Tampere University

Minttu Halme

# INTEGRATING KNOWLEDGE MANAGEMENT INTO BUSINESS INTELLIGENCE SYSTEMS MAINTENANCE SERVICES

Master's thesis
Faculty of Management and Business
Examiner: Jonna Käpylä
Examiner: Miikka Palvalin
April 2024

# ABSTRACT

Minttu Halme: Integrating knowledge management into business intelligence systems maintenance services
Master's thesis
Tampere University
Master's Degree Program in Information and Knowledge Management
April 2024

---

Business intelligence (BI) aims to support decision-making in organizations. BI systems maintenance services aim to prolong the lifespan and enhance the functionalities of BI environments. BI systems maintenance services are knowledge-intensive offerings. Knowledge may be the biggest factor in increasing an organization's competitiveness. To remain competitive, knowledge should be managed. The study aims to understand how knowledge management supports BI systems maintenance services.

The study starts with a literature review. Knowledge management and BI systems maintenance services are introduced. It was noted that the research area that combines knowledge management into BI systems maintenance services lacks research. The empirical research was conducted as a case study and the data collection method was a semi-structured interview. 16 interviews were conducted with the target company's employees and customers.

The study creates a theory-based framework that can be utilized in understanding how knowledge management enriches BI systems maintenance services. Knowledge management strategy and vision should be formulated first. After that, knowledge and knowledge flow barriers should be recognized in the BI systems maintenance service. The value of knowledge assets is maximized after the recognized barriers are solved. Knowledge management success factors and IT systems support knowledge management incentives during the process.

The study enriches the theoretical framework with empirical results. The target company's BI-systems maintenance service is called AMS. Knowledge management strategy and vision were not in the scope of the empirical study; however, theory conclusions suggest that knowledge management strategy should integrate personalization and codification strategies. The long-term vision in BI systems maintenance services is to manage knowledge as effectively as possible to create economic value. Short term vision is to remove barriers and maximize the value of knowledge assets through process and method development.

Identified knowledge and knowledge flow barriers are recognized in themes: poorly defined service and the vision is missing, documentation quality, accessibility, and absence, customer expectations, poorly defined subprocesses, lack of AMS management, and lack of knowledge management. Knowledge management incentives that solve the identified barriers are in themes: AMS owner, AMS documentation, harmonized and documented processes, and managing AMS.

Supporting IT systems are contract management, communication channels, knowledge storage, and sales support channel. Success factors are top management support, managing explicit and tacit knowledge, knowledge sharing, and knowledge creation. The success factors are based on the theory's conclusions. It is supposed that the results of the study will be implemented in the target company's BI systems maintenance service.

Key Words: Knowledge management, business intelligence maintenance services, ITSM, continuous services

# TIIVISTELMÄ

Minttu Halme: Tietojohtaminen osana liiketoimintatiedon hallinnan järjestelmien ylläpitopalvelua
Diplomityö
Tampereen yliopisto
Tietojohtamisen diplomi-insinöörin tutkinto-ohjelma
Huhtikuu 2024

---

Liiketoimintatiedon hallinta (engl. Business intelligence, BI) pyrkii tukemaan päätöksentekoa organisaatioissa. BI-järjestelmien ylläpitopalveluiden tavoitteena on pidentää BI-ympäristöjen käyttöikää sekä tehostaa toimintoja. BI-järjestelmien ylläpitopalvelut ovat tietointensiivisiä palveluita. Tieto on mahdollisesti suurin tekijä, joka lisää organisaation kilpailukykyä. Tietoa pitää hallita, jotta organisaatio pysyy kilpailukykyisenä. Tutkimuksen tavoitteena on ymmärtää, miten tietojohtaminen tukee Bi-järjestelmien ylläpitopalveluita.

Tutkimus alkaa kirjallisuuskatsauksella, joka esittelee tietojohtamisen ja BI-järjestelmien ylläpitopalvelut. Tutkimuksen aikana todettiin, että ei ole tutkimusta, joka yhdistää tietojohtamisen ja BI-järjestelmien ylläpitopalvelut. Empiirinen tutkimus toteutettiin tapaustutkimuksena ja tiedonkeruumenetelmänä oli puolistrukturoitu haastattelu. Haastatteluja oli yhteensä 16, ja haastateltavat olivat kohdeyrityksen työntekijöitä sekä asiakkaita.

Tutkimuksessa luodaan teoriapohjainen malli, jota voidaan hyödyntää ymmärtämään, miten tietojohtaminen rikastuttaa BI-järjestelmien ylläpitopalveluita. Tietojohtamisen strategia ja visio tulee muotoilla ensin. Tämän jälkeen tietoon ja tietovirtoihin liittyvät esteet tulee tunnistaa BI-järjestelmien ylläpitopalvelusta. Maksimoidakseen tiedon arvon, tunnistetut esteet tulee ratkaista. Tietojohtamisen menestystekijät ja tietojärjestelmät tukevat tietojohtamista BI-järjestelmien ylläpitopalveluja.

Teoriapohjainen malli rikastetaan empiirisillä tuloksilla. Kohdeyrityksen BI-järjestelmien ylläpitopalvelua kutsutaan AMS:ksi. Tietojohtamisen strategia ja visio eivät kuuluneet empiirisen tutkimuksen piiriin; teorian päätelmät kuitenkin osoittavat, että tietojohtamisen strategian tulisi yhdistää personointi- ja kodifiointistrategiat. BI-järjestelmien ylläpitopalveluiden pitkän aikavälin visio on hallita tietämystä mahdollisimman tehokkaasti taloudellisen arvon luomiseksi. Lyhyen aikavälin visio on poistaa esteitä ja maksimoida tietämyksen arvo.

Tunnistetut tieto ja tietovirta haasteiden teemat ovat: huonosti suunniteltu palvelu ja visio puuttuu, dokumentaation laatu, saavutettavuus ja poissaolo, asiakkaiden odotukset, huonosti määritellyt osaprosessit, AMS-johtamisen puute ja tietojohtamisen puute. Tietojohtamisen toiminnot tunnistettujen haasteiden ratkaisemiseksi ovat tunnistettu teemoissa AMS:n omistaja, dokumentaatio, harmonisoidut ja dokumentoidut prosessit sekä AMS:n jatkuva hallinta.

AMS:ia tukevia IT-järjestelmiä ovat sopimustenhallintajärjestelmä, viestintäkanavat, tietämysvarastot ja myynnin tukikanava. Tietojohtamisen menestystekijöitä ovat ylimmän johdon tuki, eksplisiittisen ja hiljaisen tiedon hallinta, tiedon jakaminen ja tiedon luominen. Menestystekijät perustuvat teorian johtopäätöksiin. Tutkimuksen tulokset on tarkoitus ottaa käyttöön kohdeyrityksen BI-järjestelmien ylläpitopalvelussa

Avainsanat: Tietojohtaminen, liiketoimintatiedonhallinnan järjestelmien ylläpitopalvelut, ITSM, jatkuvat palvelut

# PREFACE

Completing this thesis has been a journey filled with challenges, discoveries, and personal growth. It is the culmination of months of dedicated research, analysis, and reflection. Throughout this process, I have been fortunate to receive support and guidance from many individuals who have generously shared their expertise and encouragement.

This thesis represents not only my own efforts but also the contributions of those who have provided invaluable insights, feedback, and inspiration along the way. I am deeply grateful to my thesis advisors Miikka and Jonna, whose wisdom and guidance have been instrumental in shaping this work. I would also like to express my appreciation to Juha for guidance and support during this journey.

My time at Tampere University has been rich with learning, cherished friendships, and unforgettable memories. I am grateful for the experiences and connections I have made during my studies. As I transition beyond the university, I eagerly anticipate continuing my journey of learning and embracing new experiences.

In Tampere, 12th April 2024

Minttu Halme

# CONTENTS

# LIST OF FIGURES

# LIST OF TABLES

# LIST OF SYMBOLS AND ABBREVIATIONS

| | |
|---|---|
| AMS | Application management service, the target company's BI systems maintenance service |
| BI | Business intelligence |
| IT | Information technology |
| ITSM | Information Technology Service Management |
| KPI | Key performance indicator |
| SLA | Service level agreement |

.

# 1. INTRODUCTION

This chapter presents an introduction to this research. The first sub-chapter talks about the motivation and background of the research. The next one discusses the research problem, objectives, and focus. As well, thesis structure is presented.

## 1.1 Research background

Business intelligence (BI) consists of tools, technologies, and methodologies used to collect, store, access, and analyze data (Watson 2009). The BI environment encompasses integrating data from source systems to data warehouses, and then data marts (Watson 2009). The data from data marts can be utilized by BI technologies and applications (Watson 2009). BI aims to support decision-making in organizations (Lim et al. 2012). BI maintenance services keep BI environments working after the development of BI functionality has ended (Gupta et al. 2019). Continuous services aim to prolong the lifespan and enhance the functionalities of BI environments (Li et al. 2014). Information technology service management (ITSM) is a management approach where IT service is at the center and the aim is to provide value to IT service customers (Mora et al. 2022). ITSM covers the entire IT management (Mora et al. 2022). ITSM consists of customer and process perspectives when managing IT as a business (Winniford et al. 2009).

Knowledge may be the biggest factor in increasing an organization's competitiveness (Davenport & Prusak 1998, 13). Knowledge helps organizations to operate, and it is part of all the products and services that organizations provide (Davenport & Prusak 1998, 13). To remain competitive, organizations should manage their intellectual resources and capabilities, such as knowledge (Zack 1999). Knowledge-intensive organizations rely heavily on knowledge and know-how and therefore it is crucial to organize knowledge management in a manner that fosters the use of existing knowledge and new knowledge creation (Laihonen 2005, 8). Knowledge is the core asset of consultancies and that is the reason why they were one of the first businesses that paid attention and made investments in knowledge management (Zack 1999; Hansen et al. 1999).

Knowledge management consists of the processes and methods employed to maximize the value derived from an organization's knowledge assets (Teece 2000). The purpose of knowledge management is to enhance an organization’s ability to compete (Zack 1999). The proper knowledge management strategy can gain a competitive advantage for an organization since the customer capital and knowledge can be leveraged more efficiently (Smith 2004). Consulting firms that lack effective knowledge management systems and procedures often find themselves repeating work for different clients, even when there are no restrictions on sharing such information (Teece, 2000).

As IT is a key source of value creation, and knowledge is a strategic asset that enables businesses to develop competitive advantage ITSM should be enriched with knowledge management (Baradari et al. 2023). IT maintenance consumes 50–80% of IT budgets and costs (Hou & Zheng 2020). Therefore finding the best practices for BI systems maintenance services have an economic impact as well. Knowledge management and ITSM are both management approaches, and they should be implemented together (Baradari et al. 2023). Current ITSM best practices, such as ITIL, underestimate the role of knowledge management in design and development (Baradari et al. 2023; Mohamed et al. 2008). IT outsourcing has been increasing during the past years (Hou & Zheng 2020). ITIL notices knowledge management as a source of continual value co-creation, but knowledge management is not considered in ITIL extensively (Agutter & Villa 2022). Knowledge management is not considered in BI maintenance context either.

The target company is an IT consulting company providing a wide range of IT solutions to customers. The study is commissioned by the business unit of data and analytics. The data and analytics business unit provides BI experience such as data warehousing, dashboard development, and business planning solutions. The demand for BI systems maintenance services has been increasing and it has created a need to develop the target company’s BI systems maintenance service offering.

## 1.2 Research objectives, scope, and questions

Research objectives are based on the target company’s willingness to develop BI systems maintenance services. The objective of the study is to understand the current status of BI systems maintenance services and how to develop them. The aim of the study is not to cover the development process of BI systems maintenance services completely, yet the scope of the study is knowledge management.

The scope of knowledge management is chosen because of the lack of research combining BI systems maintenance services and knowledge management. Baradari et al. (2023) suggest that since IT is a key source of value creation, and knowledge is a strategic asset that enables businesses to develop competitive advantage, ITSM should be enriched with knowledge management (Baradari et al. 2023). ITSM has plenty of knowledge, and knowledge management assists in saving costs in ITSM. (Weed-Schertzer 2019, 111; Manuel et al. 2013). The study aims to combine knowledge management into BI systems maintenance services and understand the benefits of that.

To address the research objectives in the scope chosen, the study aims to reach the objectives of the target company but also to create new research on the area of BI systems maintenance services enriched with knowledge management. The main research question is formulated as follows:

*How could knowledge management support BI systems maintenance services?*

With the main research question, the aim is to understand knowledge management incentives that would assist in daily operations of BI systems maintenance services, and how they would assist. The study gives a new perspective on developing BI systems maintenance services for the target company. The main research question is supported by three sub-research questions:

*What kind of knowledge-sharing challenges there are in the process?*

*How does knowledge management enhance knowledge flow between the operators?*

*How do knowledge management practices support the knowledge needs of different operators?*

The first sub-research question creates an understanding of knowledge-sharing challenges in the target company, that could be amended with knowledge management. The second sub-research question aims to create an understanding of the knowledge flows in the target company, that could be supported with knowledge management. The third sub-research question unravels the knowledge needs of the operators and the knowledge management incentives supporting the knowledge needs.

The research aims to understand the dimensions of knowledge management in BI systems maintenance services. The goal of the study is to suggest how knowledge management practices support BI systems maintenance services. The outcome of the study will be utilized in developing BI systems maintenance services for the target company. The aim of the study is reached by literature review and interview research as an empirical research method.

## 1.3 Thesis structure

This thesis is structured as follows. The second, and third chapters cover the theoretical background as a literature review. The second chapter focuses on knowledge in BI systems maintenance services and presents the essential terms: knowledge, knowledge-intensive organization, BI systems maintenance services, ITSM, knowledge flows, and inefficiencies in knowledge markets. The third chapter focuses on knowledge management and presents the SECI model, the processes of creating, codifying, and sharing knowledge, knowledge management as a concept, and personalization and codification strategies. The fourth chapter concludes the presented theory.

The fifth chapter presents research methodology, data collection and analysis methods, research implementation, and Case presentation. The sixth chapter introduces the findings, and the seventh chapter focuses on a discussion of the findings and answers to the research questions. The last chapter concludes the study and presents the study evaluation, the novelty of the study, and future research possibilities.

# 2. KNOWLEDGE AND BUSINESS INTELLIGENCE SYSTEMS MAINTENANCE SERVICES

Knowledge enables businesses to develop their competitive advantages (Baradari et al. 2023). Due to the importance of knowledge for organizations and the multiplicity of knowledge as a concept, it is essential to define knowledge. This chapter focuses on presenting essential terms regarding knowledge and business intelligence (BI) systems maintenance.

## 2.1 Knowledge as a concept

Knowledge may be the biggest factor in increasing an organization's competitiveness (Davenport & Prusak 1998, 13). Knowledge helps organizations to operate, and it is part of all the products and services that companies provide (Davenport & Prusak 1998, 13). However, knowledge is understood differently by different people or in different contexts. Plato once defined knowledge as "justified true belief". Knowledge can be categorized in different ways, such as a wisdom hierarchy and the contrast between tacit and explicit knowledge (Rowley 2007; Nonaka & Takeuchi 1995, 61). Based on Rowley's (2007) literature review it is apparent that there are many definitions regarding knowledge. In this thesis, knowledge is understood by the definition of Davenport and Prusak (1998) which divides knowledge into data, information, and knowledge. Rowley's (2007) wisdom hierarchy is presented so the relationship between terms related to knowledge is understandable.

Rowley (2007) has formed a general understanding of the wisdom hierarchy based on literature which is shown in Figure 1. Data is quintessential, information is next, then knowledge and wisdom are on top of the hierarchy. Rowley (2007) notes that meaning, applicability, transferability, value, human input, and structure are low to data, but these attributes increase when going upper in the hierarchy. On the contrary, computer input and programmability are high to data but decrease when going upper in the hierarchy (Rowley 2007).

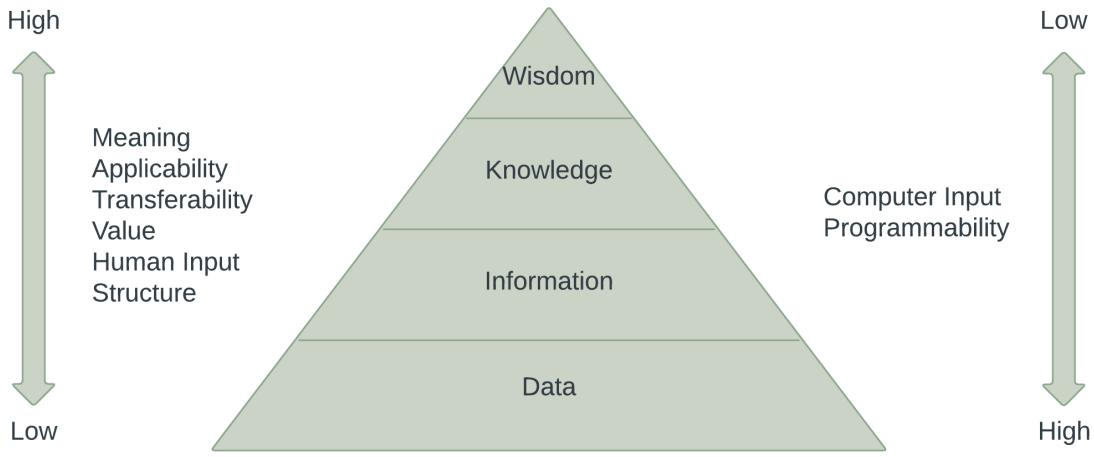


***Figure 1.*** *Wisdom hierarchy (Rowley 2007)*

There is a common understanding in literature that concepts of data, information, and knowledge are defined as related, but the definitions of concepts differ between authors (Rowley 2007). Sometimes other levels are added to the hierarchy. For instance, Ackoff (1988) adds levels of intelligence and understanding.

Data means sets where there are distinct objective facts about events, one typical example is transaction data. Data itself does not tell anything about the context and data has no inherent purpose. Data only describes what has happened, but it does not offer an interpretation of the context or talk about the significance or insignificance of the data. Data itself cannot give instructions for what should be done based on the data. Data is often stored in databases in organizations. All organizations need data, and some industries are completely dependent on data.  Data is important for organizations as it serves as the basis for creating knowledge. (Davenport & Prusak 1998, 2–3)

In turn, information is often compared to a traditional message that can be transmitted from one individual to another. Data becomes information when a purpose is added to it. Information is therefore data with meaning and purpose.  Another characteristic of information is that information is organized according to purpose. Information aims to make a change in the thoughts or views of the recipient of the message. Information moves in organizations within networks. Information in the form of a message may be formal, such as email, or less formal, like a note. (Davenport & Prusak 1998, 3–5)

Knowledge is a deeper and broader concept than data and information. Knowledge is a mix of experiences, values, context-related information, and expertise. Knowledge provides a framework for incorporating and evaluating new information and experiences, meaning that knowledge is created when a person processes information. Knowledge resides in people and organizations, and knowledge is often embedded into routines,

processes, practices, documents, and repositories. Knowledge is transferred through communication between individuals and groups. Knowledge can be used for making better decisions, for instance relating to strategy or service's lifecycle. Knowledge is not a simple concept; therefore, it is difficult to describe in words or logical terms. (Davenport & Prusak 1998, 5–6)

Knowledge is often divided into concepts tacit and explicit. Polanyi (2009) has presented the concept of tacit knowledge. Tacit knowledge is defined as follows: "We know more than we can tell" (Polanyi 2009, 4). Knowledge is divided into concepts of tacit and explicit knowledge after Polanyi's (2009) work. There are plenty of definitions for tacit and explicit knowledge. A common definition is conducted by Nonaka and Takeuchi (1995). Tacit knowledge is personal and context-specific and therefore difficult to communicate and formalize (Nonaka & Takeuchi 1995, 59). Explicit knowledge can be expressed in formal and systematic language (Nonaka & Takeuchi 1995, 59).

Table 1 presents some distinctions between tacit and explicit knowledge. Tacit knowledge is subjective, while explicit knowledge is objective. Knowledge of experience is often tacit knowledge while knowledge of rationality is associated with explicit knowledge. Tacit knowledge tends to be simultaneous and analog while explicit knowledge is sequential and digital. (Nonaka & Takeuchi 1995, 60–61)

***Table 1.*** *Two types of knowledge (Nonaka & Takeuchi 1995, 61)*

| **Tacit knowledge** | **Explicit knowledge** |
|---|---|
| **Subjective** | Objective |
| **Knowledge of experience (body)** | Knowledge of rationality (mind) |
| **Simultaneous knowledge (here and now)** | Sequential knowledge (there and then) |
| **Analog knowledge (practice)** | Digital knowledge (theory) |

Explicit knowledge is knowledge that can be expressed explicitly, such as words and numbers (Nonaka & Konno 1998). Explicit knowledge can be shared in the format of data, specifications, manuals, and so on (Nonaka & Konno 1998). Explicit knowledge can be transferred between people systematically and formally (Nonaka & Konno 1998).

A common view is that knowledge is primarily tacit (Nonaka & Konno 1998). Tacit knowledge is personal and hard to formalize and that makes tacit knowledge hard to transfer between individuals (Nonaka & Konno 1998). Subjective insights and intuitions

are examples of tacit knowledge (Nonaka & Konno 1998). Tacit knowledge resides in the actions, experiences, and ideas of individuals (Nonaka & Konno 1998). Tacit knowledge can be seen in two dimensions: technical and cognitive (Nonaka & Konno 1998). The technical dimension includes personal skills, and it is often referred to as the “know-how” type of knowledge (Nonaka & Konno 1998). The cognitive dimension includes beliefs, ideals, values, schemata, and mental models that are rooted in individuals (Nonaka & Konno 1998).

## 2.2 Knowledge-intensive organizations

Characteristics of knowledge-intensive organizations are high knowledge intensity, low capital intensity, and professionalism (Valtakoski & Järvi 2005). The importance of knowledge is emphasized in knowledge-intensive organizations (Laihonen 2005, 56). Several consulting companies have made knowledge sharing as one evaluation criterion when evaluating performance (Davenport & Prusak 1998, 48). Organizational knowledge is more dynamic than individual knowledge since the knowledge is transferred by many forces (Davenport & Prusak 1998, 25). However, the key asset of knowledge-intensive organizations is the knowledge residing in employees (Valtakoski & Järvi 2005). The importance of knowledge consists of new knowledge creation and knowledge supporting business. Knowledge can be harnessed to support business by storing, sharing, and reusing existing knowledge (Laihonen 2005, 56).

Lowendahl (2005, 46–47) summarizes the value creation processes of professional service firms by three critical processes: the ability to sell a credible promise, the activities required to deliver what has been promised, and learning from the project. All these processes are deeply related to knowledge. These processes exist in all service sectors, but the complexity of these processes is high in professional service firms since the dimensions of the field are the unconventionality of the service, the customer interaction, the information asymmetry, and the dependence on specific professionals (Lowendahl 2005, 48).

The first process is the ability to sell a credible promise and it depends on the firm’s ability to document the success of previous projects, and the professionals that a firm is assigning to the project (Lowendahl 2005, 46). The more unconventional and innovative the service is and the larger the knowledge gap is, the more complex the process of selling credible promises is likely to be (Lowendahl 2005, 46). Laihonen (2005, 56) notes that this process can be considered as knowledge flows between the firm and

the customer. With knowledge flows the organization can store previous competencies and utilize the knowledge in gaining new customers and doing the projects (Laihonen 2005, 56).

The second value creation process is the activities required to deliver what has been promised, and it aims for efficiency. This process involves the professionals assigned and the client firm and its focus is on the actual quality of deliverables, the perceptions of quality by all relevant client firms, and the delivery efficiency (Lowendahl 2005, 47). It is important to invest in methods and processes that allow more efficient delivery of services in the future which leads to avoiding similar problems repeating with another client (Lowendahl 2005, 47). A dilemma of this value-creation process is how to apply standard procedures to unique problems and still provide customized and personalized solutions to customers (Lowendahl 2005, 47). Another dilemma is how to efficiently organize the processes between different professionals when not all professionals participate in customer interaction (Lowendahl 2005, 47). Laihonen (2005, 46) emphasizes that this value-creation process is also about knowledge flows. The product is knowledge that is transmitted by knowledge flows but also the knowledge flows in which knowledge is shared and utilized are emphasized in this process (Laihonen 2005, 46).

The third value creation process is about learning and transferring gained new knowledge in future projects as well. The dilemma of this process is how to keep professionals satisfied with their job in solving challenging problems, while at the same time encouraging professionals to develop procedures and approaches to be better utilized by others in the future (Lowendahl 2005, 47).

## 2.3 Business intelligence systems maintenance services

Business intelligence (BI) encompasses a wide range of tools, technologies, and methodologies used to collect, store, access, and analyze data, to assist business professionals in making more informed decisions (Watson 2009). BI consists of applications, technologies, and processes (Watson 2009). A generic BI environment consists of integrating data from source systems to data warehouses, and then data marts (Watson 2009). The data from data marts can be utilized by BI technologies and applications (Watson 2009). BI aims to support decision-making in organizations (Lim et al. 2013). BI is always changing, like IT in general (Watson 2009). The change is driven by technology, business needs, or better ways of doing things (Watson 2009).

BI maintenance services keep BI environments working after the development of functionality has ended and the scope is to keep BI service viable as long as possible (Gupta et al. 2019). Continuous services aim to prolong the lifespan and enhance the functionalities of BI environments (Li et al. 2014). Hence, the primary concern of continuous BI service is to maintain and improve the operational quality of the BI environment (Li et al. 2014). IT maintenance consumes 50% – 80% of IT budgets and therefore IT maintenance is important from an economical point-of-view as well (Hou & Zheng 2020). BI maintenance services consist of software upgrades, bug fixes, and new feature implementation (Gupta et al. 2019). BI maintenance services improve performance, reliability, adaptability, and efficiency (Gupta et al. 2019; Li et al. 2014; Khanna et al. 2017).

The phase of BI maintenance service is both pivotal and challenging within the BI development cycle (Gupta et al. 2019). It demands significant time and financial investments (Gupta et al. 2019). BI maintenance service consists of IT, people, and processes (Mora et al. 2022). Continuous services are a growing market (Khanna et al. 2017). Khanna et al. (2017) stated methods as possible ways to reduce the workload in continuous services. Incremental re-documentation improves the understandability of the BI environment and increases the efficiency of the maintenance process (Khanna et al. 2017). Dead code elimination means deleting all code that has no function, and that improves the environment performance since the system uses fewer resources (Khanna et al. 2017). Continuous BI service team should gain a proper understanding and knowledge of the environment to minimize the risk of errors (Khanna et al. 2017).

Typically, IT maintenance consists of routine problems (Hou & Zheng 2020). IT maintenance often lacks precise work processes since IT maintenance is different compared to new systems development which usually have schedules and processes (Hou & Zheng 2020). Lack of user commitment can also create challenges to problem-solving (Hou & Zheng 2020). IT maintenance requires organization-specific knowledge about the operations to be supported and technical knowledge to achieve desired IT quality (Aydin & Bakker 2008).

## 2.4 IT service management

IT Service Management (ITSM) is a prevalent approach to managing IT services (Winkler & Wulf 2019). There is no single text that describes and defines ITSM fully, even though there is much literature where the concept is portrayed (Iden & Eikebrokk

2013). ITSM is a process-centric approach assuming that IT functions have a set of interconnected activities and provides a service-centered management approach to IT operations management (MacLean & Titah 2023). Another definition is that ITSM is routines used to provide IT services to a customer organization while covering all phases of the IT service lifecycle (Winkler & Wulf 2019). ITSM pertains to the strategic framework dedicated to the delineation, governance, and provisioning of IT services with the primary objective of aligning these services with the overarching business objectives and the specific demands of clients (Winniford et al. 2009).

ITSM is a management approach where IT service is at the center and the aim is to provide value to IT service customers (Mora et al. 2022). As well, management of the IT function becomes more benefit-driven (MacLean & Titah 2023). The initial focus of ITSM was on IT operational processes such as IT service support and IT service delivery processes (Mora et al. 2022). Currently, ITSM covers the entire IT management (Mora et al. 2022). ITSM consists of customer and process perspectives when managing IT as a business (Winniford et al. 2009). ITSM manages IT as a service (Iden & Eikebrokk 2013). ITSM encompasses IT planning, delivery, support, and security (Winniford et al. 2009). MacLean and Titah (2023) present that the practices are administrative controls, cultural controls, cybernetic controls, planning controls, and rewards.

Adoption of ITSM is costly and cumbersome for organizations. Managers need to be clear on what are the expected outcomes, since without expectations managers cannot be confident in the success of the initiative. The outcomes of ITSM are IT function productivity, transparency, customer orientation, and control experience. ITSM improves the quality and the cost-efficiency of the delivery of IT services. Standardized processes and systems provide more visibility to managers into the performance of IT employees. The shift from technology-centered to communication-centered makes the operations of ITSM more visible to external stakeholders as well as it can create a greater desire to understand the customer needs and the value for the organization. ITSM creates mixed attitudes, many see ITSM as an opportunity, but others are frustrated by the tightness of control limiting their autonomy. Organizations implementing ITSM tend to have higher levels of customer satisfaction since they are satisfied with the higher levels of service quality. (MacLean & Titah 2023)

ITIL versions are considered as the frameworks of ITSM (Mora et al. 2022). ITIL v2011 is an ITSM framework that aims to provide help for implementing and performing ITSM through best practices (Mora et al. 2022; Jäntti 2012). ISO/IEC 20000:2005 is a standard that aims to effectively deliver managed services to meet business and customer requirements (Mora et al. 2022). Also, ITIL v4 is considered an ITSM framework (Mora

et al. 2024). Iden and Eikebrokk (2013) recognize these frameworks as a part of ITSM. ITIL and ITSM together are popular tools in IT management (Iden & Eikebrokk 2013).

ITIL has several processes, such as incident management and problem management (Baradari et al. 2023). Incident management exists by service deck function and the main function is to restore the normal service operation (Baradari et al. 2023). Typical incident management activities are for instance investigating, resolving, and closing the incident (Baradari et al. 2023). Problem management concentrates on the life cycle of problems, which are the root causes of incidents (Baradari et al. 2023). Activities of problem management are detection, categorization, and prioritization (Baradari et al. 2023).

The four dimensions of service management are organizations and people, information and technology, partners and suppliers, and value streams and processes (Agutter 2020). The service value chain of ITIL includes activities: plan, improve, engage, design and transition, obtain/build, deliver, and support (Agutter 2020). Each ITIL practice is based on these four categories and supports multiple activities of the service value chain (Agutter 2020). There are 34 practices in total and each practice includes several activities (Agutter 2020). For instance, continual improvement is practice, and it includes activities such as “securing time and budget for continual improvement” and “coordinating improvement activities across the organization” (Agutter 2020).

## 2.5 Knowledge flows

Knowledge flows play an important role in terms of whole knowledge management since with their help, knowledge can be transferred to where knowledge is needed (Laihonen 2005, 57). In many cases, knowledge management is more about managing knowledge flows than actually managing knowledge (Laihonen 2005, 57). Managing knowledge flows is emphasized in knowledge-intensive organizations since a large part of the service, and especially the knowledge generated in the service process is context-bound and often only exists in the interaction situation in question (Laihonen 2005, 47). Knowledge flows in a knowledge-intensive organization form a very complex entity (Laihonen 2005, 27). Already in the year 2005, it was noted that the role of knowledge flows in new knowledge creation and knowledge sharing is significant (Laihonen 2005, 57).

Knowledge flow is the same as the information flow with which actors shape their worldview (Laihonen 2005, 26). Knowledge flow is invisible, and it carries and accumulates knowledge between people or knowledge processing mechanisms (Zhughe 2002). Laihonen (2005, 57) adds that knowledge flows are also used to transfer knowledge from one place and form to another. Knowledge flow has three attributes: direction, content, and carrier (Zhughe 2002). These attributes define the sender, the receiver, the shareable knowledge, and the media that transmits the knowledge (Zhughe 2002). Zhughe (2002) states that knowledge flow should be incorporated into the software development process since software development needs effective communication to improve team members' work. Knowledge flow assists in switching the team members of the software project also (Zhughe 2002).

In most interactions, it is a matter of knowledge flows, from which new knowledge is formed only when the recipient combines the received information or knowledge with their previous knowledge and perceptions (Laihonen 2005, 26). Knowledge flows are recognized at many levels: between individuals, individuals and knowledge storages, individuals and groups, groups and within them, and between groups and the organization (Laihonen 2005, 57). Communication processes and information flows together to form the knowledge flows within the organization (Laihonen 2005, 57). Knowledge flows may reside in any cooperative team, no matter whether team members intentionally make use of it or not (Zhughe 2002).

Zhughe (2002) notes that a knowledge flow should have five features: information accumulation, classification, abstraction, analogy, and version management. Information accumulation means that knowledge accumulates during each task, and it can be utilized later. Classification means that a knowledge flow has the ability to categorize knowledge based on various projects and team members. Abstraction means that a knowledge flow should be capable of representing knowledge at different levels of abstraction and refining its content. Analogy means that a knowledge flow should be able to establish associations between related contents through analogies. Lastly, version management means that a knowledge flow should manage the evolutionary progression of knowledge flow. (Zhughe 2002)

Some examples of knowledge flows are know-how that is transferred by people and experience gained from projects (Laihonen 2005, 47). These knowledge flows concern for example transferring business knowledge, sharing experiences, and implementing an organization's strategy, as well as the complex networks formed by these (Laihonen 2005, 27). Laihonen (2005, 58) suggests that interaction and knowledge flows that interaction creates between different actors are the key to creating new knowledge and

utilizing the existing knowledge. Through these, the organization can respond to the increasing complexity of the external operating environment (Laihonen 2005, 58).

## 2.6 Inefficiencies in knowledge markets

Good knowledge sharing affects the company's success, and the potential value of knowledge is materialized when knowledge flows freely (Davenport & Prusak 1998, 48–49). Free knowledge sharing is beneficial for organizations. Knowledge sharing increases the atmosphere of openness and trust, which helps to understand what happens in an organization (Davenport & Prusak 1998, 49). Additionally, work productivity increases and new innovations are born from existing information (Davenport & Prusak 1998, 48). Shared awareness of the company's strategy and goals helps the individual to direct his work towards a common goal and makes the individual feel that his work is part of a larger whole (Davenport & Prusak 1998, 49). In organizations that share knowledge well, employees see the value of their expertise and know that they will get help when needed (Davenport & Prusak 1998, 49). This increases satisfaction with work since employees are not frustrated by communication, unnecessary work, or decisions that are not communicated (Davenport & Prusak 1998, 49). As well, sharing knowledge creates new knowledge (Davenport & Prusak 1998, 49).

Especially three factors affect knowledge inefficiency: incomplete information about the knowledge market, knowledge asymmetry, and locality of knowledge. Incomplete information about the knowledge market means that organizations do not know where to find their own already existing knowledge (Davenport & Prusak 1998, 40). This happens because there is not enough information about where to find knowledge (Davenport & Prusak 1998, 40). On the other hand, knowledge asymmetry means that one department of the organization has an abundance of knowledge, but at the same time, another department lacks that knowledge (Davenport & Prusak 1998, 40–41). Strong asymmetry prevents the utilization of knowledge where it is needed (Davenport & Prusak 1998, 41). Locality of knowledge means that knowledge is often shared only with persons who are close to oneself in the organizational structure (Davenport & Prusak 1998, 41). People tend to settle for the knowledge that is "good enough", and that leads to inefficiency, as people utilize the knowledge that is not optimal, while the better knowledge remains unused (Davenport & Prusak 1998, 41).

Various challenges make knowledge difficult to flow (Davenport & Prusak 1998, 43). One challenge is that there is too little good information about where the knowledge resides in organizations, and that causes problems in knowledge utilization (Davenport & Prusak 1998, 40). Other challenges are cultural factors, monopoly of knowledge, pretentious lack of knowledge, reluctance to share knowledge with a person who has different organizational status than oneself, and missing knowledge infrastructure (Davenport & Prusak 1998; 96–97; Davenport & Prusak 1998, 41–45). Knowledge monopoly means that only one person in a group holds certain knowledge (Davenport & Prusak 1998; 43). Pretentious lack of knowledge is that knowledge exists, but it is hard to get (Davenport & Prusak 1998; 42).

Several factors affect the efficiency of knowledge flows. Lin et al. (2012) classify the key factors influencing and hindering the knowledge flows in the context of commercial business operations into five distinct dimensions: knowledge characteristics, knowledge source, knowledge receiver, contextual factors, and mechanisms. These are presented in Table 2. Examples of these factors are the value of the source unit's knowledge stock, the motivational mindset of the source and target units, the existence of transmission channels, and the absorptive capacity of the target unit (Lin et al. 2012).

***Table 2.*** *Relevant determinants of knowledge flow (Lin et al. 2012)*

| *Dimension* | *Barriers to knowledge flow and source* |
|---|---|
| *Knowledge characteristics* | Ambiguity<br>Non-validated knowledge |
| *Knowledge source* | Unwilling to devote time and resources to sharing knowledge<br>Fears about job security<br>Low awareness and realization of knowledge-sharing<br>Fear of loss of ownership<br>Non-adequately rewarded<br>Sense of self-worth<br>Poor communication skills<br>Lack of trust in people |
| *Knowledge receiver* | NIH syndrome<br>Lack of absorptive capability<br>Lack of retentive capacity<br>Lack of trust in knowledge<br>Untrustworthiness<br>Lack of contact time and interaction<br>Differences in experience level<br>Difficult relationships<br>Lack of awareness |
| *Contextual factors* | Culture and cultural characteristics<br>Organizational structure<br>Poor physical work environment<br>Lack of spaces to share<br>Excessive size of business units<br>Time and resource constraints<br>Lack of organizational incentives<br>Lack of leadership<br>Lack of complete or standard regulations<br>Lack of coordination between units<br>Geographical dispersion<br>Context differentiation<br>Competitiveness<br>Different Languages<br>Overly technical terminology |
| *Mechanisms* | Lack of tangible mechanisms<br>Failure to develop a transactive memory system<br>Lack of intangible mechanisms<br>Lack of integration of IT systems and processes<br>Lack of compatibility among diverse IT systems<br>Unrealistic expectations of employees and mismatches with individual needs<br>Employees lack familiarity and experience with new IT systems<br>Lack of training regarding new IT systems<br>Lack of communication with employees about the advantages of the new system |

Riege (2005) presents knowledge-sharing barriers in dimensions of individual, organizational, and technology. Several knowledge-sharing barriers at the individual level were identified, and some of them were the same as barriers to knowledge flow presented by Lin et al. (2012) such as lack of time, differences in experience levels, and fears about job security. However, Riege (2005) adds to the list of barriers low awareness of the value brought by knowledge sharing, dominance to share explicit knowledge over tacit, age and gender differences, lack of social network, and differences in education levels.

As well, some organizational-level barriers are already presented by Lin et al. (2012). Integration of knowledge management strategy and knowledge sharing initiatives into the organization's goals and strategic approach is unclear or completely missing is one potential barrier (Riege 2005). Shortage of appropriate infrastructure supporting sharing practices, lack of organization resources that would provide adequate sharing opportunities, not invented here syndrome, knowledge flows are restricted into certain directions, and size of business units often is not small enough and unmanageable to enhance contact are as well recognized as organizational level knowledge sharing barriers (Riege 2005).

Technical level knowledge sharing barriers are also presented already by Lin et al. (2012), but one addition is a mismatch between individuals' need requirements and integrated IT systems and processes restricting sharing practices. Also, the lack of technical support for integrated IT systems prevents communication flows and work routines (Riege 2005).

# 3. KNOWLEDGE MANAGEMENT

Knowledge-intensive organizations rely heavily on knowledge and know-how and therefore it is crucial to organize knowledge management in a manner that fosters the use of existing knowledge and new knowledge creation (Laihonen 2005, 8). To remain competitive, organizations should manage their intellectual resources and capabilities, such as knowledge (Zack 1999). Managing and creating new knowledge has become a sustainable competitive advantage for companies (Nonaka & Takeuchi 1995, 6–7; Davenport 1998, 15–16). This chapter presents knowledge management and related processes of creating, codifying, and sharing new knowledge. Also, SECI-model is presented since it describes knowledge sharing and knowledge creation which are pivotal in knowledge management.

## 3.1 SECI model

There are several process models related to knowledge. SECI-model by Nonaka and Takeuchi (1995, 61) is a widely-known process model that describes knowledge sharing and knowledge creation. SECI model has become the best-known theory for organizational knowledge creation (e.g., Popadiuk & Choo 2006; Baldi et al. 2018; Farnese et al. 2019). The fundamental idea of the SECI model is that knowledge is created and shared through social communication, and by communication tacit knowledge transfers to explicit knowledge (Nonaka &Takeuchi 1995, 61). SECI model is presented in Figure 2.

There are four dimensions in the SECI model: socialization, externalization, combination, and internalization (Nonaka & Takeuchi 1995, 62). It can be noticed from Figure 2 that there is a spiral in the middle of the four dimensions, which describes that the domains follow each other. The contrast between tacit and explicit knowledge is at the center of theory, since transforming from tacit to explicit knowledge, is referred to as the most important organizational knowledge creation method (Nonaka & Takeuchi 1995, 70–72).

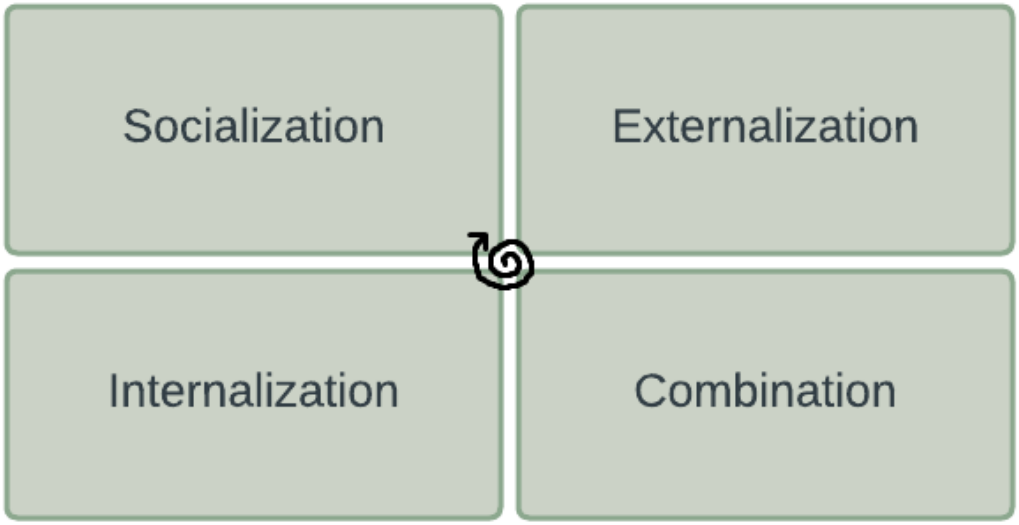


***Figure 2**. SECI-model (Nonaka & Takeuchi 1995, 71)*

Tacit knowledge transforms new tacit knowledge through social communication in socialization. Transferred knowledge could be for instance technical skill or mental model. Social communication is not only conversations but also get-togethers and meetings between people. What is essential in socialization is shared experience and during that knowledge is shared and created. Knowledge is transferred in socialization for example by observing and practicing. (Nonaka & Takeuchi 1995, 62–64)

In externalization, tacit knowledge is transformed into explicit knowledge, such as figures of speech, hypotheses, and models. It is possible to further share knowledge in an explicit form. The interaction between people is at the center of the externalization phase. From the four dimensions of the SECI model, externalization is seen as the basis for new knowledge creation since in this dimension tacit knowledge is transformed into explicit knowledge. (Nonaka & Takeuchi 1995, 64–67)

In combination, explicit knowledge from different sources is systematized into entities. Knowledge is in explicit form through the combination phase. Systematization may mean organizing, combining, or categorizing knowledge. Systematizing knowledge can lead to new knowledge when new knowledge is combined with previously stored knowledge. An example of a combination is learning at school, which is often about combining new knowledge with formerly known. (Nonaka & Takeuchi 1995, 67–69)

In internalization, explicit knowledge is shaped into an individual's tacit knowledge through the understanding process. Knowledge codified in verbal or written format assists in internalization. Internalization is often related to learning by doing, but individuals may learn by reading and listening as well. Verbal stories, written documents, and instructions assist individuals in creating tacit knowledge for themselves from explicit knowledge in the internalization phase. (Nonaka & Takeuchi 1995, 69–70)

A spiral visible in Figure 2 represents that knowledge shift in dimensions sequentially and the four dimensions of SECI model repeats. Organizational knowledge increases during the phases of the SECI model. SECI model comprises the idea that new knowledge originates in an individual, and through phases, knowledge is transmitted to a group or whole organization. An individual's tacit knowledge is the basis of new knowledge creation. (Nonaka & Takeuchi 1995, 72)

## 3.2 Creating, codifying, and sharing new knowledge

Knowledge does not flow easily and therefore employees must be motivated to create, share, and use knowledge (Davenport & Prusak 1998, 158). The motivational aspect of knowledge management should be a long-term incentive (Davenport & Prusak 1998, 158). Some consulting firms evaluate employees based on knowledge sharing (Davenport & Prusak 1998, 158). When building a knowledge foundation, important factors are a knowledge-oriented culture, human infrastructure, and senior management support (Davenport & Prusak 1998, 160).

The most important asset of organizations is knowledge, and therefore if an organization is unsuccessful in creating new knowledge, the business suffers (Davenport & Prusak 1998, 67). An essential thing is that sufficient time and space have been reserved for new knowledge creation (Davenport & Prusak 1998, 67). The reserved space means knowledge storage but also knowledge sharing spaces (Davenport & Prusak 1998, 67). Also, sufficient internal resources and capabilities that can be utilized in a new way and the openness to change or absorptive capacity are relevant to new knowledge creation (Davenport & Prusak 1998, 65). One notable aspect is that the new knowledge creation is difficult to measure (Davenport & Prusak 1998, 67).

Typically, knowledge is created in informal communities, which over time can turn into more formal communities (Davenport & Prusak 1998, 65). In these communities, communication creates new knowledge, although the knowledge can be difficult to codify (Davenport & Prusak 1998, 65). For example, knowledge is the product of consulting companies, and they often organize the groups that previously functioned as informal communities into formal groups where knowledge is shared (Davenport & Prusak 1998, 66). The traditional way to create new knowledge is to create departments or groups just for this purpose, such as traditional R&D units (Davenport & Prusak 1998, 58). These groups are often isolated from other daily activities and that causes challenges

in transmitting the knowledge to users that need it and isolated R&D teams will not always understand the value of their work (Davenport & Prusak 1998, 58–59). Improving working conditions increases new knowledge creation more than improving the process of new knowledge creation itself (Davenport & Prusak 1998, 52). Examples of working conditions are space and team structure (Davenport & Prusak 1998, 52).

Codifying knowledge is important to gain value from the knowledge that resides in organizations (Davenport & Prusak 1998, 87). The purpose of codifying knowledge is to get the knowledge into an accessible form where it is available to those who need it (Davenport & Prusak 1998, 68). Accessible forms mean an organized, explicit, transferable, and easily understandable form (Davenport & Prusak 1998, 68).

The main problem when storing knowledge in organizations is how to store knowledge in such a way that it does not lose its unique value and become data or information (Davenport & Prusak 1998, 68). Some kind of structure must be stored for knowledge, but too much structure destroys knowledge (Davenport & Prusak 1998, 68). It is pointless to try to codify all the organization's knowledge, since complex and over time developed tacit knowledge is almost impossible to codify (Davenport & Prusak 1998, 69–70). However, because of the significant value contained in tacit knowledge, it is important to attempt to codify knowledge (Davenport & Prusak 1998, 81). A few examples of how to codify knowledge are knowledge maps and storing knowledge in IT systems (Davenport & Prusak 1998, 72; Davenport & Prusak 1998, 84).

Data and information are consistently exchanged electronically, but it appears that knowledge flows most effectively within a human network (Davenport & Prusak 1998, 161). For instance, Teece (2000) notes that especially tacit knowledge is difficult to share without transferring the people. Knowledge sharing process consists of both, sending and receiving it (Davenport & Prusak 1998, 101). Spontaneous and unorganized knowledge transfer is important for organizational success (Davenport & Prusak 1998, 89). Knowledge sharing often happens through communication which is why it is essential to find effective ways for people to talk and listen to each other (Davenport & Prusak 1998, 88). However, knowledge is transferred through various channels that support and complement one another (Davenport & Prusak 1998, 159). The ways of sharing knowledge must fit both the culture of the organization and the culture of the country (Davenport & Prusak 1998, 92).

There are solutions to the obstacles caused by cultural factors. Lack of trust can be improved by building relationships and trust face-to-face (Davenport & Prusak 1998, 97). Creating a common ground through training, discussion, teamwork, and work rotation

improves the barriers caused by different cultures and vocabularies (Davenport & Prusak 1998, 97). As well, it is essential to create an atmosphere where it is ok to not know everything about everything (Davenport & Prusak 1998, 97). An organization can enhance the value of knowledge sharing by rewarding individuals through financial rewards, salary increases, or promotions (Davenport & Prusak 1998, 47–48). The organization's financial commitment to sharing knowledge shows that the organization truly understands the value of knowledge (Davenport & Prusak 1998, 48). Wise use of IT may help in knowledge sharing since computers can provide an infrastructure for knowledge sharing, and IT systems can act as knowledge storage (Davenport & Prusak 1998, 45). Creating unambiguous knowledge-sharing places helps in sharing knowledge between individuals, since individuals tend to be too busy for searching new knowledge (Davenport & Prusak 1998, 46–47). A physical or virtual event can serve as a place for knowledge sharing, such as a meeting organized for knowledge sharing, a group discussion, or an intranet (Davenport & Prusak 1998, 46).

## 3.3 Knowledge management

Knowledge is the core asset of consultancies and that is the reason why they were one of the first businesses that paid attention and made investments in knowledge management (Zack 1999; Hansen et al. 1999). Knowledge-intensive organizations rely heavily on knowledge and know-how and therefore it is crucial to organize knowledge management in a manner that fosters the use of existing knowledge and new knowledge creation (Laihonen 2005, 8). To remain competitive, organizations should manage their intellectual resources and capabilities, such as knowledge (Zack 1999).

The purpose of knowledge management is to enhance an organization's ability to compete since knowledge is the basis of competition (Zack 1999). Zahedi et al. (2023) note that the ultimate objective of knowledge management is to realize knowledge flows in a way that assists an organization in achieving its objectives. Knowledge management is difficult to define (Real 2001). However, knowledge management consists of the processes and methods employed to maximize the value derived from an organization's knowledge assets (Teece 2000). Knowledge management extends beyond just technology, yet it can benefit from the use of information technology (Teece 2000). Knowledge management techniques and tools must find their full expression if competition advantage is to be built and maintained (Teece 2000). There are several success factors in knowledge management, for instance, knowledge-creating and sharing culture, managing explicit and tacit knowledge, and top-management support (du Plessis

2007). New organizational structures or ways of working should be always considered from a knowledge management point of view (Laihonen 2005, 57)

The goal of every organization is to select a proper knowledge management strategy that reflects the organization's competitive strategy (Smith 2004). Knowledge management should be linked to the creation of economic value and competitive advantage since the chosen strategy should support the value creation to customers, turn a profit for the organization, and focus on how the organization's employees produce value, differentiation, and speed (Zack 1999; Smith 2004). The proper knowledge management strategy can gain a competitive advantage for an organization since the customer capital and knowledge can be leveraged more efficiently (Smith 2004).

Knowledge management strategy should aim to develop an awareness of an organization's knowledge assets and their locations (du Plessis 2007). As well, a knowledge management strategy should clearly define how knowledge contributes to creating value (du Plessis 2007). Knowledge management strategy is a process that consists of integrated projects phased over time (du Plessis 2007). Knowledge management strategy includes a short- and long-term vision as well as needs and risks associated with knowledge management strategy (du Plessis 2007). Strategic knowledge management is about strategically codifying and personalizing both explicit and tacit knowledge in organizations to increase overall performance (Venkitachalam & Willmott 2017). However, knowledge management may be difficult since knowledge often resides in employees, and they may be likely to resist attempts to codify the knowledge (Valtakoski & Järvi 2005).

It is essential to understand that knowledge management strategy and knowledge strategy are different concepts. Knowledge management strategy consists of structural and technical management issues, and knowledge strategy deals with business outcomes and supports competitive advantage (Denford & Chan 2011). Zack (1999) states that knowledge strategy defines the processes necessary for knowledge acquisition, sharing, and utilization as well as identifies and highlights valuable knowledge-based resources and capabilities. Knowledge management strategy is a kind of umbrella term that includes knowledge strategy. Both of these strategies aim for sustainable competitive advantage (Zack 1999).

Consulting firms that lack effective knowledge management systems and procedures often find themselves repeating work for different clients, even when there are no restrictions on sharing such information (Teece, 2000). Nevertheless, it's essential to strike a balance and not exaggerate the significance of knowledge management, as the

analysis and resolution of business issues typically depend on the specific context (Teece, 2000). The conclusion would be that knowledge management gives a competitive advantage, but it does not solve all problems.

Earl (2001) presented knowledge management schools of thought which are the technocratic, behavioral, and economic schools. There are three knowledge management strategies cited the most: personalization and codification strategy, knowledge management schools of thought, and knowledge management processes or lifecycle (Shongwe 2015). It can be observed that knowledge management is a wide topic. In this thesis, the chosen approach is personalization and codification strategies.

## 3.4 Personalization and codification strategies

According to Hansen and others (1999), there are two dominant strategies of knowledge management: the personalization strategy and the codification strategy. Strategies are utilized to share explicit and tacit knowledge. The codification aims to capture and codify knowledge in explicit form so the knowledge can be utilized by every employee of the organization. On the other hand, people trust in knowledge sharing via communication in a personalization strategy. The firms utilizing personalization trust that knowledge is stored in people. So, the personalization strategy relies on humans while the codification strategy on computers. That means that the codification strategy exploits IT as a knowledge storage while in the personalization strategy, IT assists in communication between people. Even though Hansen and others (1999) studied knowledge management strategies mostly in the context of consulting firms, these strategies apply in other industries also. (Hansen et al. 1999)

A company's knowledge management strategy should reflect the organization's competitive strategy (Hansen et al. 1999). The alignment between knowledge management and competitive strategy is presented in Table 3. Information system implementation is an example of where codified knowledge is essential since the employees deal with similar problems in every project (Hansen et al. 1999). Strategy consulting is about deepening the understanding of the problems and offering customized solutions so it is obvious to follow a personalization strategy since the problems differ from customer to customer (Hansen et al. 1999).

***Table 3.*** *Knowledge management in consulting firms (Hansen et al. 1999)*

| | *Codification* | *Personalization* |
|---|---|---|
| *Competitive strategy* | To provide high-quality, reliable, and fast information system implementation by reusing codified knowledge | Provide creative, analytically rigorous advice on high-level strategic problems by channeling individuals' expertise |
| *Economic model* | Reuse economics | Expert economics |
| *Knowledge management strategy* | People-to-documents | Person-to-person |
| *Information technology* | Invest heavily in IT | Invest moderately in IT |
| *Human resources* | Hire college graduates who can reuse knowledge and the implementation of solutions.<br>Training in groups and through computer-based distance learning.<br>Rewarding for using and contributing to document databases. | Hire MBAs who like problem-solving and can tolerate ambiguity.<br>Training through one-on-one mentoring.<br>Rewarding for directly sharing knowledge with others. |

Companies that utilize codification strategy typically have a competitive strategy that relies on providing information system implementation by reusing codified knowledge. Their economic model is reuse. Reuse economics means that they invest once in a knowledge asset and then reuse that asset many times. Typically, they use large teams where there are many seniors. This type of firm focuses on generating large overall revenues. In codification strategy, knowledge management strategy is people-to-documents which means they have an electronic document system where it is supposed to store the knowledge for further use. So, it is obvious that the firms relying on codification strategy invest heavily in information technology since the goal is to connect people with reusable knowledge that is codified. Human resources rely on hiring employees who can reuse knowledge and the implementation of solutions. Training is done in groups and through the computer. They reward people for utilizing codified knowledge from databases. (Hansen et al. 1999)

On the other hand, companies utilizing a personalization strategy have a competitive strategy where they provide advice on high-level strategic problems by channeling individual expertise. The economic model is expert economics which means charging high fees for customized solutions to unique problems. Typically, there are small teams where there are only a few seniors. The focus is on high-profit margins. Knowledge

management strategy is person-to-person which means that the focus is on developing networks that connect people for tacit knowledge sharing. Companies relying on personalization strategies invest moderately in information technology since the purpose of information technology is to assist in conversations and the exchange of tacit knowledge. Human resources rely on hiring highly educated individuals who like problem-solving and can manage ambiguity. Training is done through one-on-one mentoring. They reward people for sharing knowledge directly. (Hansen et al. 1999)

Both strategies cannot be pursued at the same time and if trying so, the companies tend to run into problems (Hansen et al. 1999). However, there should be an 80-20 split between the strategies, one should be pursued predominantly, and the other strategy should be supported (Hansen et al. 1999). Knowledge management strategies should coexist in different business units of the company only if business units operate like stand-alone companies (Hansen et al. 1999).

When choosing a knowledge management strategy, a company should consider such questions as what value a customer expects from a company, how the knowledge stored in the company adds value for a customer, does the company offer standardized or customized products, does the company have a mature or innovative product, and do the employees rely on explicit or tacit knowledge to solve problems (Hansen et al. 1999). A codification strategy fits best to companies selling standardized and mature products, and where employees rely on explicit knowledge (Hansen et al. 1999). Even though the answers to the questions above suggest a knowledge management strategy, there are still issues of existing multiple business units, and knowledge commoditization over time (Hansen et al. 1999).

Contrary visions are presented in the literature also. Jasimuddin et al. (2005) have presented an argument that personalization and codification strategies need to be integrated so all benefits from tacit and explicit knowledge can be reached (Jasimuddin et al. 2005). They suggest that a symbiosis strategy would be the best option for organizations since it combines the positive features of both strategies (Jasimuddin et al. 2005). Another critique is that Hansen et al. (1999) present personalization and codification strategies as distinct strategies. However, Kumar and Ganesh (2011) state that these strategies are significantly correlated with each other, meaning there is some reinforcement between strategies. Venkitachalam and Willmott (2016) also note that numerous studies have proven that a flexible shift between codification and personalization strategies is effective.

# 4. THEORY CONCLUSIONS

This chapter presents the theory's conclusion. A theory-based framework for enriching BI systems maintenance service with knowledge management is presented as a result of the chapter.

## 4.1 ITSM and knowledge management

As IT is a key source of value creation, and knowledge is a strategic asset that enables businesses to develop competitive advantage ITSM should be enriched with knowledge management (Baradari et al. 2023). ITSM is knowledge work (Manuel et al. 2013). The current ITSM practice underestimates the role of knowledge management (Baradari et al. 2023). Knowledge management and ITSM are both management approaches, and they should be implemented together (Baradari et al. 2023).

Current ITSM best practices, such as ITIL, underestimate the role of knowledge management in design and development (Baradari et al. 2023; Mohamed et al. 2008). For example, knowledge sharing is a key activity in knowledge management, and that activity is not defined in ITIL (Baradari et al. 2023). ITIL considers knowledge in its dimensions. The first dimension, organizations and people, should instructs to consider the knowledge and deep specialization of employees (Agutter 2020). The second dimension of ITIL is information and technology. That dimension directs to consider what information is managed by the services, what supporting information and knowledge are needed to deliver and manage the services, and how the information and knowledge assets will be protected managed, archived, and disposed of (Agutter 2020).

Incident management benefits from knowledge management (Baradari et al. 2023). Initial diagnosis, investigation, and resolution are the activities that benefit mainly from knowledge management activities knowledge utilization, and knowledge discovery (Baradari et al. 2023). Problem management in ITSM is highly dependent on knowledge management activities (Baradari et al. 2023). Problem management activities problem investigation and diagnosis, raising known error records, and problem resolution benefit from knowledge discovery, knowledge utilization, knowledge capturing, knowledge assimilation, and knowledge sharing (Baradari et al. 2023).

The role of knowledge management in ITSM is nowadays significant (Baradari et al. 2023). ITSM has a lot of knowledge and knowledge management is needed in ITSM

(Weed-Schertzer 2019, 111). Knowledge management assists in saving costs in ITSM (Manuel et al. 2013). Typically, IT service manager undervalues worker's personal knowledge (Trusson et al. 2013). An example of a knowledge management approach in ITSM is centralized knowledge storage (Weed-Schertzer 2019, 134).

## 4.2 Knowledge management in BI systems maintenance services

The study aims to answer how knowledge management supports BI systems maintenance services. Based on the literature review it is implicit that BI systems maintenance services should be enriched by knowledge management. Knowledge management should be understood in organizations, and the general vision and strategy give the foundation to initiate knowledge management strategy. Organizations should choose an appropriate knowledge management strategy first.

Understanding of barriers to knowledge flow and source should be undertaken in knowledge management. For instance, lack of training regarding new IT systems is one barrier and it can be undertaken by training. Creating a common ground through training, discussion, teamwork, and work rotation improves the barriers caused by different cultures and vocabularies. Knowledge-oriented culture, human infrastructure, and senior management support should be considered in BI systems maintenance services since they give a solid foundation to knowledge management. Organizations should have an atmosphere that supports knowledge management, and that means that it is ok to not know everything.

Knowledge storage and knowledge sharing opportunities are knowledge management activities that assist in knowledge flow. Besides knowledge storage, IT that supports knowledge flows should be considered also, such as electronic meeting tools. Emphasis on IT investments depends on the chosen knowledge management strategy. Also, supporting human resources activities should rely on the chosen knowledge management strategy. Figure 3 portrays the conclusion about knowledge management activities that should be undertaken when trying to enrich BI systems maintenance services with knowledge management. Figure 3 focuses on vision, foundation and aim, barriers, how to maximize the value of knowledge assets, IT, success factors, and knowledge management strategy including knowledge strategy.

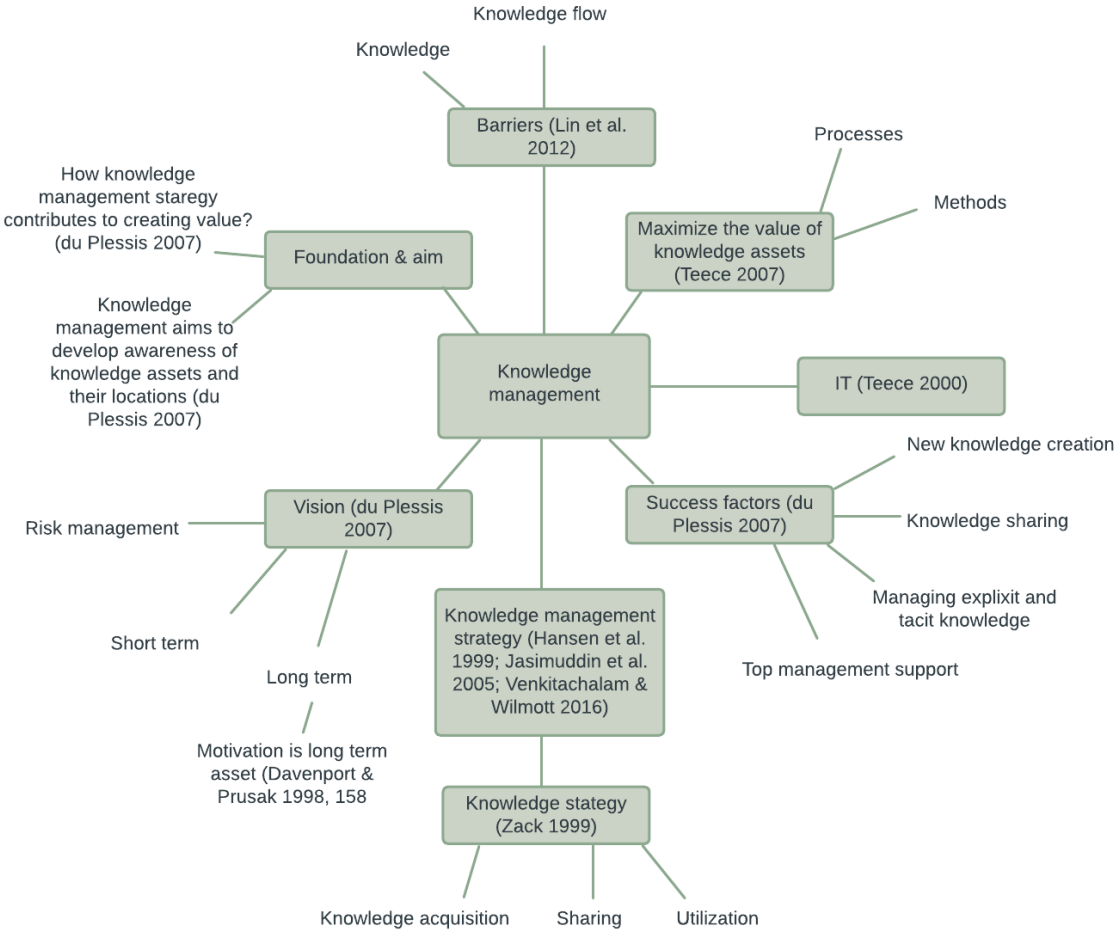


***Figure 3.*** *Conclusion on knowledge management in the context of the study*

No framework in the literature combines knowledge management with BI systems maintenance services. This chapter defines a framework describing how knowledge management supports BI systems maintenance services. The ultimate object of knowledge management is to realize knowledge flows (Zahedi et al. 2023). Figure 3 portrays a theory-based conclusion on what should be undertaken in knowledge management. Figure 4 portrays the generalized version of how to improve BI systems maintenance services with knowledge management.

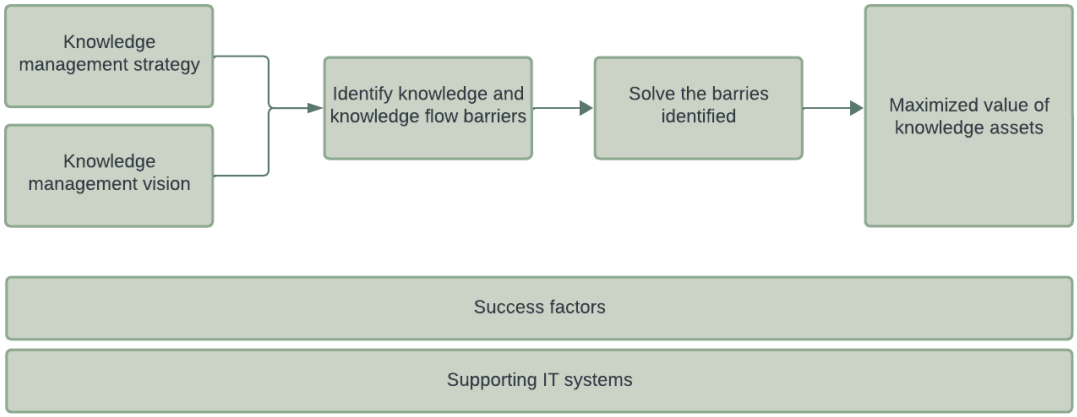


***Figure 4.*** *Process of how to improve BI systems maintenance services with knowledge management*

First, a knowledge management strategy should be decided. Integration of personalization and codification strategies should be integrated so all the benefits from tacit and explicit knowledge can be reached (Jasimuddin et al. 2005). Codification aims to reuse economics and people-to-documents approaches to knowledge management while personalization aims to expert economics and person-to-person approach to knowledge management. Results presented that the person-to-person approach is not as effective as needed. However, BI systems maintenance services cannot rely on reuse economics since customer's environments differ. On this ground, it would be effective to follow a knowledge management strategy that integrates personalization and codification. Smith (2004) states that it is essential to select a knowledge management strategy that reflects an organization's competitive strategy.

The vision of knowledge management should be formed (du Plessis 2007). The long-term vision in BI systems maintenance services would be to manage knowledge as effectively as possible to create economic value. Short term vision is to remove barriers and maximize the value of knowledge assets through process and method development (Lin et al. 2012; Teece 2007). Risk management in AMS' knowledge management should include an assessment of risks. Risk management is not in the scope of the empirical study since AMS itself is not in an effective state to have a risk assessment. However, Davenport and Prusak (1998, 66) noted a risk that knowledge is stored with too much structure and that destroys the knowledge.

Success factors of knowledge management should be remembered all the time. Success factors are top management support, managing explicit and tacit knowledge,

knowledge sharing, and new knowledge creation (du Plessis 2007). Prosperous implementation of success factors guarantees the success of knowledge management. Also, IT may support knowledge management (Teece 2000), and therefore it is essential to select necessary IT systems, such as project management tools and knowledge storage.

# 5. RESEARCH METHODOLOGY

This chapter presents the research methodology in the form of research onion by Saunders et al. (2019, 130). After that, the Case is presented. The last two sub-chapters describe research implementation, data collection, and analysis design.

## 5.1 Research methodology

Research methodology is the theory of how the research should be accomplished (Saunders et al. 2019, 3). Research methodology helps in making informed choices about the research (Saunders et al. 2019, 3). The methods chosen for this research are presented in the form of research onion by Saunders et al. (2019, 130). Figure 5 presents philosophy, approach to theory development, methodological choice, strategy, time horizon, and techniques and procedures. The following sub-chapters present the methodological choices from the outer layers towards the inside.

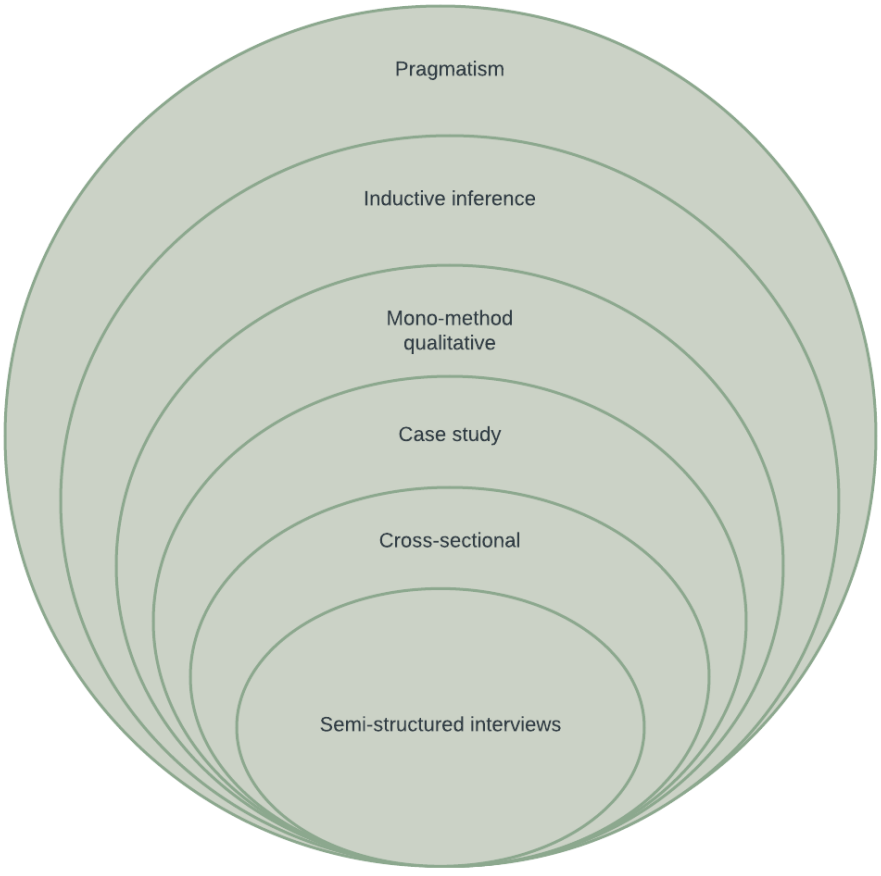


***Figure 5.*** *Research Onion (According Saunders et al. 2019, 130)*

### Philosophy: pragmatism

In pragmatism, research starts with a problem, and the goal is to present a practical solution that shapes the practices (Saunders et al. 2019, 151). The research questions most likely emphasize practical solutions (Saunders et al. 2019, 151). There is more interest in practical solutions than abstract distinctions in pragmatism research (Saunders et al. 2019, 151). The research problem and research questions are the determinants of research design and strategy (Saunders et al. 2019, 151). The research is based on the target company's will to develop BI systems maintenance services, and the research questions emphasize practical solutions. Concepts are relevant only where they support action (Saunders et al. 2019, 151). Theories, concepts, ideas, hypotheses, and research results are considered as tools of thought and action (Saunders et al. 2019, 151).

No single point of view can give the whole picture but there are several different ways of interpreting situations and conducting research (Saunders et al. 2019, 151). Research strategy selection is driven by the nature of the research problem (Saunders et al. 2019, 160). The suitable research methods are the ones that enable reliable, well-founded, and credible data collection that advances the research (Saunders et al. 2019, 151). Knowledge is valued as an enabler for actions to be carried out successfully, and reality is important in the practical effects of ideas (Saunders et al. 2019, 151). The reality of the target company's BI systems maintenance service and practical action proposals are central to the study.

### Approach to theory development: inductive inference

There are three different approaches to reasoning: inductive, deductive, and abductive (Saunders et al. 2019, 152). Choosing the appropriate approach is important since it helps in making decisions about research design and research strategies (Saunders et al. 2019, 157). The chosen reasoning approach depends on the research philosophy, the emphasis of the research, and the research topic (Saunders et al. 2019, 157). Typically, pragmatists select the abduction inference, but if the research topic is new with little existing literature the selection is induction (Saunders et al. 2019, 157). Inductive inference is the selection for this research since the research topic is new (Baradari et al. 2023).

Inductive inference aims to create new or develop existing theories based on the collected research material (Saunders et al. 2019, 155). The purpose of inductive reasoning is to understand comprehensively so the nature of the problem is understood better

(Saunders et al. 2019, 155). Collected research data is used to examine phenomena, identify themes and patterns, and create a conceptual framework (Saunders et al. 2019, 153). The aim is to generate and build a theory (Saunders et al. 2019, 153). The study aims to generate a theory of how to enrich BI systems maintenance services with knowledge management. Known premises are utilized to create untested conclusions (Saunders et al. 2019, 153). The perspective of generalization is from specific to general (Saunders et al. 2019, 153). As this study concentrates on the target company's BI systems maintenance service, the perspective is from specific to general.

**Methodological choice: mono method qualitative**

Quantitative research is a data collection technique that generates or uses numerical data while qualitative research generates or uses non-numerical data (Saunders et al. 2019, 175). Non-numerical data means for instance words, images, audio recordings, and so on (Saunders et al. 2019, 175). However, this distinction is a bit narrow since, in reality, many research designs combine quantitative and qualitative elements (Saunders et al. 2019, 175). Quantitative research studies relationships between numerically measured variables (Saunders et al. 2019, 178).

Qualitative research is often associated with interpretive philosophy, but pragmatist philosophy can be undertaken also (Saunders et al. 2019, 179). It is typical to accomplish qualitative research with inductive inference and the result of the study is a new framework or a richer theory that already exists in the literature (Saunders et al. 2019, 179). Qualitative research is an appropriate choice since the research area is new and the aim is to create new knowledge in the area. Qualitative research studies the meanings and the relationship between them (Saunders et al. 2019, 179). Mono method qualitative study means that only one data collection technique is utilized, such as semi-structured interviews (Saunders et al. 2019, 179). Qualitative research is associated with several research strategies, and one example is case studies (Saunders et al. 2019, 180).

**Strategy: case study**

Research strategy is the link between the research philosophy and the choice of methods to collect and analyze data (Saunders et al. 2019, 189). A case study is a suitable choice in many kinds of research settings, the research philosophy can be for example positivist or interpretivist, the methodological choice can be quantitative or qualitative,

and the approach to theory development could be inductive or deductive (Saunders et al. 2019, 197).

A case study is about studying a topic or phenomenon in its real-life setting (Saunders et al. 2019, 196). The ‘case’ may refer to different entities, such as a group, an organization, or an association (Saunders et al. 2019, 196). Choosing and determining the case to be studied and the boundaries of the research is essential in defining a case study (Saunders et al. 2019, 196). A case study is an appropriate choice for understanding the interactions between the phenomena and their context (Saunders et al. 2019, 197). Case studies can be designed to identify what is happening and why or to understand the effects of the situation and its implications for action (Saunders et al. 2019, 197). The outcome of the case study is empirical descriptions and the development of theory (Saunders et al. 2019, 197).

Case studies may cover single or multiple cases (Saunders et al. 2019, 198). A single case is typically used when the case is a critical, extreme, or unique case but on the other hand, sometimes a single case is selected since it is typical or it provides an opportunity to study a phenomenon that is not previously considered much (Saunders et al. 2019, 198). Using multiple cases tries to verify the findings across the cases (Saunders et al. 2019, 198).

Flyvbjerg (2006) presents and invalidates five misunderstandings of case studies. The first misunderstanding is that theoretical knowledge is more valuable than concrete, practical knowledge. This misunderstanding is invalidated by stating that concrete and context-dependent knowledge is more valuable that predictive and universal at least in the study of human affairs. The second misunderstanding is that generalization cannot be done based on an individual case. However, it is stated that generalization is overvalued, and the value of examples is underestimated.

The third misunderstanding is that a case study is most useful for generating hypotheses, but it is noted that a case study is useful for generating and testing hypotheses but is not limited to these activities only, a case study can provide unique information as well. The fourth misunderstanding is that a case study contains a verification bias, but it is revealed that a case study does not contain a grater verification bias than other research methods. The last presented misunderstanding is that it is often difficult to summarize and develop general propositions and theories based on the case study. It is admitted that summarizing a case study is often difficult but typically the reason is in the research area not the research method of case study. As well, often generalization of case study is not a desired outcome since the study is a narrative. (Flyvbjerg 2006)

A case study is a proper choice in this study since there is a topic that will be studied in a real-life context. In this research, the ‘case’ means the existing BI systems maintenance service. The research is about identifying the current situation and its implications for action, and the aimed outcome is a theory that combines knowledge management into BI systems maintenance services. Even though Flyvbjerg (2006) explained that typically generalization is not a desired outcome in case studies, generalization of a theory is desired outcome in this study. A single case was selected since the case is unique in the context of the target company.

**Time horizon: cross-sectional**

The time horizon decides if the research is a cross-section of the present or presentation of events over a given period (Saunders et al. 2019, 212). A longer time period is called a longitudinal study, and the ‘snapshot’ of the period is called a cross-sectional study (Saunders et al. 2019, 212). A typical example of a cross-sectional study is a case study where interviews are organized over a short period of time (Saunders et al. 2019, 212). The chosen time horizon is cross-sectional since there is a phenomenon that will be studied in the exact time and context.

**Data collection method: semi-structured interview**

Research interviews help gather valid, reliable, and relevant data to conduct research (Saunders et al. 2019, 435). This study aims to gather relevant data on the research area. Interviews can also help refine the ideas related to the research question and objectives (Saunders et al. 2019, 435). The commonly used typology is that there are structured, semi-structured, and unstructured interviews (Saunders et al. 2019, 437). Semi-structured interviews are normally used to gather data and analysis will be conducted qualitatively (Saunders et al. 2019, 442).

There is a list of themes and maybe some key questions related to these themes in semi-structured interviews (Saunders et al. 2019, 437). The interview themes may be developed from previously conducted interviews or discussions with others (Saunders et al. 2019, 437). Both of these suggest that the approach to theory development is inductive (Saunders et al. 2019, 437). The research questions in this study are based on the discussions with others. When selecting an inductive approach with a semi-structured interview, it is natural to follow an exploratory approach, and interview themes evolve depending on what emerges from the data analysis (Saunders et al. 2019, 437).

## 5.2 Case AMS

The case studied is commissioned by twoday. Organizations have detected a need to develop their BI systems maintenance services. twoday have formed BI systems maintenance services agilely and based on customer needs. It is noticed by twoday that AMS is miscellaneous thus development is needed. The target organization twoday is a Nordic group providing IT consulting, data-driven technology, and tailored IT solutions (twoday, n.d.). The study was done for the data and analytics unit. The data and analytics unit provides experience for instance in data warehousing, dashboard development, and business planning solutions.

twoday provides BI systems maintenance service called AMS. AMS's purpose is to extend BI systems' lifecycle. BI system maintenance takes place after BI system development. Key AMS operators are sales, project lead, and AMS team and their AMS tasks are described in Figure 6. One employee usually performs in multiple roles in twoday. The definition of AMS varies since it has evolved organically based on the customer's needs. However, generally, AMS is a service that provides monitoring and maintenance services for customers' BI systems.

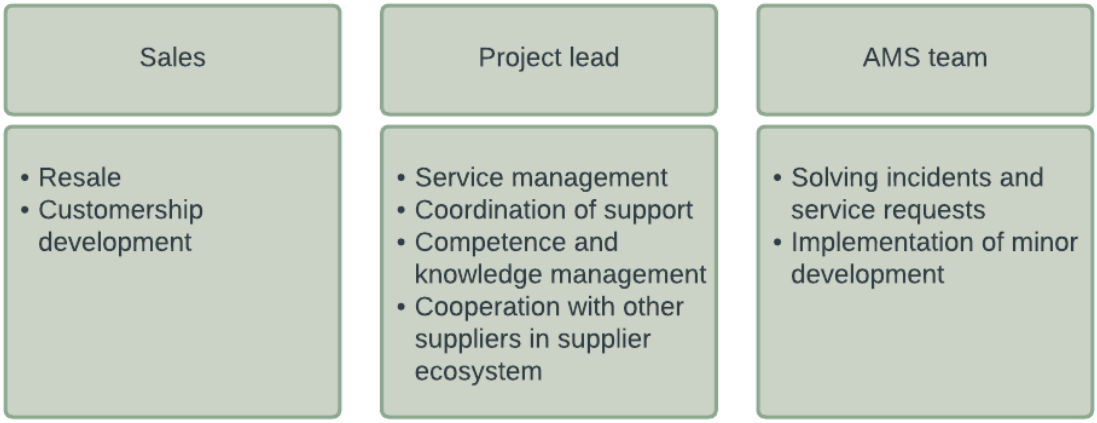


***Figure 6**. Key internal operators and their responsibilities in AMS*

Project leads are responsible for development projects also, thus operating in AMS is not their main interest. If the AMS team cannot solve an incident or service request, then the initial project team assists the AMS team. If the initial project team is not available, then other project team members assist AMS. AMS team has four employees only focusing on AMS work. Other personnel are connected to AMS, such as management. Management of AMS is not entrenched so senior managers of the data and ana-

lytics unit steer AMS. One of the AMS team members is named to be a technical service manager, and they are responsible for providing technical capabilities to the AMS team.

External operators are customers and other suppliers in the supplier ecosystem. Principal roles in the customer side are end user and service manager and their responsibilities are described in Figure 7. Customer roles differ by the customer, but all AMS customers have at least end-users and a service manager. Some customers might have domain-specific key users or such.

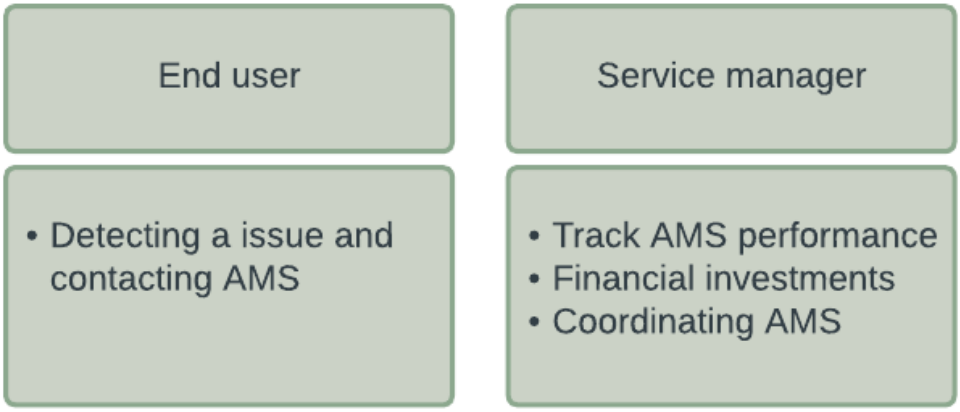


***Figure 7**. Key customer operators and their responsibilities in AMS*

AMS solves three types of issues: service requests, monitored incidents, and issues found manually. Service requests are issues discovered by end users. End users create tickets for twoday's AMS team. Monitored incidents are automatically detected by systems, such as Data Vault Modeller. Manually detected issues are discovered through data loading logs by the AMS team. An overview of the AMS process is portrayed in Figure 8. AMS process differs between customers. Some customers have defined that end users report issues to the customer's key user network or such, and only key users can contact twoday's AMS. Some customers do not have a ticketing system, so they report tickets via email, and emails are generated as tickets to twoday's Jira.

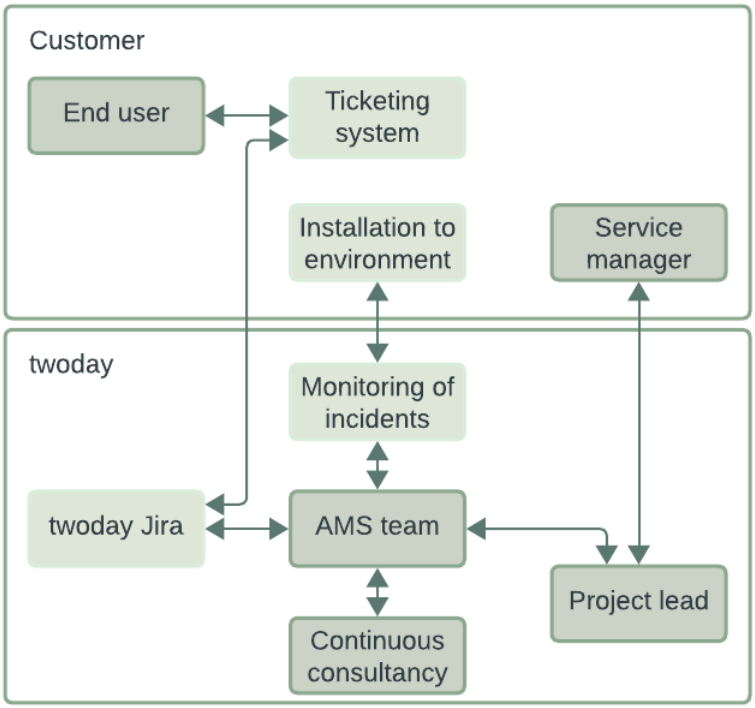


***Figure 8**. AMS process*

AMS contracts steer AMS work. All contracts define SLA, service hours, pricing, service description, and AMS team but the definitions differ. A few customers have four SLA categories, and some customers have only two. Service hours are typically business hours, but some customers have extended service hours also in critical times.

AMS has subprocesses, such as documentation, developing the AMS process, training, escalation, and disturbance management. As well, there are several other operators related to AMS. The project team supports the AMS team when the issue is too complicated to be solved by the AMS team. Also, it is necessary to note that even though there is an AMS solution, not all the environments are under the AMS maintenance. Project teams support the environments they have developed along with the other work.

## 5.3 Research implementation and data collection

The research started by meeting representatives from the target organization and discussing the research objectives. The literature review started after the objectives were set. The chosen scope of the study was based on a lack of research on the area combining knowledge management and BI systems maintenance services and then the chosen scope of the study was agreed with the target organization's representatives

and then started the actual theory writing process which was followed by empirical research.

Data collection is performed with semi-structured interviews. The purpose of semi-structured interviews is to clarify the current and desired state of AMS. The main focus of interviews is on knowledge tied in AMS, knowledge flows, knowledge needs, and challenges in knowledge sharing. A framework is created based on the interviews and literature, that helps to understand how knowledge management assists in BI systems maintenance services.

A list of themes and some key questions related to these themes are followed in semi-structured interviews (Saunders et al. 2019, 437). The wording and order of questions could vary in each interview (Eriksson & Kovalainen 2008). The semi-structured interview allows the interviewer to ask additional questions (Saunders et al. 2019, 437). There were two interview frames, one for internal operators of the target company and the other for customers of the target company. Interview frames are presented in Appendix A and B. The interview frames were general, and the interviews themselves varied based on the interviewee's role and competencies. If necessary, more detailed questions are asked during the interview.

The themes for internal operators' interviews are basic information, AMS basics, AMS daily work, knowledge, knowledge needs, knowledge flows, and ideal AMS. Basic information and AMS basics are asked so the context of the interviewee's questions can be understood transparently. The theme of AMS daily work aims to gather information about the AMS processes itself and the interviewee's commitment to each process. Themes of knowledge, knowledge needs, and knowledge flows are aimed at understanding the knowledge residing in AMS and its dimensions, such as knowledge flows currently and how they should be organized in the future. The ideal AMS team aims to be the concluding theme.

The interview frame for customers concludes with themes of basic information, daily operations in AMS, knowledge, knowledge and its dimensions, and expectations and areas for development in AMS and customer experience. Basic information gathers the contextual information about the interviewee. Daily operations aim at understanding how the customer experiences the AMS. The theme of knowledge and its dimensions strives to understand the knowledge customers have and would want to have, whether are there any knowledge-related challenges, and how knowledge flows currently. The last theme about the expectations and customer experience aims to get action points from the customer.

The main stakeholders of AMS were interviewed by a few representatives. Interviewees were selected based on the target company's suggestion. Internal interviewees were contacted via Microsoft Teams meeting invitation, which briefly introduced the topic of the study and the interview research. The interview invitation asked about the recipient's willingness to participate in the study and guided the recipient to decline the interview or propose a new time for the interview. Customers were contacted via email which briefly introduced the topic of the study and the interview research and proposed to the recipient to suggest suitable interview times. None of the interviewees declined the interview. In total 16 interviews were conducted, and Figure 9 presents the interview distribution based on the job description.


***Figure 9**. Distribution based on the job description of the interviewee*

The interviews were conducted during November and December in 2023 and each was in length from 45 minutes to 60 minutes. All interviewees were declared about privacy and asked to consent to the recording of the interview, to which every participant gave their consent. Interviews were recorded for transcription and re-listening of the interview.

The focus of the research is on understanding AMS' current state and the actions for future development from a knowledge point of view. The main objective of the study is to enhance the internal processes and that is the reason why most of the interviewees are twoday's employees. Interviews followed the interview frame in Appendix A and B. Additional questions were asked if needed, and the interview frame was deviated if the interviewee did not understand or had no knowledge of the question. The interview recording was stopped after answering the last interview question.

All the interviews had 1 hour meeting reservations and that was a suitable time. The interview frame involved the repetition of questions, and that was convenient since the answers complemented each other.

## 5.4 Analysis design

The recordings were transcribed after conducting the interviews. The transcriptions include all speech of the interviewees but pauses and interjections were not transcribed. In pragmatism, the goal is to present a practical solution that shapes the practices (Saunders et al. 2019, 151), and therefore too precise transcriptions are not necessary.

After transcription, the transcribed interview material was analyzed. With the help of interview material, the purpose is to compile an understanding of AMS's current and future state from a knowledge management point-of-view. There are several qualitative data analysis methods (Saunders et al. 2019, 641). Some qualitative analysis methods are associated with specific research methodologies (Saunders et al. 2019, 642).

Thematic analysis is a suitable choice since it offers an approach to analyzing qualitative data sets and leads to descriptions, explanations, and theorizing (Saunders et al. 2019, 651). The purpose of thematic analysis is to search for themes that are in the data, such as observations (Saunders et al. 2019, 651). Thematic analysis is a suitable choice with the chosen research methodology also (Saunders et al. 2019, 651). The procedure of thematic analysis is to become familiar with the data, code the data, search for themes and recognize relationships, and refine the themes and test propositions (Saunders et al. 2019, 652).

After the interviews were transcribed started the familiarization process with the interview material and then coding the interview material. Coding involves labeling interview material into categories with similar meanings (Saunders et al. 2019, 653). Qualitative data sets are typically large and complex, and coding assists in comprehending all the meanings of the data set (Saunders et al. 2019, 653). Coding was performed in Microsoft Excel by copying quotations to columns of code. Codes were created while reading the research material.

Searching for themes and recognizing relationships followed coding. Saunders et al. (2019, 657) defined a theme to be a category incorporating several codes. Expectation management, communication about the aims, and two-way communication are examples of the codes in the study that were grouped under the theme of customer communication. Themes involve making judgments about the data (Saunders et al. 2019,

657). Searching for themes and recognizing relationships followed were done in a new Microsoft Excel sheet by copying content from the earlier sheet that included data coding. Themes were created while reading the coded research material.

Refining themes is re-reading and reorganizing data which leads to combining themes or separating a theme into several themes (Saunders et al. 2019, 658). Refining themes is needed to avoid false interpretations (Saunders et al. 2019, 660). Expectation management, communication about the aims, and two-way communication are examples of the codes in the study that were grouped under the theme of customer communication. However, some parts of two-way communication were grouped in other themes such as communication between the project team and the AMS team.

Refining themes was done twice, and the first phase was done by copying data from the previous Microsoft Excel sheet to a new sheet. The last version is in Microsoft OneNote pages where the data was copied from the previous Microsoft Excel sheet. The refined themes were created by reading the previous version of the analyzed research material. It was necessary to implement refining themes twice so the data analysis is reliable, and results can be interpreted from the analyzed material. All the analysis phases included always a quotation from an interviewee and a mention of whose quotation that is.

# 6. KNOWLEDGE FLOWS, CHALLENGES, AND NEEDS IN AMS

This chapter describes the results of the interviews. The case is presented in chapter 5.2. The first subchapter focuses on the knowledge flows. The second, third, and fourth subchapters describe knowledge-sharing challenges. The fifth subchapter provides an understanding of knowledge sharing and the last subchapter knowledge needs of each AMS operator.

## 6.1 Knowledge flows

The majority of interviewees acknowledged that the easiness of knowledge sharing depends on the situation. Sales A identifies that knowledge sharing is hard and the reason is a lack of documentation and responsibility people since people do not prioritize questions that are not under their responsibility. Project lead C agrees that knowledge sharing is hard, and they mention reasons documentation and the company's focus is on creating new, not on supporting the existing environments. AMS developers C and D identify that knowledge sharing has been harder and nowadays it is easier since their competencies have been developed and documentation is wider now than it has been in the past.

Project lead A thinks that knowledge sharing is not quite difficult since knowledge resides near, in AMS team or managers. Developer A considers that AMS knowledge sharing is easy since they have been in this industry long and therefore, they have seen a lot of different AMS solutions. Developer A points out also that their own need for AMS knowledge is quite narrow. Project lead B explains that at least the forum where to ask for knowledge is clear: technical matters from the AMS team, contract matters from Manager B, and general matters from other project leaders. However, it depends on the question, and how complete the answer is (Project lead B). Manager A also agrees that knowledge sharing is better and simpler nowadays. Knowledge sharing was challenging in the past because of incoherent processes and a lack of management. Manager A concludes that Manager B is the most common knowledge source, but they have many other responsibilities and therefore getting knowledge from Manager B is difficult. Manager B reports that knowledge sharing is easy for their purposes.

Knowledge flows are part of knowledge sharing. Knowledge flows were discussed with all the interviewees. Figure 10 shows an overview of knowledge flows currently in AMS. Figure 10 is created based on the interviewees.

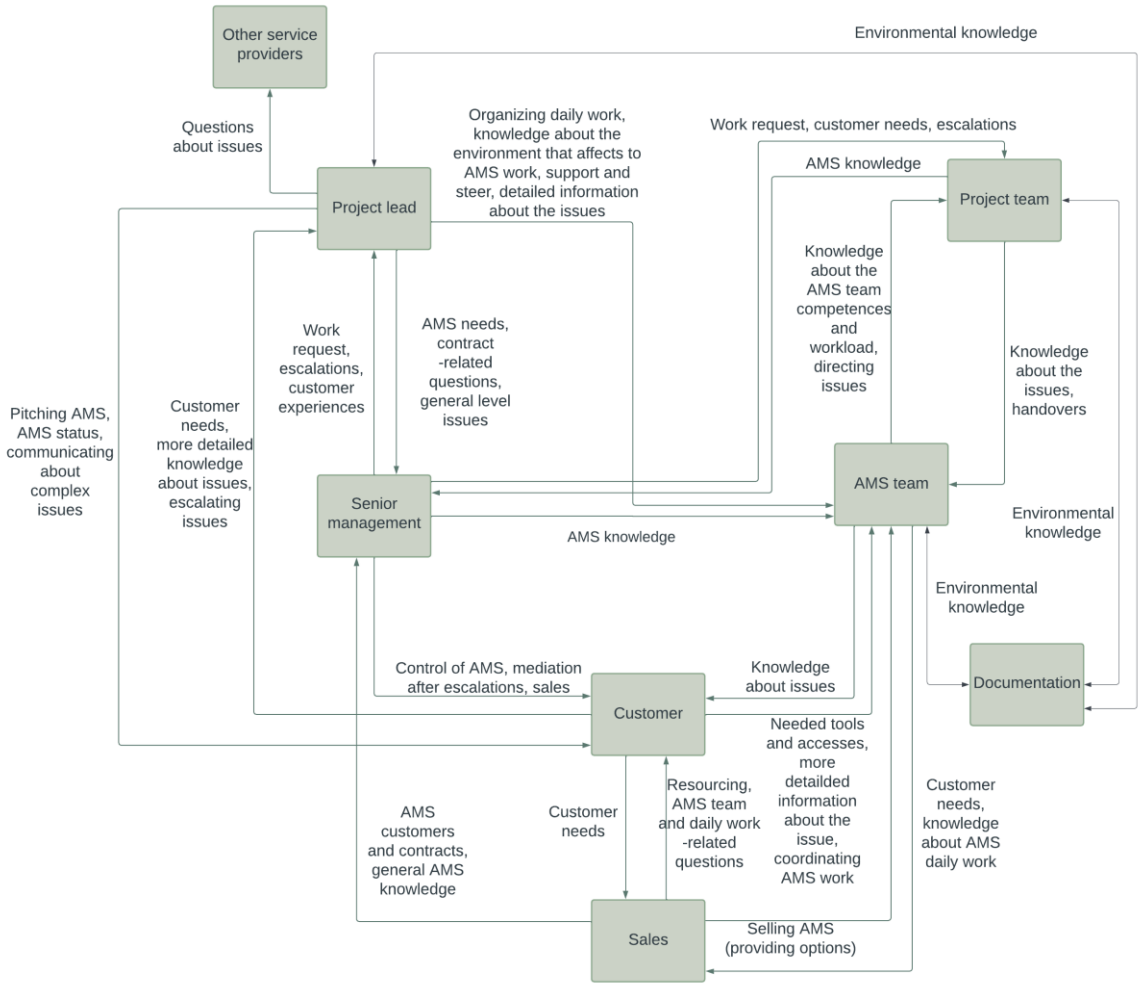


***Figure 10.*** *Knowledge flows in AMS*

The majority of interviewees see that they acquire new knowledge rarely. Sales A and B notice that the need to acquire new knowledge depends based on customer needs. Manager B also explains that they need to acquire new knowledge whenever they are creating an AMS proposal for customers. Developer A also emphasizes that acquiring new knowledge is topical when discussing with customers on AMS, but these discussions occur only a few times a year. AMS developer D explains that acquiring new knowledge is affiliated with new customers to AMS or if some knowledge is forgotten.

AMS-related knowledge sharing is challenging (Manager A). Interviewees identified factors that affect knowledge sharing in AMS. Project lead A acknowledges that the amount of knowledge and information has been increasing and it is challenging to know everything. Manager B demonstrates that sales proposals are agreed upon a

long time before handover starts and the time between challenges knowledge sharing. Developer A sees lack of time as a significant factor that slows knowledge sharing. Manager A supposes that knowledge sharing is easier internally than externally. Manager A points out personal attitude affects knowledge sharing, since developers may feel overwhelmed when they must share all the knowledge of the environment they have developed. Furthermore, Manager B sees that developers should be more committed to knowledge sharing. Customer A remarks that tools and ways of working should be established.

A significant factor decreasing the ability of knowledge sharing is cooperation. Project lead A wishes that the AMS team shares their knowledge back to the project team. However, AMS developer A comments that the AMS team is sharing their knowledge on repeating issues with project teams since there is a need for a fix. AMS developer D acknowledges that the AMS team is recognizing trends of incidents and that knowledge should be shared with the project team. As well, Sales A emphasizes the significance of knowledge sharing between the AMS team and the project team. The AMS team should be notified if something is passed to production and therefore under the AMS team's scope (Sales A). Correspondingly, the project team should receive the information if the project team is constantly passing to production developed features that cause plenty of incidents (Sales A). Project lead B suspects that the AMS team should act proactively if the AMS team wants knowledge from the project team, but this cooperation between the project team and the AMS team should be enhanced in the future. Sales B points out that AMS's daily work is not transparent toward sales, but customer account managers would want to know how the service is working and whether are there any issues. Additionally, Sales A identifies that they do not know about AMS's daily work, they just expect that everything is well working. Manager A concludes that AMS communication should be two-way.

Cooperation is needed between AMS solutions and inside AMS operators. Challenges in AMS knowledge sharing are observed to work well by AMS developer A. However, Project lead A describes that even though the AMS team's internal knowledge sharing is well, the knowledge sharing should be better between the AMS team and other AMS resources. Project A has one consultant that is agreed to be an AMS resource (Project lead A). The resource reserved outside of the AMS team is not cooperating with the rest of the AMS team as well as it could be (Project lead A). Manager B believes that the AMS team and project leads are responsible for knowledge sharing between AMS offerings. AMS lacks clear service manager roles, and the project leads do not have

much interest in AMS and its development (Manager B). When there are no clear responsibilities for knowledge sharing and harmonizing between AMS offerings, that is not as effective as it could be (Manager B). Project lead B requests also a person who is responsible for knowledge sharing and harmonizing among all AMS offerings.

Weak knowledge sharing causes challenges in understanding the values and objectives (Manager A). The objectives should be understood internally, and everyone involved should know what challenges AMS is solving and what are the expected daily tasks (Manager A). Customers should understand the value of AMS also (Manager A). Being transparent with customers creates trust and understanding of value, but it might be challenging (Manager A). When customers do not understand the value of AMS or transparency is missing, then customer satisfaction may weaken massively, if the AMS team makes a mistake (Manager A). If the value is understood and AMS is transparent, then mistakes do not break the trust massively (Manager A). Project lead B analyses that transparency is reasonably well, but it could be improved as well.

Interviewees discussed also factors that affect customer communication. Project lead A points out that customer communication is well since the AMS team is highly competent. AMS developers emphasize that customer relationships help in communication. Developer B believes that the AMS team's communication templates promote customer communication. Project lead C points out that responsibilities on the customer side are not clear always and that lowers communication and knowledge sharing. The customer of project B is not always sure what is in the target company's responsibility and what is other suppliers' responsibility and the customer does not inform end-users about how to create tickets (Project lead C). The misunderstanding of responsibilities and ways of working affects to communication and effectiveness of AMS. However, Customer A and B both are pleased with the communication between the customer and the AMS team.

IT systems supporting knowledge sharing is one theme affecting the effectiveness of knowledge sharing. Project lead A points out that they are not familiar with the AMS team's own knowledge bases, they do not even know where those exist. Sales B wishes for visibility of AMS working, and the visibility of AMS would be gained through a dashboard. The dashboard would alert sales personnel if customers are not satisfied, and then sales can take action toward customers being more satisfied (Sales B). Sales B also points out that material management systems would be helpful since then knowledge is simpler to find. Some Microsoft Teams channels would also be beneficial if there are questions related to AMS and no knowledge of who can answer the question (Sales B). AMS developer C mentions that communication channels to end users

would be a target for improvement and Customer A agrees on that. There are communication channels, but at times, AMS developer C is not sure who are the end users, so it is challenging to inform the correct group. However, Customer B is satisfied with the current technical channels for customer communication, which are Atlassian Jira and Microsoft Teams. AMS developer A suggests that the AMS team's monitoring reports could be an informative tool to support customer communication if the monitoring reports are shared with customers.

## 6.2 Factors affecting to knowledge-sharing challenges

This chapter presents different factors that create challenges to knowledge sharing. The themes of the challenges are customer-specific AMS solutions, knowledge-intensity, resolution of incidents and errors, AMS service management, sales process, challenges during handover, and AMS team's learning processes.

**Customer-specific AMS solutions**

AMS has been evolving organically based on customer needs. The need for support IT organizations has been increasing linearly over the past five or ten years since customers' IT environments have been increasing and getting more complicated, but internal IT organizations have not grown (Sales A). Manager A describes that AMS offering is created based on customer needs. Many customers asked at the same time for support after the project ended and it was necessary to create a service for that need (Manager A). The first AMS solution in the target company was sold during the year 2015 (Manager B). Manager B describes:

"*We have always had AMS solutions, but in the beginning, we had a couple of them as a slightly different type. Then these that we have now are like next-gen things, so made much more formally*." (Manager B, translated by author)

Project lead A points out that when there are occasions where there is no AMS contract, but the project team is maintaining the environment that has been developed. Customer A does not have AMS as a service, but they explain that they utilize tools provided by the target company to support the existing environment. Customer A has initiated an internal support structure, where they inspect all noticed incidents and try to solve them on their own. If an incident is caught by Customer A's team but cannot be resolved on their own, they inform the target company's project team (Customer A).

Project team and customer have also weekly meetings regarding support tasks (Customer A). Customer A's experiences with support and maintenance without an AMS contract confirm Project lead A's susceptions.

Developer A remarks that the drawback of the work as a BI developer is to maintain all the projects developed already. Project lead B states that AMS has taken the pressure off the project teams since the AMS team at least starts the incident or problem-solving. Sales A explains that the AMS offering has been evolving but it is not complete yet:

"*Nowadays, it's a little easier to respond when customers ask. Still not quite easy enough*." (Sales A, translated by author)

AMS is different per customer. Customers have different types of AMS needs, reporting needs, and knowledge needs and that is defining the target company's AMS offering (Manager B). Project lead B explains that low-level operations, such as monitoring, are the same but everything beyond that is different per customer. Project lead B thinks that customer needs have defined AMS to be customer-specific. Project lead B points out that since AMS was set up agilely and then expanded, coherence was lost during that. AMS is not a ready-made service that includes specific features, but features are created reacting to customer needs (Project lead B). Developing AMS is customized and project-specific (Project lead B).

The vast majority of interviewees would like to have more coherent and unified AMS solutions. Project lead B suggests that it would be pleasant to bundle the good practices that have been obtained from different customers and projects and the bundle would assist in making more unified AMS. AMS developer C agrees that more general rules and scopes in AMS would assist the AMS team to perform their job in the best possible manner. Currently, all processes and integrations are customer-specific (AMS developer C). Project lead A suspects that creating a coherent AMS solution requires time. Manager B notes that customers will always have customer-specific needs so not everything should be unified.

**Knowledge-intensity**

The majority of the interviewees recognize challenges in understanding knowledge-intensive environments. The main idea of business is always similar, but terminology, exceptions, and people may cause difficulties in understanding the environment fully (Manager A). Furthermore, business logic and domain-specific knowledge are seen as challenging. Manager A explains that even if the code in a database can be read and

understood quite easily, the logic behind the code is not often understood without difficulties.

AMS developer A agrees that business logic is the most difficult part to understand, but data lineage is seen as more challenging. Project lead C agrees with the challenges with data lineage and says that data lineage is the thing that always requires the most work. Data lineage means understanding where the error is initiated and what are the places where the error flows (Project lead C).

Developer C summarizes the challenges in AMS solutions at the general level to be non-existent standardized environments. All environments are different compared to each other and there is no certain logic recognizable. Even if standardized environments exist, they are not necessarily created smartly. When standardized environments do not exist, the AMS team has to understand the code fully before being able to solve incidents.

**Resolution of incidents and errors**

AMS daily work is considered working at a sufficient level by the majority of interviewees. Manager B emphasizes that the AMS team is highly competent and that is the target company's advantage when compared to other companies' AMS offerings. The AMS team can solve most of the issues and customers are satisfied with the AMS team's expertise and ability to solve issues. AMS developer A describes daily work as follows:

"*We are just looking anything that fail. Even though we don't know about some stuff, we have to figure it out*." (AMS developer A)

Activities that are considered as working well are the resolution of incidents and monitored errors (Project lead A, B & C; Manager B; Developer B; AMS developer A; C). Project lead A points out that there is automatism that tells the AMS team and the customer that something is wrong in the environment and the AMS team starts the work with the issue quite rapidly. AMS developer C considers that automatism has been a huge improvement to the AMS process since it notifies if something should be taken care of, and it eases customer communication also. The objective of AMS developer A is to get everything in AMS as automated as possible.

Project leads B and C see that the AMS team works proactively. However, Customer B notes that they are not that satisfied with the proactive manner of the AMS team. Generally, Customer B considers that AMS works okay, but there is room for improvement.

Manager A emphasizes that the AMS team should develop the process of resolution of incidents and errors and should work more proactively. Even though Project lead B remarks that the AMS team is working proactively, they remark too that proactively working should be improved:

"*It's not much followed how some performance with downloads develops over time and that it would be proactively raised from there that "hey there is a clear slowdown, and you could pay attention to that"*" (Project lead B, translated by author)

AMS developers A and D emphasize that the freedom they have assists in their daily work. Freedom means that customers do not restrict the AMS team to have access to environments (AMS developer A) and the AMS team can arrange their daily activities on their own (AMS developer D).

Tickets are delivered with missing information, and it complicates the process of fixing the incident (AMS developer A). AMS developer A wishes for tickets to come with more information, and their suggestion is to have a template for mandatory information to supply a ticket. Customer A identifies as a challenge that ticket resolution may take longer when the AMS team needs more information from the customer.

Developers B and C and Manager A see that one challenge is that developers are involved in AMS work too much and long. Developers should be contacted only when needed (Developer B). Manager A wishes that developers do not need to maintain the environment at all. Developer C remarks that the one who has developed the solution at first knows it best and will be the fastest problem-solver. Efficiency challenges arise if AMS is completely unconnected from development (Developer C).

**AMS service management**

There are no proper service managers in AMS (Sales A). All the interviewed project leaders remark that they have a service manager role in AMS and it has been a natural continuation since they have been the project manager of the project that is now in AMS responsibility. Sales A explains that selling AMS to new customers suffers from the lack of proper service managers. However, Sales A remarks that any AMS customer has not ended an AMS contract because of the lack of a service manager, so apparently customers have settled to the current level of service manager. Manager B identifies that one development target is that AMS will have a proper service manager or service manager that takes care of customers' needs on AMS.

Sales A points out also that gaining new customers is more difficult if the sales team cannot show how AMS work is reported to customers month by month. All project leaders agree that reporting the AMS work should be developed.

Project lead A points out that reporting AMS work enhances the service on the target company's side also since the reporting provides a baseline of current status and helps to improve the AMS internally. Project leads B and C emphasize calculating key performance indicators (KPIs) of AMS work. The current AMS solution does not have any coherent template about what is always measured (Project lead B). The data needed for measurement calculation is fragmented into different ticketing systems and that challenges the measurement calculation (Project lead C). Project lead C mentions that if all the customers have the same KPIs, the data needed to calculate KPIs can be fetched easily, and the calculations are the same for all the customers, then KPI calculations would be simple. Furthermore, customer communication about KPIs should be improved since currently KPIs are calculated manually and presented as a slide set to the customer (Project lead C). It would be beneficial if customers could always check the status of AMS, not only during service meetings when the target company presents the metrics (Project lead C).

Service management meetings vary between the customers. There are weekly meetings in AMS solution B and operations are more transparent to the customer when compared to AMS solution C which has only quarterly meetings (Project lead B). Project lead C and Customer B agree that the status meetings create transparency. Project lead C remarks that AMS status meetings have been running for about a year with the customer of AMS solution B.

Project lead C thinks that the metrics in AMS solution B are not as good as possible and the KPIs do not measure service level agreements (SLAs) at all. However, Customer B is satisfied with the metrics and service meetings provided by Project lead C. Developer C points out that the main task of KPIs is to measure if SLAs are fulfilled. Other useful KPIs are the amount of resolved tickets in each ticket status and open tickets in each ticket status. These KPIs help to understand what the open tickets are and what is the reason why the tickets are created. Furthermore, the customer experience should be measured for resolved tickets (Developer C).

**Sales process**

Potential customers want to ensure that potential partner provides also continuous services and if the customer is not pleased with the target company's AMS offering that

sometimes leads to not even reaching an agreement on the project (Sales A). Managers A and B emphasize that AMS should be discussed during the sales process of the project, since then knowledge transfer between the project team and the AMS team would be easier when the continuum is known already during the project. Typically, customers want to ensure that AMS is a possibility during settling the project contract, but AMS contracts are settled when the project is ongoing (Sales A). Existing customers ask for AMS proposals usually when the development project ends or is about to end and the customer notices that the support provided by the project team is not enough anymore (Sales A). Developer A thinks that the support provided by the project team has no SLAs or such and the support is usually better than it needs to be since the project team members are so conscientious. Some customers do not understand what can be expected of support by the project team, and a reason for the misunderstanding might be in communication between the target company and the customer (Developer A).

Sales need to define AMS service to the customer during the sales process. Sales B describes that a salesperson should define what AMS does, how AMS works, why AMS exists, and how it helps a customer. Sales B concludes the knowledge sharing during the sales process:

"*It's not always about the what. … I'm always saying to the practice leads there is two whys you have to be able to answer: why do you exist and why should anyone care?*" (Sales B)

Manager B points out that the salesperson should describe also how the handover between the project and the AMS happens. Manager A emphasizes that customer expectations for the AMS team's resolution should be defined during the sales process. If the resolution is not just a quick fix but needs minor development, then it is not the AMS team's responsibility, but the minor development task needs to be projected (Manager A).

The sales process should be developed (Project lead B). The main development target is the AMS offering itself (Manager A & B; Project lead A, B & C; Sales A & B). Sales A emphasizes that AMS offering should be as clear as possible since the target company employees should always be able to define what it is, how to use it, what it costs, what it solves, and what it might not solve. Some details regarding AMS as a service mentioned by Project lead A are SLAs, AMS working hours, handover, and AMS service management. Sales B wishes that AMS would be a modular type that the target com-

pany can build for customers based on their needs and requirements, whereas Manager B wants AMS to be a unified solution that is similar to all customers. Manager B emphasizes that customer needs should always be taken into account in AMS.

AMS team members have technical backgrounds, and they are supposed to have enough technical competencies to support the customer. AMS team members' technical knowledge is appreciated in the target company (e.g. Developer A, Manager B). However, Sales A argues that the AMS team's technical competencies are limited to data warehouse knowledge. AMS developer C confirms that the AMS team has only basic knowledge of Power BI, for instance. Sales A emphasizes that it would broaden the AMS offering if the AMS team knew different reporting tools, such as Power BI and Qlik. AMS service and its processes can expand on other solutions as well.

Communication about AMS should be clear, both internally and externally (Manager A). Sales A also wishes that AMS is easy to communicate with customers during sales processes. Sales B emphasizes that currently, AMS is hard to communicate to customers, since the product is not clearly defined and documented in the target company. Sales A describes the challenges during the sales process:
"*Still, even though the services and the way to describe the services have developed, there is quite a lot of reinventing the wheel. For example, the same account manager made a big AMS-based offer in the spring and now in the fall, and yes, he built both pretty much from scratch again."* (Sales A, translated by author)

Contracts are signed during a sales process. Project lead C points out that AMS is not defined comprehensively enough in the contracts that the target company has currently. AMS contracts have incomplete definitions of the scope of responsibility, SLAs, and working hours (Project lead C). The looseness of contracts causes misunderstandings between the target company and customer, for instance, Project lead A mentions that one customer interprets that the AMS team provides some working hours that are included in a fixed fee, but Sales B does not agree with the customer.

Project lead A remarks that having a unified understanding of contractual matters needs to be improved. AMS developer C affirms that AMS team members have a lot of grey areas on whether they should do something or not. On the other hand, Project lead B sees that AMS contracts are fine since the contracts are loose enough and therefore the target company has not promised anything that the target company cannot keep. Manager B emphasizes that the pricing model of AMS is working well, and it is not needed to change the pricing model.

Sales B also suggests that SLAs should be clearly defined, since it is important to customers, but also to the target company since it gives coherence to AMS's overall process. Customer B confirms that the SLAs are not defined as detailed as needed. SLAs should promise a resolution time in each category that is based on business criticality (Customer B). Project lead C sees that loose SLAs create uncertainty for the AMS team on when the incident should be resolved.

Customer B adds that resourcing should also be defined in the contract. Customer B sees that the same team should not provide support and development since then support may suffer from a heavy workload on development. However, AMS developers A, C, and D think that doing development work also helps in AMS work. AMS developer C describes:

"*And it's easier to maintain and understand project business systems when you are developing stuff, so you better know where is what and what does it do*." AMS developer C

**Challenges during handover**

Handover means the knowledge transfer actions when the environment or part of it is assigned to AMS team support. Handover includes an overview of the project and development work (Project lead A). Details are introduced if the AMS team asks for (Project lead A). After the handover AMS team is ready to provide support and solve incidents (Developer A). Handover varies depending on the size and complexity of the project and project tools (AMS developer B). The handover takes time around three months (AMS developer B). Handovers are needed since then the AMS team gets an idea of what is coming (AMS developer A)

Projects are different and that affects handovers also. Project lead A describes that project B is developed by the target company while project D is developed by the target company, but the customer is also doing minor development on their own. Knowledge sharing is easier to do when the development is done by the target company and therefore the knowledge is inside the target company (Project lead A). Manager B proposes that handovers have been weak and most of the projects do not have complete knowledge transfer processes. Manager B thinks that the existing knowledge transfers focus on what AMS should do, rather than new knowledge creation in the AMS team about the environment itself. Developer A assesses that the handover process is defined clearly but they do not have much experience with handovers. Sales B is uncertain how to describe handover to customers.

There are several ways to do the handover since the coherent handover process is not defined yet (Manager B). There was a dedicated developer in project A who held weekly or biweekly meetings with the AMS team and they went through tickets so the AMS team would be familiarized with the environment and upcoming incidents (AMS developer A). Another way is to have knowledge-sharing sessions each of them having own themes, such as introduction, data loads, and measure calculations (Developer A). Sometimes project manager introduces the project and the expectations for the AMS team (AMS developer C). Project manager B ponders if handovers are even done officially, it is mostly sharing the documentation with the AMS team. Project lead C notes that sometimes the project is under AMS support even before the documentation is shared with the AMS team. AMS developer A narrates the typical handover process:

"*Then handovers, that's what we are always asking but never get ones. … Usually what we do, we just grab a developer or project manager and try to go over as many as possible current issues and just to start getting idea of how we should work, we should we start.*" (AMS developer A)

Lack of documentation is a challenge during handover (AMS developer A, C & D). Existing project documentation is introduced during handover (Project lead A). However, AMS developer A discusses that there are projects that have no documentation. AMS team documents projects on their own for AMS team's usage (AMS developer D).

The AMS team self-learns during handovers as well. The AMS team usually does not ask many questions, and it seems that the AMS team's approach is to learn by doing (Project lead A). AMS team learns independently by documentation and looking through the environment (AMS developer A). A typical challenge is that the AMS team does not know what the customer expects from AMS (AMS developer C).

The challenge of handovers is to introduce the project cost-effectively since it is impossible to introduce every part of the project (Developer C). Ideally, the AMS team and project team have sessions where every important part of the project is introduced (Manager A). Sales A wishes that there would be a generalized process to do handover and standardized documentation for AMS handover and customers. The generalized handover process includes the knowledge sharing of what should be done by the target company and by the customer (Sales A). The handover process should be known in the target company and communicated clearly to customers during the sales process (Sales A). The generalized handover process would have standardized work-

shops during handover which are customized based on the extent and type of the environment (Sales A). Manager B adds that it would be good to have a unified plan of handover where the objectives of each week are defined.

Documentation is needed to be improved (Developer D). It would be beneficial if a project team documents their insights on the most typical incidents and generally what the AMS team may expect from that environment (Project lead A). On the other hand, Manager A sees that scenarios are quite unnecessary since it is impossible to create scenarios for everything. Developer A sees that there should exist documentation about technical components, such as what they are and how they are calculated/developed.

General knowledge transfer should exist during handovers also. AMS team should know at a general level about who are the responsible personnel in each area from the development team but in the customer side as well (Developer A & C). AMS team should gain knowledge of the environment's different part's criticality since that knowledge guides AMS team daily work (Manager B). Other success factors of handovers are that the project team provides support to the AMS team during the first weeks of AMS (Manager A), good communication (AMS developer B), and collaboration (AMS developer B).

**AMS team's learning processes**

AMS team has other learning processes beyond handovers. Identified learning processes are developing technical competencies and training new members. Project lead A discusses that a new team member's training process is initiated and performed by AMS developer A, but any of the interviewed project leads were not familiar with the training process. Also, Manager B is not familiar with the training process, even though they have been the ones who initiated the AMS itself at the beginning.

The training process starts with getting accesses, sharing all documentation, and then going through incident cases together (AMS developer A). AMS developer B adds that there are general introductions of the AMS team and technologies. Going through incidents happens organically in Microsoft Teams calls where the more senior team member either solves the issue and explains or guides the new team member to solve the issue (AMS developer A, B, C & D). AMS developer B thinks that the training process works well, and useful practices are shadowing, observation, guidance, and direct interaction. AMS developer A sees that practicing is better than going through documentation while AMS developer C thinks that understanding the whole picture is necessary

so going through documentation is important also. AMS developer B does not like self-learning through theory since it hinders the development of practical skills. Personal skills affect training methods effectivity (AMS developer C & D).

AMS developers C and D pointed out that learning new technical skills is usually initiated by documentation. Previously there have been training sessions on different technical areas also (AMS developer C). Training sessions are not active anymore because of lack of time (AMS developer C). Project lead A points out that it would be beneficial to know the learning process of the AMS team, since then project leaders and other stakeholders can add content to training. Robust learning processes would be good (Project lead C).

## 6.3 Documentation

Everyone who was interviewed discussed the challenges in documentation. Challenges are divided into three themes: absence, quality, and accessibility of documentation. Sales A emphasizes that answers have been received always somehow despite the challenges in the documentation.

### Absence of documentation

AMS-related documentation includes sales materials, contracts, and system and environment knowledge about the solution maintained by the AMS team. Even though there is documentation in AMS, a commonly recognized challenge is that needed documentation does not exist as such. Project lead B describes:

"*Internally, we probably don't have this kind of general written information, it's mainly information communicated in other ways.*" (Project lead B, translated by author)

Interviewees estimated the ratio between getting new knowledge from codified documents and through communication. Two interviewees stated that 0 % of knowledge is in written format. The most common answer was 20 % in written format and 80 % through communication. An emerging theme was that getting new knowledge usually starts with communication and during the communication also documents are shared.

Sales materials are created per proposal, and there is no common template for AMS proposals (Sales A). The way of describing the AMS solution has evolved, but it is not yet sufficient (Sales A). The lack of documented general AMS knowledge is problematic since then all proposals are different and creating a proposal consumes time more

when compared to the situation when there are general documents available (Sales A). Manager A made an AMS proposal for a customer, and it failed because of the lack of documentation. Sales B demonstrates the lack of sales documentation:

"*When I created the process for example, it wasn't like based on one document or even a few documents it was asking people well what is AMS? And often they're like well I don't know. But like I think it's this. So, then I pieced all that information together and then had to visualize it in my mind*" (I13)

Developer B notes that the AMS contract is one of the most important documents to the AMS team since the contract defines what is promised to the customer, for instance, what service level agreements are. Made customer promises guide AMS daily work since the promised AMS deliverables should be fulfilled (Sales B).

Documentation about the system and environment is made by the project team and AMS team (AMS developer A, Project lead B). Project lead A points out that the project team documents all the things needed to understand the ensemble of development work, and that includes explanations about what has been done to where and what is the logic behind the solution. In turn, Project lead B remarks that sometimes the project team documents instructions for the AMS team. AMS developer A comments that the AMS team themselves documents environments, connections required to get into the environment, and reoccurring issues. Even though there is documentation about the maintained AMS solution AMS developer D concludes the challenges associated with the lack of documentation:

"*You are lacking everything at first, so it is quite a challenge to gather all the things you need to address all the issues that occur. Because in some cases team leaders and developers don't have any kind of documentation and they are guessing how it could work*" (AMS developer D)

**Quality and accessibility of documentation**

There are quality issues in existing documentation, such as documents are not always updated, detailed, or extensive enough. AMS developer C notes that it is impossible to document everything while Project lead C points out that it is common that documentation is not updated, or some part of the documentation is completely missing. Manager A explains that it is challenging to document solutions at the level that the documentation would be useful:

"*How should documentation be approached for a project that has been in progress for a year? A measure may have been changed four times. It is documented at the beginning, but no meetings and discussions that took place after that has not been documented which would be the logical chain to how the rule has been born. This is not only our problem, but also in the customer's mind, they never remember why something was calculated*." (Manager A, translated by author)

Interviewees discussed the challenges in finding the knowledge needed. Manager A points out that if they need documented knowledge, they should ask someone where the knowledge can be found. Developer A agrees with Manager A, they mention that they do not even know what to look for since there is a lack of information sources. Sales A points out that AMS-related documentations are fragmented into different systems. On the other hand, AMS developer A sees that the documentation system that the AMS team utilizes is working well. Project lead A discusses that they have had problems getting access to AMS agreements. Project lead C mentions that one future need for AMS would be a centralized system where all AMS-related knowledge is stored.

## 6.4 AMS management

Management of AMS was discussed with all the interviewees. This chapter presents the current status of management and identified management needs for the future.

#### AMS management currently

The vast majority of interviewees pointed out that there is room for improvement in managing AMS. Project lead A concludes that there is no visible manager of AMS even though some evolution has happened. Currently, there is a technical service manager who is responsible for the AMS team's competence development, training new AMS team members, and ensuring the AMS team's working conditions (Project lead A). The technical service manager is responsible at the operational level (Manager B). Customer level management is done by project leaders, and it was established based on customer needs (Manager A). Proper AMS management is minimal:

"*The time senior managers can spend on [management] is the minimum. It is managed to the extent that it runs and does not fall apart*." (Manager B, translated by author)

Manager B questions if AMS is even managed at all. AMS developer C identifies that AMS is a new service and is still under development. Manager B also admits that AMS is initiated organically and even though AMS is working well, the structures around AMS are not as supportive as they could be. Manager B explains that no one has had the time to develop AMS as a whole. Project lead C clarifies that there have been meetings for planning AMS comprehensively, but those were not effective since no one had the leading role. Project lead A believes that the target company's functions usually lack concreteness and ownership and the target company's personnel is making decisions based on sense.

The role of the technical service manager is not widely known in the target company, for instance, Project lead B ponders the technical service manager's responsibilities and how the role is visible in their daily work. Developer A admits that they do not know how AMS is managed. AMS developers understand and appreciate the role of the technical service manager. Project lead A points out that nowadays when there is a technical service manager, it is easier to point questions to the person who knows about AMS.

The lack of management produces broader effects, one of which is uncertainty in responsibilities. AMS developers A, C, and D agreed that they are not always sure about the AMS team's responsibilities. The AMS team occasionally gets questions from customers about why the AMS team is not doing something (AMS developer A). At times, the AMS team does not even know that the environment exists that the customer is asking about (AMS developer A). AMS developer C discusses that project B has a lot of grey areas since there are environments that are under the AMS team's responsibility, but other environments are not under the AMS team's responsibility, AMS team can survey the environment but not make any changes. Manager B claims that responsibilities are shared with each person on AMS.

Another effect of lack of management is that the managemental roles and their relation are not clear inside the target company. Project lead B admits that they do not know what the scope of each managemental role is, how managers relate to each other and what are the consequences for customers. The roles should be clearer (Project lead B). Feedback and resourcing are other factors that are lacking due to managemental inefficiencies. AMS developer A clarifies that the AMS team does not get feedback on their work. The AMS team wishes to feedback especially from customers (AMS developer A). Resourcing is identified by Customer B. Customer B suggests that the availability of the AMS team as workdays should be visible to the customer.

**AMS management needs in the future**

Management is needed in AMS if the objective is to be competitive and shape the process constantly (Manager A). Manager A points out that Manager B is a kind of leader of AMS currently. Manager B sees that the vision of the ideal AMS should be the first initiative and then comes management, but at some point, the ideal situation is that AMS has an owner. Project lead A suggests that the first step to developing AMS is that AMS get an owner. Sales A believes that the owner of AMS is needed since then the ownership can be represented to customers also and that creates faith between the parties. As well, Project leads B and C emphasize the need for upper-level management in AMS:

"*If no one leads [AMS], it will not happen by itself. It's an unfortunate fact*." (Project lead C, translated by author)

AMS manager is needed since there is extensive work to do with harmonizing between customers and generalizing daily processes (AMS developer D). Project lead B identifies that management is needed to build a coherent process that defines responsibilities. Defined responsibilities should be communicated to each party and be invisible to everyone (Project lead B). Defining and communicating responsibilities as management incentives would help in resourcing also (Project lead B). The need to manage AMS can be concluded:

"*Management also is the platform builder who makes the process better*." (AMS developer D)

AMS has a financial impact; Project lead C explains that 27 % of one customer's invoicing is about AMS. Developer C emphasizes that cost effectiveness is important to both parties: customer and supplier since AMS expends overmuch money if AMS processes are ineffective. Due to financial impact, managing AMS effectively is seen as an important task (Developer C). Sales A proves that the demand for AMS has increased linearly during the past five or ten years.

Project lead A suggests that there should be two managers in AMS: one who is focused on the technical side and the other focused on the customer side. AMS developer D wishes that there would be a coordinator, that supports on a daily basis (technical service manager kind of). AMS developer C suggests a different approach: management is needed at different levels. The IT department should manage AMS as an entity, and they instruct on processes, competencies, and financial effectiveness. Service managers should provide help to AMS team members to succeed in daily work, but also be responsible for the customer side. The third management dimension is that

the development team is in an indirect leadership role compared to the AMS team. The development team can assign tasks to AMS team members. (Developer C) Regardless of how the management is organized, the roles and responsibilities of managers should be clear and communicated inside the target company and to customers (Project lead B).

## 6.5 Knowledge needs

Each group has knowledge needs and they differ. The next subchapters present knowledge needs based on the interviews. Knowledge needs are presented by groups of operators: sales, AMS team, customer, project team, and management. The needs generally in the target company are presented at last.

### Sales

Knowledge needs of sales are presented in Figure 11 which is formulated based on interviews. Knowledge needs are presented in themes of AMS offering itself, sales support, customer-related knowledge, and market-related knowledge.

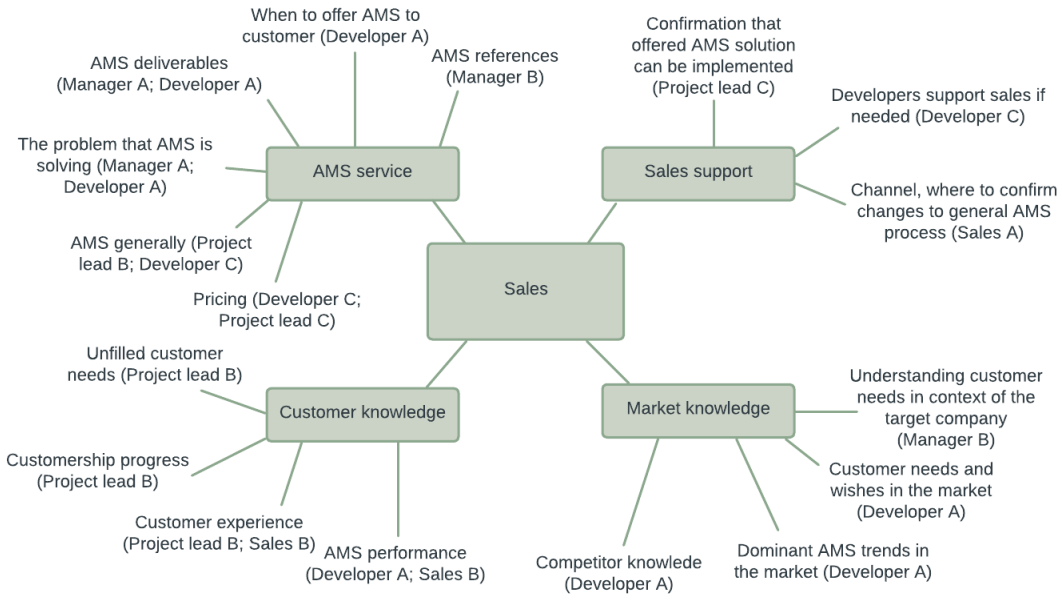


***Figure 31**. Knowledge needs of sales*

Project lead B suspects that most of the AMS offerings are sold by Manager B, not by the sales organization. AMS developer C summarizes that sales personnel should know how to sell AMS better generally. Sales should know the fundamentals of AMS; it

is not necessary to know the details (Developer C). Sales should know about the support they can get. Market knowledge is needed for steering the vision of AMS, developing the AMS offering itself, and steering the sales work (Developer A).

### AMS team

The knowledge needs of the AMS team are presented in Figure 12 which is formulated based on interviews. Knowledge needs are presented in themes of AMS daily work, environment, AMS offering, and customer knowledge.

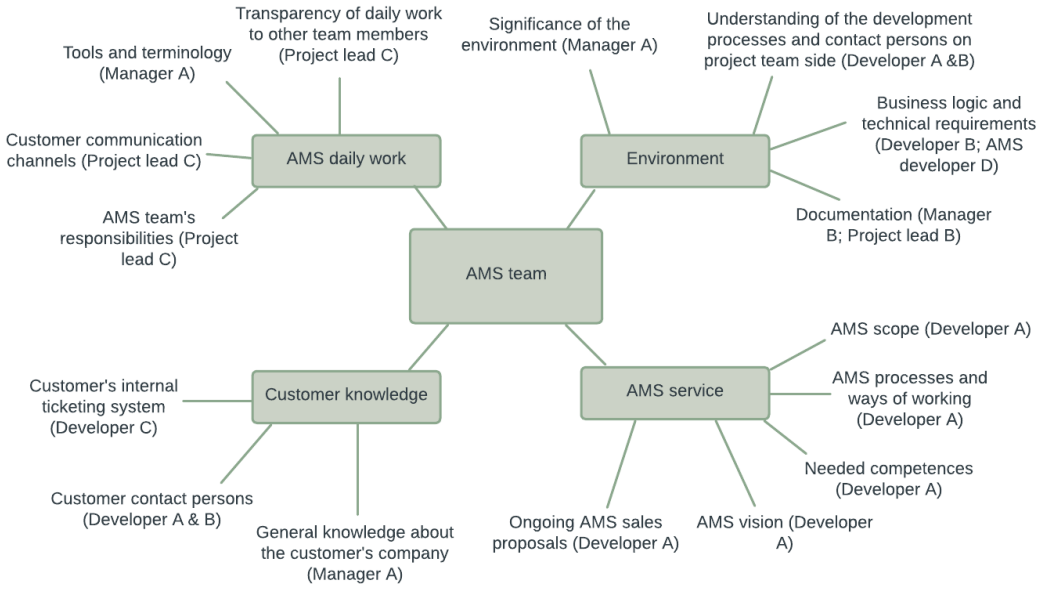


***Figure 42.*** *Knowledge needs of the AMS team*

Terminology regarding AMS should be known by the AMS team since then they understand customers better (Manager A). Responsibilities are necessary to know so the AMS team knows what is expected from them and customer experience does not suffer (Project lead C). Fundamentals of the environment itself are reasonable to know, since the knowledge may motivate the AMS team (Manager A). Every AMS developer discusses the challenges in documentation, as noted in Chapter 6.3.

### Customer

As Manager B says, customers' knowledge needs differ. However, Figure 13 portrays customers' knowledge needs identified by interviewees. Themes are general, sales, AMS offering, and AMS team.

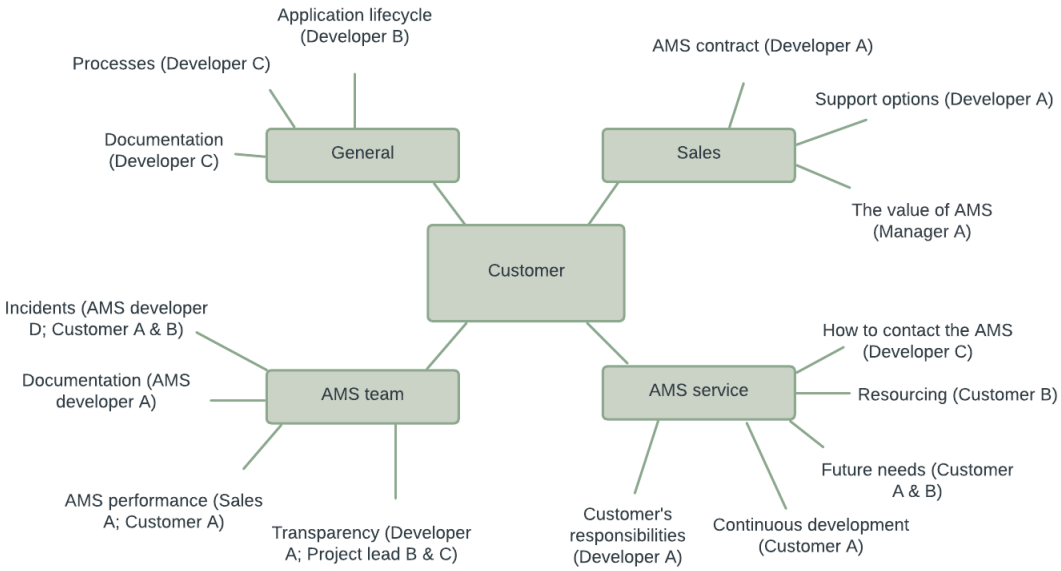


***Figure 13.*** *Knowledge needs of customers*

AMS processes should be known by customers, so they are aware of agreed actions and general documentation promotes customer knowledge (Developer C). AMS processes should be known by customers, such as how AMS runs (Developer A). Developer C emphasizes that even though customers have their own support processes, they should know how to contact the target company's AMS as agreed. Application lifecycle should be understood by customers, so they understand the existence of AMS (Developer B).

Customers need to understand the value and potential AMS gives (Manager A). AMS contract should be clear: what are the SLAs, how AMS works and what are the promises (Developer A). Customers need knowledge about different support options (Developer A). Different options are most likely presented during the sales process but also when AMS is ongoing, customers need to know what the possibilities are to customize or change the service while they have a fixed-term contract (Developer A).

Continuous development concerns for instance ways of working and communication in AMS (Customer A). It is expected that AMS as a whole will constantly evolve (Customer A). Future needs mean that customer needs may change, and it is needed to ensure occasionally that customer needs and AMS are in the right place (Customer A). Service providers such as Microsoft constantly update their services and customers need knowledge of how the updates affect their services. Resourcing is needed

knowledge so the customer is confirmed that there are enough AMS resources (Customer B). Customer should also know their responsibilities regarding AMS (Developer A).

Transparency is a multilevel knowledge need. The customer must know if data loadings have failed or slowed down during the last night since the data might be business critical (Project lead B). Since data business criticality AMS team should transparently communicate with customers (Project lead B). There might be plenty of work in AMS that is invisible to the customer (Developer A). The customer should know the number of incidents and the work ensued by incidents to the AMS team (Developer A). Customers should be ensured that AMS is working as proactive as possible, and therefore transparency is requisite (Project lead C). Customers want to be sure that every ticket will be solved and that nothing is lacking (Project lead C). Customer A concludes that they want to be sure that AMS works as promised.

Needed knowledge about incidents is how many and what kind of incidents there have been (Sales A). AMS developer D comments that typical questions are also what the impact of the incident is, how soon the incident will be solved, and will the incident reoccur. Customer A describes that descriptions about incidents, but also root causes of incidents are desired knowledge. Customers need to know how AMS performs, whether promises are kept, how SLAs are fulfilled, and so on (Sales A).

The AMS team maintains their knowledge base regarding the AMS solution (AMS developer A). The knowledge gathered by the AMS team is necessary to provide to customers since it helps customers solve issues on their own (AMS developer A). It has been settled that customers solve the simplest issues and documentation by the AMS team assists that (Project lead C).

**Project team**

Developer C argues that the project team should know everything that the AMS team knows but the project team have also own knowledge needs. The knowledge needs of the project team are portrayed in Figure 14. There are three themes in Figure 14: project, AMS, and general.

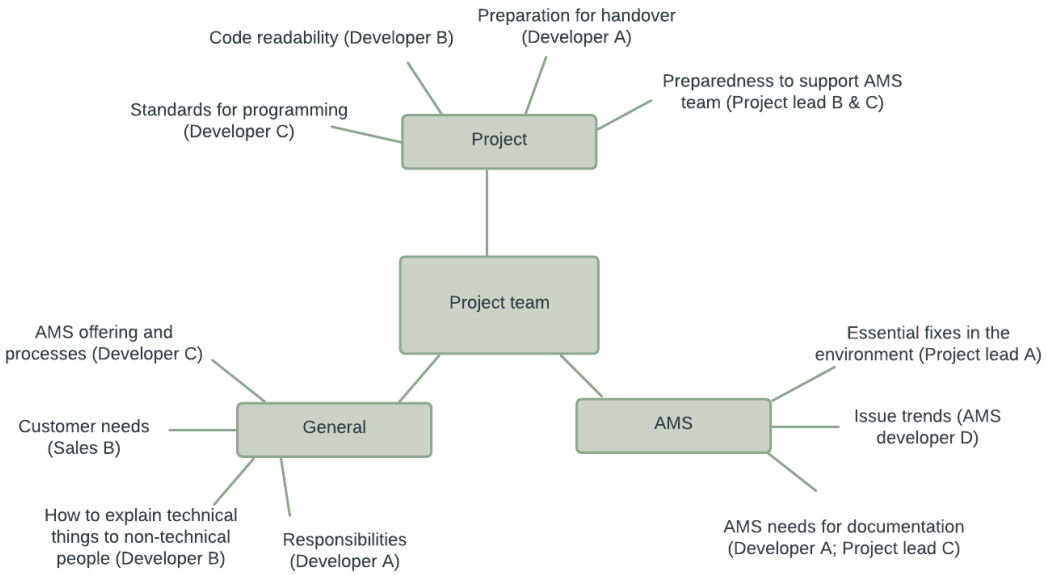


***Figure 13.*** *Knowledge needs of the project team*

The knowledge of AMS and its processes is needed so the project team may support customers also if the AMS team is not capable of but the knowledge is needed so the architecture of an environment can be designed in a way that supports AMS work (Developer C). Developer C provides an example of an architecture issue: they have worked with an environment where AMS was not taken into consideration when the environment was developed. When AMS started the work on supporting the environment, architectural reasons were the main reason why the AMS team was overloaded.

Developer B emphasized that knowledge of how to communicate with non-technical people is needed. Developer A points out that responsibilities between AMS and project teams should be known so nobody does unnecessary work. Customer needs should be known, so the project team can suggest to sales that customers might benefit from a new feature or service (Sales B).

Developer C suggests that the project team should know and follow the employer's programming standards since then AMS would be more effective. Effectiveness comes when only business logic differs between the customers and the AMS team does not have to understand different types of coding in each system (Developer C). Developer B emphasizes code readability: how easy it is to follow the code and understand the business logic behind the code. Code readability is enhanced with comments, clean code, and technical documentation.

The project team should be prepared for handovers, since then the project team can plan the documentation and handover itself (Developer A). The project team should

know the documentary needs of the AMS team so the project team can create constantly documentation that will be useful to the AMS team's purposes (Developer A; Project lead C).

The project team needs knowledge from the AMS team of the matters where major fixes are developed to the environment or there is a clear trend on issues (Project lead A; AMS developer D). Trends on issues are needed knowledge so the issue is solved permanently, not only the specific instance (AMS developer D).

**Management**

Only a few knowledge needs of management were identified by interviewees. Figure 15 presents three interviewees' recognized levels of managers and their knowledge needs on AMS. The manager levels interviewees recognized are service manager, technical service manager, and senior manager.

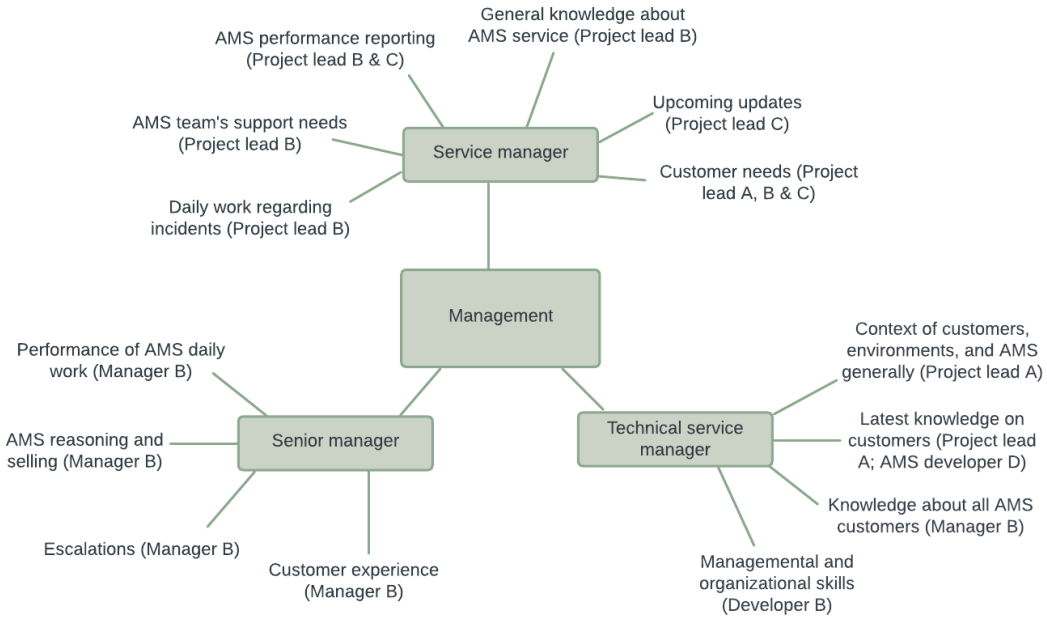


***Figure 15**. Knowledge needs of management*

General knowledge regarding AMS is needed by service managers (Project lead C). Service managers should know about daily work since they can provide support to the AMS team if needed (Project lead B). Service managers present AMS performance measurements and upcoming updates to customers (Project lead B & C). Upcoming updates mean updates on platforms such as Microsoft 365 and Azure (Project lead C).

Technical service managers need to know more than regular AMS team members since the technical service manager presents the latest knowledge to the AMS team and is responsible for the technical side of the AMS team (AMS developer D). Manager B emphasizes that not all AMS team members should necessarily know all customers and their environments, but the technical service manager should have knowledge of all customers.

Senior managers need fundamental knowledge of AMS performance, but escalations go through senior managers (Manager B). Manager B also demonstrates that senior managers should have knowledge that aids managers in selling and reason AMS to customers.

**Generally in the target company**

Everyone in the target company should know the general presentation of AMS. Many developers in the target company have been involved in a great number of projects and their baggage is following developers (Manager A). If developers know about AMS, it will create a trust that projects may sometimes shift to the responsibility of someone else but also it might enhance the volume of sold AMS offerings (Manager A). Developer A recognizes the baggage of old projects but also points out that AMS is not introduced to the whole business unit. Developer A suspects that the majority of developers know that AMS exists, but they do not even know what AMS is solving. Developer B agrees that AMS should be more appreciated among the target company's developers. Manager B concludes that the whole organization should understand AMS' value for themselves, sales understand AMS as a well-selling service, and developers understand that AMS will relieve the burden of old projects.

The vision of AMS is one theme that was highlighted by interviewees. Developer A emphasizes that the whole business unit in the target company should know if a reason is there to promote AMS more broadly to customers. Developers need the knowledge of AMS's future visions when developers discuss with customers that AMS would be well fitting solution in the future after the project because then developers need to provide correct information about AMS (Developer A). AMS developers A, C, and D agree that knowledge of AMS vision would benefit them also, however, AMS developer A thinks that such knowledge of AMS vision does not exist. Sales B concludes the need for future vision:

"So, we understand what the strategy is related to our AMS offering and once we have the common goal, then we're all sort of aiming in the same direction." (Sales B)

Chapters 6.2 – 6.4 discussed challenges in documentation. Interviewees described knowledge needs regarding documented knowledge. AMS developer A concludes that it is needed to spend more time documenting, and Project lead B agrees that we should document as much as is reasonably possible. Figure 16 portrays the need for documentation by themes of AMS offering, environment, and general.

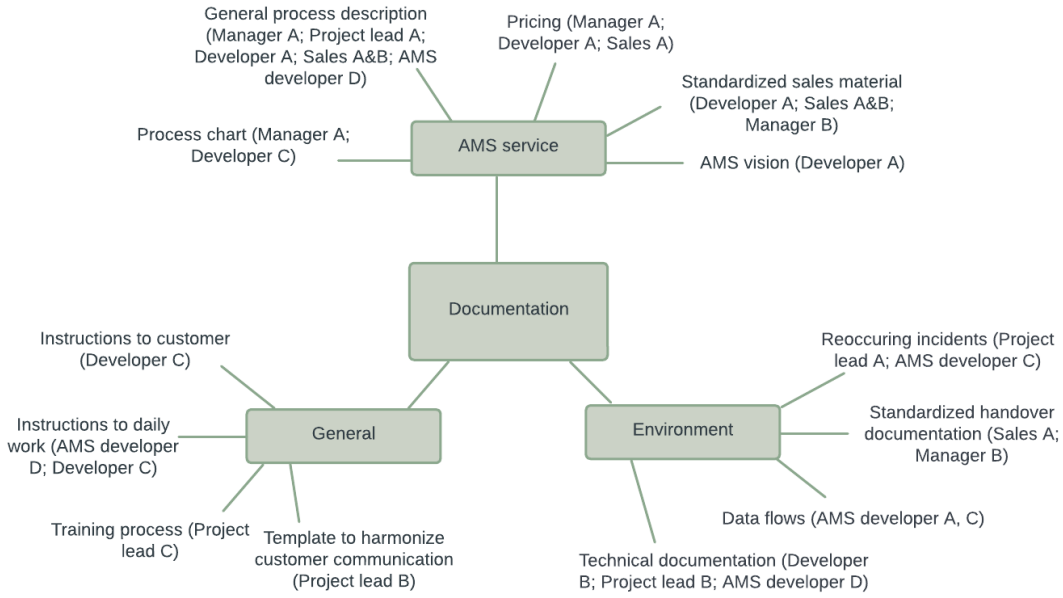


***Figure 16**. Documentation needs*

A simple process chart is needed since it aids in explaining AMS shortly at the general level (Manager A). The general process description portrays AMS as a whole: what AMS does and in what way (Manager A). Standardized sales material portrays comprehensively AMS and its subprocesses and reasons for the AMS solution (Manager B). Standardized sales material allows everyone to familiarize themselves with AMS and then project leaders may open a sales discussion about AMS with customers (Developer A). Standardized sales material helps sales to reason AMS coherently and comprehensively to customers (Sales A). Standardized sales material allows sales to reuse sales material and there is no need to refactor everything always (Sales A). The quality of sales material is determined by the need to ask for more information from someone (Manager B). Sales B suggests that documentation portrays AMS as a whole, and sales personnel could personalize sales offers based on the customer's environment size, and still, the AMS solution would follow general rules. AMS pricing model consists of fixed fee and time and material-based billing (Sales A). The pricing model should be contemplated and documented since then pricing can be reasoned to the customer and AMS is not seen as an open checkbook (Sales A).

Documenting reoccurring issues would help the AMS team (Project lead A). Standardized handover documentation should be based on a standardized handover process (Sales A). Sales A suggests that there should be standard documentation needed from the project team which supports the AMS team, and a standard process to execute handover, for instance, there is a list of requirements for customers. These are quite simple things but the target company does not have the documentation currently (Sales A). There should be standard architecture documentation about every detail such as where passwords are stored (Manager B). AMS team should get also contractual knowledge about what has been promised to customers, for instance, SLAs (Manager B). Dataflows are necessary since without any documentation, it takes a while to get the initial source of the issue (AMS developer A & C). Technical documentation consists of technical components, such as what they mean and how a measure is calculated (Developer B).

Project lead C sees that training new AMS team members is mostly through trial and error, and there should be clear rules and procedures for training. Instructions for daily work mean that every process and guideline should be documented for the AMS team (Developer C). AMS's daily work should follow the standards the target company has defined (Developer C). Instructions to customers mean that customers get their version of documents that are needed in their work (Developer C). A template for customer communication would harmonize the current tailored AMS services (Project lead B).

# 7. DISCUSSION

The purpose of this chapter is to discuss empirical results with literature. This chapter aims to interpret empirical results. The ultimate object of knowledge management is to realize knowledge flows (Zahedi et al. 2023). The first sub-chapter presents knowledge-sharing challenges comparing empirical results to literature. The second subchapter discusses how knowledge flows can be enhanced by knowledge management. The third subchapter presents knowledge management practices supporting the knowledge needs of the operators. The last subchapter enriches the theory-based framework with empirical results.

## 7.1 Knowledge sharing challenges

Easiness of knowledge sharing depends on situations and affecting factors are documentation, responsible people, the target company not focusing AMS process, the amount of knowledge being huge, the gap between sales and handover, personal attitude, commitment, tools, ways of working, cooperation, transparency, two-way communication, and IT systems. All these factors can be recognized in the framework created by Lin et al. (2012). This subchapters answers to the first sub-research question:

*What kind of knowledge-sharing challenges the are in the process?*

The definition of AMS varied between interviewees so there is no common definition of AMS or knowledge sharing about what AMS is. AMS has been evolving based on customer needs and it is not a complete service yet, customers' needs steer AMS still. AMS differs between customers and some customer gets AMS-like support from the project team. It is implicit that the ambiguity of the AMS definition is present in the target organization. Ambiguity of knowledge is defined as a barrier to knowledge flow (Lin et al. 2012). Ambiguity caused by a variety of AMS solutions affects work efficiency also.

Documentation does not support knowledge sharing since there are challenges in quality, accessibility, and absence of codified knowledge. Documentation quality issues are that documentation is not updated or a part of the documentation is completely missing, therefore documented knowledge is non-validated and that implements a barrier of non-validated knowledge (Lin et al. 2012). Accessibility means that if some documentation is needed, it is typically needed to ask someone where the documentation can be

found. Accessibility appears because of time and resource constraints, lack of coordination between units, lack of spaces to share, and lack of IT systems and processes (Lin et al. 2012).

Missing information in tickets challenges AMS to create knowledge on the issue. That may be caused by different languages, context differentiation, unwillingness to devote time and resources to sharing knowledge, and poor communication skills. Terminology, exceptions, and people cause difficulties for the AMS team to understand the environment fully and can be recognized the barriers of overly technical terminology, difficult relationships, differences in experience level, lack of awareness, lack of spaces to share, time and resource constraints, and context differentiation (Lin et al. 2012).

Business logic and data lineage are difficult to understand, and it is caused by low-quality handovers and challenges in documentation. Handovers are poor due to the non-existent coherent handover process and knowledge transfer processes. Some projects are completely undocumented. Recognizable barriers are lack of spaces to share, time and resource constraints, lack of leadership, lack of complete or standard regulations, non-adequately rewarded, low awareness and realization of knowledge sharing, and lack of tangible mechanisms (Lin et al. 2012).

The gap between the AMS contract and the AMS handover creates a knowledge gap. As well, AMS contracts are typically signed at the end of the project, and then AMS needs are not considered during the project. That creates challenges in knowledge sharing between the AMS team and project team and barriers of low awareness and realization of knowledge sharing, time and resource constraints, lack of complete or standard regulations, and lack of coordination between units can be recognized (Lin et al. 2012).

Some customers do not understand what can be expected from the project team, and the reason is communication. As well, the AMS team does not always know what customer expects from the AMS team. Poor communication skills, lack of contact time and interaction, and context differentiation are barriers recognized in understanding the expectations (Lin et al. 2012).

Processes do not support knowledge sharing. For instance, learning processes are not clear and documented and that leads to non-existing knowledge about them. If the process were documented, then documentation and the process itself would be enhanced by other operators also. Interviewees noted that personal characteristics and skills affect training methods effectivity. Lack of tangible and intangible mechanisms, organizational incentives, and complete or standard regulation are the barriers to processes (Lin

et al. 2012). AMS is not managed properly, and ownership and concreteness are lacking. Knowledge about AMS management is not visible in the target company. That is caused by a barrier lack of leadership (Lin et al. 2012). AMS performance measurement is challenging without proper service management structures since the data is fragmented into different systems. Data fragmentation causes a barrier to the lack of integration of IT systems (Lin et al. 2012).

The sales process has challenges in describing AMS to customers since AMS is not defined and documented in the target company, and customer needs are not always understood. The barriers in sales are poor communication skills, lack of complete or standard regulations, and lack of tangible mechanisms. Knowledge barriers in sales are based on AMS process ambiguity and therefore all existing knowledge barriers create challenges to AMS sales.

Three factors affecting knowledge inefficiency defined by Davenport and Prusak (1998, 40) are incomplete information about the knowledge market, knowledge asymmetry, and locality of knowledge. All mentioned three factors are discovered in the AMS process of the target company. The target company's employees do not know where they find existing knowledge. Knowledge asymmetry is visible between sales and the AMS team, for instance. Sales know what they have sold but the knowledge does not flow to the AMS team. Some interviewees noted that typically knowledge is shared with people near themselves, and that causes locality of knowledge.

The target organization can maximize the value of knowledge assets by removing the identified barriers to knowledge and knowledge flows. Knowledge is the core asset of AMS and therefore the target organization should manage it (Zack 1999).

## 7.2 Knowledge flows

Chapter 6.1 presented the knowledge flows of AMS. Easiness of knowledge sharing depends on the situation. However, challenges in knowledge sharing were identified as well (e.g. Sales A, Project lead C). Figure 17 presents knowledge management activities that could support knowledge flows between the AMS operators. Knowledge management activities are identified based on Figure 10 which describes knowledge flows between the operators. This subchapter answers the second sub-research question:

*How does knowledge management enhance knowledge flow between the operators?*

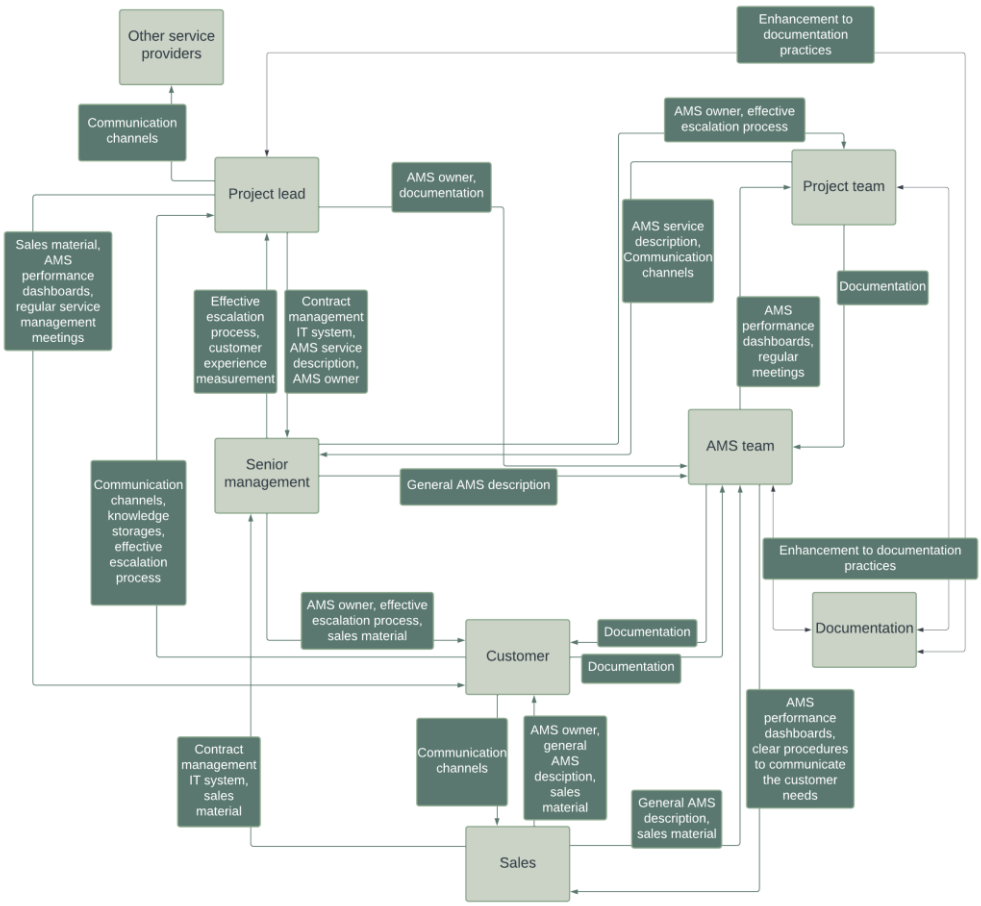


***Figure 17.*** *Knowledge management incentives that support knowledge flows*

The next description of the Figure 17 is structured by the themes arising from Figure 17. The identified themes are IT, documentation, and leadership. More detailed level knowledge management incentives are presented in the upper level themes in the following paragraphs.

Wise use of IT may help in knowledge flows (Davenport & Prusak 1998, 45). Communication channels, knowledge storage, and contract management IT systems are identified as IT systems that ease knowledge flows. A contract management system would help to share the knowledge about AMS contracts, and therefore it would ease knowledge flows between project lead, sales, and senior management. Knowledge storage would save documentation in one place. Also, knowledge flows between sales and project leads would be enhanced if the knowledge is always stored in a place where the knowledge can be found later on.

Communication channels assist knowledge flows between the target company's operators and customers or other service providers. However, clear communication channels would ease knowledge flows between the target company's internal operators. Even

though there would be communication channels in AMS, there should be clear procedures to communicate. For instance, the AMS team communicates to sales about customers' needs that the AMS team has noticed. Communicating about customer needs may not be forgotten as easily if clear communication procedures are established. AMS performance dashboards could ease knowledge flows between sales, customers, the AMS team, and project leads since then there would be reliable knowledge easily available regarding the performance of AMS. AMS performance dashboards can be considered as supporting IT systems.

Enhancements to documentation practices are other knowledge management incentives that would assist knowledge flows. Incremental re-documentation improves the understandability of the BI environment and increases the efficiency of the maintenance process (Khanna et al. 2017). The AMS team communicates with customers and project team members when the AMS team needs detailed knowledge about the issues. Repeating or unnecessary knowledge flows would decrease if the environment were documented, and documentation is updated always.

Transforming tacit knowledge into explicit knowledge is noticed in the SECI model as a phase of externalization (Nonaka & Takeuchi 1995, 64–67). Sales material, general AMS description, and AMS service description are mostly in tacit format in the target company. When knowledge is in explicit format, it is possible to share knowledge and create new knowledge with other operators (Nonaka & Takeuchi 1995, 64–67). Sales material would assist the knowledge flows between senior management, sales, project leads, the AMS team, and customers. General AMS description is also knowledge that should be in explicit form and it would support knowledge flows between senior management, AMS team, sales, and customers. Service description in explicit form would create an understanding of what are the tasks of the AMS team and service description would steer the work of the AMS team and support knowledge flows. Sales material, service description, and general AMS description assist also in selling credible promises which is crucial to the target company (Lowendahl 2005, 46)

Lack of leadership is noticed as a barrier to knowledge flow (Riege 2005; Lin et al. 2012). AMS does not have an owner and senior managers spend as little as possible to steer the AMS work. AMS needs an owner. The owner of the AMS would also be responsible for knowledge management of the AMS, so the managemental aspect of AMS is profound. Knowledge flows between the project lead, senior management, AMS team, customers, and sales would ease if AMS had an owner. Currently, project leads are organizing AMS's daily work, and that should be in AMS owner's responsibility.

Regular service management meetings and regular meetings between the AMS team and project team are examples of creating sufficient time and space to share knowledge (Davenport & Prusak 1998, 67; Lin et al. 2012). IT maintenance typically lacks precise work processes (Hou & Zheng 2020). An effective escalation process would be a process that needs generalization and that would support knowledge flows as well between the customer, project lead, senior management, and project team.

## 7.3 Knowledge management practices supporting the knowledge needs of the operators

Knowledge management consists of the processes and methods employed to maximize the value derived from an organization's knowledge assets (Teece 2000). Consulting firms that lack effective knowledge management systems and procedures often find themselves repeating work for different clients, even when there are no restrictions on sharing such information (Teece, 2000). This subchapter answers for the third sub-research question:

*How do knowledge management practices support the knowledge needs of different operators?*

Sales need knowledge about AMS service, such as what is the problem AMS is solving, when to offer AMS to customers, AMS deliverables, pricing, and references. These knowledge needs can be covered by sales material and service descriptions in explicit form. Also, market knowledge is needed by sales and that means competitor knowledge, dominant AMS trends on the market, customer needs and wishers in the market, and understanding customer needs in the target company. SECI model has phases of socialization and combination (Nonaka & Takeuchi 1995, 71). Socialization means that tacit knowledge transforms into new tacit knowledge through communication through social communication, such as meetings (Nonaka & Takeuchi 1995, 62–64). Combination means fetching explicit knowledge from different sources and systemizing the knowledge into new entities (Nonaka & Takeuchi 1995, 67–69). Sales personnel should fetch market data from different sources and communicate with other people to get the needed knowledge. Notable is that market knowledge cannot be fetched only from the target company’s knowledge sources.

Sales also need information about customers: unfilled customers’ needs, customership progress, customer experience, and AMS performance. The process of getting cus-

tomer knowledge may be hindered due to knowledge barriers of unwillingness to devote time and resources to knowledge sharing, lack of coordination between units, and lack of spaces to share (Lin et al. 2012). Customer needs can be understood by regular meetings with customers, and communicating with other operators in the target company that are in contact with the customer. Customer experience can be measured by inquiries. AMS performance can be visualized through a dashboard. Customership progress can be understood by foregoing incentives.

Sales need support from other AMS operators. The needs of the channel, where to confirm changes to the general AMS process and confirmation that the offered AMS solution can be implemented can be fixed by devoting time to sharing knowledge, but also IT can support in the process. There may be a Microsoft Teams channel where to ask any AMS-related questions. The target company should encourage value creation from knowledge (Laihonen 2005, 46), so the developers assist sales when needed.

The AMS team needs knowledge about the AMS as a service: the scope, processes, and ways of working, needed competencies, vision, and ongoing sales proposals. Sales need to share knowledge with the AMS team even before the contract is officially signed, so the AMS team knows what is coming and should they develop their competencies. Other above-mentioned knowledge needs can be fulfilled by creating and sharing service descriptions in explicit format. Also, other needs of the AMS team are responsibilities, customer communication channels, tools and terminology, and transparency of the daily work towards other team members. Transparency can be fulfilled by devoting time and resources and creating a space for knowledge sharing (Lin et al. 2012). Responsibilities, customer communication channels, and tools and terminology should be defined in the AMS contract and that should be available to the AMS team as well. Also, the AMS owner should make sure that everyone in the AMS team knows all the responsibilities and agreed ways of working with the customer.

The AMS team needs knowledge of the environment and customer also: the significance of the environment, business logic, understanding of the development processes, customer contact persons, documentation, customers' supporting processes, and an overview of the customer’s company. As incremental re-documentation improves the understandability of the BI environment and increases the efficiency of the maintenance process (Khanna et al. 2017), and it is noted that the documentation is missing or incomplete often, the documentation practices should be developed. Project teams and the AMS team should devote time and resources to documenting the environment. The documentation should be available, and the AMS team uses Atlassian

Confluence currently for storing and sharing the knowledge. The documentation will address the need for business logic as well. The customer should share the knowledge about all of the contact persons and the company, their supporting processes, and the significance of the environment. A standard knowledge-gathering template from customers during the initiation of the AMS would assist the AMS team in getting all the necessary knowledge. Understanding of the development process should be shared by the project team during the handover.

The project team needs also general AMS knowledge: responsibilities, and AMS as a service, customer needs. Responsibilities are covered by sharing the contractual matters with the project team also, so they know what is in their responsibility. The service description covers the knowledge needed of generally AMS. The project team should absorb customer needs from customers by themselves, but the AMS team should devote time to sharing the knowledge needs as well to the project team (Lin et al. 2012).

Project teams need knowledge from the AMS team, such as issue trends, and essential fixes to an environment, and the AMS team needs documentation. Good knowledge sharing affects the company's success, and the potential value of knowledge is materialized when knowledge flows freely (Davenport & Prusak 1998, 48–49). Therefore, there should be an open and active culture of sharing knowledge between the AMS team and project teams.

Project-related knowledge needs of project teams are preparedness to support the AMS team, preparation for handover, code readability, and standards for programming. Preparedness to support the AMS team means that the project team knows what is in their responsibility, but the knowledge-sharing channels between the AMS team and project teams should be devoted as well. Davenport & Prusak (1998, 97) notes that knowledge is transferred through various channels that support and complement one another.

Managers' knowledge needs differ between the managers. Senior managers need knowledge about how to sell AMS, escalations, customer experience, and performance of AMS daily work. The above suggests that there should be an owner of AMS. That would possibly reduce the knowledge needs of senior managers, since then AMS is the owner's responsibility. However, still, senior managers would want to know at least at the general level about the needs. The needs can be covered by AMS performance dashboards, sales material, and customer experience inquiries. Escalations should be carried through the AMS owner. IT maintenance typically lacks precise work processes (Hou & Zheng 2020). An effective escalation process should be defined and that would

support the knowledge needs of the management as well. Also, it would be wise to devote time and space to sharing knowledge between the AMS owner and senior management.

Technical service manager needs knowledge about AMS generally, the context of the customer environments, and the latest knowledge on all customers. General AMS knowledge can be devoted by service description since then the knowledge is in explicit format and the technical service manager can fetch the knowledge through the SECI model's phase of internalization where explicit knowledge is formed to tacit knowledge (Nonaka & Takeuchi 1995, 69–70). Context of the customer environments should be absorbed from the customer or AMS owner through communication by the technical service manager. Technical service manager absorbs the latest knowledge of all customers through socialization with the AMS team (Nonaka & Takeuchi 1995, 62–64).

Service managers are currently project managers, and they need knowledge about daily work, the AMS team's support needs, AMS performance, general AMS knowledge, upcoming updates, and customer needs. General AMS knowledge should be addressed by service description and performance by a dashboard, as justified above already. The AMS team and service managers should devote time and space to discussing the AMS team's support needs and daily work. Service managers already have a process to get knowledge about upcoming updates to infrastructure. However, the process should be shared with all the service managers, so the ways of working are coherent. Customer needs should be gathered via recurring meetings with the customer.

Customers' general knowledge needs are documentation, processes, and how to contact AMS and AMS resourcing. These can be covered by the AMS service description that is shared with customers. Resourcing should be defined in the contract at a precise level as well as customers' responsibilities should be addressed in the contract. Customers need to know continuous development and future needs. Continuous development means that customers want to know that AMS as a service is evolving constantly. Future needs mean that customers need to know upcoming changes in the infrastructure or environment. Service managers should proactively devote time to sharing knowledge with customers. Sales personnel and service managers should also help the customer to understand the value of AMS. Different support options should also be shared with customers as well, so they know the possibilities to fine-tune the supporting contract with the target company.

Customers need transparent knowledge from the AMS team about incidents, performance, and documentation. Knowledge about incidents and documentation should be shared with the customer so the customer can learn as well. There should be tangible mechanisms, and devoted spaces to share the knowledge (Lin et al. 2012). AMS performance can be shared via a dashboard already mentioned, but also during meetings.

Most of the knowledge needs regarding documentation are covered already. However, as a summary, many documents should be created, maintained, and shared with the necessary people. General documentation needs are sales material, process description, and pricing model. As well documented instructions to customers and the AMS team are needed since they steer the daily work. AMS personnel training process should be also documented so onboarding new team members is efficient. Also, a documented customer communication template and handover process would ease the operational work of the AMS team. Environmental documentation is needed as well and it should cover reoccurring issues, data flows, and technical documentation. The standardized documentation assists in learning and transferring the knowledge into future AMS services. Learning and transferring gained new knowledge in future projects creates value (Lowendahl 2005, 47).

## 7.4 Knowledge management in BI systems maintenance services

Chapters 7.1 – 7.3 presented how knowledge flows can be supported by knowledge management, knowledge sharing barriers, and knowledge management practices supporting AMS and therefore answered sub-research questions. This chapter answers the main research question:

*How could knowledge management support BI systems maintenance services?*

Figure 4 in Chapter 4.2 concludes theory-based view of how knowledge management enriches BI systems maintenance services: select knowledge management strategy, create knowledge management vision, identify knowledge and knowledge flow barriers, and solve the barriers identified to get maximized value of knowledge assets. The general-level plan of action to support BI systems maintenance services with knowledge management is enriched with the empirical results and is presented in Figure 18.

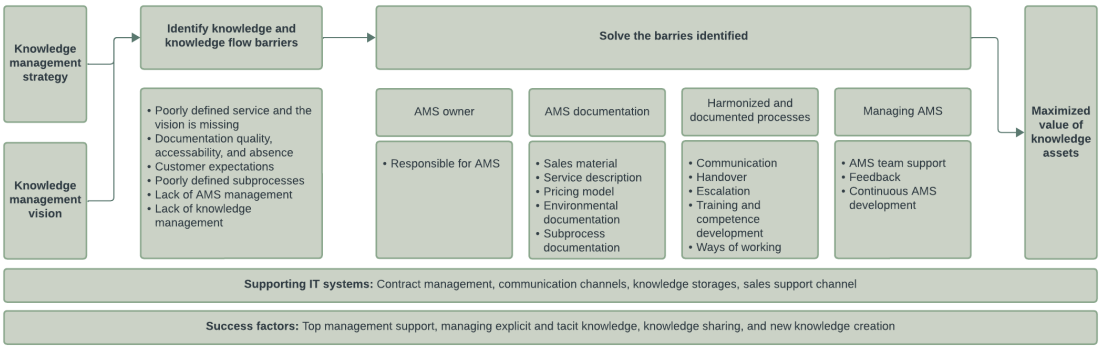


***Figure 18**. Updated version of the process of how to improve BI systems maintenance services with knowledge management*

Knowledge management strategy and vision were not in the scope of the empirical study and therefore the phases are not enriched with any empirical results. However, theory suggests that knowledge management strategy should integrate personalization and codification strategies. Also, it is essential to select a knowledge management strategy that reflects an organization's competitive strategy (Smith 2004). Theory conclusions suggest that the long-term vision in BI systems maintenance services is to manage knowledge as effectively as possible to create economic value. Short term vision is to remove barriers and maximize the value of knowledge assets through process and method development (Lin et al. 2012; Teece 2007).

Figure 18 presents knowledge and knowledge flow barriers identified during the empirical study. The barriers identified are in themes: poorly defined service and the vision is missing, documentation quality, accessibility, and absence, customer expectations, poorly defined subprocesses, lack of AMS management, and lack of knowledge management. Knowledge management incentives that solve the identified barriers are in themes: AMS owner, AMS documentation, harmonized and documented processes, and managing AMS. Chapters 7.1 – 7.3 present the barriers and suggested knowledge management incentives on a detailed level and with reasons.

Supporting IT systems are contract management, communication channels, knowledge storage, and sales support channel. Supporting IT systems are as well identified based on empirical research and the reasoning for these is presented in Chapters 7.1 – 7.3. Success factors are top management support, managing explicit and tacit knowledge, knowledge sharing, and knowledge creation. The success factors are based on the theory's conclusions.

Figure 18 presents the high-level framework for the target organization, how to enhance AMS with knowledge management, and get the maximized value of knowledge assets. The purpose of codifying knowledge is to get the knowledge into an accessible

form where it is available to those who need it (Davenport & Prusak 1998, 68). Strategic knowledge management is about strategically codifying and personalizing both explicit and tacit knowledge in organizations to increase overall performance (Venkitachalam & Willmott 2017). Learning and transferring gained new knowledge in future projects as well is a value-creation process for organizations (Lowendahl 2005, 47). However, knowledge management may be difficult since knowledge often resides in employees, and they may be likely to resist attempts to codify the knowledge (Valtakoski & Järvi 2005). The next steps for the target organization are to understand the value of knowledge residing in AMS and then enhance AMS processes from a knowledge management point-of-view by the suggestions of this study.

# 8. CONCLUSIONS

The study aimed to research how knowledge management would enrich BI continuous maintenance services. This chapter presents a summary of the study, research evaluation, the novelty value of the study, and suggestions for future research.

## 8.1 Summary

BI aims to support decision-making in organizations (Lim et al. 2012). Continuous BI services keep BI environments working after the development of BI functionality has ended (Gupta et al. 2019). ITSM is a management approach where IT service is at the center and the aim is to provide value to IT service customers (Mora et al. 2022).

Knowledge is the core asset of consultancies and that is the reason why they were one of the first businesses that paid attention and made investments in knowledge management (Zack 1999; Hansen et al. 1999). Knowledge management consists of the processes and methods employed to maximize the value derived from an organization's knowledge assets (Teece 2000).

The research problem was to understand the status of BI systems maintenance services and how to develop them. The scope of the study was knowledge management. The aim was to understand knowledge management incentives that would assist in the target company’s BI systems maintenance services, and how they would assist.

Knowledge management and ITSM are both management approaches, and they should be implemented together (Baradari et al. 2023). Although, knowledge management is not researched in the context of BI service management. The study creates a theory-based framework that can be utilized in understanding how knowledge management enriches BI systems maintenance services. Knowledge management strategy and vision should be formulated first. After that, knowledge and knowledge flow barriers should be recognized in the BI systems maintenance service. The value of knowledge assets is maximized after the recognized barriers are solved. Knowledge management success factors and IT systems support knowledge management incentives during the process.

The study enriches the theoretical framework with empirical results. Knowledge management strategy and vision were not in the scope of the empirical study; however, theory conclusions suggest that knowledge management strategy should integrate personalization and codification strategies. The long-term vision in BI systems maintenance services is to manage knowledge as effectively as possible to create economic value. Short term vision is to remove barriers and maximize the value of knowledge assets through process and method development (Lin et al. 2012; Teece 2007).

Identified knowledge and knowledge flow barriers are recognized in themes: poorly defined service and the vision is missing, documentation quality, accessibility, and absence, customer expectations, poorly defined subprocesses, lack of AMS management, and lack of knowledge management. Knowledge management incentives that solve the identified barriers are in themes: AMS owner, AMS documentation, harmonized and documented processes, and managing AMS.

Supporting IT systems are contract management, communication channels, knowledge storage, and sales support channel. Success factors are top management support, managing explicit and tacit knowledge, knowledge sharing, and knowledge creation. It is supposed that the results of the study will be implemented in the target company's BI systems maintenance service. The study provides an understanding of the AMS process to the target organization but also contributes to the literature. The research area combining knowledge management and BI systems maintenance services has not been researched before.

## 8.2 Research evaluation

There are different research evaluation methods presented in the literature. Lincoln and Guba (1985) have formulated criteria of dependability, credibility, transferability, and authenticity criteria. The evaluation criterion is similar to the evaluation method including criteria of reliability and validity, but the four criteria method by Lincoln and Guba (1985) is in a qualitative research context. Authenticity criteria are not evaluated due to authenticity criteria are designed for constructivist and interpretivist research. (Saunders et al. 2019, 216–217)

Dependability refers to the reliability of recording every alteration to create a trustworthy record of the evolving research focus, which can be comprehended and assessed by others (Saunders et al. 2019, 217). The study describes the methodology, research

setting, data collection, and data analysis comprehensively so the readers can understand and evaluate the study.

Credibility emphasizes ensuring that the research participants' socially constructed realities match with the participants' intended. Multiple techniques assist in enduring credibility. Trust and relations are built through lengthy research involvement which leads to collecting sufficient research data. Fundamental analysis considers negative cases by refining the analysis to produce an explanation of the phenomenon being studied. Make sure that the researcher's expectations are not privileged over by recording the expectations and challenging them during data analysis. Checking data, analysis, and interpretations with participants. Reflection is used with another person on ideas and testing out findings. (Saunders et al. 2019, 217) The researcher was new in the target company and case, so there were no expectations of study results. Different people in the organization were interviewed, so different interests and perspectives were present. As well, the data, analysis, and interpretations were discussed during the study with a couple of participants of the study. The researcher had relations with 14 of the interviewees at the time of the interview, so trust and relations were present.

Transferability of the study into different settings is provided to a reader by providing a complete description of the research question, design, context, findings, and interpretations (Saunders et al. 2019, 217). The research questions are presented with background information. Design and context are presented through methodology, case description, research setting, data collection methods, and data analysis methods. Interpretations are based on interview results and theory, and these are presented thoroughly in the study.

Qualitative research is not necessarily intended to be replicated since the interpretations tend to be related to the social context, but research design description, context, and methods could help other researchers conduct similar research (Saunders et al. 2019, 216). As stated above, the possibility of undertaking similar research is presented in the study.

## 8.3 Theoretical implications

BI systems maintenance services enriched with knowledge management are missing in the literature, but as well research about BI systems maintenance services is lacking. The theory utilized from the existing literature is about BI, IT, and ITSM, so it was possible to describe a coherent theory. As a result of the literature review, a summarizing

knowledge management framework was created. The framework was utilized in the target company's case to identify knowledge and knowledge flow barriers.

ITSM should be enriched with knowledge management (Baradari et al. 2023). ITIL notices knowledge management as a source of continual value co-creation, but knowledge management is not considered in ITIL extensively (Agutter & Villa 2022). Therefore, the study completes the existing ITSM literature from BI point-of-view since the case was about BI systems maintenance service. The results of the study provided a general framework combining knowledge management into BI systems maintenance services, but also enriched the literature with a case. The presented framework provides a general understanding of knowledge management in BI systems maintenance services but also provides concrete examples of knowledge management incentives in the BI systems maintenance context.

## 8.4 Suggestions for future research

The study creates a new general framework, and future research could concentrate on validating the research results of this study, for example by different cases. The created framework is high-level, and it can be also researched on a detailed level. Future research may concentrate for example on IT systems that can support knowledge flows in BI systems management. As well, the case of the study was about BI maintenance service, and it would be beneficial to research if the results of this study can be generalized into general IT in service management field.

Typical knowledge and knowledge flow barriers in BI systems maintenance services would be another future research idea. As well, studying detailed levels of how to solve the knowledge and knowledge flow barriers found would be consequential. The research area of BI systems maintenance services enriched by knowledge management was completely unresearched before this study, so there are plenty of future research possibilities.

# REFERENCES


Ackoff, R.L. (1988). From data to wisdom. Journal of Applied Systems Analysis, 16(1) 3-9.

Agutter, C. (2020). ITIL® 4 Essentials: *Your essential guide for the ITIL 4 Foundation exam and beyond, second edition* (Second Edition edition). IT Governance Publishing. https://doi.org/10.2307/j.ctv10crcdh

Agutter, C., & Villa, K. (2022). *ITIL® 4 Drive Stakeholder Value (DSV): Your companion to the ITIL 4 Managing Professional DSV certification (1st ed.).* IT Governance Publishing.

Aydin, M. N., & Bakker, M. E. (2008). Analyzing IT maintenance outsourcing decision from a knowledge management perspective. *Information Systems Frontiers,* 10(3), 293–305. https://doi.org/10.1007/s10796-008-9084-5

Baldé, M., Ferreira, A. I., & Maynard, T. (2018). SECI driven creativity: the role of team trust and intrinsic motivation. *Journal of Knowledge Management*, 22(8), 1688-1711. https://doi.org/10.1108/JKM-06-2017-0241

Baradari, I., Shoar, M., & Nezafati, N. (2023). Defining the relationship between IT Service management and knowledge management: towards improved performance. *Knowledge Management Research & Practice,* 21(2), 384–396. https://doi.org/10.1080/14778238.2021.1903349

Trusson, C. R., Doherty, N. F., & Hislop, D. (2013). Knowledge sharing using IT service management tools: conflicting discourses and incompatible practices: Knowledge sharing in ITSM. *Information Systems Journal* (Oxford, England), 24, 347–371. https://doi.org/10.1111/isj.12025

Crossan, M. M., Lane, H. W., & White, R. E. (1999). An Organizational Learning Framework: From Intuition to Institution. *The Academy of Management Review*, 24(3), 522–537. https://doi.org/10.2307/259140

Davenport T. & Prusak, L. (1998). *Working Knowledge: How Organizations Manage What They Know*. Harvard Business School Press.

Denford, J. S. & Chan, Y. E. (2011). Knowledge straregy typologies: defining dimensions and relationships. *Knowledge Management Research & Practice*, 9, 102-119.

Earl, M. (2001). Knowledge Management Strategies: Toward a Taxonomy. *Journal of Management Information Systems*, 18(1), 215–233. https://doi.org/10.1080/07421222.2001.11045670

Eriksson, P, and Anne Kovalainen. *Qualitative Methods in Business Research*. Second edition. London: SAGE Publications, 2008. Web.

Farnese, M. L., Barbieri, B., Chirumbolo, A., & Patriotta, G. (2019). Managing knowledge in organizations: A nonaka's SECI model operationalization. *Frontiers in Psychology,* 10, 2730–2730. https://doi.org/10.3389/fpsyg.2019.02730

Flyvbjerg, B. (2006). Five Misunderstandings About Case-Study Research. *Qualitative Inquiry*, 12(2), 219–245. https://doi.org/10.1177/1077800405284363

Gupta, P., Mehlawat, M. K., & Mahajan, D. (2019). Multi-objective optimization framework for software maintenance, component evaluation and selection involving outsourcing, redundancy and customer to customer relationship. *Information Sciences*, 483, 21–52. https://doi.org/10.1016/j.ins.2019.01.017

Hansen, M. T., Nohria, N., & Tierney, T. (1999). What's your strategy for managing knowledge? *Harvard business review*, 77(2), 106–187.

Hou, L., & Zheng, W.-J. (2020). A Latent Class Regression Approach to IT Maintenance Outsourcing Service Management. *IEEE Transactions on Engineering Management*, 67(1), 81–91. https://doi.org/10.1109/TEM.2018.2864979

Iden, J., & Eikebrokk, T. R. (2013). Implementing IT Service Management: A systematic literature review. *International Journal of Information Management*, 33(3), 512–523. https://doi.org/10.1016/j.ijinfomgt.2013.01.004

Jasimuddin, S.M., Klein, J.H. & Connell, C. (2005). The paradox of using tacit and explicit knowledge: Strategies to face dilemmas. *Management Decision*, 43(1), pp. 102-112. https://doi.org/10.1108/00251740510572515

Jäntti, M. (2012). Improving IT Service Desk and Service Management Processes in Finnish Tax Administration: A Case Study on Service Engineering. In *PROFES* (pp. 218–232). Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-642-31063-8_17

Khanna, S., Shah, A., Jain, S., & Ramanathan, L. (2017). Software Maintenance: Challenges and Issues and Models for Reducing the Maintenance Cost. *International Journal of Advanced Research in Computer Science*, 8(3).

Kumar, J.A. & Ganesh L.S. (2011). Balancing knowledge strategy: codification and personalization during product development. *Journal of Knowledge Management*, 15(1), 118-135. https://doi.org/10.1108/13673271111108738

Li, S.-H., Yen, D. C., Lu, W.-H., & Chen, T.-Y. (2014). The characteristics of information system maintenance: an empirical analysis. *Total Quality Management & Business Excellence*, 25(3-4), 280–295. https://doi.org/10.1080/14783363.2013.807679

Lin, C., Wu, J.-C., & Yen, D. C. (2012). Exploring barriers to knowledge flow at different knowledge management maturity stages. *Information and Management*, 49(1), 10–23. https://doi.org/10.1016/j.im.2011.11.001

Lim, E.-P., Chen, H., & Chen, G. (2013). Business Intelligence and Analytics: Research Directions. *ACM Transactions on Management Information Systems*, 3(4), 1–10. https://doi.org/10.1145/2407740.2407741

Løwendahl, B. R. (2005). *Strategic Management of Professional Service Firms* (3rd ed.). Samfundslitteratur.

MacLean, D., & Titah, R. (2023). Implementation and impacts of IT Service Management in the IT function. *International Journal of Information Management*, 70, 102628-. https://doi.org/10.1016/j.ijinfomgt.2023.102628

Mora, M., Marx Gómez, J., Garrido, L., & Pérez, F. C. (2013). Knowledge Management in ITSM: Applying the DIKW Model. In *Engineering and Management of IT-Based Service Systems* (Vol. 55, pp. 1–18). Springer Berlin / Heidelberg. https://doi.org/10.1007/978-3-642-39928-2_1

Mohamed, M. S., Ribière, V. M., O'Sullivan, K. J., & Mohamed, M. A. (2008). The re-structuring of the information technology infrastructure library (ITIL) implementation using knowledge management framework. VINE. Very Informal Newsletter on Library Automation, 38(3), 315–333. https://doi.org/10.1108/03055720810904835

Mora, M., Marx Gomez, J., Reyes-Delgado, P. Y., & Adelakun, O. (2022). An integrative agile ITSM framework of tenets and practices – its design and exploratory utilization. *Journal of Organizational Computing and Electronic Commerce,* 32(2), 99–129. https://doi.org/10.1080/10919392.2022.2068905

Nonaka, I., & Konno, N. (1998). The Concept of "Ba": Building a Foundation for Knowledge Creation. *California Management Review*, 40(3), 40–54. https://doi.org/10.2307/41165942

Nonaka, I. & Takeuchi, H. (1995) *The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of innovation*. Oxford University Press.

du Plessis, M. (2007). Knowledge management: what makes complex implementations successful? *Journal of Knowledge Management,* 11(2), 91–101. https://doi.org/10.1108/13673270710738942

Popadiuk, S. and Choo, C.W. (2006). Innovation and knowledge creation: how are these concepts related? *International Journal of Information Management*, 26(4), 302-312. https://doi.org/10.1016/j.ijinfomgt.2006.03.011

Polanyi, M. (2009). *The tacit dimension, with a new foreword by Amartya Sen*. University of Chicago Press

Riege, A. (2005). Three-dozen knowledge-sharing barriers managers must consider. *Journal of Knowledge Management,* 9(3), 18–35. https://doi.org/10.1108/13673270510602746

Rowley, J. (2007). The wisdom hierarchy: representations of DIKW hierarchy. *Journal of Information Science*, 33(2), 163-180. https://doi.org/10.1177/0165551506070706

Saunders, M., Lewis, P., & Thornhill, A. (2019). *Research methods for business students*. (8th ed.). Pearson Education, Limited.

Smith, A. D., 2004. Knowledge management strategies: a multi-case study. *Journal of Knowledge Management*, 8(3), 6-16. https://doi.org/10.1108/13673270410541006

Teece, D. J. (2000). Strategies for Managing Knowledge Assets: the Role of Firm Structure and Industrial Context. *Long Range Planning*, 33(1), 35–54. https://doi.org/10.1016/S0024-6301(99)00117-X

twoday. (n.d.). *Meistä*. Retrieved 16.2.2024 from https://www.two-day.fi/meista?_gl=1*ffau73*_up*MQ..&gclid=EAIaIQob-ChMI6oWa3rCvhAMVmAWiAx0WgQCuEAAYASABEgJk5fD_BwE

Valtakoski, A., & Järvi, K. (2016). Productization of knowledge-intensive services: Enabling knowledge sharing and cross-unit collaboration. *Journal of Service Management,* 27(3), 360–390. https://doi.org/10.1108/JOSM-01-2015-0004

Venkitachalam, K. & Willmott, H. (2016). Determining strategic shifts between codification and personalization in operational environments. *Journal of Strategy and Management*, 9(1), 2-14. https://doi.org/10.1108/JSMA-09-2014-0082

Venkitachalam, K., & Willmott, H. (2017). Strategic knowledge management—Insights and pitfalls. *International Journal of Information Management*, 37(4), 313–316. https://doi.org/10.1016/j.ijinfomgt.2017.02.002

Zack, M. H. (1999). Developing a Knowledge Strategy. *California Management Review,* 41(3), 125–145. https://doi.org/10.2307/41166000

Zhuge, H. (2002). Knowledge flow management for distributed team software development. *Knowledge-Based Systems*, 15(8), 465–471. https://doi.org/10.1016/S0950-7051(02)00031-X

Watson, H. J. (2009). Tutorial: Business Intelligence – Past, Present, and Future. *Communications of the Association for Information Systems*, 25, 39–. https://doi.org/10.17705/1CAIS.02539

Winkler, T. J., & Wulf, J. (2019). Effectiveness of IT Service Management Capability: Value Co-Creation and Value Facilitation Mechanisms. *Journal of Management Information Systems, 36(2)*, 639–675. https://doi.org/10.1080/07421222.2019.1599513

Winniford, M., Conger, S., & Erickson-Harris, L. (2009). Confusion in the Ranks: IT Service Management Practice and Terminology. *Information Systems Management*, 26(2), 153–163. https://doi.org/10.1080/10580530902797532

Zahedi, M. R., Naghdi Khanachah, S., & Papoli, S. (2023). Identifying and prioritizing the factors affecting the knowledge flow in high-tech industries. *Journal of Science and Technology Policy Management.* https://doi.org/10.1108/JSTPM-01-2021-0011

# APPENDIX A: THE INTERVIEW FRAME FOR INTERNAL OPERATORS OF THE TARGET COMPANY

Theme 1: Basic information

1. What is your role in twoday?
2. How long you have been in a job relationship with twoday?
3. How would you describe AMS?
4. What is your relationship with AMS?
5. What AMS-related tasks do you do?
6. How long you have worked with AMS-related tasks?
7. Which AMS customers and projects you are related to and in what role?

Theme 2: AMS basics

1. What do you consider as the stakeholders of AMS?
2. What do you consider as the subprocesses of AMS?
3. What do you consider as the factors (e.g., subprocesses, ways of working) that work well in AMS?
4. What do you consider as the factors (e.g., subprocesses, ways of working) that need improvement in AMS?
5. What is your opinion on the management side of AMS currently?
    a. What about the future needs?
6. Who are AMS-related people you communicate with and what are the matters you communicate?
    a. Inside twoday
    b. Outside twoday

Theme 3: AMS daily work

1. How are projects transferred from the project team to the AMS team?
    a. A project as a whole or after each sprint etc?
2. How AMS team orientate to a new project?
    a. How long does it take to orientate to a new project?
3. What are the challenges in getting a new AMS project and orientating to it?
    a. Are there challenges in understanding business logic?
4. How do you describe the ideal transition from project team to AMS team?
5. How new AMS team members are trained?
    a. Are there any challenges?

Theme 4: Knowledge

1. What is relevant AMS-related knowledge to you?

2. What do you consider as important knowledge to others in AMS?
3. Where do you find the knowledge needed?
4. Who are the people you ask for help?
5. How often do you need to gain new knowledge?
6. Is it easy or hard to find the proper knowledge in each situation?
    a. Why?
7. What kind of challenges you have faced when you have AMS-related knowledge needs?

Theme 5: Knowledge needs

1. What are your common knowledge needs related to AMS?
2. What do you consider as knowledge needs of AMS customers?
3. What do you consider as knowledge needs of the project team?
4. What do you consider as knowledge needs of the AMS team?
5. What do you consider as knowledge needs of AMS technical service manager?
6. What do you consider as knowledge needs of sales?
7. Has any knowledge needs been identified and solved yet?
    a. What?
8. Do you need knowledge about more general level knowledge about what is twoday's strategy for AMS?
9. Do you know every time your responsibilities in AMS-related things?

Theme 6: Knowledge flows

1. How do you share AMS-related knowledge?
    a. How often do you share AMS-related knowledge?
2. What is the ratio between getting new AMS-related knowledge in written format and communicating with people?
3. What codified knowledge do you utilize?
4. Do you store AMS-related knowledge in written format?
5. Do you help colleagues to get new AMS-related knowledge through communication?
6. How often do you communicate with customers about AMS-related matters?
    a. What is the aim of the communication?
7. Which channels do you use for knowledge sharing on AMS-related matters?
    a. What are the technical systems used in knowledge sharing?
8. What kind of AMS knowledge-sharing challenges you can recognize generally?

Theme 7: Ideal AMS

1. What activities you would develop in AMS?
2. What activities are working in the current AMS?
3. Do you have anything else to add about AMS?

# APPENDIX B: THE INTERVIEW FRAME FOR CUSTOMERS OF THE TARGET COMPANY

Theme 1: Basic information

1. What is your role in your company?
2. What is your role regarding twoday?
3. How long have you been in contact with twoday regarding maintenance services?
4. What tasks related to AMS do you perform?
5. How would you describe the AMS service provided by twoday?

Theme 2: Daily operations in AMS

1. Who do you consider as stakeholders in AMS?
2. What do you see as subprocesses in AMS?
3. Have you been satisfied with the AMS service you receive from a daily operations perspective?
    a. What factors have influenced your satisfaction?
4. How do you perceive the error resolution process?
5. How do you perceive the administrative side of AMS?
6. What would you like to see added to the AMS service?
7. Are there any matters you have provided feedback on twoday about?

Theme 3: Knowledge and its dimensions

1. What kind of AMS-related knowledge do you share in your work?
2. What kind of AMS-related knowledge do you need in your work?
3. With whom do you share AMS-related information?
4. What AMS-related issues do you communicate with twoday about?
5. How do you communicate with twoday regarding AMS-related matters?
6. Do you feel that twoday and your company have a common understanding of AMS?
7. What challenges in sharing AMS-related information can you identify?
8. Has communication been successful?

Theme 4: Expectations and areas for development in AMS & customer experience

1. What do you consider as well-functioning parts of AMS?
2. What needs to be related to AMS do you have that have not been addressed by twoday?
3. What would you improve in AMS?
4. What are your expectations for the AMS service?
5. Is there anything else to add regarding AMS?