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Identification and management of knowledge gaps across ITIL services

MASTER´S THESIS

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Declaration

I hereby declare that I am the sole author of the thesis entitled “Identification and management of knowledge gaps across ITIL services”. I duly marked out all quotations. The used literature and sources are stated in the attached list of references.

In Prague on June 10th, 2019

Signature

Olga Smirnova

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Abstract

Knowledge management offers a wide range of benefits such as improving the collaboration between teams, divisions and hubs. It also increases employee and service productivity, helps develop knowledge for future research as well as increases customer satisfaction. This is especially true when it brings to enterprise organizations the ability to control, share, update, reuse and benefit from this knowledge. It also helps to understand the existing knowledge gaps and implement solutions to reduce the level of impact on the current and future operations of the organization.

For the purpose of anonymity, the name of the organization where the research study was performed is blinded and will be referred to as Telecom company XYZ. To maintain the privacy of the given company the profile will be described just very briefly so there is no chance it can be identified.

The main objective of this diploma thesis is an evaluation of the current state of the ITIL service management processes using ITIL 2007 edition (previously known as ITIL Version 3) in a given Telecom company XYZ. It should be noted that ITIL 2007 Edition is the one predominately used in most companies today. There is a newer version ITIL 4 Edition that was just released in February 2019. Companies are still assessing improvements and changes but regardless the work completed for this thesis remains relevant. The goal is to identify the areas for improvement for extending the value of ITIL service management processes by using the knowledge mapping concept and knowledge mapping tool and techniques. To identify the areas for improvement, a knowledge gap analysis will be performed. It will help companies understand the importance of establishing a knowledge mapping process as a continuous process that allows a company to manage and control the knowledge gaps inside IT services of Telecom company XYZ that operates based on ITIL 2007 edition framework. The goal will be to identify the knowledge gaps across ITIL services, to demonstrate the examples of knowledge gaps that were identified and the proposal to eliminate them.

Keywords

ITIL, service, process, ITIL processes, Knowledge, Knowledge Mapping, KM, Knowledge management, Knowledge gap, Knowledge management process, Knowledge Mapping process, Knowledge mapping tool, Knowledge map, Knowledge Asset, Critical Knowledge.

Content

1. Chapter 1 Introduction

1.1 Topic Definition

In the modern economy and technology era, knowledge plays an important role for organizations to gain a competitive advantage and achieve their business objectives. Knowledge has become the fundamental resource that allows organizations to function intelligently (Wiig, 1995) as well as become "*the factor that creates value for the organization*" (Wiig, 1993) and become "*the most valuable asset that an organization has*" (Wiig, 1993). From a business prospective "*knowledge is what employees know about work-related disciplines, products, processes, their customers, one another, mistakes, and successes*" (APQC, 2018).

Knowledge should be viewed as one of the main components required for a company to succeed. It also gives an advantage for companies to create strategic decisions and successful competition in the market. This ability to manage knowledge assets has become more important in the modern economy. The evidence is expressed in the exorbitant number of books, articles, definitions, theoretical material and the practical case studies that have been created about Knowledge and Knowledge management topics.

Managers are trying to find an effective way to extract value from knowledge assets in their organizations (Wiig, 1997) as well as "*to manage knowledge to the best advantage for their business***"** (Wiig, 1986). "*Opportunities for building, creating, deploying, exploiting, and controlling- i.e. managing knowledge - are becoming increasingly important in today's business and technical environments***"** (Wiig, 1986). The important goal of Knowledge management is to help organization to gain the value from the knowledge assets that organizations have (Wiig, 1997) in order to help them to solve business problems (APQC, 2019).

Nowadays many companies execute knowledge management systems. In order to create an effective knowledge management strategy, companies need to understand what knowledge they possess and where they do not have enough expertise. A Knowledge mapping processes is an effective framework/technique for this purpose. It allows companies to learn what knowledge exist in organization, identify critical knowledge, map this knowledge, figure out where there is not enough expertise and where there are knowledge gaps in the company processes (APQC, 2018).

There are several approaches how this process can be performed in an organization. Authors offer different concepts and templates of knowledge maps "*a visual representation of an organization's internal and/or external knowledge resources*" (APQC, 2018) and give suggestions on how the knowledge mapping process can be implemented. However, during my research, I noticed that there still are not many available cases that introduce a practical implementation of a full cycle knowledge mapping process within IT organizations.

However, the benefits of knowledge mapping process seem to be a very valuable for IT service management organizations that implement the ITSM service framework ITIL. Information Technology Infrastructure Library (ITIL) "*is a set of good practices for successful service management*" (OGC, 2007) ITIL also sees knowledge as the one of the Strategic assets "*those that provide the basis for core competence, distinctive performance, durable advantage, and qualifications to participate in business opportunities*" (OGC, 2007).

Therefore, this thesis concentrates on investigating use cases of a knowledge mapping process implementation and what value the Knowledge mapping technique can bring if it will be applied to the popular ITSM service framework ITIL 2007 edition (previously known as ITIL Version 3).

1.2 Aim and objectives

The aim of this thesis is to implement knowledge mapping process across ITIL services in a given Telecom company XYZ and analyze the results by identifying as well as measuring the existing knowledge gaps and prepare proposal for reducing the level of knowledge gaps resulting in the improvement of service

In addition to the aim, the following objectives will be delivered through the research:

- To reveal the key theoretical aspects related to Knowledge, Knowledge management, Knowledge mapping and ITIL 2007 edition (previously known as ITIL Version 3) framework.
- To analyze the existing knowledge mapping techniques and knowledge mapping tools and its practical implementation.
- Implement knowledge mapping framework into ITSM ITIL processes in Telecom company XYZ.
- Analyze the result of implementation knowledge mapping framework in a real company by identification and measuring knowledge gaps.
- To prepare proposal for reducing the level of knowledge gaps resulting in the improvement of service.

1.3 Research approach and methods

A combination of research strategies will be applied in this research. Two main methods which will be used for writing the thesis are: secondary research and illustrative case study. Overall the research methodology applied within the current thesis represents the qualitative approach. This approach is used for any data collection process that provides non-numerical data (Saunders, 2009) and use "*semi-structured methods such as in-depth interviews*" (M.Macqueen, et al., 2005). Also, the advantage of the qualitative method is

that it gives participants the opportunity to answer the questions in their own words and the flexibility for the researcher to deepen the initial participant responses by asking additional questions like “Why” and “How” (M.Macqueen, et al., 2005).

In addition, deductive thinking will be applied in order to analyze the findings of the thesis that will show how the knowledge mapping technique can benefit the ITSM framework ITIL and write an appropriate conclusion.

Based on the aim of the research the core research question was formulated as following:

How to identify knowledge gaps across ITIL services in a Telecom company XYZ that implemented the ITIL 2007 edition (previously known as ITIL Version 3) ITSM service management framework ITIL?

During the research another 6 sub-questions will be answered in support of answering the main question.

The 6 sub-questions of the research were designed into two parts: literature review and case study.

Sub-questions related to literature review:

1. What is Knowledge and why it is important to manage knowledge in an organization?
2. What are the types of knowledge and why it is important for a sustainable and successful organizational performance?
3. How Knowledge mapping techniques and tools are used to help manage knowledge?

Sub-questions related to case study:

1. How to implement a Knowledge mapping framework in an ITIL ITSM service management organization?
2. How to identify and measure the knowledge gaps in the researched process?
3. How the identified knowledge gaps can be eliminated or reduced?

1.4 Prerequisites and limitations

This research will be relevant for companies who are using the ITIL 2007 edition (previously known as ITIL Version 3) framework to manage their ITSM processes. It should be noted that there is not enough available literature that shows the full cycle of the practical implementation of the Knowledge mapping process. Another limitation of the case study research method is the time frame. It often leads to generalizing the conclusion based on the research of just the existing ITSM ITIL processes of the given company. Because of the

time limitation the research was done based on just one ITSM ITIL process in the company. However, these processes were considered the most important and largest in scope process. Therefore, the author adjusted the research methodology to the existing situation to fulfil all the necessary activities without impact on the quality of research or final conclusion.

1.5 Thesis structure

The overall thesis research structure is following:

1. Main research question
2. Literature review
3. Case study
4. Data Analysis
5. Research findings
6. Proposals
7. Conclusion

1.6 Thesis structure Outputs and Expected benefits

The result of this research can provide significant benefits to organizations that utilize the ITIL 2007 edition (previously known as ITIL Version 3) service management framework. The identification of Knowledge gaps across ITIL services along with the timely reduction or closing of these gaps will improve the overall performance of ITIL services as well as the satisfaction of end users. It was proven that by adding a knowledge mapping process, it helps to identify knowledge gaps across the ITIL services that it can extend and improve the work of the ITIL ITSM organization. It accomplishes this by making the ITIL processes that are necessary to run and operate the company along with the appropriate knowledge assets more accessible for teams, easier to share, transfer and build new knowledge to help them be even more efficient in the future.

2. Chapter 2 Literature review

1.2. Literature review

This chapter provides the overall literature review approach for this thesis. Namely, which data sources were studied and used, how information was gathered, and which literature played an important part during the research process. These sources were then used to find the answer to the main research question and as well as sub-questions. The more detailed literature review will also be provided in Chapter 3 and 4 of this thesis.

The terms and concepts of Knowledge, Knowledge management and Knowledge mapping has been studied by many researchers and covered in many research papers, publications, articles and books. Therefore, the literature about these topics for the purpose of the research were selected based on the relevance of the research to the overall aim and objectives as well as the popularity among other authors.

To find literature that will answer the main question of this research the following strategy was applied. The researcher chose the key words and applied them in popular academic research search engines.

The list of necessary key words related to this Master thesis were the following:

- Knowledge
- Knowledge management
- Knowledge gap
- Knowledge map
- Knowledge mapping
- Knowledge mapping process

The list of Research engines that were used to find relevant literature were the following:

- ResearchGate https://www.researchgate.net/
- JSTOR https://www-jstor-org.zdroje.vse.cz/
- ProQuest Central https://search-proquest-com.zdroje.vse.cz/index
- OECD iLibrary https://knihovna.vse.cz/english/resources/oecd-ilibrary/?info
- Google Scholar https://scholar.google.com/
- Scopus https://www-scopus-com.zdroje.vse.cz/

Based on the above described approach the following literature was chosen as the core for this research.

Table 1: List of publications used for Knowledge, Knowledge management and Knowledge mapping frameworks and theories review.

Publication/Article/Research paper
Thomas H. Davenport and Lawrence Prusak, 2000. Working Knowledge: How Organizations Manage What They Know. *Ubiquity*.
Ali Saleh S. Balaid, Masoumeh Zibarzani, Mohd Zaidi Abd Rozan, 2013. A Comprehensive Review of Knowledge Mapping Techniques. *Journal of Information systems research and innovation*.
Jiankang Wang, J. X., 2009. Knowledge management audit framework and methodology based on processes. *Journal of Technology Management in China*.
Bhatt, G. D., 2001. Knowledge management in organizations: examining the interaction between technologies, techniques, and people. *Journal of Knowledge Management*.
Samuel Driessen, Willem-Olaf Huijsen and Marjan Grootveld, 2007. A framework for evaluating knowledge-mapping tools. *Journal of Knowledge Management*.
Wexler, M. N., 2001. The who, what and why of knowledge mapping. *Journal of Knowledge Management*.
Eppler, M., 2001. Making Knowledge Visible through Intranet Knowledge Maps: Concepts, Elements, Cases. *System Sciences*.

In addition to these, some additional authors such as Ikujiro Nonaka, Jay Liebowitz and Karl Wiig who are very well known for their work and publications about Knowledge and Knowledge management topics were also utilized. They are considered some of the core authors who started the discussion on these topics and addressing the phenomenon as well as the theoretical foundation of knowledge and knowledge management in their many publications and books. They are considered some of the top researchers in Knowledge and Knowledge management field. Based on the reputation of these authors in the scientific world, the researcher of this paper decided to include some relevant publications and books in the core list of literature.

Table 2: List of publications of the most known and reputable authors used for Knowledge, Knowledge management and Knowledge mapping frameworks and theories review.

No	**Publication/Article/Research paper/Books**
1.	Ikujiro Nonaka, G. v. K., 2009. Tacit Knowledge and Knowledge Conversion: Controversy and Advancement in Organizational Knowledge Creation Theory. *Organization Science*.

2.	Nonaka, I., 1994. A Dynamic Theory of Organizational Knowledge Creation. *Organization Science*.
3.	Wiig, K. M., 1993. Knowledge Management Foundations: Thinking about Thinking: How People and Organizations Create, Represent and Use Knowledge. *Schema press, Ltd.*
4	Kelvin Chan, Jay Liebowitz., 2006 The synergy of social network analysis and knowledge mapping: A case study. *International Journal of Management and Decision Making*.
5.	Jay Liebowitz, 2009. Knowledge Retention. Strategies and Solutions. *CRC Press*.
6.	Wiig, K. M., 1995. Knowledge Management Methods: Practical Approaches to Managing Knowledge. *Schema press, Ltd.*
7.	Wiig, K. M., 1997. Knowledge Management: Where Did it Come From and Where Will It Go? *Journal of Expert Systems with Applications*.
8.	Von Krogn, G., Ichijo, K. & Nonaka, I., 2000. Enabling knowledge creation: How to unlock the mystery of tacit knowledge and release the power of innovation. *Oxford University Press*.

Also, the researcher was inspired by the work that was done by the APQC organization in the knowledge management and knowledge mapping fields. APQC (American Productivity & Quality Center) "*it is the world's foremost authority in benchmarking, best practices, process and performance improvement, and knowledge management*" (APQC, 2019) with "*unique structure as a member-based nonprofit makes it a differentiator in the marketplace*" (APQC, 2019).

The researcher noticed that some authors referenced this organization in their papers when they write about process performance, process improvement, knowledge management, knowledge mapping, etc. Later the researcher found out that the APQC organization has more than 40 years of experience with Knowledge management as one of its core competences. The researcher created an account on APQC website https://www.apqc.org/ and discovered many valuable research documents. These played a large role in the researcher's knowledge and ideas which contributed to this research. The list of main resources and articles from the APQC website that were used for the research are represented below.

Table 3: List of APQC publications used for Knowledge, Knowledge management and Knowledge mapping frameworks review.

No	**Articles/white papers/ conference papers**	**links**
1.	APQC, 2018. Getting Started with Knowledge Mapping.	https://www.apqc.org/knowledge-base/documents/knowledge-map-and-process-map-overview
2.	APQC, 2018. Knowledge Mapping Charter Template.	https://www.apqc.org/knowledge-base/documents/knowledge-mapping-charter-template
3.	APQC, 2018. Knowledge Mapping in Action (Executive Summary).	https://www.apqc.org/knowledge-base/documents/knowledge-mapping-action-executive-summary
4.	APQC, 2018. Identifying and Prioritizing Critical Knowledge.	https://www.apqc.org/knowledge-base/documents/identifying-critical-knowledge-apqc-overview
5.	APQC, 2015. The Executive's Role in Knowledge Management: Lessons Learned from 20 Years.	https://www.apqc.org/knowledge-base/documents/executives-role-knowledge-management-lessons-learned-20-years-km

Books about ITIL® V3 service management framework (IT Infrastructure Library (ITIL) were also studied and used for this research mainly to understand the vision of the ITIL framework on the main topics of this research. These included such items as Knowledge, Knowledge Management and Knowledge Mapping in order to help the researcher understand the importance of these topics for ITSM ITIL processes. It also helped to discover opportunities to combine ITIL framework with the techniques and concepts of knowledge mapping that were found in other literature.

Table 4: List of ITIL 2007 edition (previously known as ITIL Version 3) books used for Knowledge, Knowledge management and Knowledge mapping frameworks review.

No	**Books**
1.	OGC, 2007. ITIL. Service Strategy. *London: TSO.*
2.	OGC, 2007. ITIL. Continual Service Improvement. *London: TSO.*
3.	OGC, 2007. ITIL. Service Operation. *London: TSO.*

4.	OGC, 2007. ITIL. Service Transition. *London: TSO*.
5.	OGC, 2007. ITIL. Service Design. *London: TSO*.

After conducting the literature review, the author discovered that the topic of Knowledge, Knowledge management and Knowledge mapping was studied by many researchers, but no similar works were explored. Therefore, this thesis can be viewed as a contribution to Knowledge mapping and ITIL 2007 edition (previously known as ITIL Version 3) relevant literature for practical application of the suggested joined frameworks. In the next chapter the researcher will present the views and how this literature either supports or deviates from the goal of my thesis. However, it should be noted that most of the literature is in line and fully support the foundational work required to support my thesis.

3. Chapter 3 Theoretical foundation of Knowledge, Knowledge Management and Knowledge mapping

3.1 Definition of Knowledge

"*Knowledge is a multifaceted concept with multilayered meanings*" (Nonaka, 1994)

In order to find the answer to the main question and sub-questions of this thesis, it is worth to identify the term of Knowledge, because it is one of the main terms of this research. Researchers look at knowledge from different prospective.

Some definitions describe how knowledge is derived from experience and your learning process. According to Merriam-Webster dictionary, the definition of knowledge is "*information, understanding, or skill that you acquire through experience or education*" (Merriam-Webster, 2019). Thomas H. Davenport and Lawrence Prusak provide the following definition "*Knowledge develops over time, through experience that includes what we absorb from courses, books, and mentors as well as informal learning*" (Davenport & Prusak, 2000). Karl M. Wiig defined knowledge as the information obtained from experience and learnings over time that can then be applied in various business situations to solve problems, as the combination of "*facts, truths, and beliefs, perspectives and concepts, judgments and expectations, methodologies and know-how. Knowledge is accumulated and integrated and held over longer periods to be available to be applied to handle specific situations and problems*" (Wiig, 1995).

Another group of definitions link the term of knowledge with the theory of DIKW hierarchy that represent the pyramid which shows the relationships between data, information, knowledge, and wisdom. According to Information Technology Infrastructure Library (ITIL 2007 edition), knowledge is formed in the following sequence or order "*Data–to–Information–to–Knowledge–to–Wisdom*" (OGC, 2007). It means data is considered the base for forming Information, Knowledge and Wisdom. In ITIL 2007 edition term Data explained as "*the set of discrete facts about events*" and the Information is "*providing context to data"* (OGC, 2007). ITIL determines Knowledge as "*composed of the tacit experiences, ideas, insights, values and judgements of individuals. People gain knowledge both from their own and from their peers' expertise, as well as from the analysis of information (and data). Through the synthesis of these elements, new knowledge is created*" (OGC, 2007) another words we all continue to learn by forming new knowledge through our own experience as well as the experience of our peer network (OGC, 2007).

Karl M. Wiig one of the most recognizable researcher in the knowledge management field in his work "Management of Knowledge: Perspectives of a new opportunity" considers knowledge from the prospective of how easy it is to obtain knowledge from different knowledge domains such as Public domain, Expert domain and Personal Knowledge domains. He also considers four types of knowledge according to the complexity, levels of abstraction and aggregation such as "*Facts and Data, Perspectives or gestalts, Hypotheses and reasoning stepping stones and Strategies for how to reason*" (Wiig, 1986). He goes on to provide an overview on how difficult to obtain knowledge from different domains. For example, Karl M. Wiig considered that with the technologies and search engines available today finding knowledge in the public domain is becoming quite simple. However, expert knowledge remains a challenge and harder to obtain. „*it is relatively easy to obtain and elucidate knowledge in the public domain. It is harder to obtain expert knowledge, and very time and resource consuming to obtain personal knowledge*" (Wiig, 1986).

Based on the trends of the knowledge economy, some authors connect their definitions of knowledge to the business needs and look at knowledge from the business and organizational prospective. Thomas H. Davenport and Lawrence Prusak define Knowledge as the "*fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. In organizations, it often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices, and norms*" (Davenport & Prusak, 2000). Authors considered that the key to success in this new knowledge economy will be to ensure you understand all the various documents, processes and other information that are critical to your business (Davenport & Prusak, 2000).

Timo Kucza in his work "Knowledge Management Process Model" says that "*Knowledge is essential in everyday work. Everyone knows how to carry out his work and this knowledge can be reused later in similar tasks by adopting this knowledge to new situations*" (Kucza, 2001), another words the reuse of knowledge that can be applied time and time again to handle routine transaction is essential for productivity (Kucza, 2001). But the real advantage will be to leverage it when faced with new situations or challenges (Kucza, 2001). Karl M. Wiig believes that "*corporate knowledge that is built and deployed for purposes of maximizing the organization's goals and objectives*" (Wiig, 1986).

Many authors recognized that knowledge is one of the drivers of the companies' performance and has become an important asset, as well as a strategic advantage to help them to achieve their business goals. Ikujiro Nonaka and Georg von Krogh in their work "Tacit Knowledge and Knowledge Conversion Controversy and Advancement in Organizational Knowledge Creation Theory" noticed that "*The resource-based theory of the firm showed the importance of knowledge alongside other costly to-imitate resources for competitive advantage"* (Nonaka & Krogh, 2009).

For this research it is important to identify Knowledge as "*the most important asset of organizations (Carneiro, 2000)*" (Kucza, 2001). As you can see, the term Knowledge asset became common and is used by many researchers. Karl M. Wiig defined Knowledge asset as "*the valuable knowledge available for use or exploitation, must be nurtured, preserved,*

and used to the largest extent possible by both individuals and organizations" (Wiig, 1995). According to APQC Glossary, Knowledge is what employees know about work related activities, data, processes and products. All these knowledge assets belong to the enterprise and can be used to fulfill enterprise goals (APQC, 2018). The Importance of Knowledge is a significant element of the main company's processes and its influence on it's core products was also represented by Wang, Jiankang and Xiao, Jiuling in their work "*Knowledge management audit framework and methodology based on processes*" where they say that "*Along with era of knowledge economy's arrival, the knowledge had already substituted for the traditional elements of production such as land, machinery equipment and so on and become the first element of production*" (Wang & Xiao, 2009).

The variety of examples of these definitions that were discussed in this chapter show us how the definition of Knowledge has evolved over time. It also highlights the importance of the term for this research. In this thesis the researcher will be focusing mostly on the definitions that viewed knowledge in terms of an asset to the business including what a company possesses, what is consider an important part of company's processes, what is necessary to have and manage in order to achieve their business objectives and goals. In addition to it will show how knowledge assets can be identified and mapped by using the knowledge mapping framework to provide significant value to a company by identifying knowledge gaps in the companies' processes.

3.2 Theoretical foundation of Knowledge Management

"*Knowledge is essential in everyday work. Everyone knows how to carry out his work and this knowledge can be reused later in similar tasks by adopting this knowledge to new situations. The general purpose of Knowledge Management (KM) is to make knowledge usable for more than one individual, e.g. for an organisation as a whole; that is, to share it*" (Kucza, 2001).

The topic of Knowledge Management has been an increasing issue for companies since the early 1990's. Business consultants and researchers have been trying to express to companies the importance and potential competitive advantage that could be achieved through knowledge creation and the corresponding knowledge worker that possess it. It could then be utilized as a learning environment to provide a foundation for the postindustrial information economy (Von Krogn, et al., 2000).

In the book "Knowledge Management Methods: Practical Approaches to Managing Knowledge" Karl Martin Wiig Chairman, Knowledge Research Institute, Inc. wrote "*Historically, knowledge has always been managed, at least implicitly. However, effective and active knowledge management requires many new perspectives and methods and touches on most facets of the organization. We need to develop a new discipline and prepare a cadre of knowledge professionals with a blend of expertise that we have not previously seen. This is our challenge!*" (Wiig, 1995). Although Knowledge Management is considered as quite a new discipline, scientists and the research organizations have already

done a significant amount of contribution into its evolution of approaches and processes. According to Karl M. Wiig, although historically knowledge has always been managed, it wasn't until the mid 1980's that companies began to realize it's importance and potential competitive advantage that it could bring (Wiig, 1997). This was probably one of the contributing factors to the European Knowledge Management association being established in 1996 (Wiig, 1997).

The popularity of Knowledge Management as a topic in business literature has driven knowledge to be seen as a critical component for helping companies maintain a competitive advantage (Bhatt, 2001). Nowadays, Intellectual Capital these days often far outweighs a company's financial assets (Wiig, 1999). For instance, as an example think about the Coca Cola company and the recipe and processes for making their products. Timo Kucza in their book "Knowledge Management Process Model" includes the citation of Cindy Johnson, Director of Collaboration and Knowledge Sharing at Texas Instruments, where she said "*Knowledge management is really about recognizing that regardless of what business you are in, you are competing based on the knowledge of your employees*" (Kucza, 2001).

APQC (American Productivity & Quality Center) one of the most visible research organization in the Knowledge management space is developing and successfully implementing the knowledge management approaches for more than 20 years (APQC, 2015). According to APQC organization "*a fundamental tenet of knowledge management is that it should focus on solving important business problems*" (APQC, 2018).

Many researchers have also determined that Knowledge management utilizing a set of approaches and processes can help to improve a business's performance. By Karl M. Wiig Knowledge management "*is a set of distinct and well-defined approaches and processes to find and manage positive and negative critical knowledge functions in different kinds of operations, identify new products or strategies, augment human resource management, and achieve a number of other, highly targeted objectives*" (Wiig, 1999). According to APQC Glossary "*Knowledge Management (KM) - the application of a structured process to help information and knowledge flow to the right people at the right time so they can act more efficiently and effectively to find, understand, share, and use knowledge to create value for the organization*" (APQC, 2018).

Here Bookhamer and Zhang were looking to press on the existing theories of Knowledge Management by establishing some type of framework that could be used globally. Their "*proposed formal framework of global knowledge management consists of eight major components: global information infrastructure, core IT capabilities, information resource management strategies, IT cultures, global outsourcing, transborder data flows, global virtual teams, and global system design, development, and implementation*" (Bookhamer & Zhang, 2016). A company could then use this framework to achieve their Knowledge Management objectives aligning it with their strategic priorities (Bookhamer & Zhang, 2016).

As we can see from the previous chapter that authors determined that Knowledge is the most important corporate asset of an organization. Therefore, managers should handle, use and manage the knowledge assets that their organizations possess effectively. In this research, it is also important to provide the definition that will describe Knowledge

management as a process that helps organizations to manage their knowledge assets in the most effective way. According to Karl M. Wiig one of the important objectives of Knowledge management is to "*realize the best value of its knowledge assets*" (Wiig, 1997). Within a company it is critical that there are defined processes to manage knowledge, consisting to identify, organize, transform and utilize it effectively (Wiig, 1997). As mentioned earlier, Knowledge is a company's largest asset however they often fail to recognize its importance or manage it effectively which prevents their ability to utilize it is often required (APQC, 2019). Think about that employee you spent two years training that just announced they are leaving the company.

By Thomas H. Davenport and Lawrence Prusak "*explicitly recognizing knowledge as a corporate asset is new, however, as is understanding the need to manage and invest it with the same care paid to getting value from other, more tangible assets. The need to make the most of organizational knowledge, to get as much value as possible from it, is greater now than in the past*" (Davenport & Prusak, 2000). In today's fast past business environment, it is even more critical now that we invest in managing knowledge so that we can get the most value out of it as soon as possible (Davenport & Prusak, 2000). ITIL 2007 edition (previously known as ITIL Version 3).

As was already explained earlier ITIL (Information Technology Infrastructure Library) 2007 edition is a popular framework implementing effective work processes for IT service management. Therefore, for this research it is also important to understand the view of ITIL on the Knowledge management topic. In ITIL 2007 edition Knowledge Management is defined as "*the ability to deliver a quality service or process rests to a significant extent on the ability of those involved to respond to circumstances – and that in turn rests heavily on their understanding of the situation, the options and the consequences and benefits, i.e. their knowledge of the situation they are, or may find themselves, in*" (OGC, 2007). In today's business environment making the right decisions quickly is critical and this can only be accomplished when you have the right knowledge at your fingertips (OGC, 2007). At the same time ITIL defines "*the purpose of Knowledge Management is to ensure that the right information is delivered to the appropriate place or competent person at the right time to enable informed decision. The goal of Knowledge Management is to enable organizations to improve the quality of management decision making*" (OGC, 2007). As we can see the definition of Knowledge management that is provided by ITIL, it is aligned with the definitions of other authors that we mentioned in this research.

Knowledge management provide governance for the knowledge assets of organization. We can see from the literature that the quality of Knowledge management makes the processes of organization more effective. It means, better Knowledge management gives advantage to companies to beat their competitors in the market, to provide better services, also became more cost effective. It gives organizations opportunity to make right and fast decisions at the right time. Therefore, the effective Knowledge management influence overall performance of the organization.

Once organization decided to implement a knowledge management process and determine the goals for knowledge management the next important step will be the identification of the knowledge that an organization has and then determine the types of this knowledge as

well as its criticality (APQC, 2018). Organization need to know what knowledge 1) it possesses, 2) needs to be documented, 3) needs to be stored, 4) needs to be shared and 5) needs to be applied.

3.3 Types of Knowledge: Tacit and Explicit

"*Knowledge is justified true belief, individual and social, tacit and explicit*" (Von Krogn, et al., 2000).

There are two categories of knowledge, Tacit and Explicit that are necessary to distinguish in order to perform knowledge management activities.

Ikujiro Nonaka best known for his study of knowledge management in his work "A Dynamic Theory of Organizational Knowledge Creation" looking at the two classification of knowledge. When defining Explicit Knowledge think of it as information that can be identified, stored and easily accessed. Whereas Tacit Knowledge is much harder to formalize, codify and communicate as it has a personal quality (Nonaka, 1994). A lot of research has been done on these two types of knowledge that is important to understand and manage in the realm of the modern economy where organizational knowledge plays an essential role.

According to APQC Knowledge Management Glossary Tacit Knowledge is "*Knowledge that resides in the minds of individuals and is surfaced in response to a situation or action*" (APQC, 2018). Explicit Knowledge is "*Knowledge that is conducive to being written down or expressed verbally*" (APQC, 2018).

Also, Ikujiro Nonaka in the work "Tacit Knowledge and Knowledge Conversion: Controversy and Advancement in Organizational Knowledge Creation Theory" distinguishes Tacit and Explicit knowledge as the following: "*Knowledge that is uttered, formulated in sentences, and captured in drawings and writing is explicit. Explicit knowledge has a universal character, supporting the capacity to act across contexts*" (Nonaka & von Krogh, 2009). "*Knowledge tied to the senses, tactile experiences, movement skills, intuition, unarticulated mental models, or implicit rules of thumb is "tacit". Tacit knowledge is rooted in action, procedures, routines, commitment, ideals, values, and emotions*" (Nonaka & von Krogh, 2009).

Researchers noticed that the differences between the two types of knowledge is also impacting the management of them. For instance, Ikujiro Nonaka in the work "*The Knowledge-Creating Company" said that ""tacit" knowledge—the valuable and highly subjective insights and intuitions that are difficult to capture and share because people carry them in their heads*" (Nonaka, 2007).

Timo Kucza has the similar point of view on Tacit knowledge. In his work "Knowledge Management Process Model" researcher is explaining why it is difficult to capture tacit knowledge. He sees the roots of it that the knowledge that is generated in human minds is

very complex, because "*human actions depend on a large number of parameters. It is the complexity that enables the adoption to different kind of situations*" (Kucza, 2001). Although there are clear definitions for each type of knowledge, it is hard to imagine transferring Tacit knowledge into Explicit, but it is possible (Kucza, 2001). It is *"difficult to record or document knowledge in such a way that others can benefit from it"* (Kucza, 2001). Also, *"such explicit knowledge never describes the original tacit knowledge as a whole, but instead assumes a common basis of understanding on which the transmission back to implicit knowledge is based*" (Kucza, 2001).

APQC also as the previous researchers consider that there are many differences between two kinds of knowledge and for the organizations it is a big challenge to manage knowledge assets especially in the form of Tacit knowledge. Knowledge has been classified into two basic types Explicit and Tacit. At times they are also referred to as formal or informal as Explicit is codified and Tacit is uncodified. The reason for this is that Explicit knowledge can be found in books, documents, reports and other written forms. Whereas Tacit knowledge is information that remains learned and, in our heads, usually gained by experience and interactions with other people. This makes it harder to capture and catalog so it can be used without the original context from the person who possesses it. This is one of the biggest risks to an organization because if the information can't easily be captured and shared when a person leaves or retires this organizational knowledge leaves with them (APQC, 2015).

Despite the fact that Tacit knowledge is difficult to capture and manage it plays an important role for organizations together with Explicit knowledge, because when creating knowledge, obviously you need to take into account both Explicit and Tacit knowledge. But what is even more important is that you look at the interchange between them as you look at both the internal and external relevance (Nonaka, 1994). In summary, when we conduct our Knowledge management activities, we need to pay attention to both types of organizational knowledge as well as their interconnections.

One of the important activities of Knowledge management relies on taking Tacit knowledge and putting it into an Explicit form that is not only storable but easy to access. (Dalkir, 2005). The possibility how to complete this activity will be described it in the next chapters of this research. One of the most important instruments/tools to perform this activity is the Knowledge map. According to Denham Grey "*the knowledge map is a navigation aid to explicit (codified) information and tacit knowledge, showing the importance and the relationships between knowledge stores and dynamics. The knowledge map, an outcome of synthesis, portrays the sources, flows, constraints and sinks (losses or stopping points) of knowledge within an organization*" (Grey, 1999). "*Knowledge mapping provides a basic tool for managers and employees to retrieve necessary knowledge and to analyse the relationships between knowledge sources. Knowledge maps point to knowledge but do not contain it. Knowledge maps are guides, not repositories* (Davenport and Prusak, 1998)" (Chan & Liebowitz, 2006) .

As we can see the Knowledge mapping process and tools play an important role in the identification of tacit and explicit knowledge in the organization. These are required to help capture both types of knowledge, prioritize the important knowledge as well as help identify

areas where neither of these two types of knowledge exist. This process and different types of knowledge mapping tools will be widely discussed in the next chapter of this research.

3.4 Knowledge mapping system definition and core concept

The concept of knowledge mapping was studied by many researchers over a fair number of years. Some of them see Knowledge Mapping as the one of the techniques essential for creating a Knowledge management system. "*Knowledge mapping is a useful exercise, but it is not an end in itself. It is a tool, like a roadmap, that helps you chart a course from point A to point B. To get real long-term value from knowledge mapping, an organization must use the maps as jumping-off points to identify gaps and implement KM tools and approaches designed to improve the quality and flow of knowledge*" (APQC, 2018).

Karl Martin Wiig in his book "Knowledge Management Methods: Practical Approaches to Managing Knowledge" says that knowledge mapping system involves *"(a) gathering relevant information from worker and the organization; (b) displaying this information; and (c) using that information for a variety of purposes. These purposes include: training, communicating to the public and other business, planning, problem-solving, decision-making, and uncovering both knowledge gaps and hidden strengths"* (Wiig, 1995).

Nowadays knowledge mapping became popular techniques that attract manager's attention as it helps them to gain a deep understanding of the knowledge domains within an organization as well as see the relationships between them that brings them a deep conceptual understanding (Balaid, et al., 2013). It is a tool used to identify and capture knowledge in an organization. By using techniques like knowledge mapping an organization can capture a large and complex set of knowledge which can both be acquired and accessed much easier without it (Balaid, et al., 2013).

This importance of knowledge mapping as the effective tool for managers was also noticed much earlier. Karl Martin Wiig mentioned that when a company obtains knowledge from its employees it can change forever some of the upper management tasks in the future. What he believed was that at the very least knowledge mapping was a new effective tool for management to enhance the quality of their work while increasing the output of their organizations (Wiig, 1995).

Experts consider "Knowledge Mapping" as the Knowledge analysis and inventory method that is used to develop concept maps that contain information that could be put into data hierarchies or networks. The work is challenging and conducted through a series of interviews and self-documentation. This broad knowledge gathering methodology provides specialized processes and procedures to extract and document information from the experts within an organization (Wiig, 1995). Another words it is the knowledge mapping process and tools that are used to locate the knowledge within a company. There are multiple ways of gathering the information usually through either interviews, questionnaires or

sometimes even observations. The questionnaire should be designed to help identify the people in the organizations that have specialized knowledge or considered experts in a particular area (Igbinovia & Ikenwe, 2017). "*Knowledge Mapping can focus on a process, role, competency or learning need, function, or strategic priority*" (APQC, 2018). It is the knowledge mapping that essentially consists of the relationship between various knowledge items of people and activities (Driessen, et al., 2007).

Denham Grey explains knowledge mapping as the process of using processes to survey, audits and analyze information in an organization in an attempt to track both acquisition as well as data loss. It also looks at both personal and group expertise as well as how knowledge is connected and flows through the company. It creates these knowledge maps that will help a company understand the relationship between loss of staff and how it correlates to loss of Intellectual Capital. This provides target areas to focus on critical areas to capture knowledge (Grey, 1999).

Therefore for this research Knowledge mapping will be considered as "*an ongoing quest within an organization (including its supply and customer chain) to help discover the location, ownership, value and use of knowledge artifacts, to learn the roles and expertise of people, to identify constraints to the flow of knowledge, and to highlight opportunities to leverage existing knowledge*" (Grey, 1999).

Mark N Wexler in his work "The who, what and why of knowledge mapping" explains who is using knowledge mapping process, what data used for that and why Knowledge mapping important and widely used in the modern organizations. The real value that knowledge mapping provides is that is serves as a company's organization memory. As information evolves and changes over time it helps keep tract of the interactions not only between internal organization but external ones as well. It is because they contain the important and actionable information in the proper context of the organization. In order for them to be effective they must identify the who, what and why within the knowledge mapping process. If done right the knowledge maps help identify the most important Intellectual Capital which can be used to help new employees, improve learnings in the company and potentially even identify potential threats or opportunities (Wexler, 2001).

In terms of this research Knowledge mapping is determined as the process that has its own process lifecycle, consist several steps and final output of this process is the knowledge map that allows to identify and analyze during the process existing knowledge gaps.

4. Chapter 4 Research design and Case study

4.1 Research design

The practical part of the research is based on secondary research that is provided in sub-chapter 4.2 that has the aim to provide an overview of the existing types of knowledge maps and reveal valuable insights that can contribute to the ITIL 2007 edition framework. In addition, the case study in sub-chapters 4.3 through 4.8 includes the practical implementation of Knowledge mapping process on ITIL service processes including the design of knowledge map, collecting the data through knowledge mapping, analyzing the data, summarizing the findings and challenges. In addition, sub-chapter 4.9 includes a proposal for reducing the level of knowledge gaps in the Problem management process and sub-chapter 4.10 includes a proposal for implementation of Knowledge Mapping across ITIL services.

4.2 Knowledge mapping techniques and knowledge maps

There is a big range of knowledge mapping techniques as well as types that were created and implemented by knowledge researchers in companies and in the scientific world. Some maps such as Functional knowledge maps and Competency maps can be used for representing and understanding an organisational structure, its core competency and organizational directory of knowledge resources. (Balaid, et al., 2013). Knowledge Assets Maps can we thought of as a visual mechanism or table to capture a company's capabilities. These core capabilities can be further broken down to produce a visual representation of an individual or aggregation of skills for the people in a given company. As an example, Knowledge asset map lays out how a team's knowledge can be represented and captured their core competencies. On the map the large blocks are used to depict knowledge on a particular topic and then smaller blocks are used to capture basic information they possess in a particular area (Eppler, 2001). Process knowledge mapping is used to identify or show what current knowledge is required to support a company's business processes. A process knowledge map is created by analyzing a company's business processes one by one and determining where knowledge bottlenecks exist, what current knowledge is needed and how to acquire it (Balaid, et al., 2013). Another type is Knowledge Application maps that show the linkage as to how certain types of knowledge have been applied to a particular process stage or specific business situation. They often use a mechanism of pointers to find or locate specific types of knowledge such as documents, specialists or even databases (Eppler, 2001).

In the work “The synergy of social network analysis and knowledge mapping: a case study” Kelvin Chan and Jay Liebowitz identify five types of knowledge mapping that can be used to capture a company’s organizational knowledge. These include: Knowledge Source, Asset, Structure, Application and Development Maps. Each of these are used to capture a different view of the knowledge and information that can be found in a company. The first type Knowledge Source is used to map the structure containing the population of experts as well as their domain expertise. As an example, it could answer a question like who has the Knowledge to run a large Global Project. The second is Knowledge Assets which contain the actual list of knowledge of an individual, department or even the whole organization. This in the next level of detail for capturing knowledge and can answer questions such as which how many of our software developers can program in Java. The third type, Knowledge Structure is used to outline knowledge domains from global architecture perspective and most importantly how the various pieces relate to each other. The example given here was “What skills are needed to evaluate a company and how do they relate to one another?”. The fourth type, Knowledge Application Maps shows the types of knowledge that could be applied to a certain process or in a specific business situation and then lists the pointers to locate or find the given information. It could be used to answer such questions are what experience we have in our company for considering moving from in-house development to outsourcing. Last the fifth type is a Knowledge Development Map which is used to list the competencies that are needed to development an individual or teams in the organization with a specific set of skills to achieve a goal. For example, it answers questions like what are the skills required to develop a high performing team in the organization? (Chan & Liebowitz, 2006).

APQC organisation contributed a lot to the field of categorisation of Knowledge maps as the APQC identifies seven types of maps grouped into three categories: enterprise, cross-functional, and process-explicit. The following diagram demonstrate the categories and associated types:

Types of Knowledge Maps	
Enterprise Knowledge Maps	
Strategic Overview Knowledge Map	The largest in scope, this map is used to gauge the level of knowledge or expertise an organization has to meet its strategic goals.
Expertise Overview Knowledge Map	This map provides a broad understanding of what knowledge an organization has in various parts of the business and what knowledge may be at risk.
Cross Functional Knowledge Maps	
Expertise Tacit Knowledge Map	This map is used to identify specific experts and their areas of expertise. It usually works best inside a business unit or a division with similar units.
Technical/Functional Knowledge Map	This map helps an organization more clearly understand its strengths and gaps within specific technical or functional knowledge domains (e.g., ship design, component assembly).
Process-Explicit Knowledge Maps	
Process-based Knowledge Map	This map identifies specific knowledge needs and the sources, recipients, locations, and formats of knowledge within a process or domain. It is particularly useful to establish a baseline for knowledge management (KM) solutions such as communities or mentoring.
Job/Role-based Knowledge Map	This map inventories the knowledge required for various jobs or roles. It is similar to the functional/technical knowledge map, but it includes the specific knowledge that each job role needs to be successful.
Competency/Learning Needs Knowledge Map	This map explicitly articulates the learning or competency needs associated with a business process or job role.

Figure 1: Types of Knowledge maps, (APQC, 2018).

According to APQC enterprise knowledge maps provide a high-level picture for an organization set of knowledge as well as where there are gap and they are at risk. They go on to describe how Cross-Functional maps are then used to index or catalog a company's knowledge and the experts in specific areas, functions or domains. Lastly, they talked about the Process and Role-Based knowledge maps although narrow from a scope perspective are the most in-depth. The benefit is these have enough details to instruct someone to perform a specific job function or execute a particular business process (APQC, 2018).

With such a big variety of tools, it helps researchers to find suitable problem-solving method among potential mapping techniques (Balaid, et al., 2013). APQC said that *"there is no perfect knowledge map for all situations. Organizations have implemented knowledge*

maps in a variety of ways, but having a "buffet" of choices helps the team pick and choose the aspects of the maps that fit, tweaking each to the nuances of a given situation" (APQC, 2018).

Literature review of the research revealed that not many of the above-mentioned knowledge mapping tools and techniques are widely used in real companies. At the same time some of the approaches have the solid track record of suceesufull implemenations in organisations that will be described futhur in this research.

4.3 Case study: Creation of Knowledge mapping tool

This chapter describes the knowledge-mapping framework that was chosen by the author of this thesis for practical implementation in the real company based on theoretical and practical research on the knowledge mapping topic.

For this research the process-based knowledge map template form APQC was taken as the starting point. It was then adapted by the researcher to the needs of this thesis by utilizing their practical experience doing knowledge mapping, best-practices provided by APQC organization, other findings that were discovered during the literature review and the needs of the researched company.

APQC offers a template for a process-based knowledge map to guide companies how to perform knowledge mapping for their processes (APQC, 2018). This template can be extended to meet the individual needs of the companies and modified to incorporate internal terminology, structure and specific knowledge mapping goals (APQC, 2018).

According to APQC the process-based knowledge map identifies information assets that are required in a particular business process or specific domain (APQC, 2018). The template is used to help document the knowledge that is necessary to execute a companies business processes and at all sub levels. Therefore, this template is a good choice for companies that understand their businesses processes and want to document them as well as the flow of knowledge between them (APQC, 2018). This is why the researcher decided to look to apply this template to ITIL because the ITIL framework contains a very well-defined set of processes in the IT Service Management domain. The research will then dive into and show the linkage as to how Knowledge Map from APQC can be applied to ITIL 2007 edition framework to provide value to the researched company.

Excerpt from APQC's Process-Based Knowledge Map Template

Process	Activity	What knowledge is needed?	Who owns this knowledge?	Tacit or Explicit?	Where is this knowledge?	Who can validate this knowledge?	How big is the knowledge gap?	Additional Details
List the process for which knowledge is being mapped	*List the specific activities within that process*	*List the types of knowledge required to perform this activity*	*List the sources of record or experts who own this knowledge*	*Mark as T, E, or T/E*	*List repositories or people who have the knowledge*	*List individuals or systems who can verify*	*Rate as 1, 3, or 5 (1 = small, 3 = medium, 5 = large)*	*Provide any notes or further context*

Figure 2: Process-Based Knowledge Map Template (APQC, 2018).

APQC designed the process-based knowledge map in such way that it can be modified according to requirements and needs of the organization to help them capture their internal knowledge which can then be used to resolve various problems. The map is considered a perfect fit for this research as it can be aligned well with the Process structure of the ITIL framework and can be modified to include components from another types of knowledge maps.

The research of ITIL 2007 edition methodology and the initial meeting with the team leader of the IT Services process area of the researched company helped the researcher to understand the high level structure of the IT Service Management processes in the organisation and understand what knowledge is important for the company's ITIL service management processes and which core questions can help to reveal this knowledge. The first vision of knowledge mapping tool (knowledge map) was created based on the initial research in the company mentioned above, studied of published case studies and literature review.

Name of participant_____ Name of ITIL process_____								
Sub-processes/tasks	Sub-processes/tasks outcomes	Knowledge assets that are critical for the Sub-processes/tasks	Where are the knowledge assets stored?			Who has this knowledge?		Type of Knowledge assets: Tacit, Explicit or both
			Shared folders repositories, servers	Individual folders and repositories, personal PCs	Nowhere, employees experience and skills	Name of teams, working groups, departments, divisions	Name and role of employee	

Figure 3: Knowledge Map Template (Author, 2019).

The represented template is a Knowledge map (knowledge mapping tool) that was chosen for implementing the Knowledge mapping process in the researched company in its IT Service Management organisation that utilized ITIL 2007 edition (previously known as ITIL Version 3) process-based framework. The template of knowledge map is an Excel-based tool that contains a set of questions that help to summarize knowledge that is necessary to perform ITIL processes as well as to identify knowledge gaps in each step/section/sub-process of ITIL processes.

The template is designed to capture the following aspects of the ITIL processes: 1) the core sub-processes and tasks and their outcomes, 2) critical Knowledge assets for these sub-processes and tasks, 3) where the knowledge assets are stored including shared folders, 4) employee knowledge and experience as well as who possess it including their name and role in the company and 6) the type of knowledge assets (explicit or tacit).

4.4 Case study: Telecom Company XYZ

4.4.1 Company overview

In this section the researcher will describe insights and findings in an actual company utilizing a real business case. The name of the company has been changed to Telecom Company XYZ in order to keep it anonymous. It will be described at a very high level as too many details could reveal its origin.

A leading fast-growing telecommunication company has grown to become a multinational conglomerate operating in Europe, America's and Asia Pacific. It is made up of both Telecommunication Companies and Internet service providers. It is well-known in the Telecom Sector for its disruptive technology solutions following the evolution of mobile communication in our growing digital society. It has more than 100,000 employees around the globe.

4.4.2 Structure of Operation Services

The researcher completed her analysis based on internal company organizational charts for the Telecom Company XYZ to determine the current structure of the Information Technology division which revealed the following:

Global Operations Command Center (GOCC) organization is divided into two divisions: external and internal divisional support groups. The External support group called the "*Customer care center*" deals with issues from external clients of the company and the Internal support group "*IT center management*" resolves issues of employees (end-users)

of the company. At the same time the Internal support group is called the "*IT Center Management*" which is divided into two sub-divisional groups: *Global technical services division (operations level)* and the *Internal ITIL Operations team (governance level)*.

1. *Global technical service division (operations level)* contains several support teams divided into three levels depending on the level complexity of the IT incident or request that need to be executed/resolved.

Level 1 support team is the (*Help Desk*) and includes a call center that work on low propriety issues. For such issues a low level of IT expertise is required. For example, a low priority item is when just a few personnel are impacted. It could be service is partly degraded but still operating normally for most of the users within the Service Level Agreement (SLA).

Level 2 support team (*Technical staff*) responsible for application and networking services. Work on medium level of incidents. For example, when multiple personnel are impacted in one physical location. Service is degraded and still functional but not operating within SLA. For such issues advanced level of IT expertise is required.

Level 3 support team (*Technical expert*) responsible for application development and architecture. Work on high priority incidents. For example, when all or multiple users of a specific service are impacted from different physical locations. Service is unavailable or significantly degraded and functional but not operating within SLA. The most advanced level of IT expertise is required.

2. *Internal ITIL Operation team (governance level)*. This team provides the governance to the ITIL processes and operational procedures that exist in the *IT Center Management* division. The structure of operational processes and procedures are based on the ITIL 2007 edition (previously known as ITIL Version 3) framework and include Incident management, Change management, Problem management, Configuration management and Knowledge management.

The *Incident management* team is responsible for providing the registration procedure of all IT related incidents that are happening in the organization. It also brings together various stakeholders to discuss and review IT Services and statuses as well as ensures that a standardized and consistent approach is used to efficiently resolve all levels of incidents. The team consists of several Incident Specialists, Process Analysts and Process Owners.

The *Change management* team is responsible for governance of a standardized and consistent approach that is used for efficient work with all changes within the organization. The team is responsible for governance of all procedure for all changes deployed in the company in the Production environment. The team facilitates the dialog between the Business and IT divisions. They are responsible for improving day to day operations related to performing any IT changes. The team consists of several Change Coordinators, Process Analysts and Process Owners.

The *Problem management* team is responsible for managing lifecycle of all IT related problems. Their responsibilities include the acceptance or rejection of the problem investigation, root cause analysis as well as corrective and preventive actions. In addition,

they are also responsible for preventing future incidents and minimizing the impact of high-level incidents that were not prevented. The team consists of several Problem Specialists, Process Analysts and Process Owners.

The *Configuration management* team is responsible for creating the guidelines and procedure to operate all IT assets. They manage the lifecycle of the Configuration Items (CIs) by creating, updating, deleting, changing attributes and relationship keeping all data up to date. The team consists of several IT Asset Admins, Process Analysts and Process Owners.

The *Knowledge management team* is responsible for managing the lifecycle of all IT related knowledge articles which includes creating, updating, deleting, changing attributes and content. They are also responsible for improving the quality of knowledge articles and monitoring of its usage. The team consists from several Knowledge Authors, Process Analysts and Process Owners.

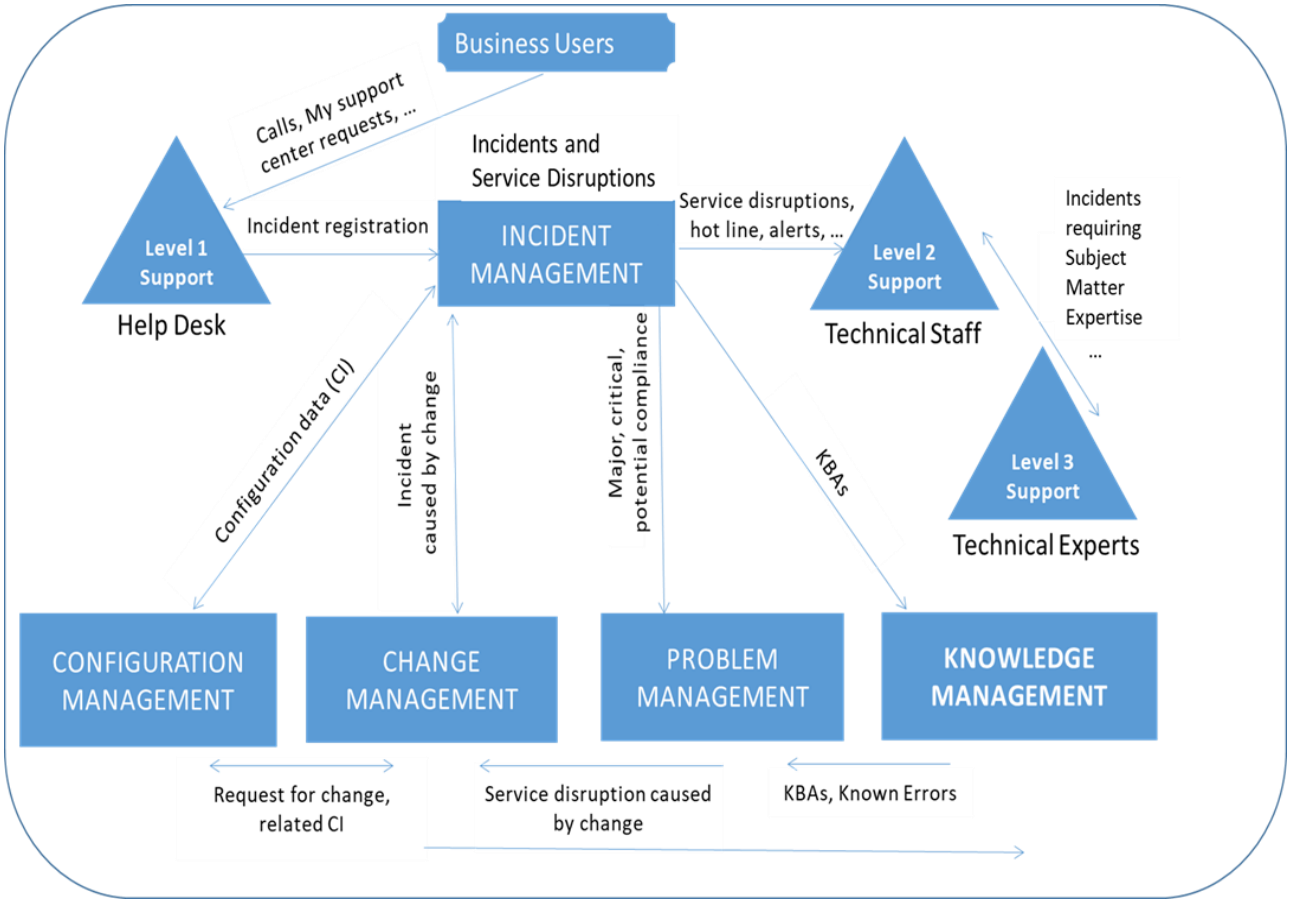

Figure 4: Structure of IT Center Management division within Telco Company XYZ based on ITIL 2007 edition concept (Author, 2019).

4.4.3 Problem definition

Based on the research and analysis that was done by researcher in the organisation the Telcom Company XYZ has the following areas that need to be improved:

- Sharing information across multiple internal and external teams as well as working across multiple geographical areas and time-zones.
- Teams collaboration and cooperation.
- Timely response to their customers and end-users along with quality of provided services.
- Ability to capture, store, transfer and share knowledge between the above-mentioned teams.

The company was suffering from high internal operational costs particularly in the IT Service desk area. The problem stemmed from the companies fast growing nature which led to knowledge being spread and not easily shared across multiple internal and external teams and multiple geographical areas and time-zones.

A few years ago, when the company was financially struggling, the IT service desk was pressured to move to a managed service model to reduce costs. The company used to have a small group of internal resources to support its IT applications and infrastructure. The team had worked together and resided in the same physical area making it easy to share their knowledge and work as a team.

The new model forced company to create three levels of response under *Global Technical Services division*. These included a Level 1 help desk now located in Asia, a Level 2 Application and Networking Services team located in US and a Level 3 team of application developers and infrastructure architects located in Europe to respond to deep technical questions. The *Internal ITIL Operations team* had also been geographically and process-based split to align with the ITIL 2007 edition processes framework for incident, problem, configuration, knowledge and change management processes.

To help pull everything together and operate effectively in the new organisational structure a *Global Operations Command Center (GOCC)* was formed with main responsibility in coordinating all activities across these teams, their processes and to all types of IT incidents. The challenge then became how can a geographically dispersed team work and share the knowledge required to provide timely responses to their customers and end-users.

The company now needs to invest in how to capture, store, transfer and share knowledge between the above-mentioned teams so they can be more effective and provide better quality of IT services to the internal end-users. The company would need a new innovative way to tackle this problem. It was the researcher's idea to link the ITIL processes with knowledge mapping in order to capture, manage and share knowledge across the new organization to solve this problem. The researcher did not find any previous companies that tried this method to solve what you would think is a very common business problem.

4.4.4 Strategy of company

Based on discovered knowledge mapping techniques and approaches the researcher put together the following strategy to address the problems listed above in the previous sub-chapter.

Strategy Steps:

Step 1: Introduce the project of Knowledge mapping to all interested parties such as team leads of IT Center Management.

Step 2: Choose the knowledge management tool as well as concept and adjust it to the needs of the ITIL service management organisation.

Step 3: To identify the candidate teams to conduct a pilot project of the knowledge mapping process within *Global Operations Command Center (GOCC)*.

Step 4: Fill the Knowledge maps with data collected through the Knowledge mapping process.

Step 5: Apply a knowledge gap measurement system and identify the level of knowledge gaps across the ITIL service operational processes.

Step 6: Analyse the result and create the proposal for how the existing knowledge gaps can be closed or reduced.

Step 7: To create the proposal how Knowledge mapping process can be applied on entire ITIL service management organization.

The listed above strategy was revived and agreed with the head of the Internal ITIL Operations team. These steps will help lay the foundation to ensure the company has all right knowledge to successfully operate its IT Service Management processes in order to provide better service for the end-users. Also, these steps will help the IT Service organisation to share, use and re-use the knowledge, to better achieve their company objectives.

4.4.5 Strategy Execution

The *Internal ITIL Operations team (governance level)* was identified as a good candidate for participating in the Knowledge Mapping Process and Knowledge Gap Analysis. It was selected because this team is in the service delivery management organization responsible

for oversight and governance of the IT support services within the Telecom Company XYZ. It includes more than 50 employees across different regions and areas throughout the company. This team is responsible for effective work and constant improvement of IT operations and services including ITIL service management processes.

To assist in achieving the strategy described above, the decision was made to conduct a pilot of the knowledge mapping process across an important ITIL process called "Problem Management" which is one of the largest in scope and the least mature process in the researched organization. Team leaders identified it was the best process as it would provide the most value to the researched company as it was necessary to improve the capturing and storing of important knowledge for easy retrieval, distributing, sharing, managing and updating this information. Therefore, it was decided to apply the Knowledge mapping framework including the Knowledge gap measurement as the solutions to solve the above-mentioned problems. Also, the analysis would then be used to identify knowledge gaps and areas for improvement of the process.

4.5 Case study: Application of Knowledge mapping framework

The research will be done based on the internal support group "*Internal ITIL Operations team (governance level)*". This organization is established based on ITIL 2007 edition framework and follows best practices for IT service management (ITSM) that focuses on aligning IT services with the needs of business. This team delivers procedure and governance for such ITIL processes as Incident management, Change management, Problem management, Configuration management and Knowledge management. Although Knowledge management exist as the established process, its scope in the company mostly provide governance for creating technical knowledge articles that helps incident analysts to resolve any incidents. However, this process does not provide the approach for how to manage all existing knowledge across geographical spread of the Internal ITIL Operations team and how to identify knowledge gaps and areas for improvement of the processes.

The *Internal ITIL Operations team (governance level)* communicates and collaborates with such working teams as Call Center, ITSM technical team, Major services support team, Analytics team, Content management team, Help desk, etc. The Internal ITIL Operations team is responsible for aligning all IT processes in the company in order to provide the best quality of IT services and resolve any IT incidents as fast as possible and with the highest quality possible.

Knowledge mapping will be used as the powerful diagnostic to identify knowledge assets in Internal ITIL Operations team (governance level) and the level of knowledge gaps. It will be used specifically to capture what is explicit and what is tacit knowledge in the given ITIL process and a subsequent knowledge gap measurement and analysis that will be done based on the collected data.

The results of Knowledge Maps are ways to inventory and quickly retrieve where those knowledge assets reside in a company (Russ, 2010).

For this research, the researcher chose the Problem management process which was the largest in scope and the least mature process in the researched organization.

Problem Management Process is one of the core processes in ITIL service organization that handles the life cycle management of IT problems that occur in an organization. The main goal is to ensure you manage and track all problems, determine root cause in order to prevent them from happening again and minimize the impact to the business (OGC, 2007).

In preparation for the interviews the researcher utilized the following guidelines:

1) Identified the individuals in the organization that are critical for obtaining the necessary information to populate the knowledge maps.
2) Defined the structure of the interview process (in-person semi-structured interview).
3) Created the questions based on the research and each participants role in the organization.
4) Set a maximum time of one 1 hour for first interview with the potential of a 30-minute follow-up interview to answer any open questions.

The researcher prepared in advance the knowledge mapping tool that was described in the section 4.4. of this research and was used for the entire interview process.

The researcher started building the Knowledge map with an interview of the leader of the Problem management process (Process owner) in order to create a list of sub-processes (tasks/activities) that were identified as core for preforming the Problem management process. Based on the initial interview with the Process owner, the core activities, tools, systems, applications and data stores for the Problem management process were identified and mapped in the Knowledge Mapping tool. This helped the researcher to prepare for more detailed analysis of the process and the next set of interviews with the other team members who are working on the sub-processes and activities of Problem management.

The team leader suggested the following list of sub-processes (tasks) that are core for preforming the Problem management process:

- Problem Review Board
- Pre - Problem Review Board
- Post - Problem Review Board
- Audit
- Trainings for IT audience
- Governance
- Metrics

A number of interviews were performed with the people who are responsible for the different task of these processes in order to get a detailed overview of each task. The names of the people whom researcher interviewed and their positions in the company are included in the final version of the Knowledge map. The interviews were in the form of semi-structured face to face interview, where specific questions and topics for the respondents were prepared in advance but allowed the respondents to be flexible in their answers and

ask the researcher questions as well. Moreover, the researcher had to assure all the participants that their answers will remain anonymous and the information they provided will not be revealed or used for any other purposes apart from this research.

The main questions that were included in the Knowledge map:

- What are the main Sub-processes/tasks that you have in the Problem Management process?
- What are the main outcomes of the above-mentioned Sub-processes/ tasks?
- What are the key Knowledge assets that are critical for the above-mentioned Sub-processes/tasks?
- Where are the knowledge assets stored?
- Who has this knowledge?
- What are the types of Knowledge assets: Tacit, Explicit or both?

After completing the set of interviews with the Problem Management team, the Knowledge map for this process was filled with the collected data **(Appendix A: Completed Knowledge map for Problem management).**

This map captured the key sub-processes and tasks of the Problem Management process, all critical Knowledge assets that allow the researched organization to functionally run and operate, the location of these Knowledge assets including portals, folders and employee knowledge and experience, the name of the teams and employees who possess these knowledge assets as well as the type of these knowledge assets (Tacit or Explicit).

4.6 Case study: Knowledge Gap Analysis

ITIL 2007 edition (previously known as ITIL Version 3) suggests "*An analysis of the knowledge gap (if any) within the organization should be undertaken. The gap will need to be researched and established by direct investigation of staff's understanding of the knowledge requirements for them to deliver their responsibilities compared with their actual observed knowledge"* (OGC, 2007). *"The output from the knowledge gap exercise will form the basis for a communications improvement plan which will enable planning and measurement of success in communication of knowledge*" (OGC, 2007). However, the ITIL 2007 edition framework does not suggest any practical audit techniques or methods for how to perform analysis of knowledge gaps within the ITIL services. Also, in the literature review researcher did not find a big variety of metrics that can be used to measure the knowledge gaps across companies' processes. However, the valuable concept of measuring knowledge gaps in the business processes was suggested by the APQC organisation. According to APQC gap analysis is "*a technique for identifying variances between goals and current performance in order to determine next steps to move from the current state to a desired is a future state*" (APQC, 2018). Researcher found that it is a

valuable and applicable concept for this research. This measurement concept was adopted by the author to fit the aim of this research and represented in the following table.

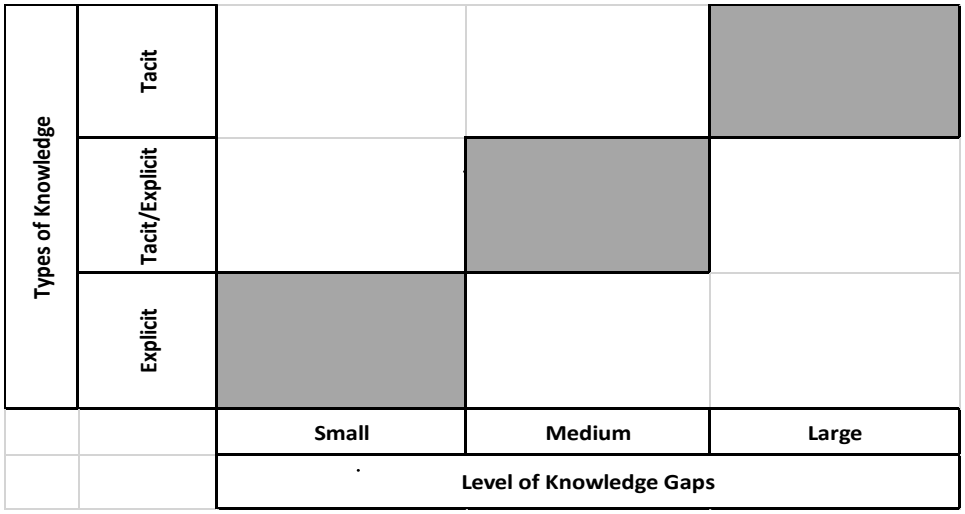

Figure 5: Knowledge gaps measurement matrix (Author, 2019).

To describe the concept represented above the Gap analysis is done on the following basis:

- **Small Gap**
  If the process relies and operates mostly on the Explicit knowledge it shows small gap on the process.

- **Medium Gap**
  If the process relies and operates on Tacit and Explicit Knowledge it shows a Medium gap on the process.

- **Large Gap**
  If process relies and operates based mostly on Tacit knowledge only it shows a Large gap on the process

The knowledge assets that were collected during the Knowledge mapping process into Knowledge map were measured by the researcher based on the Measurement framework described above and the results are represented on the tables below.

Sub-processes/tasks	Sub-processes/tasks outcomes	Knowledge assets that are critical for the Sub-processes/tasks	Type of Knowledge assets: Tacit, Explicit or both	Level of Knowledge gaps
Audit	Reduce amount of overdue opened cases and make sure that time frames of closure are followed	List of old opened cases	Explicit	Small
		Criteria to select case for audit	Tacit	Large
		Case Tracker	Explicit	Medium
		Pattern case Tracker	Tacit	Large
		Recent updates on the current situation of the opened cases	Explicit/Tacit	Medium

Figure 6: Knowledge gaps Analysis for Audit (Author, 2019).

Sub-processes/tasks	Sub-processes/tasks outcomes	Knowledge assets that are critical for the Sub-processes/tasks	Type of Knowledge assets: Tacit, Explicit or both	Level of Knowledge gaps
Problem Review Board	Accept or decline the IT problem investigation	The list of new approved cases after Pre-PRB Call	Explicit	Small
		Instructions for how to prepare the PRB agenda	Tacit	Large
		PRB agenda	Explicit/Tacit	Medium

Figure 7: Knowledge gaps Analysis for Problem Review Board (Author, 2019).

Sub-processes/tasks	Sub-processes/tasks	Knowledge assets that are critical for the Sub-processes/tasks	Type of Knowledge assets: Tacit, Explicit or both	Level of Knowledge gaps
Pre-PRB	The final decision which cases will be presented on the PRB call	List of approved cases by Problem coordinators cases	Tacit	Large
		Criterias of the final cases approve for PRB call	Tacit	Large
		The final list of the approved cases for PRB call	Explicit	Small

Figure 8: Knowledge gaps Analysis for Pre-PRB (Author, 2019).

Sub-processes/tasks	Sub-processes/tasks outcomes	Knowledge assets that are critical for the Sub-processes/tasks	Type of Knowledge assets: Tacit, Explicit or both	Level of Knowledge gaps
Post-PRB	Summarize all deccisions and recommendations during the PRB call and send out meeting minutes	Instructions for how to prepare meeting minutes after each PRB call	Tacit	Large
		Recommendations from subject matter experts for each presented case in the PRB meeting	Explicit	Small
		Notes (meeting minutes) after each PRB meeting	Explicit/Tacit	Medium
		Prepared e-mail of Meeting minutes to send it out	Explicit/Tacit	Medium

Figure 9: Knowledge gaps Analysis for Post-PRB (Author, 2019).

Sub-processes/tasks	Sub-processes/tasks outcomes	Knowledge assets that are critical for the Sub-processes/tasks	Type of Knowledge assets: Tacit, Explicit or both	Level of Knowledge gaps
Trainings for IT audience	Introduce IT audience to the Problem management process, the main bemefits and outputs, tools and tasks	Admin Access to the Learning system in order to create new Problem Management training or modify existing trainings	Explicit	Small
		Feedback from the Training participants on the attended training	Explicit/Tacit	Large
		Knowledge about ITSM organization (we can create a JobAid)	Tacit	Large
		Marketing communication to the IT audience about available courses, new updates as well as new courses	Explicit/Tacit	Medium

Figure 10: Knowledge gaps Analysis for Trainings for IT audience (Author, 2019).

Sub-processes/tasks	Sub-processes/tasks outcomes	Knowledge assets that are critical for the Sub-processes/tasks	Type of Knowledge assets: Tacit, Explicit or both	Level of Knowledge gaps
Governance	Create guidelines and procedure to operate the process	IT SOPs	Explicit	Small
		Job Aids	Explicit	Small
		Instructions for how to update and create new IT SOPs	Tacit	Large
		Instructions for how to update and create new Job Aids	Tacit	Large
		Knowledge about Problem Management process	Tacit	Large
		Marketing communication to IT audience about the creation or updates to the IT SOP or Job Aids	Explicit/Tacit	Medium

Figure 11: Knowledge gaps Analysis for Governance (Author, 2019).

Sub-processes/tasks	Sub-processes/tasks outcomes	Knowledge assets that are critical for the Sub-processes/tasks	Type of Knowledge assets: Tacit, Explicit or both	Level of Knowledge gaps
Metrics	Manage and track adherence to the ITSOP	Access to ITSM system, Incident and Problem modules	Explicit	Small
		Daily Problem management reports	Tacit	Large
		Access to the Daily Problem Management Dashboard	Explicit	Small
		Problem Management dashboard Key metrics	Tacit	Large
		Weekly report for the IT managers on the Problem Management metrics	Tacit	Large

Figure 12: Knowledge gaps Analysis for Audit (Author, 2019).

Described above in the knowledge measurement tool which includes a clear definition of what is considered tacit versus an explicit knowledge assets. The status of critical Knowledge assets in the researched organization were identified and the Knowledge gaps were measured and assessed in three categories (small, medium and large).

4.7 Research findings

After the data was collected through interviews in the knowledge mapping tool (knowledge map) for the Problem management process, the researcher applied the knowledge gap measurement system described in section 4.7 of this thesis and identified the following list of Large and Medium level of knowledge gaps.

Table 5: Identified Knowledge gaps in Problem management process.

ITIL Process	Sub-processes/tasks	Critical Knowledge Assets	Knowledge gaps
Problem management	Audit	Criteria to select case for audit	Large
Problem management	Audit	Case Tracker	Medium
Problem management	Audit	Pattern case Tracker	Large
Problem management	Audit	Recent updates on the current situation of the opened cases	Medium
Problem management	Problem Review Board	Instructions for how to prepare the PRB agenda	Large
Problem management	Problem Review Board	PRB agenda	Medium
Problem management	Pre-PRB	List of approved cases by Problem coordinators cases	Large
Problem management	Pre-PRB	Criterias of the final cases approve for PRB call	Large
Problem management	Post-PRB	Instructions for how to prepare meeting minutes after each PRB call	Large
Problem management	Post-PRB	Recommendations from subject matter experts for each presented case in the PRB meeting	Small
Problem management	Post-PRB	Notes (meeting minutes) after each PRB meeting	Medium

Problem management	**Post-PRB**	**Prepared e-mail of Meeting minutes to send it out**	**Medium**
Problem management	**Trainings for IT audience**	**Feedback from the Training participants on the attended training**	**Large**
Problem management	**Trainings for IT audience**	**Knowledge about ITSM organization (we can create a JobAid)**	**Large**
Problem management	**Trainings for IT audience**	**Marketing communication to the IT audience about available courses, new updates as well as new courses**	**Medium**
Problem management	**Governance**	**Instructions for how to update and create new IT SOPs**	**Large**
Problem management	**Governance**	**Instructions for how to update and create new Job Aids**	**Large**
Problem management	**Governance**	**Knowledge about Problem Management process**	**Large**
Problem management	**Governance**	**Marketing communication to IT audience about the creation or updates to the IT SOP or Job Aids**	**Medium**
Problem management	**Metrics**	**Daily Problem management reports**	**Large**
Problem management	**Metrics**	**Access to the Daily Problem Management Dashboard**	**Small**
Problem management	**Metrics**	**Problem Management dashboard Key metrics**	**Large**
Problem management	**Metrics**	**Weekly report for the IT managers on the Problem Management metrics**	**Large**

The completed knowledge map along with the result of Knowledge Gap measurement was presented to both the Problem management team and Problem management Process owner in order for them to verify the findings and discuss the possibilities for closing or reducing the knowledge gaps in the researched sub-processes and tasks.

The result of the research satisfied the Team as well as Process owner and they agreed with all finding that were represented in the table above.

The researcher and the Process Owner decided to assign the statuses to the knowledge gaps that were identified during the Knowledge mapping process. The following statuses were defined:

- Small Gap - Low priority
- Medium Gap - Medium priority
- Large Gap - High Priority

Researcher agreed with Process Owner that further analysis and the development of a proposal on how to close or reduce the knowledge gaps will focus just on the high and medium priority gaps. The Low priority gaps will be not be taken into account as they are considered as the normal operational (working) situation and represent the normal working sub-process/task that has all the necessary explicit knowledge and are well documented in order to operate with good or higher quality.

4.8 Research challenges

During the implementation of the pilot of the Knowledge mapping process, the researcher identified a challenge during the research interviews with the Respondents.

This was known as knowledge mapping barriers which according to APQC is called "knowledge is power". In some cases, this occurs when employees hold back information and don't share it with the rest of the organization because they feel it provides them an advantage over others and could be viewed as power making them feel more important or valuable in the organization. The challenge if often overcome when you explain to those being interviewed that the knowledge map should be viewed as a tool that allows them to identify critical knowledge and barriers to the flow of how it is used in the organization. Still you may need to convince them that it will actual help them to perform their tasks more efficiently, avoid error and rework and help position them to success in the future (APQC, 2018).

4.9 Proposal 1: Reducing and eliminating knowledge gaps in the Problem Management process

The identified knowledge gaps to analyze were divided into Medium and High priority. The Knowledge gaps with Low priority represented normal working processes that operate mostly on Explicit knowledge and it was determined that there is no need to implement any changes them. The author of this thesis then proposed a list of solutions that potentially

could illuminate the Knowledge gaps on the sub-processes and tasks of Problem management process. This will result in improving the ITIL services. The proposal was discussed with the Problem management team including the Problem management Process Owner in order to get their opinion, suggestions and confirmation on how the situation with the existing knowledge gaps could be approached. The comments from Process owner and the Team were recorded in the section "Comments". Then the proposal was presented to the Head of Internal ITIL Operations team. The proposal below contains an action plan with suggested solutions on how the Medium and High priority knowledge gaps can either be closed or reduced.

Sub-processes/tasks	Sub-processes/tasks outcomes	Knowledge assets that are critical for the Sub-processes/tasks	Type of Knowledge assets: Tacit, Explicit or both	Level of Knowledge gaps	Gap priority	Action plan	Comments
Audit	Reduce amount of overdue opened cases and make sure that time frames of closure are followed	List of old opened cases	Explicit	Small	Low	Does not need improvement	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Criteria to select case for audit	Tacit	Large	High	Identify the key criteria of the sub-process and create a JobAid that will provide clear guidelines to all team members and will be stored in the internal portal for the Team's access	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Case Tracker	Explicit	Medium	Medium	Process Automation that helps to retrieve the data about opened cases from ITSM operational database and generates an up to date report	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Pattern case Tracker	Tacit	Large	High	Create an additional field in the Problem ticket form that will mark the case as the pattern and relate it to the same group of pattern cases based on the assigned code by the Problem specialist	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Recent updates on the current situation of the opened cases	Explicit/Tacit	Medium	Medium	Create the page on the internal portal where the team will copy all email communications about the status of all opened cases	Confirmed by Process Owner and Head of Internal ITIL Operations team

Figure 13: The action plan for Audit sub-process (Author, 2019).

Sub-processes/tasks	Sub-processes/tasks outcomes	Knowledge assets that are critical for the Sub-processes/tasks	Type of Knowledge assets: Tacit, Explicit or both	Level of Knowledge gaps	Gap priority	Action plan	Comments
Problem Review Board	Accept or decline the IT problem investigation	The list of new approved cases after Pre-PRB Call	Explicit	Small	Low	Does not need improvement	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Instructions for how to prepare the PRB agenda	Tacit	Large	High	Identify the key aspects of the PRB Agenda and create a JobAid that will provide clear guidelines to all team members and store it in the internal portal for Team's access	Confirmed by Process Owner and Head of Internal ITIL Operations team
		PRB agenda	Explicit/Tacit	Medium	Medium	Create a Team space on the ITSM portal where Team can work together on the same file to prepare an Agenda and send via e-mail.	Confirmed by Process Owner and Head of Internal ITIL Operations team

Figure 14: The action plan for Problem Review Board sub-process (Author, 2019).

Sub-processes/tasks	Sub-processes/tasks	Knowledge assets that are critical for the Sub-processes/tasks	Type of Knowledge assets: Tacit, Explicit or both	Level of Knowledge gaps	Gap priority	Action plan	Comments
Pre-PRB	The final decision which cases will be presented on the PRB call	List of approved cases by Problem coordinators cases	Tacit	Large	High	Automation of process by Creating a field in the Problem ticket form that will allow the problem coordinator to mark the case as approved and select it for pre-prb call	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Criterias of the final cases approve for PRB call	Tacit	Large	High	Identify the key criteria for the final cases approve for the PRB call and create a JobAid that will provide clear guidelines to all team members and stored in the internal portal for the Team's access	Confirmed by Process Owner and Head of Internal ITIL Operations team
		The final list of the approved cases for PRB call	Explicit	Small	Low	Does not need improvement	Confirmed by Process Owner and Head of Internal ITIL Operations team

Figure 15: The action plan for Pre-PRB sub-process (Author, 2019).

Sub-processes/tasks	Sub-processes/tasks outcomes	Knowledge assets that are critical for the Sub-processes/tasks	Type of Knowledge assets: Tacit, Explicit or both	Level of Knowledge gaps	Gap priority	Action plan	Comments
Post-PRB	Summarize all deccisions and recommendations during the PRB call and send out meeting minutes	Instructions for how to prepare meeting minutes after each PRB call	Tacit	Large	High	Identify the key aspects of meeting minutes after PRB call and create a JobAid that will provide clear guidelines to all team members on how to prepare meeting minutes after PRB call. The JobAid will be stored in the internal portal for the Team's access	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Recommendations from subject matter experts for each presented case in the PRB meeting	Explicit	Small	Low	Does not need improvement	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Notes (meeting minutes) after each PRB meeting	Explicit/Tacit	Medium	Medium	Create the Team space on the ITSM portal where Team can store the notes (meeting minutes) after each PRB meeting	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Prepared e-mail of Meeting minutes to send it out	Explicit/Tacit	Medium	Medium	Create the Team space on the ITSM portal where Team can work together on the same file to prepare the e-mail of Meeting minutes to send it out. In addition, they can include automation of sending email (creating specific group, managing of distribution group, standardized email template, populate specific fields)	Confirmed by Process Owner and Head of Internal ITIL Operations team

Figure 16: The action plan for Post-PRB sub-process (Author, 2019).

Sub-processes/tasks	Sub-processes/tasks outcomes	Knowledge assets that are critical for the Sub-processes/tasks	Type of Knowledge assets: Tacit, Explicit or both	Level of Knowledge gaps	Gap priority	Action plan	Comments
Trainings for IT audience	Introduce IT audience to the Problem management process, the main bemefits and outputs, tools and tasks	Admin Access to the Learning system in order to create new Problem Management training or modify existing trainings	Explicit	Small	Low	Does not need improvement	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Feedback from the Training participants on the attended training	Explicit/Tacit	Large	Medium	Create post training survey by using one of the existing survey tools that will help to collect feedback from the participants and provide real-time reports in order to improve trainings and update contents accordingly	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Knowledge about ITSM organization (we can create a JobAid)	Tacit	Large	High	Employee who work in the Problem Management process need to obtain ITIL certification	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Marketing communication to the IT audience about available courses, new updates as well as new courses	Explicit/Tacit	Medium	Medium	Install (to incorporate the usage of) a marketing e-mail communication tool that will send attractive marketing communications to IT audience that are working on Problem Management about available courses, new updates as well as new courses. Also create a Knowledge article that will be stored on the Internal Problem Management portal (Team space) that explanations how to use the marketing tool and key aspects of the e-mail communications.	Confirmed by Process Owner and Head of Internal ITIL Operations team

Figure 17: The action plan for Post-PRB sub-process (Author, 2019).

Sub-processes/tasks	Sub-processes/tasks outcomes	Knowledge assets that are critical for the Sub-processes/tasks	Type of Knowledge assets: Tacit, Explicit or both	Level of Knowledge gaps	Gap priority	Action plan	Comments
Governance	Create guidelines and procedure to operate the process	IT SOPs	Explicit	Small	Low	Does not need improvement	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Job Aids	Explicit	Small	Low	Does not need improvement	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Instructions for how to update and create new IT SOPs	Tacit	Large	High	Identify the key aspects of the process for updating and creating new IT SOPs. In additiion, create a Knowledge article that will be stored on the Internal Problem Management portal (Team space) with an explanation for how to execute this process.	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Instructions for how to update and create new Job Aids	Tacit	Large	High	Identify the key aspects of the process for updating and creating new IT SOPs. In additiion, create a Knowledge article that will be stored on the Internal Problem Management portal (Team space) with an explanation for how to execute this process.	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Knowledge about Problem Management process	Tacit	Large	High	Employee who work in the Problem Management process need to obtain ITIL certification	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Marketing communication to IT audience about the creation or updates to the IT SOP or Job Aids	Explicit/Tacit	Medium	Medium	Install (to incorporate the usage of) a marketing e-mail communication tool that will send attractive marketing communications to IT audience that are working on Problem Management about available courses, new updates as well as new courses. Also create a Knowledge article that will be stored on the Internal Problem Management portal (Team space) that explanations how to use the marketing tool and key aspects of the e-mail communications.	Confirmed by Process Owner and Head of Internal ITIL Operations team

Figure 18: The action plan for Governance sub-process (Author, 2019).

Sub-processes/tasks	Sub-processes/tasks outcomes	Knowledge assets that are critical for the Sub-processes/tasks	Type of Knowledge assets: Tacit, Explicit or both	Level of Knowledge gaps	Gap priority	Action plan	Comments
Metrics	Manage and track adherence to the ITSOP	Access to ITSM system, Incident and Problem modules	Explicit	Small	Low	Does not need improvement	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Daily Problem management reports	Tacit	Large	High	Create a Knowledge article that will be stored on the Internal Problem management portal (Team space) with an explanation how to work with the Problem management reports.	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Access to the Daily Problem Management Dashboard	Explicit	Small	Low	Does not need improvement	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Problem Management dashboard Key metrics	Tacit	Large	High	Create a Knowledge article that will be stored on the Internal Problem management portal (Team space) with an explanation how to work with the Problem Management BI tool (Dashboard) and the key metrics that use it.	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Weekly report for the IT managers on the Problem Management metrics	Tacit	Large	High	Identify the key aspects of the weekly report for the IT managers, create an online template that will be accessible through the Team space portal and create a Knowledge article that will be stored on the Internal Problem management portal (Team space) with an explanation on how to populate the fields in the template and send it to the managers. (possible to include automation of sending e-mail including creating specific group, management of the distribution list, standardized e-mail template amd population of specific fields)	Confirmed by Process Owner and Head of Internal ITIL Operations team

Figure 19: The action plan for Metrics sub-process (Author, 2019).

4.10 Proposal 2: Implementation of Knowledge Mapping across ITIL services

The researcher discussed with the Head of Internal ITIL Operations team how Knowledge mapping process can benefit to entire ITIL service management organization when it was established as one of the processes to help monitor, control and asses all the knowledge assets that the ITIL service management organization possess and rely on when it provides IT services. In addition, the Knowledge mapping process that was established as the regular process will prevent the appearance of any new knowledge gaps and helps identify the existing knowledge gaps across the ITIL processes that will then result in performance improvement of the IT services.

There is the huge potential for implementing Knowledge mapping across all ITIL processes in the company. This can be accomplished the same way the Knowledge mapping process and knowledge gap measurement were done for Problem management. It is the

researcher's recommendation to complete this for all the ITIL processes in the Telecom company XYZ. The implementation of Knowledge mapping across all ITIL process will allow the company to see the areas across the processes that can be standardized, avoid overlapping and double work across processes as well as identify the best practices in some processes that could be used by other processes.

It is clear that Knowledge Mapping is a useful tool which help you to see a clear path for how to get from Point A to Point B more efficiently. It is important that companies realize in order to get the value from knowledge maps they should use them as starting points to identify gaps. Furthermore, they must then implement KM tools that will help improve the flow of knowledge. It is important to realize that knowledge mapping is dynamic and constantly changing so they must be constantly updated as processes evolve, new employees replace older ones or new goals emerge in order for them to stay relevant. Therefore, it is important for a company to frequently update their knowledge maps with any changes that may affect the flow of knowledge or present any new gaps (APQC, 2018).

Also, by establishing the Knowledge mapping as a regular ongoing process it will help the Telecom company XYZ to resolve the problem of sharing or transferring knowledge across geographically dispersed teams. This capturing, storing, transfer and sharing this knowledge between IT support teams spread across the globe can then be more effective and provide better quality of services.

Following the Project lifecycle for the Knowledge mapping process, the researcher offered to help the company extend the framework of the Pilot with one of the processes used in the Internal ITIL Operations team.

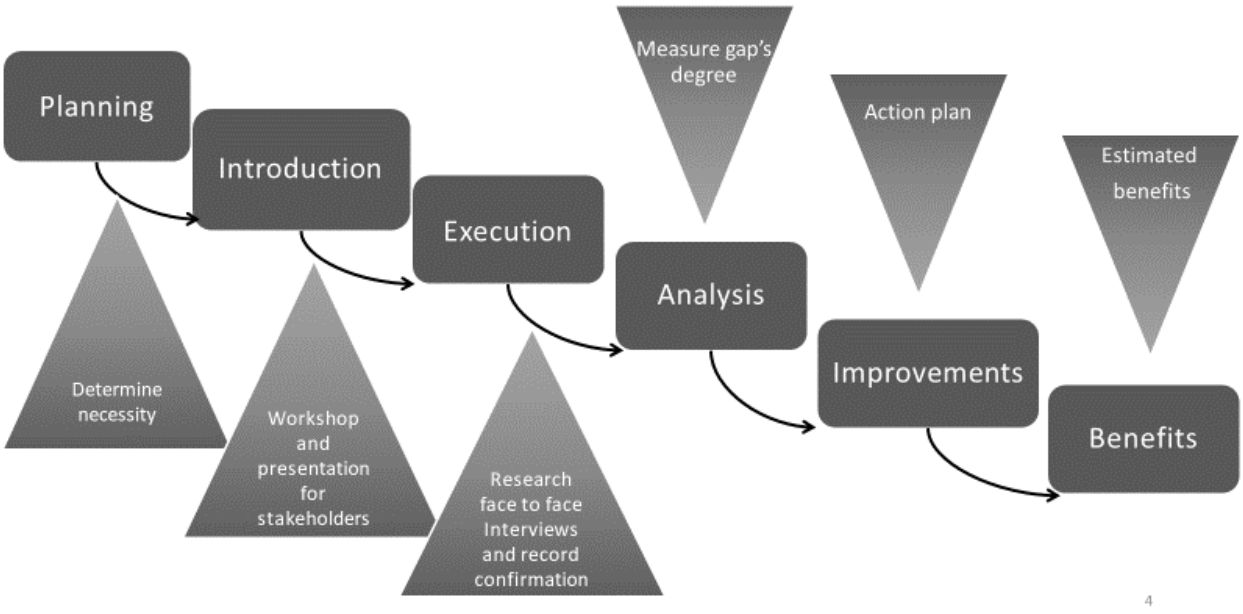

Figure 20: Knowledge Mapping Project lifecycle Proposal (Author, 2019).

Planning: conduct meetings with the managers (stakeholders) to discuss knowledge mapping requirements and explain the benefits of performing the knowledge mapping process. Identify ITIL Process Owners and other team members who will participate in the interview process. Determine the core processes, sub-processes, tasks, objectives and knowledge assets by doing the initial research with managers (stakeholders).

Introduction*:* present the concept of the Knowledge mapping project including the introduction of the knowledge mapping process, template of knowledge mapping tool, the example of knowledge map from the completed pilot to the teams and their managers. In addition, introduce the measurement system that will be used to perform knowledge gap analysis.

Execution*:* includes four steps.

- **First step** is the initial research required to collect available data about the researched processes by performing external observation and investigation of available documents and tools. The information collected about the processes needs to be included in the first draft of Knowledge map in order to help the researcher to conduct the required interviews and facilitate discussions with the participants.
- **Second step** is to perform interviews with the identified key team members.
- **Third Step** is to record the collected data and populate the knowledge map.
- **Fourth step** is getting confirmation from the Process Owners and respondents that the data and knowledge assets which were collected in the Knowledge map are correct or adjusted according to *Team's* suggestions.

Analysis: *is* based on the chosen measurement system to analyze the knowledge assets and identify knowledge gaps in the ITIL processes. It defined knowledge gaps on the following three categories: Small, Medium and Large. It then goes on to present the list of identified knowledge gaps to the Teams and Process owners to get their opinion, confirmation and discuss ideas how knowledge gaps can be reduced or eliminate. Finally, together with the managers identify the knowledge gaps that needs to be improved based on the level of priority (Low, Medium and High).

Improvements*:* based on the results of the knowledge gap analysis, the researcher discussed with the teams and managers possible solutions that can help to close or eliminate existing knowledge gaps. An action plan was then presented to the stakeholders that suggested the list of solutions for future implementation in order to get the manager's to approve in order to start the scheduling for the future implementation.

Benefits*:* prepare the final presentation for the managers (stakeholder) to highlight the successful execution of the Knowledge mapping processes, key findings and benefits.

After Knowledge mapping is completed for the core ITIL processes in the Telecom company, Knowledge maps for all processes will be stored in the Internal portal (ITIL Team space) so they are accessible for all team members. They will then be available for retrieving the knowledge to perform the processes or for adjusting the data inside process maps as things change overtime.

Knowledge mapping across the ITIL process should be reviewed periodically, as Knowledge assets and processes are not constant and always changing. So it is recommended that once per quarter the company performs a review of their Knowledge mapping process and knowledge gap analysis.

The following diagram depicts the Knowledge Mapping process describe above.

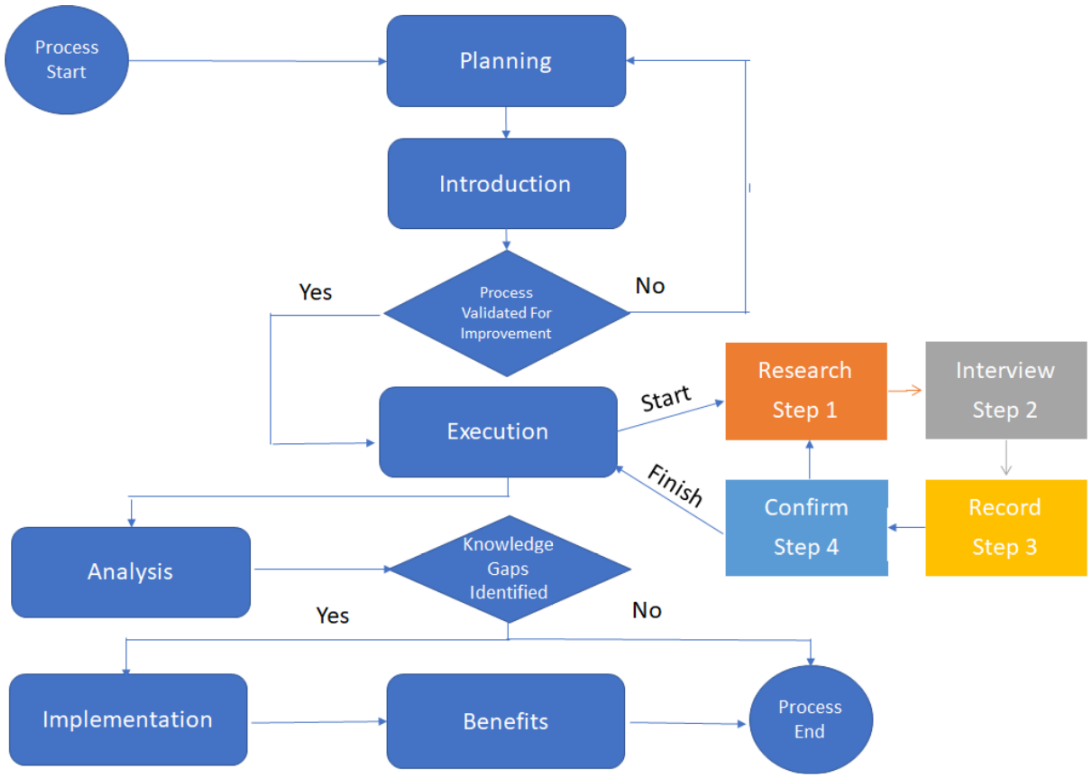

Figure 21: Knowledge Mapping Process Proposal (Author, 2019).

4.11 Results Achieved

To present the results, the author of this thesis conducted a meeting with the head of the Internal ITIL Operations team and Process Owner where the researcher presented the identified and analyzed Knowledge gaps. The gaps were divided into Medium and High priorities. The researcher then presented the measurement concept that was used to identify and analyze those knowledge gaps. Also, there was a proposed list of solutions (Action plan) presented that potentially could illuminate or reduced the identified Large and Medium Knowledge gaps on the sub-processes and tasks of Problem management process that will result in improving the ITIL services. This proposed (Action plan) was already previously discussed and validated with Process Owner and Problem management team who are considered the subject matter experts in this area. Their validation was a critical endorsement as to the validity of the research as it showed alignment of the gaps and

agreement that the action plan would provide the significant value to the company by improving the capture, share, transfer and retaining knowledge across multiple teams and geographical boundaries that will improve the performance of ITIL services. The researcher also presented the full proposal on how to implement Knowledge Mapping across other ITIL services in the Internal ITIL Operation team (governance level).

Due to the positive findings, the researcher received approval to implement both solutions Proposal 1: Action plan to reduce the level of knowledge gaps in the Problem management process and Proposal 2: Implementation of Knowledge Mapping across ITIL services.

At the submission of this thesis, the Head of Internal ITIL operations team confirmed that the two proposals were being implemented in the company. The full implementation of Proposal 1 and Proposal 2 as well as the measurement of the results of the service improvement will be the subject of another researcher.

The head of the Internal ITIL Operations team could clearly see the business value as the Knowledge map was designed in such way that employees could easily see the Knowledge gaps in their process and provided ideas for how these gaps could be closed.

Full validated research by Head of Internal ITIL operations team with the Completed Knowledge maps for Problem Management with Analysis and Action plan can be found in **Appendix B.**

The Process owners and head of Internal ITIL Operations team could easily see the advantage of utilizing the knowledge mapping process as the part of ITIL ecosystem. It showed the Internal ITIL Operations team that they could convert tacit knowledge into explicit and use the Knowledge Mapping tool to identify the areas where Tacit knowledge is dominate in order to document all necessary knowledge. It could also be used to create process documentation for easy transfer and access of these knowledge assets by multiple employees and teams across the globe. It was clearly proven that the Knowledge mapping process was the best fit for the Telecom company XYZ to solve its problem to find a solution for how to transfer and share knowledge across geographically spread teams. On addition, it also provides a mechanism for how to capture, store, transfer and share knowledge between the IT support teams and divisions so they could be more effective and provide better quality of services to the end-users. Lastly, the implementation of the Knowledge mapping process across all ITIL processes will allow them to see the area that can be standardized, where to avoid overlapping and double work across processes as well as to identify best practices in some processes that can be utilized by other processes. The researcher offered a proposal for implementing a Knowledge mapping process across all ITIL process in the organization based on the successful implementation of the pilot process for Problem management process. The result was an effective and elegant solutions for the Telecom company XYZ to resolve the knowledge transfer, sharing and capturing problems without significant investment from the company.

I used the satisfaction and confirmation from the Process owner and head of Internal ITIL Operations team as a proxy to measure the value that pilot project of Knowledge mapping process brought to them. They also agreed that they saw value with my proposal for the implementation of using the Knowledge mapping process across all ITIL processes in the

Internal ITIL Operations team. In conclusion of my results, the utilization of Knowledge mapping for the ITLT processes in combination with a knowledge mapping tool provided a successful foundation of Knowledge management within the organization that will reflect on process improvement and drive overall organizational performance.

Conclusion

The main point of the research is to implement a knowledge mapping process across ITIL services in a given Telecom company XYZ that utilized ITIL 2007 edition (previously known as ITIL Version 3) framework and analyze the result by identification as well as measuring the existing knowledge gaps. In addition, the goal was to reveal the key theoretical aspects related to Knowledge, Knowledge management, Knowledge mapping and ITIL framework. In order to accomplish this the researcher analyzed the existing knowledge mapping techniques and knowledge mapping tools and its practical implementation. Futhermore a proposal was prepared for reducing the level of knowledge gaps resulting in the improvement of service. Finally, it was shown that by applying ITIL 2007 edition structure in combination with Knowledge mapping in an organization that uses the ITIL 2007 edition service management framework, it can provide significant benefits to their organization.

ITIL 2007 Edition in Service Transition publication describes Knowledge Management as the management of Knowledge, Information and Data (OGC, 2007). This thesis focuses on how to identify the knowledge gaps in daily operational procedures and tasks. Analyse and measure identified knowledge gaps within the ITIL services in order to improve the performance of the IT service management organization. In short, it will show how an ITSM organization that utilizes ITIL 2007 Edition framework can benefit from applying Knowledge Mapping process. It is a unique approach since ITIL 2007 edition itself does not include knowledge mapping as the process for identification and measuring of knowledge gaps in daily operational procedures and tasks for ITIL Services. By doing so it will provide a consistence approach for teams to leverage their existing knowledge, share this knowledge, keep and develop new knowledge based on their existing knowledge, as well as identify additional knowledge needs in the areas where knowledge gaps were identified. This is particularly important in a fast growing and changing IT environment of the Telecom Company XYZ.

The main research question of the thesis was: "*How to identify knowledge gaps across ITIL services in a Telecom company XYZ that implemented the ITIL 2007 edition (previously known as ITIL Version 3) ITSM service management framework ITIL?*" To answer the main question, the author subdivided it into three literature review questions and three sub-questions related to the case study.

Sub-question "*What is Knowledge and why it is important to manage knowledge in an organization?*" is covered in the literature review in Chapter 3 where researcher highlighted the importance of the term Knowledge for this research and provided the definitions of knowledge to show how the term Knowledge has evolved over time. It also explains the different views on Knowledge Management in comparison with ITIL's 2007 edition (previously known as ITIL Version 3) vision.

Sub-question "*What are the types of knowledge and why it is important for a sustainable and successful organizational performance?*" is covered in the literature review in Chapter 3 and provides a definition for Explicit and Tacit knowledge as well as underlines the

importance of Explicit knowledge as the codified and documented knowledge as well as the importance to convert Tacit organizational knowledge (embedded with or in people) into explicit.

Sub-question "*How Knowledge mapping techniques and tools are used to help manage knowledge?*" is covered in the literature review in Chapter 3 and Chapter 4 where the researcher explains the knowledge mapping concept and provides a range of examples on Knowledge mapping techniques and tools, their benefits along with practical usage.

Sub-question "*How to implement a Knowledge mapping framework in an ITIL ITSM service management organization?*" is covered in the Practical part in Chapter 4 and introduces the design of knowledge mapping tool for ITIL processes as well as its practical application on the Problem Management process. The researcher also described the Project lifecycle for the Knowledge mapping process for showing a practical implementation which can be used across all ITIL processes.

Sub-question "*How to identify and measure the knowledge gaps in the researched process?*" is covered in the Practical part in Chapter 4 and describes the importance of identifying knowledge gaps in the ITIL processes and provides a Knowledge gap measurement and classification system in order to help the researched company prioritize the identified knowledge gaps.

Sub-question "*How the identified knowledge gaps can be eliminated or reduced?"* is covered in the Practical part in Chapter 4 and provides a list of identified knowledge gaps with proposals on how the gaps can be eliminated or reduced as well as the confirmation from the stakeholders on the recommended list of proposals.

In summary, it can be concluded that the aim of this thesis to implement a knowledge mapping process across ITIL services in a given Telecom company XYZ that utilized ITIL 2007 edition (previously known as ITIL Version 3) framework and analyse the result by identification as well as measuring the existing knowledge gaps was achieved. All the research questions were answered, and the research objectives were completed. As the final output of this research and perhaps one of most significant, the author created and implemented a Knowledge mapping process that will help the existing ITIL based service organization by identifying and measuring knowledge gaps in the Telecom Company XYZ to improve their ITIL services and deliver superior customer value.

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Appendix

Appendix A: Completed Knowledge map for Problem management

Name of participant: Alexandra, Process Analyst
Name of ITIL process: Problem Management

Sub-processes/tasks	Sub-processes/tasks outcomes	Knowledge assets that are critical for the Sub-processes/tasks	Where are the knowledge assets stored?			Who has this knowledge?		Type of Knowledge assets: Tacit, Explicit or both
			Shared folders repositories, servers	Individual folders and repositories, personal PCs	Nowhere, employees experience and skills	Name of teams, working groups, departments, divisions	Name and role of employee	
Audit	Reduce amount of overdue opened cases and make sure that time frames of closure are followed	List of old opened cases	Data stored in the ITSM database that can be retrived by running report			Internal ITIL Operations team, Problem Management group		Explicit
		Criteria to select case for audit			Employee experience		Helen, Process Owner	Tacit
		Case Tracker	Manually populated file stored on the Internal team portal			Internal ITIL Operations team, Problem Management group		Explicit
		Pattern case Tracker			File stored on the personal PC	Problem specialists	Danilo, Problem specialist	Tacit
		Recent updates on the current situation of the opened cases		Outlook, group emails		Problem specialists		Explicit/Tacit

Name of participant: Dominika, Process Analyst
Name of ITIL process: Problem Management

Sub-processes/tasks	Sub-processes/tasks outcomes	Knowledge assets that are critical for the Sub-processes/tasks	Where are the knowledge assets stored?			Who has this knowledge?		Type of Knowledge assets: Tacit, Explicit or both
			Shared folders repositories, servers	Individual folders and repositories, personal PCs	Nowhere, employees experience and skills	Name of teams, working groups, departments, divisions	Name and role of employee	
Problem Review Board	Accept or decline the IT problem investigation	The list of new approved cases after Pre-PRB Call	File stored on the Internal portal			Internal ITIL Operations team, Problem Management group		Explicit
		Instructions for how to prepare the PRB agenda			Employee experience		Alexandra and Dominika, Process Analysts	Tacit
		PRB agenda		Outlook, group emails		Problem Management group		Explicit/Tacit

Name of participant: Alexandra, Process Analyst
Name of ITIL process: Problem Management

Sub-processes/tasks	Sub-processes/tasks	Knowledge assets that are critical for the Sub-processes/tasks	Where are the knowledge assets stored?			Who has this knowledge?		Type of Knowledge assets: Tacit, Explicit or both
			Shared folders repositories, servers	Individual folders and repositories, personal PCs	Nowhere, employees experience and skills	Name of teams, working groups, departments, divisions	Name and role of employee	
Pre-PRB	The final decision which cases will be presented on the PRB call	List of approved cases by Problem coordinators cases		File stored on the personal PC			Jack, Problem Specialist	Tacit
		Criterias of the final cases approve for PRB call			Employee experience		Helen, Process Owner	Tacit
		The final list of the approved cases for PRB call	File stored on the Internal portal			Internal ITIL Operations team, Problem Management group		Explicit

Name of participant: Dominika, Process Analyst
Name of ITIL process: Problem Management

Sub-processes/tasks	Sub-processes/tasks outcomes	Knowledge assets that are critical for the Sub-processes/tasks	Where are the knowledge assets stored?			Who has this knowledge?		Type of Knowledge assets: Tacit, Explicit or both
			Shared folders repositories, servers	Individual folders and repositories, personal PCs	Nowhere, employees experience and skills	Name of teams, working groups, departments, divisions	Name and role of employee	
Post-PRB	Summarize all deccisions and recommendations during the PRB call and send out meeting minutes	Instructions for how to prepare meeting minutes after each PRB call			Employee experience		Alexandra and Dominika, Process Analysts	Tacit
		Recommendations from subject matter experts for each presented case in the PRB meeting	Data stored in the ticket in the ITSM database and can be retrieved by running a Problem management report			Internal ITIL Operations team, Problem Management group		Explicit
		Notes (meeting minutes) after each PRB meeting		Outlook, group e-mails		Process Analysts, Process Owner		Explicit/Tacit
		Prepared e-mail of Meeting minutes to send it out		Outlook, group e-mails		Process Analysts, Process Owner		Explicit/Tacit

Name of participant: Danilo, Problem specialist
Name of ITIL process: Problem Management

Sub-processes/tasks	Sub-processes/tasks outcomes	Knowledge assets that are critical for the Sub-processes/tasks	Where are the knowledge assets stored?			Who has this knowledge?		Type of Knowledge assets: Tacit, Explicit or both
			Shared folders repositories, servers	Individual folders and repositories, personal PCs	Nowhere, employees experience and skills	Name of teams, working groups, departments, divisions	Name and role of employee	
Trainings for IT audience	Introduce IT audience to the Problem management process, the main bemefits and outputs, tools and tasks	Admin Access to the Learning system in order to create new Problem Management training or modify existing trainings	Link to eLearning portal			Problem Management group		Explicit
		Feedback from the Training participants on the attended training		Outlook, group e-mails		Problem Management group		Explicit/Tacit
		Knowledge about ITSM organization (we can create a JobAid)			Employee experience	Internal ITIL Operations team, Problem Management group		Tacit
		Marketing communication to the IT audience about available courses, new updates as well as new courses		Outlook, group e-mails		Problem Management group		Explicit/Tacit

Name of participant: Vincent, Senior process Analyst
Name of ITIL process: Problem Management

Sub-processes/tasks	Sub-processes/tasks outcomes	Knowledge assets that are critical for the Sub-processes/tasks	Where are the knowledge assets stored?			Who has this knowledge?		Type of Knowledge assets: Tacit, Explicit or both
			Shared folders repositories, servers	Individual folders and repositories, personal PCs	Nowhere, employees experience and skills	Name of teams, working groups, departments, divisions	Name and role of employee	
Governance	Create guidelines and procedure to operate the process	IT SOPs	File stored on the Internal portal			All IT audience who work with the Problem Management process		Explicit
		Job Aids	File stored on the Internal portal			Internal ITIL Operations team, Problem Management group		Explicit
		Instructions for how to update and create new IT SOPs			Employee experience		Vincent, Senior Process Analyst	Tacit
		Instructions for how to update and create new Job Aids			Employee experience		Vincent, Senior Process Analyst	Tacit
		Knowledge about Problem Management process			Employee experience	Problem Management group		Tacit
		Marketing communication to IT audience about the creation or updates to the IT SOP or Job Aids		Outlook, group e-mails		Process Analysts, Process Owner		Explicit/Tacit

Name of participant: Helen, Process Owner
Name of ITIL process: Problem Management

Sub-processes/tasks	Sub-processes/tasks outcomes	Knowledge assets that are critical for the Sub-processes/tasks	Where are the knowledge assets stored?			Who has this knowledge?		Type of Knowledge assets: Tacit, Explicit or both
			Shared folders repositories, servers	Individual folders and repositories, personal PCs	Nowhere, employees experience and skills	Name of teams, working groups, departments, divisions	Name and role of employee	
Metrics	Manage and track adherence to the ITSOP	Access to ITSM system, Incident and Problem modules	Link to the reporting portal			Internal ITIL Operations team, Problem Management group		Explicit
		Daily Problem management reports			Employee experience		Alexandra, Process Analyst	Tacit
		Access to the Daily Problem Management Dashboard	Link to the BI portal			Internal ITIL Operations team, Problem Management group		Explicit
		Problem Management dashboard Key metrics			Employee experience	Problem Specialists		Tacit
		Weekly report for the IT managers on the Problem Management metrics			Employee experience		Helen, Process Owner	Tacit

Appendix B: Completed Knowledge map for Problem management with Analysis and Action plan

Name of participant: Alexandra, Process Analyst
Name of ITIL process: Problem Management

Sub-processes/tasks	Sub-processes/tasks outcomes	Knowledge assets that are critical for the Sub-processes/tasks	Where are the knowledge assets stored?			Who has this knowledge?		Type of Knowledge assets: Tacit, Explicit or both	Level of Knowledge gaps	Gap priority	Action plan	Comments
			Shared folders repositories, servers	Individual folders and repositories, personal PCs	Nowhere, employees experience and skills	Name of teams, working groups, departments, divisions	Name and role of employee					
Audit	Reduce amount of overdue opened cases and make sure that time frames of closure are followed	List of old opened cases	Data stored in the ITSM database that can be retrived by running report			Internal ITIL Operations team, Problem Management group		Explicit	Small	Low	Does not need improvement	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Criteria to select case for audit			Employee experience		Helen, Process Owner	Tacit	Large	High	Identify the key criteria of the sub-process and create a JobAid that will provide clear guidelines to all team members and will be stored in the internal portal for the Team's access	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Case Tracker	Manually populated file stored on the Internal team portal			Internal ITIL Operations team, Problem Management group		Explicit	Medium	Medium	Process Automation that helps to retrieve the data about opened cases from ITSM operational database and generates an up to date report	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Pattern case Tracker			File stored on the personal PC	Problem specialists	Danilo, Problem specialist	Tacit	Large	High	Create an additional field in the Problem ticket form that will mark the case as the pattern and relate it to the same group of pattern cases based on the assigned code by the Problem specialist	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Recent updates on the current situation of the opened cases		Outlook, group emails		Problem specialists		Explicit/Tacit	Medium	Medium	Create the page on the internal portal where the team will copy all email communications about the status of all opened cases	Confirmed by Process Owner and Head of Internal ITIL Operations team

Name of participant: Dominika, Process Analyst
Name of ITIL process: Problem Management

Sub-processes/tasks	Sub-processes/tasks outcomes	Knowledge assets that are critical for the Sub-processes/tasks	Where are the knowledge assets stored?			Who has this knowledge?		Type of Knowledge assets: Tacit, Explicit or both	Level of Knowledge gaps	Gap priority	Action plan	Comments
			Shared folders repositories, servers	Individual folders and repositories, personal PCs	Nowhere, employees experience and skills	Name of teams, working groups, departments, divisions	Name and role of employee					
Problem Review Board	Accept or decline the IT problem investigation	The list of new approved cases after Pre-PRB Call	File stored on the Internal portal			Internal ITIL Operations team, Problem Management group		Explicit	Small	Low	Does not need improvement	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Instructions for how to prepare the PRB agenda			Employee experience		Alexandra and Dominika, Process Analysts	Tacit	Large	High	Identify the key aspects of the PRB Agenda and create a JobAid that will provide clear guidelines to all team members and store it in the internal portal for Team's access	Confirmed by Process Owner and Head of Internal ITIL Operations team
		PRB agenda		Outlook, group emails		Problem Management group		Explicit/Tacit	Medium	Medium	Create a Team space on the ITSM portal where Team can work together on the same file to prepare an Agenda and send via e-mail.	Confirmed by Process Owner and Head of Internal ITIL Operations team

Name of participant: Alexandra, Process Analyst
Name of ITIL process: Problem Management

Sub-processes/tasks	Sub-processes/tasks	Knowledge assets that are critical for the Sub-processes/tasks	Where are the knowledge assets stored?			Who has this knowledge?		Type of Knowledge assets: Tacit, Explicit or both	Level of Knowledge gaps	Gap priority	Action plan	Comments
			Shared folders repositories, servers	Individual folders and repositories, personal PCs	Nowhere, employees experience and skills	Name of teams, working groups, departments, divisions	Name and role of employee					
Pre-PRB	The final decision which cases will be presented on the PRB call	List of approved cases by Problem coordinators cases		File stored on the personal PC			Jack, Problem Specialist	Tacit	Large	High	Automation of process by Creating a field in the Problem ticket form that will allow the problem coordinator to mark the case as approved and select it for pre-prb call	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Criterias of the final cases approve for PRB call			Employee experience		Helen, Process Owner	Tacit	Large	High	Identify the key criteria for the final cases approve for the PRB call and create a JobAid that will provide clear guidelines to all team members and stored in the internal portal for the Team's access	Confirmed by Process Owner and Head of Internal ITIL Operations team
		The final list of the approved cases for PRB call	File stored on the Internal portal			Internal ITIL Operations team, Problem Management group		Explicit	Small	Low	Does not need improvement	Confirmed by Process Owner and Head of Internal ITIL Operations team

Name of participant: Dominika, Process Analyst
Name of ITIL process: Problem Management

Sub-processes/tasks	Sub-processes/tasks outcomes	Knowledge assets that are critical for the Sub-processes/tasks	Where are the knowledge assets stored?			Who has this knowledge?		Type of Knowledge assets: Tacit, Explicit or both	Level of Knowledge gaps	Gap priority	Action plan	Comments
			Shared folders repositories, servers	Individual folders and repositories, personal PCs	Nowhere, employees experience and skills	Name of teams, working groups, departments, divisions	Name and role of employee					
Post-PRB	Summarize all deccisions and recommendations during the PRB call and send out meeting minutes	Instructions for how to prepare meeting minutes after each PRB call			Employee experience		Alexandra and Dominika, Process Analysts	Tacit	Large	High	Identify the key aspects of meeting minutes after PRB call and create a JobAid that will provide clear guidelines to all team members on how to prepare meeting minutes after PRB call. The JobAid will be stored in the internal portal for the Team's access	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Recommendations from subject matter experts for each presented case in the PRB meeting	Data stored in the ticket in the ITSM database and can be retrieved by running a Problem management report			Internal ITIL Operations team, Problem Management group		Explicit	Small	Low	Does not need improvement	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Notes (meeting minutes) after each PRB meeting		Outlook, group e-mails		Process Analysts, Process Owner		Explicit/Tacit	Medium	Medium	Create the Team space on the ITSM portal where Team can store the notes (meeting minutes) after each PRB meeting	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Prepared e-mail of Meeting minutes to send it out		Outlook, group e-mails		Process Analysts, Process Owner		Explicit/Tacit	Medium	Medium	Create the Team space on the ITSM portal where Team can work together on the same file to prepare the e-mail of Meeting minutes to send it out. In addition, they can include automation of sending email (creating specific group, managing of distribution group, standardized email template, populate specific fields)	Confirmed by Process Owner and Head of Internal ITIL Operations team

Name of participant: Danilo, Problem specialist
Name of ITIL process: Problem Management

Sub-processes/tasks	Sub-processes/tasks outcomes	Knowledge assets that are critical for the Sub-processes/tasks	Where are the knowledge assets stored?			Who has this knowledge?		Type of Knowledge assets: Tacit, Explicit or both	Level of Knowledge gaps	Gap priority	Action plan	Comments
			Shared folders repositories, servers	Individual folders and repositories, personal PCs	Nowhere, employees experience and skills	Name of teams, working groups, departments, divisions	Name and role of employee					
Trainings for IT audience	Introduce IT audience to the Problem management process, the main bemefits and outputs, tools and tasks	Admin Access to the Learning system in order to create new Problem Management training or modify existing trainings	Link to eLearning portal			Problem Management group		Explicit	Small	Low	Does not need improvement	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Feedback from the Training participants on the attended training		Outlook, group e-mails		Problem Management group		Explicit/Tacit	Large	Medium	Create post training survey by using one of the existing survey tools that will help to collect feedback from the participants and provide real-time reports in order to improve trainings and update contents accordingly	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Knowledge about ITSM organization (we can create a JobAid)			Employee experience	Internal ITIL Operations team, Problem Management group		Tacit	Large	High	Employee who work in the Problem Management process need to obtain ITIL certification	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Marketing communication to the IT audience about available courses, new updates as well as new courses		Outlook, group e-mails		Problem Management group		Explicit/Tacit	Medium	Medium	Install (to incorporate the usage of) a marketing e-mail communication tool that will send attractive marketing communications to IT audience that are working on Problem Management about available courses, new updates as well as new courses. Also create a Knowledge article that will be stored on the Internal Problem Management portal (Team space) that explanations how to use the marketing tool and key aspects of the e-mail communications.	Confirmed by Process Owner and Head of Internal ITIL Operations team

Name of participant: Vincent, Senior process Analyst
Name of ITIL process: Problem Management

Sub-processes/tasks	Sub-processes/tasks outcomes	Knowledge assets that are critical for the Sub-processes/tasks	Where are the knowledge assets stored?			Who has this knowledge?		Type of Knowledge assets: Tacit, Explicit or both	Level of Knowledge gaps	Gap priority	Action plan	Comments
			Shared folders repositories, servers	Individual folders and repositories, personal PCs	Nowhere, employees experience and skills	Name of teams, working groups, departments, divisions	Name and role of employee					
Governance	Create guidelines and procedure to operate the process	IT SOPs	File stored on the Internal portal			All IT audience who work with the Problem Management process		Explicit	Small	Low	Does not need improvement	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Job Aids	File stored on the Internal portal			Internal ITIL Operations team, Problem Management group		Explicit	Small	Low	Does not need improvement	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Instructions for how to update and create new IT SOPs			Employee experience		Vincent, Senior Process Analyst	Tacit	Large	High	Identify the key aspects of the process for updating and creating new IT SOPs. In additiion, create a Knowledge article that will be stored on the Internal Problem Management portal (Team space) with an explanation for how to execute this process.	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Instructions for how to update and create new Job Aids			Employee experience		Vincent, Senior Process Analyst	Tacit	Large	High	Identify the key aspects of the process for updating and creating new IT SOPs. In additiion, create a Knowledge article that will be stored on the Internal Problem Management portal (Team space) with an explanation for how to execute this process.	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Knowledge about Problem Management process			Employee experience	Problem Management group		Tacit	Large	High	Employee who work in the Problem Management process need to obtain ITIL certification	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Marketing communication to IT audience about the creation or updates to the IT SOP or Job Aids		Outlook, group e-mails		Process Analysts, Process Owner		Explicit/Tacit	Medium	Medium	Install (to incorporate the usage of) a marketing e-mail communication tool that will send attractive marketing communications to IT audience that are working on Problem Management about available courses, new updates as well as new courses. Also create a Knowledge article that will be stored on the Internal Problem Management portal (Team space) that explanations how to use the marketing tool and key aspects of the e-mail communications.	Confirmed by Process Owner and Head of Internal ITIL Operations team

Name of participant: Helen, Process Owner
Name of ITIL process: Problem Management

Sub-processes/tasks	Sub-processes/tasks outcomes	Knowledge assets that are critical for the Sub-processes/tasks	Where are the knowledge assets stored?			Who has this knowledge?		Type of Knowledge assets: Tacit, Explicit or both	Level of Knowledge gaps	Gap priority	Action plan	Comments
			Shared folders repositories, servers	Individual folders and repositories, personal PCs	Nowhere, employees experience and skills	Name of teams, working groups, departments, divisions	Name and role of employee					
Metrics	Manage and track adherence to the ITSOP	Access to ITSM system, Incident and Problem modules	Link to the reporting portal			Internal ITIL Operations team, Problem Management group		Explicit	Small	Low	Does not need improvement	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Daily Problem management reports			Employee experience		Alexandra, Process Analyst	Tacit	Large	High	Create a Knowledge article that will be stored on the Internal Problem management portal (Team space) with an explanation how to work with the Problem management reports.	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Access to the Daily Problem Management Dashboard	Link to the BI portal			Internal ITIL Operations team, Problem Management group		Explicit	Small	Low	Does not need improvement	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Problem Management dashboard Key metrics			Employee experience	Problem Specialists		Tacit	Large	High	Create a Knowledge article that will be stored on the Internal Problem management portal (Team space) with an explanation how to work with the Problem Management BI tool (Dashboard) and the key metrics that use it.	Confirmed by Process Owner and Head of Internal ITIL Operations team
		Weekly report for the IT managers on the Problem Management metrics			Employee experience		Helen, Process Owner	Tacit	Large	High	Identify the key aspects of the weekly report for the IT managers, create an online template that will be accessible through the Team space portal and create a Knowledge article that will be stored on the Internal Problem management portal (Team space) with an explanation on how to populate the fields in the template and send it to the managers. (possible to include automation of sending e-mail including creating specific group, management of the distribution list, standardized e-mail template amd population of specific fields)	Confirmed by Process Owner and Head of Internal ITIL Operations team