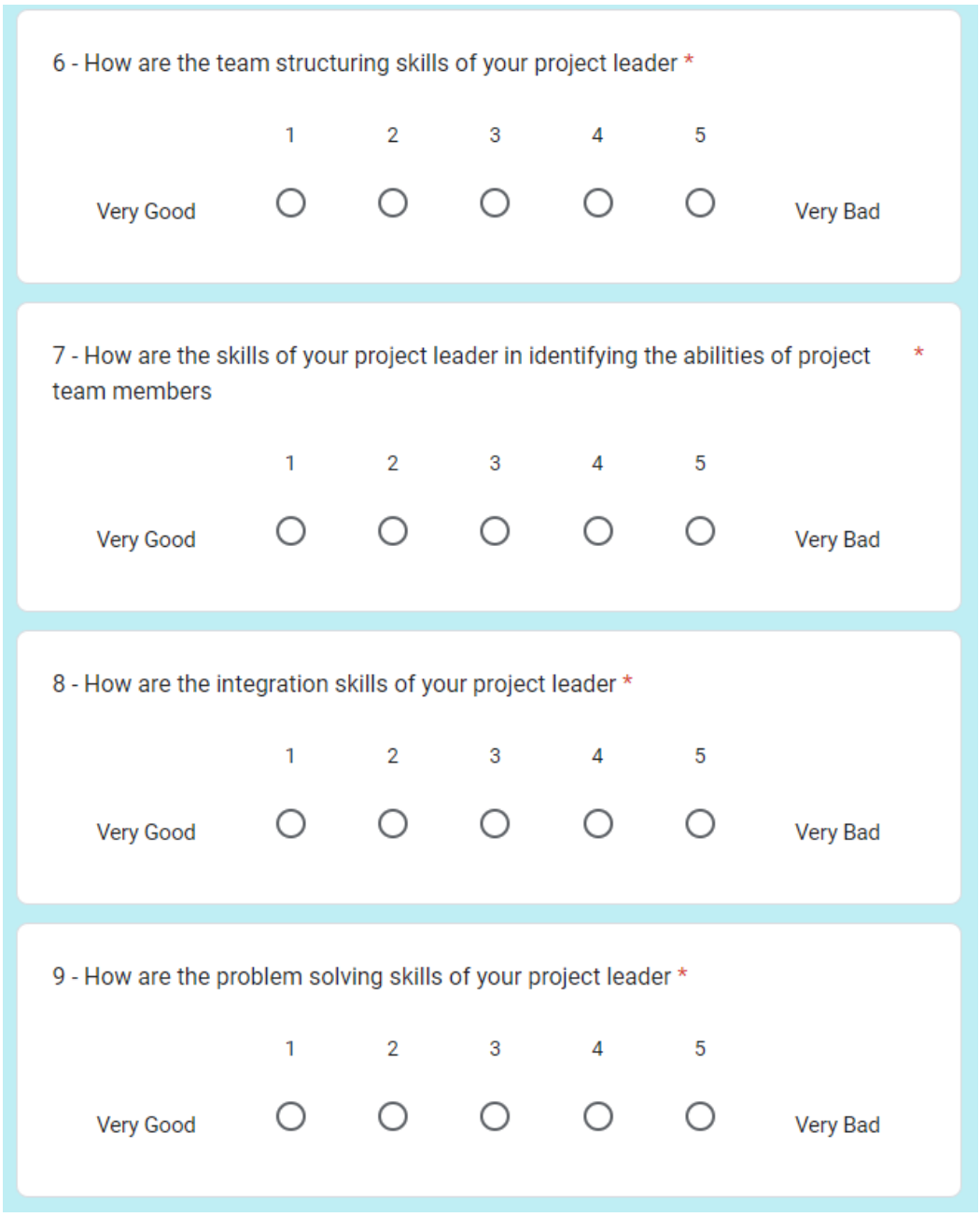


Figure 44 – Survey, part 3/14

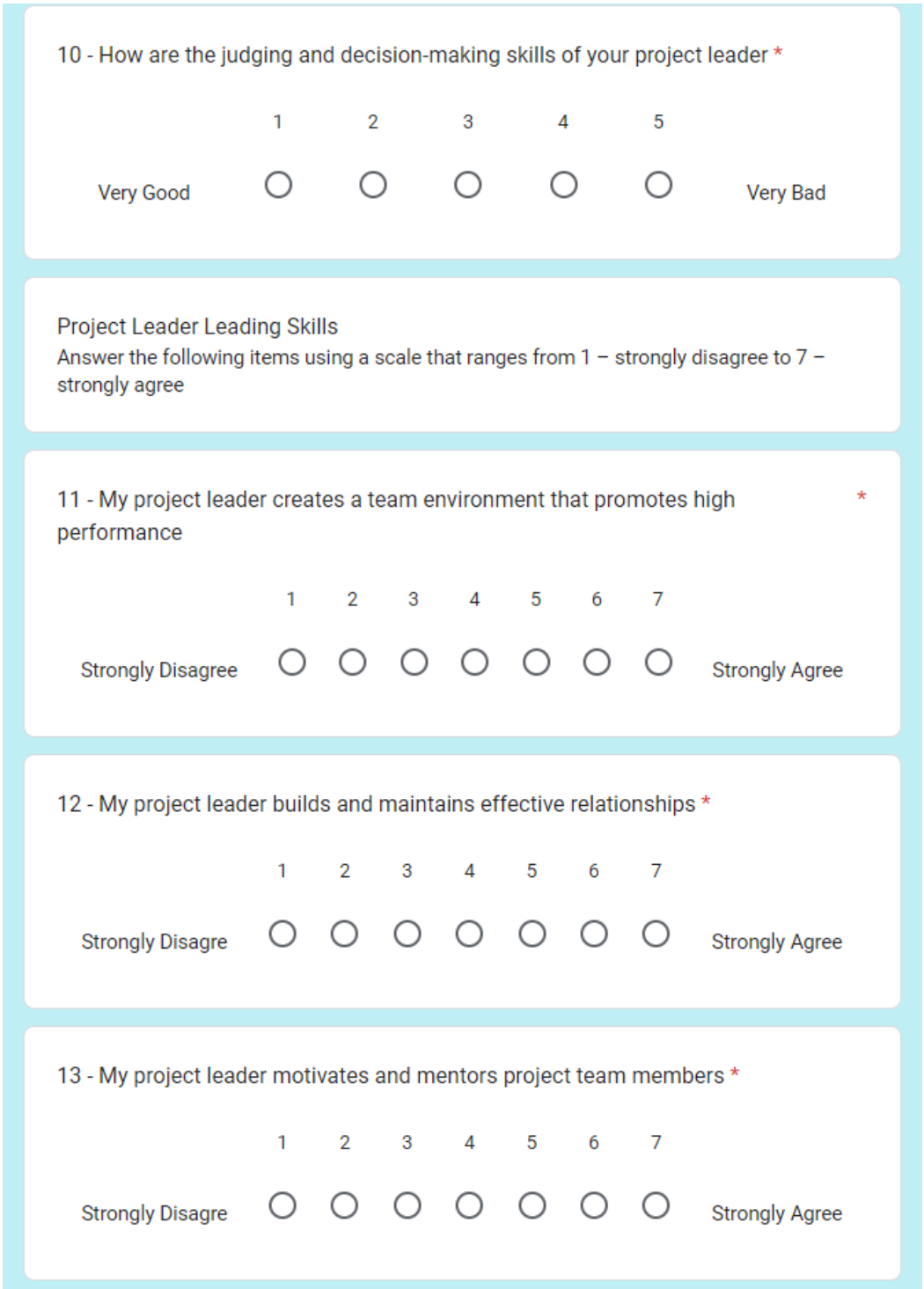


Figure 45 – Survey, part 4/14

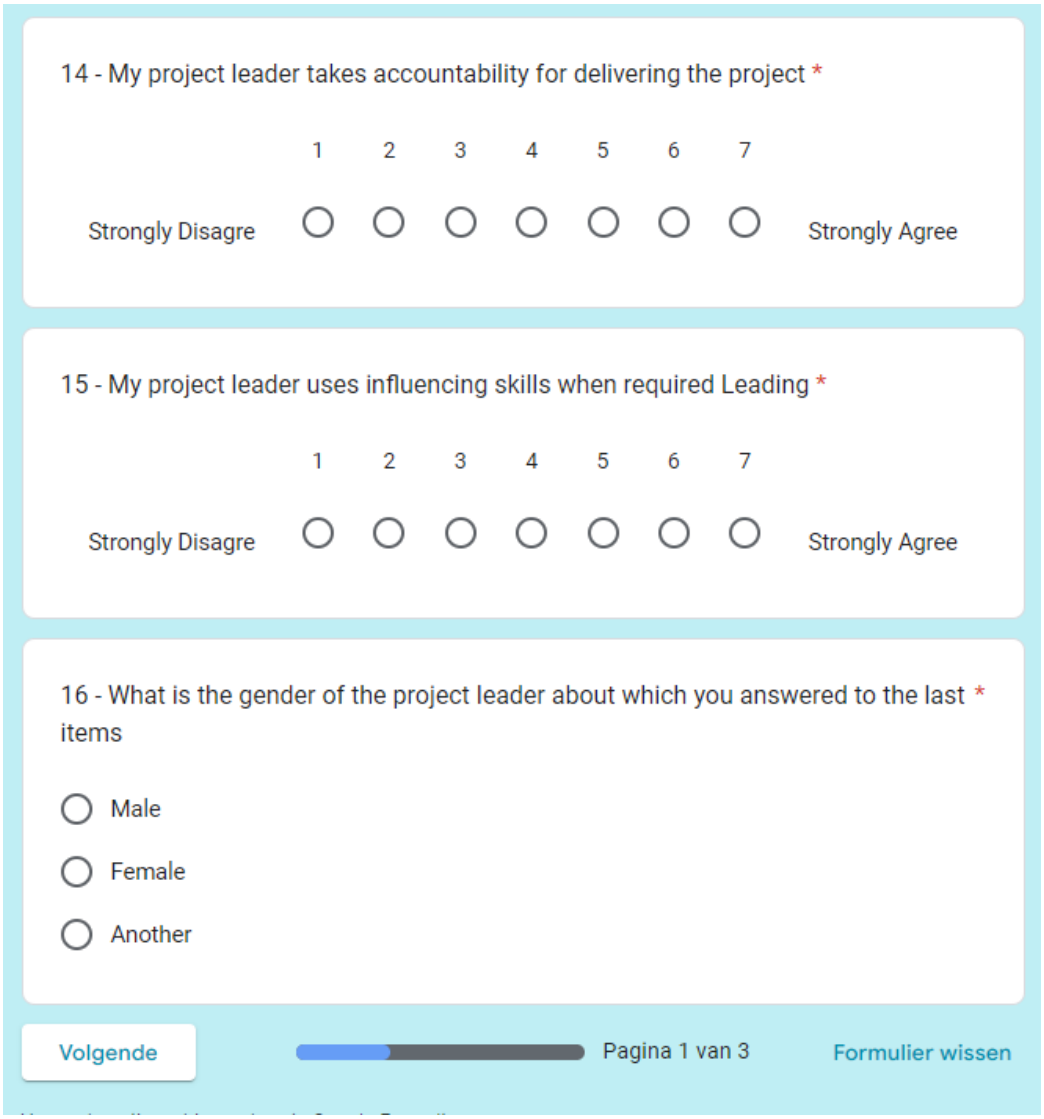


Figure 46 – Survey, part 5/14

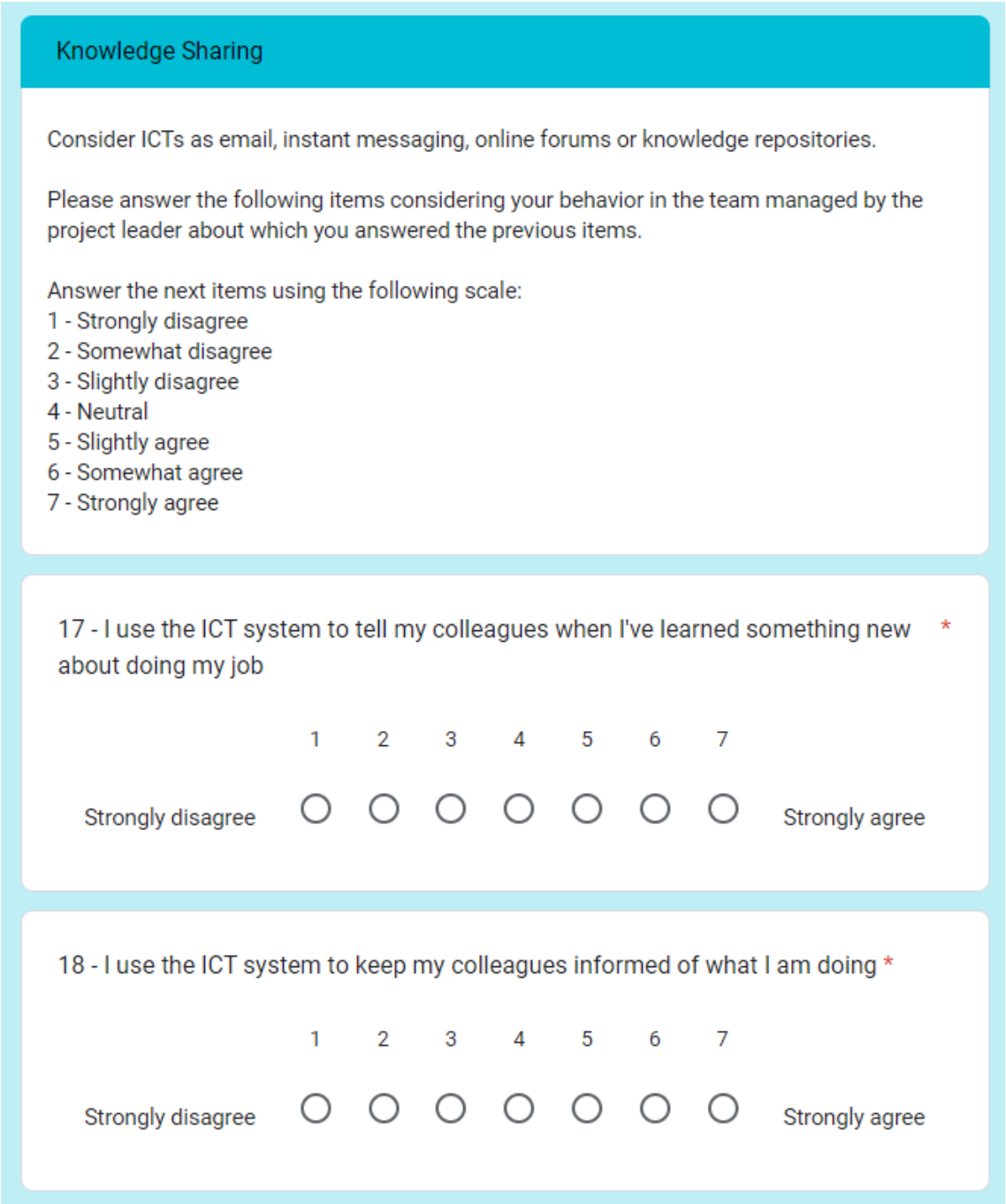


Figure 47 – Survey, part 6/14

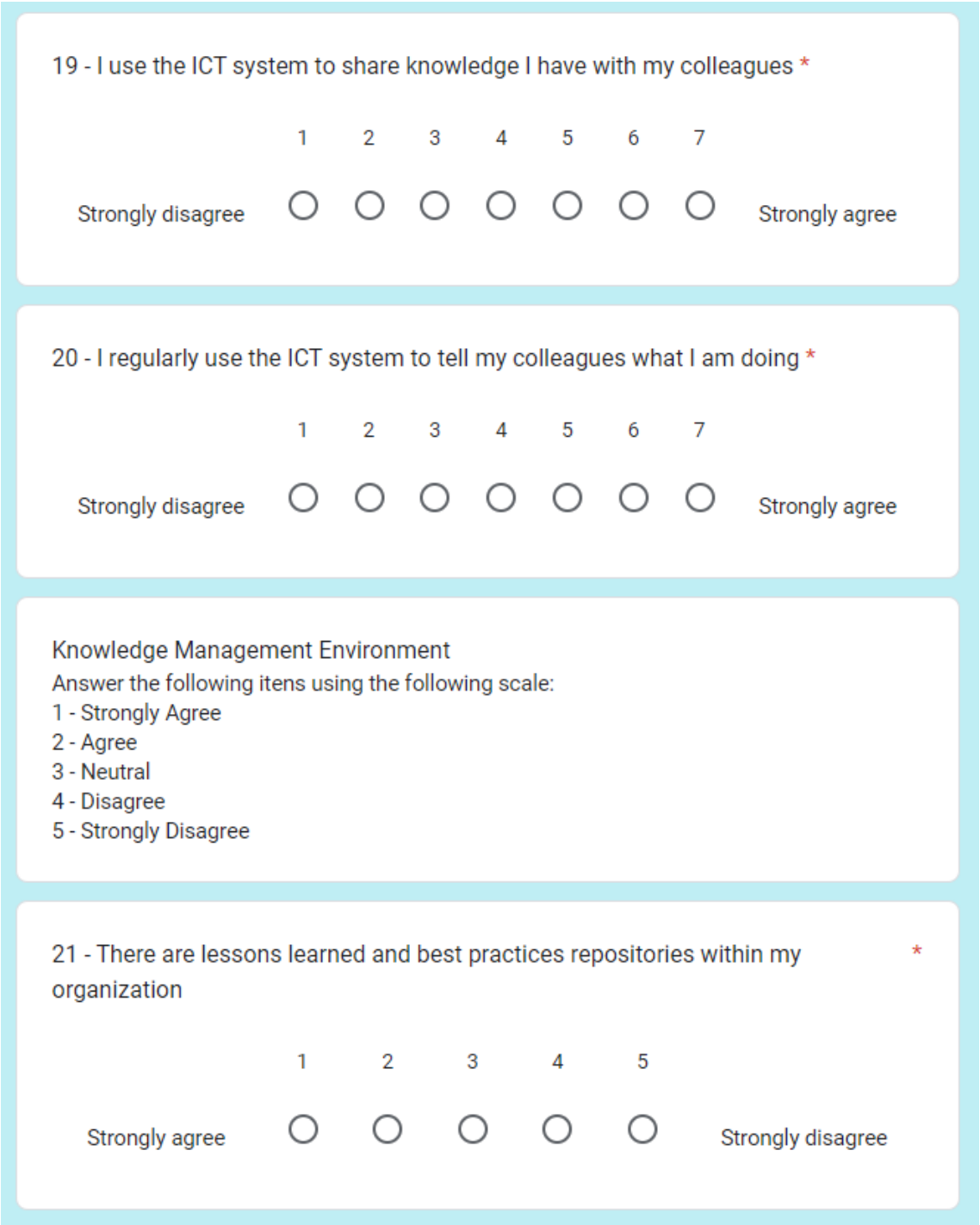


Figure 48 – Survey, part 7/14

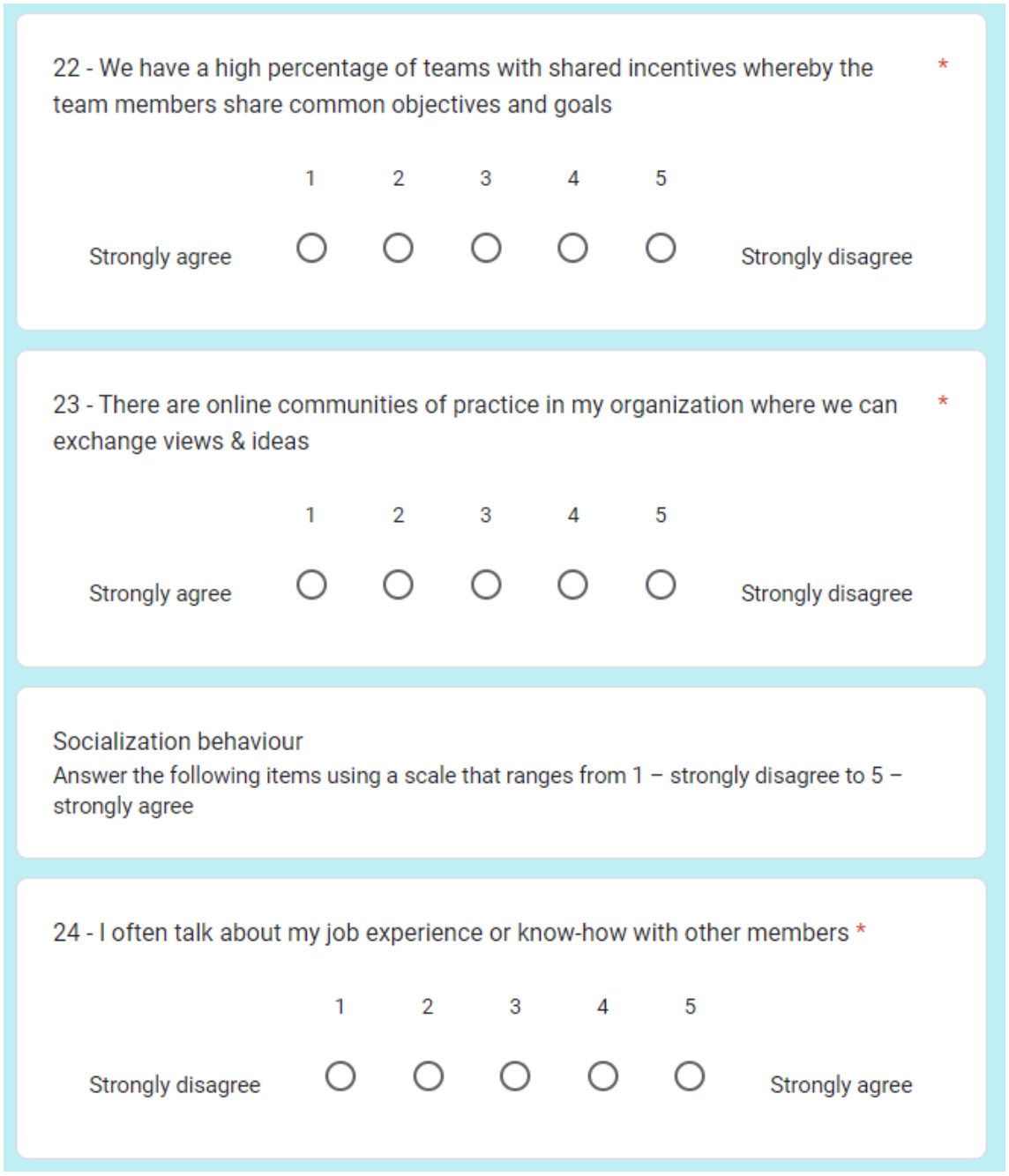


Figure 49 – Survey, part 8/14

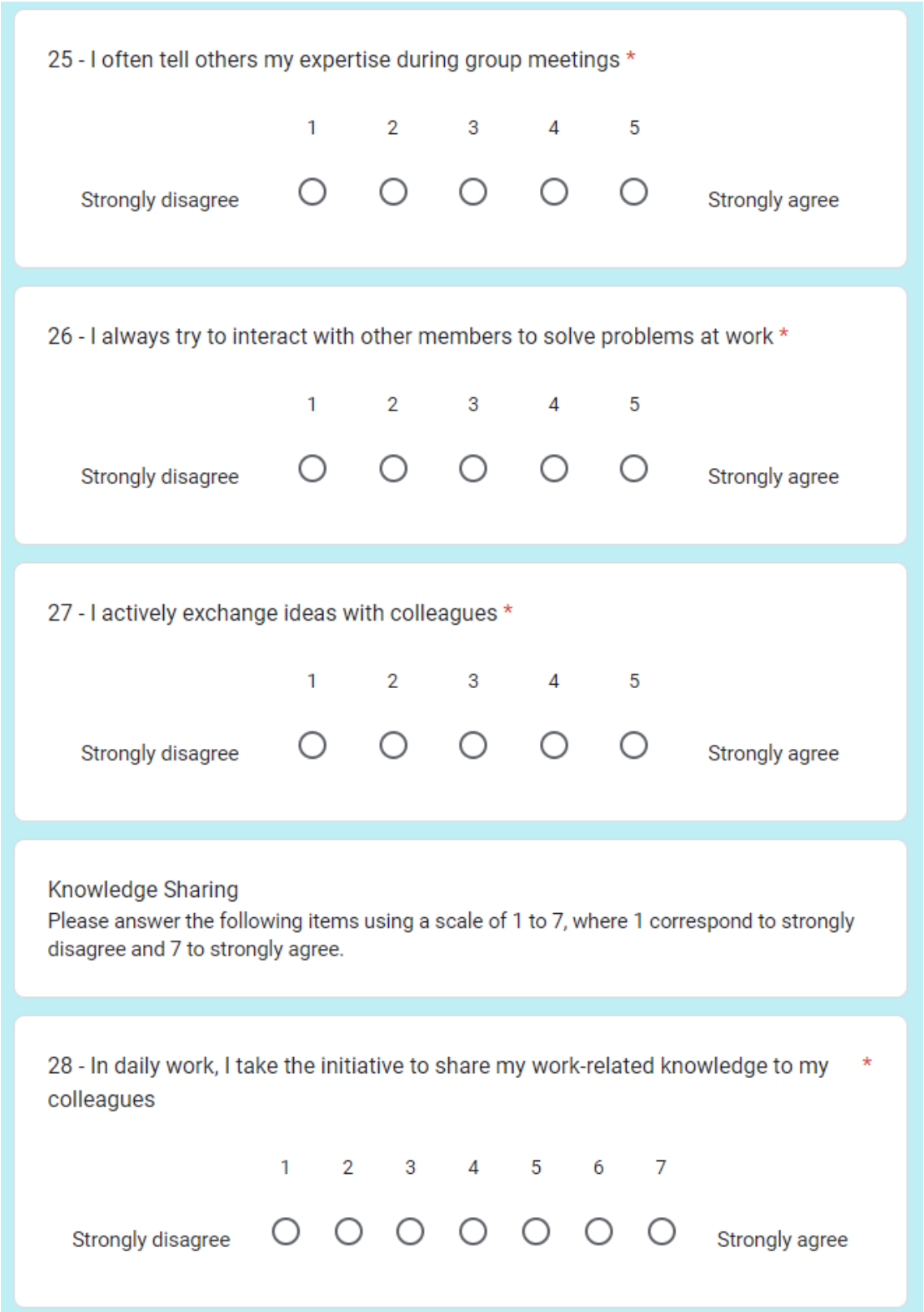


Figure 50 – Survey, part 9/14

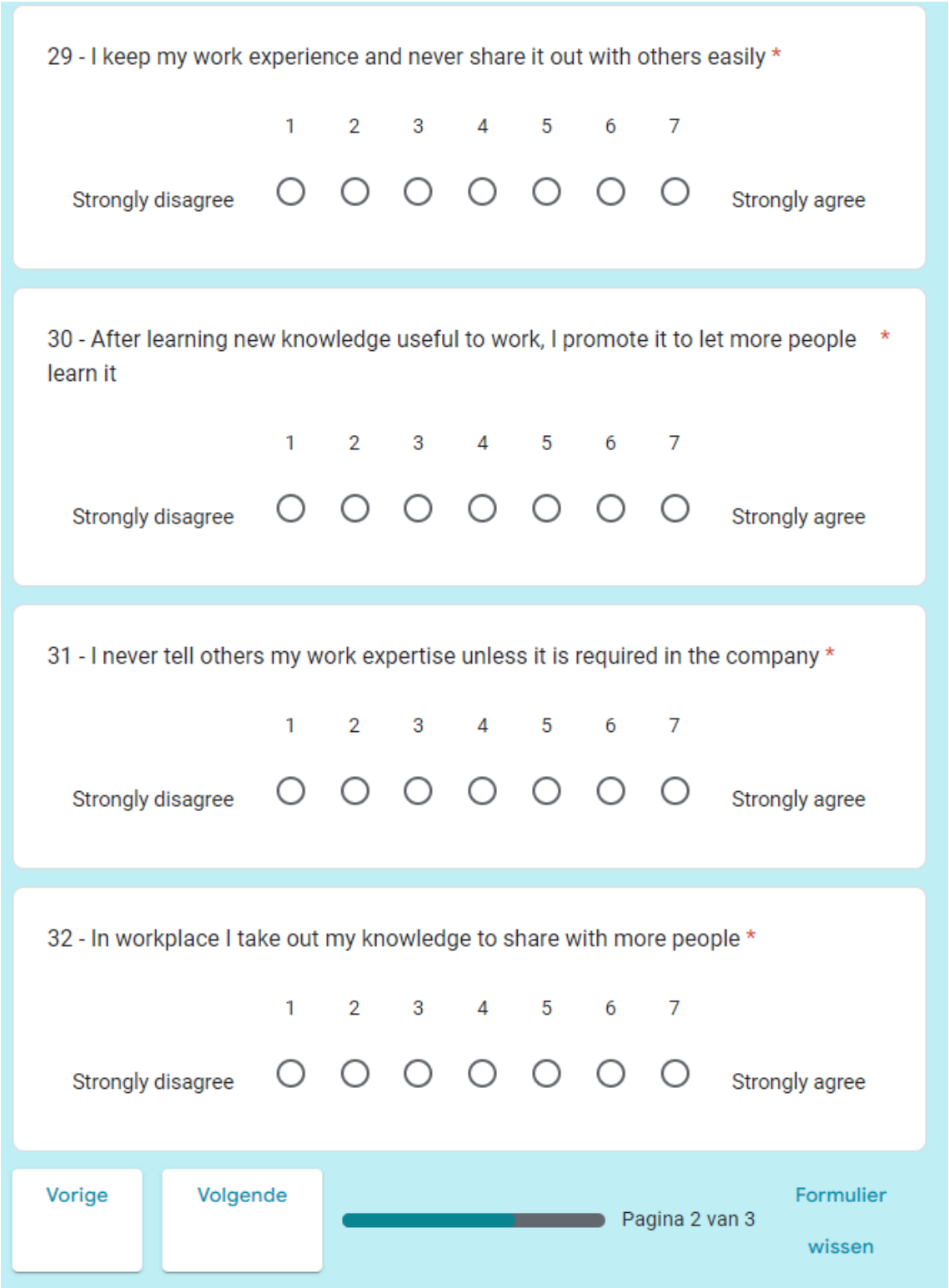


Figure 51 – Survey, part 10/14

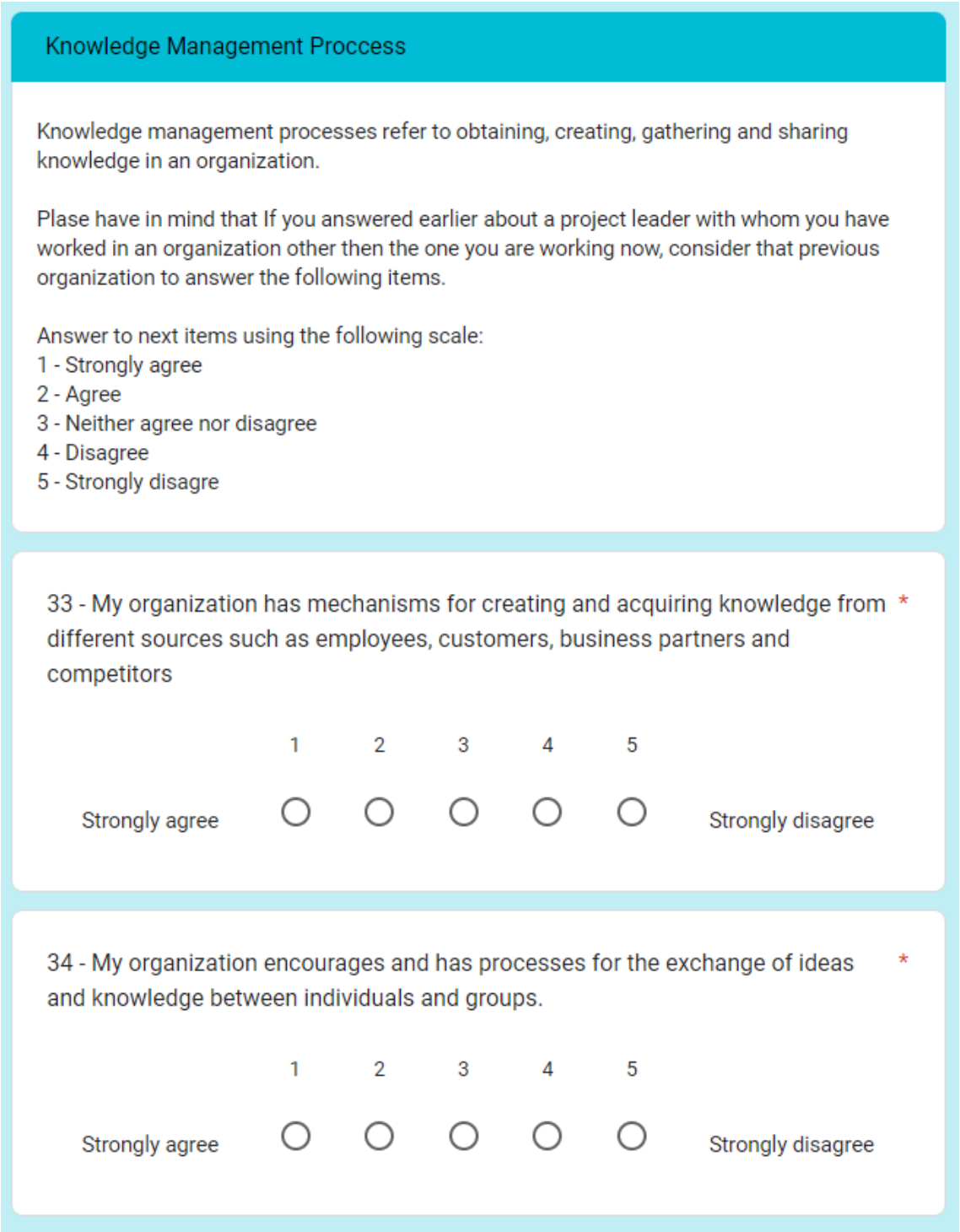


Figure 52 – Survey, part 11/14

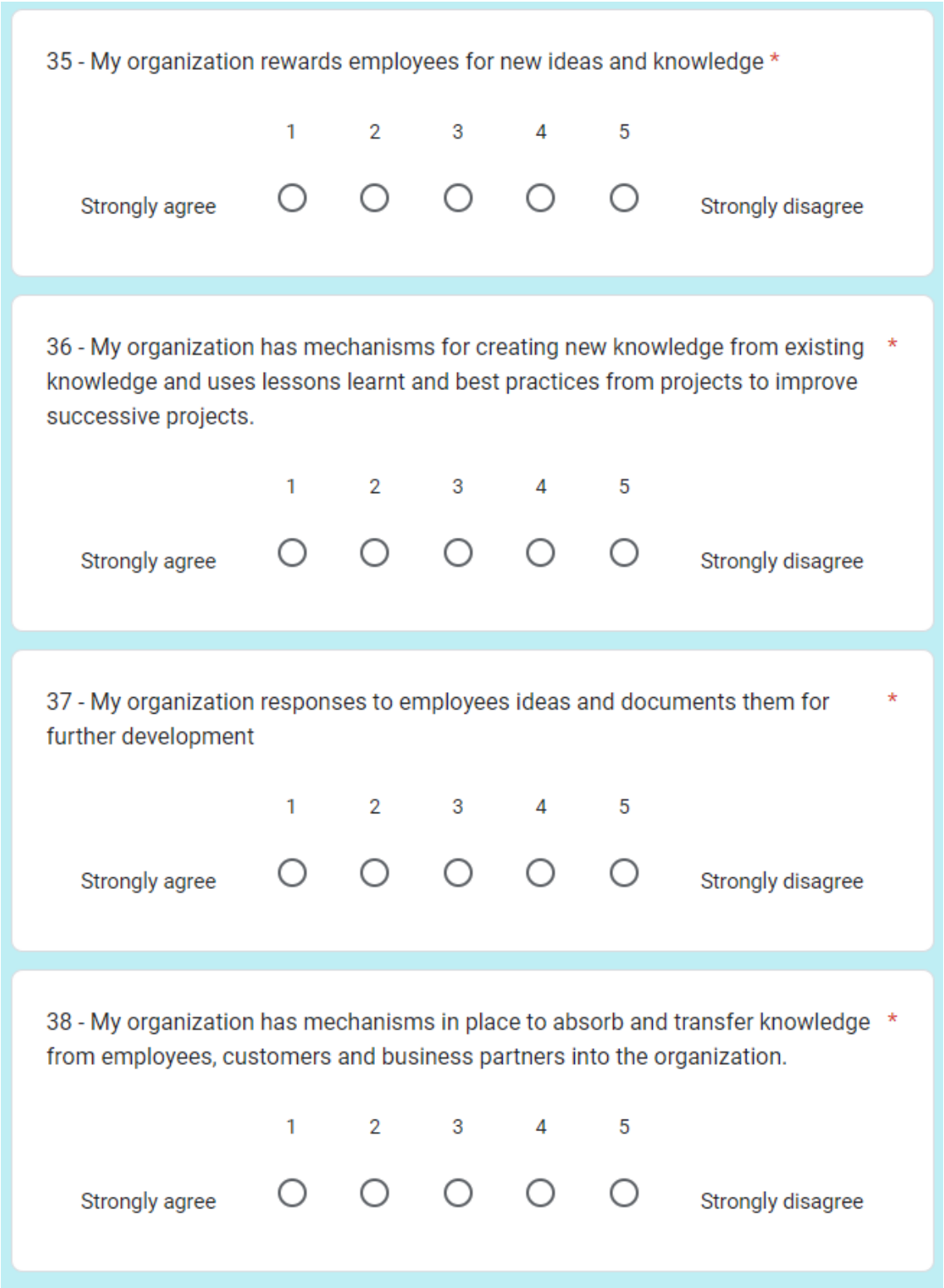


Figure 53 – Survey, part 12/14

39 - My organization has mechanisms for converting knowledge into action plans and the design of new products and services. *

	1	2	3	4	5	
Strongly agree	○	○	○	○	○	Strongly disagree

40 - My organization has policies in place to allow employees to present new ideas and knowledge without fear and ridicule. The organization showcases new ideas from employees to other staff. *

	1	2	3	4	5	
Strongly agree	○	○	○	○	○	Strongly disagree

Demographic Information
The following items refer to your personal information

41 - Gender *

- ○ Male
- ○ Female
- ○ Another
- ○ Prefer not to say

Figure 54 – Survey, part 12/14

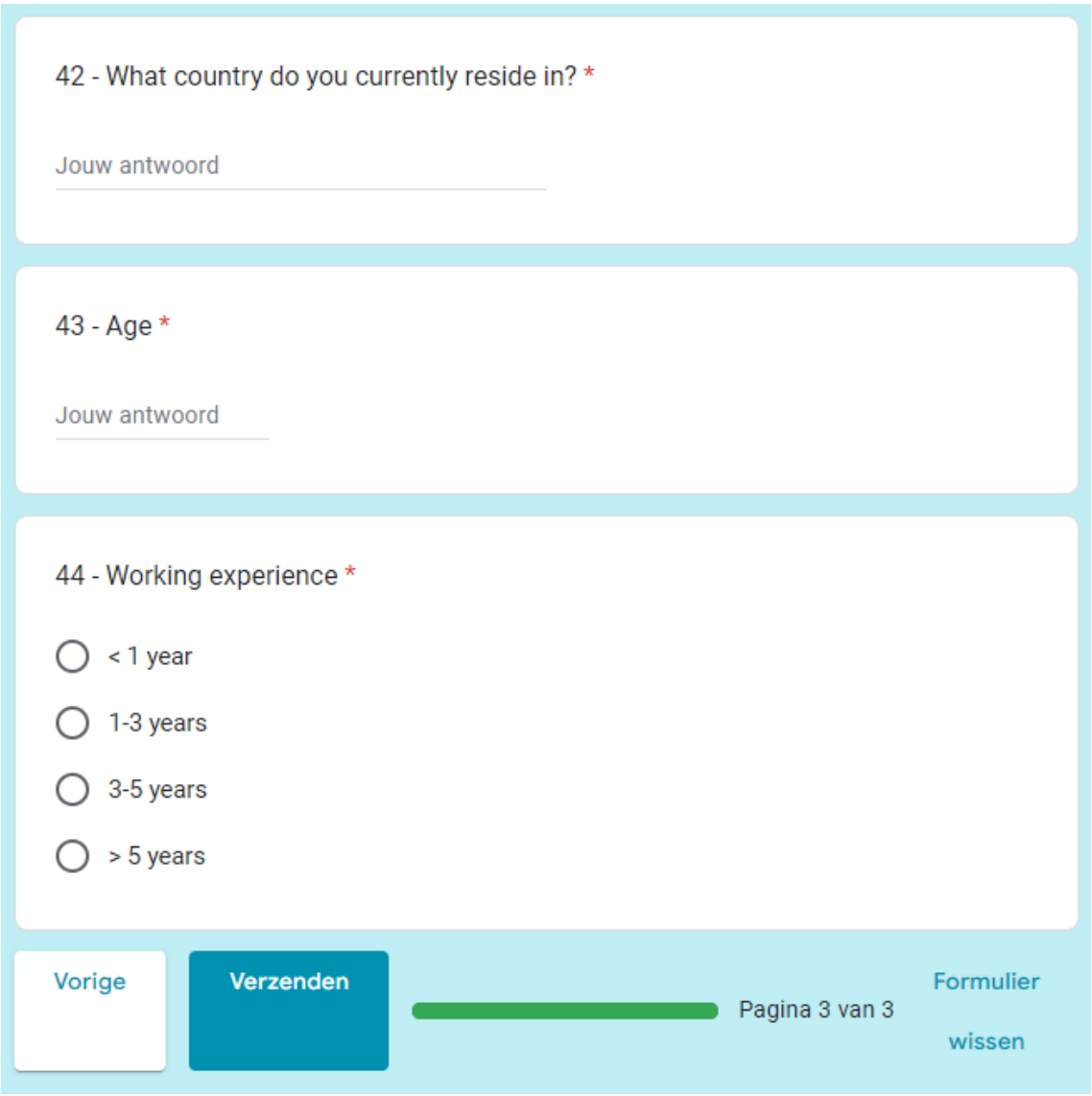


Figure 55 – Survey, part 14/14