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IT Service Management Maturity Model

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TIIVISTELMÄ:
Yrityksien tietohallinto on toiminnaltaan muuttunut vuosien saatossa vahvasti palveluntuottajan asemaan tarkoituksena tuottaa arvoa yrityksen liiketoimintaan, kuunnellen liiketoiminnan tarpeita. Tämän myötä IT-palveluiden tehokkaista prosesseista, jatkuvasta kehittämisestä ja asiakaslähtöisestä toiminnasta on tullut entistä tärkeämpää IT organisaatiolle. Tähän IT-palveluhallinnan konseptin tukemiseen on aikojen saatossa luotu erilaisia IT-palveluhallintamalleja, joista ITIL on yksi käytetyimmistä menetelmistä.

Tämän tutkimuksen tavoitteena on luoda IT-palveluhallinnan tason mittaamiseen sopiva mittaristo suunnittelutiedettä hyödyntäen. Pohjana mittariston luomisessa käytetään vuonna 2019 päivitettyä ITIL versio 4 mallia sekä olemassa olevaa tutkimusmateriaalia IT-palveluhallinnan mittareista. Mittariston tavoitteena on ilmentää yritykselle, miten voidaan IT palveluprosesseja arvioida ITIL versio 4 mukanaan tuomat arvoa tuottavan toiminnan näkökulmat huomioiden.

Kirjallisuuskatsaus kattaa IT palveluhallinnan, ITIL mallin kuvauksen, IT- palveluhallinnan kypsyysmittarit sekä katsauksen käytettyyn suunnittelutiede tutkimusmenetelmään. Suunnittelutietdettä mallintaen ITIL versio 4 kanssa yhteensopiva maturiteettimalli luotiin. Pohjana käytettiin kirjallisuuskatsauksen tieteellisiä artikkeleita ja ITIL 4 kirjallisuutta. Tämän kyseisen artefaktin testaamisessa käytettiin kahta eri ITIL 4 palvelunhallintamenetelmää joita testattiin muutaman eri IS palvelun yhteydessä arviointilomakkeen ja haastatteluiden avulla. Tätä kautta kerättiin tuloksia mallin toimivuudesta IT palveluhallinnan mittaamiseen.

Tutkimuksen tuotoksena on IT-palveluhallinnan mittaamiseen sopiva maturiteettimalli, kun halutaan käyttää näkökulmana ITIL versio 4 IT palveluhallintamallia. Koska aikaisempia ITIL versio 4 malliin luotuja, tai sitä vasten tehtyjä maturiteettimalleja, saati tutkimuksia ei löytynyt, kerättiin palautetta mallin toimivuudesta ennen kaikkea edellä mainituiden käytännön testaamisten kautta. Malli koettiin toimivaksi ja ennen kaikkea johdon tuki osoittautui tärkeäksi painopisteeksi onnistuneen IT palveluhallinnan arvioinnin mahdollistamisessa. Tutkimuksessa kerättiinkin myös yhteen suosituksia huomioon otettavista asioista ennen kuin IT-palveluhallinnan mittaamista lähdetään toteuttamaan.

AVAINSANAT: IT palveluhallinta, ITIL, kypsyysmittarit, suunnittelutiede

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Abbreviations

CMM   Capability Maturity Model

CMMI   Capability Maturity Model Integration

CMMI SVC	Capability Maturity Model Integration for Services
DSR	Design Science Research
IS	Information Systems
IT	Information Technology
ITIL	Information Technology Infrastructure Library
ITIL SVS	Information Technology Infrastructure Library Service Value System
ITSCCM	IT Service Capability Maturity Model
ITSM	Information Technology Service Management
KPI	Key Performance Indicator
PMF	Process Maturity Framework
SLA	Service Level Agreement

1 Introduction

1.1 Background

The concept of Information Systems (IS) has for a long time back evolved from the basic computer hardware and software operation management to a more service-oriented function. For this reason, different type of governance models, frameworks and best practises are highly valued by the companies globally (Love & Ness, 2016). One example of these IS models is the highly popular IT Service Management (ITSM), which has in the recent years been implemented in companies looking into ways of improving their IT services.

Like in any other business area, customer satisfaction is one of the key measurement factors in the Information Systems area. In the IS sector this customer can be either internal or external service consumer. ITSM delivers high emphasis on customer satisfaction regardless is the customer considered to be internal or external. It' seen that user satisfaction is a key component for successful IS services. Information Technology Service Management focuses on defining, managing, and delivering companies IT services in a way that it can support companies' business targets and the customer's needs (Conger et al., 2008).

This thesis is about Information Technology Service Management (ITSM) framework and how to evaluate organizations ITSM maturity level. There are several different frameworks, but the most widely used, Information Technology Infrastructure Library (ITIL) and its latest version 4, will be used in this thesis. After literate review of the existing maturity models and their aspects, a creation of a new maturity model will be created. It will have the newly published ITIL version 4 as a framework. The maturity model will be developed by using design science research method. During the research process the planned maturity model will be evaluated against real-life scenario to

demonstrate the model. This maturity model will be a quantitative self- assessment model targeted for the IS service owners. In this context the IS service owners refers to the induvial responsible for offering specific IS service to the business. The testing of the developed maturity model will be performed with a support from the case company's IS Service Managers with interviews done based on the developed questionnaire. The literate review part will contain theoretical background of IT Service Management, ITIL and maturity models.

1.2 Objective

The master thesis focuses on the IT service management process and what could be the way to evaluate the level of ITIL implementation within companies IS services. The aim is also to develop with a design science method a maturity model usable with ITIL version 4. This model would then support organisations to understand how well their IT service management processes are operating, and to gain understanding on the possible improvement areas by giving a maturity level estimation. The focus is on the IS service management level which are in the ITIL 4 framework known as service management practices.

The research question is:

- How to evaluate organisations IT Service management maturity level?

1.3 Limitations

The field of IT service management is wide, and contains several different frameworks, all aiming to support business to manage their IS services. This thesis focuses on ITIL 4 framework and its service management practises. From these 17 different service management practises, only two practises are selected for this thesis DSR section. All other ITIL 4 management practises are excluded from this thesis scope. After reviewing

published ITIL maturity articles, example from Pereira and Mira Da Silva (2011), it was evident that in limited amount of processes are enough for these type of research topics. This limitation to use only few selected processes seems also to be quite a common in the real-life business ITIL maturity evaluations practises. This excluded any major ITIL implementation programs where external partners are supporting business by conducting the overall ITIL maturity evaluations (ITIL Docs, 2019).

1.4 Methodology

Design science research methodology is used as a research methodology in this master thesis. Chapter three contains more detailed information about the methodology.

1.5 Definitions of key concepts

In this chapter the key concepts of this thesis are defined. The key concepts are IT service management, ITIL, maturity model and design science.

Information Technology Service Management (ITSM) is a model for maintenance and management of IT services. Target is to support business targets and customer needs by defining, managing, and delivering IT services to the organization. (Cronholm & Salomonson, 2014).

Information Technology Infrastructure Library (ITIL) it one the mostly used framework when implementing ITSM practises into organization to manage the IS services. It has evolved with several versions, during its 30 years existence, all targeting to effectively address changing IS environments. (Axelos, 2019, p.2).

Maturity model target is to give the organization an assessing method to evaluate how their IS services are performing according to the defined ITSM framework. According to

paper from Serrano and Pereita (2020), a maturity model can be defined as: "a method for judging whether processes used, and the way they are used, are characteristic of a mature organization".

Design science is an IS research methodology where with an iterative process the IS artifact is created to fulfil the business need (Hevner et al., 2004).

1.6   Structure of the Thesis

The thesis is divided into six parts with their own sub chapters. The first part outlines the research topic by explaining the background for the thesis. It will also introduce the research objective and the question thesis aims to answer. Introduction part also contains definitions of the key concepts and an outline of the thesis structure.

The second part is the theoretical framework sections with the literature review of Information Technology Service Management (ITSM), Information Technology Infrastructure Library (ITIL) and Maturity models.

The third chapter describes design science research model and how the methodology is used in this master thesis. Following with a chapter about developing the ITIL maturity model with a design science research methodology. It describes the process with the outcome and the findings from testing with few real-life cases. It also contains evaluation against defined objective.

The fifth chapter is about discussion which is the thesis closure part with reflection on the thesis contributions and recommendations about future research topics.

2 Theoretical background

2.1 Information Technology Service Management

Information technology has become an essential part of the organizations and the fluent IT service deliveries are required to guarantee fluent operation, especially with highly digitalized business processes. To fulfil the business side demands the IT services have become more service-oriented to achieve the customers' expectations (Kubiak & Rass,2018). This is a reaction to the change from the IT function to provide only necessary hardware components and software's to business usage for instead providing services in the form of an IT service lifecycle management. IT services contain the whole IT infrastructure with all the used applications and infrastructure elements. IT service management (ITSM) then covers the whole IT infrastructure operating tasks like planning, providing, controlling and optimizations (Kubiak & Rass,2018). There can be several different service providers, who provide their part of the IS services delivery to the company's IS function. ITSM can be seen as the glue between the customer and the IT service provider. IT Service Management commonly deals with more operational issues of IT management rather that concentrating on technology investment initiatives. Still the ITSM takes a major time and effort from the organization's IT management team. (Yandri, et al., 2019).

ITSM covers different IS aspects: people, processes, and all required technology, aiming to fulfil all the requirements customers business processes demands. The processes ITSM covers varies from the IS asset management to support and delivery of IS services, covering the whole information and communications technology (ICT) lifecycle (Galup &Dattero, 2010).

Different companies can be in different state in their ITSM phases. According to Leopoldi (2015) there are three separate phases in which the company's ITSM approach are taken:

- Stabilization is the phase where the organization want to stabilize their IS environment from a tactical perspective. In this phase the management defines the IS requirements based on company's vision and strategy. Accordingly, the underlying IS initiatives are defined. In this phase there is usually a need to evaluate the organizations current state and maturity.

- Rationalization phase has focus on doing the correct things and removing unnecessary IS components. Those components can be then IS people, processes, technologies which can be removed, modified, or added accordingly.

- Transformation phase is then bigger efforts where the organization will be transformed to achieve the future desired state.

According to Conger et al. (2008) Information Technology Service Management (ITSM) focuses on defining, managing, and delivering companies IT services. It is more of an approach to manage the IS resources. With this framework IS can provide effective support to organisation on gaining business targets and supporting internal or external customer's needs. ITSM can be said to a set of best practices, not a simple practical set of instruction to be implemented similarly to all companies. IT Service management framework ITIL, is one of the ways for companies to streamline their IS governance model and have the IT services familiar to all working in the organisation (Love &Ness, 2016). This means that everyone in the company knows what the different IS services can offer and accordingly the expectations are aligned.

According to Kubiak and Rass (2018) the most important aims for the ITSM are to:
- reduce cost,
- design, measure and operate IT services against pre-defined objectives,
- support customers business processes,
- provide user friendly services,
- provide efficient IS service processes.

To gain these targets, there are several different IS frameworks, aiming to support organizations with defining the company's IS services. The most known ones are: Control

Objectives for Information and Related Technology (COBIT), Information Technology Library (ITIL) and Microsoft Operations Framework (MOF) (Cronholm & Salomonson, 2014).

The focus point of COBIT is to view ITSM from the IT governance perspective. It provides accordingly control objectives, roles, and responsibilities with relevant ITSM process metrics (Jäntti & Cater-Steel, 2017). Microsoft Operation Framework is as the name implies is an ITSM management model from Microsoft.

From these mentioned most popular ITSM frameworks, the ITIL is the most popular one. With this commonly used framework following benefits can be achieved : improved service quality, better customer satisfaction results, well managed IT resources, organization efficiency due to standardized processes and services, increased results in the service providers incident response and resolution rates (de Sousa Pereira & Da Silva, 2010). There are true business case evidences on the academical studies performed on the topic of benefits accomplished by organizations when the ITIL implementations were well planned and executed.

Addition to all these IT service management best practice frameworks there are also different standards available to support the implementation of operation of IT services. These standards like ISO/IEC 20000-1 :2008 are for service management give more detailed description on how to operate ITSM processes and can be used as standard point of view to achieve then separately performed auditions to gain ISO 20000 certificate (IT Governance, 2021). These certificates can then be valuable when offering IT service to other companies.

2.2 Information Technology Infrastructure Library

Information Technology Infrastructure Library is better known simply with acronyms ITIL. This IT framework in one of most used ITSM frameworks in the recent years. This is also

the difference between ITSM and ITIL. ITSM is more of a concept and ITIL is a framework providing processes and terms for the ITSM (Iden &Eikebrokk, 2013). Or as Ahmad et al. (2013) it simply defines: "ITIL framework provides companies best practises to be used in their IT processes."

There have been already several versions of the ITIL framework since its initial launch on year 1980. The Central Computer and Telecommunication Agency in the UK was the initiator for ITIL framework and the Office of Government Commerce (OGC) introduced and distributed this ITIL standard in the UK. (de Sousa Pereira & Da Silva,2010).

First two versions received only minor attention, but then the worldwide acceptance as "de facto", was received with the ITIL version 3, which covered the famous service lifecycle model. This was the first time the best practises of ITIL was widely recognised and service lifecycles: service strategy, service design, service transition, service operation and continual service improvement, was implemented by hundreds of firms globally (Agutter, 2020, p. 10-19). ITIL v3 was presented as process-oriented model with 26 different process description which were then updated with the new ITIL version in year 2019. Figure 1 visualizes the ITIL 3 framework update when the ITIL v3 was replaced with ITIL version 4 and its main concept of service value system which then embraces other modern IS practises like Agile, Lean or DevOps (Axelos, 2019, p.2).
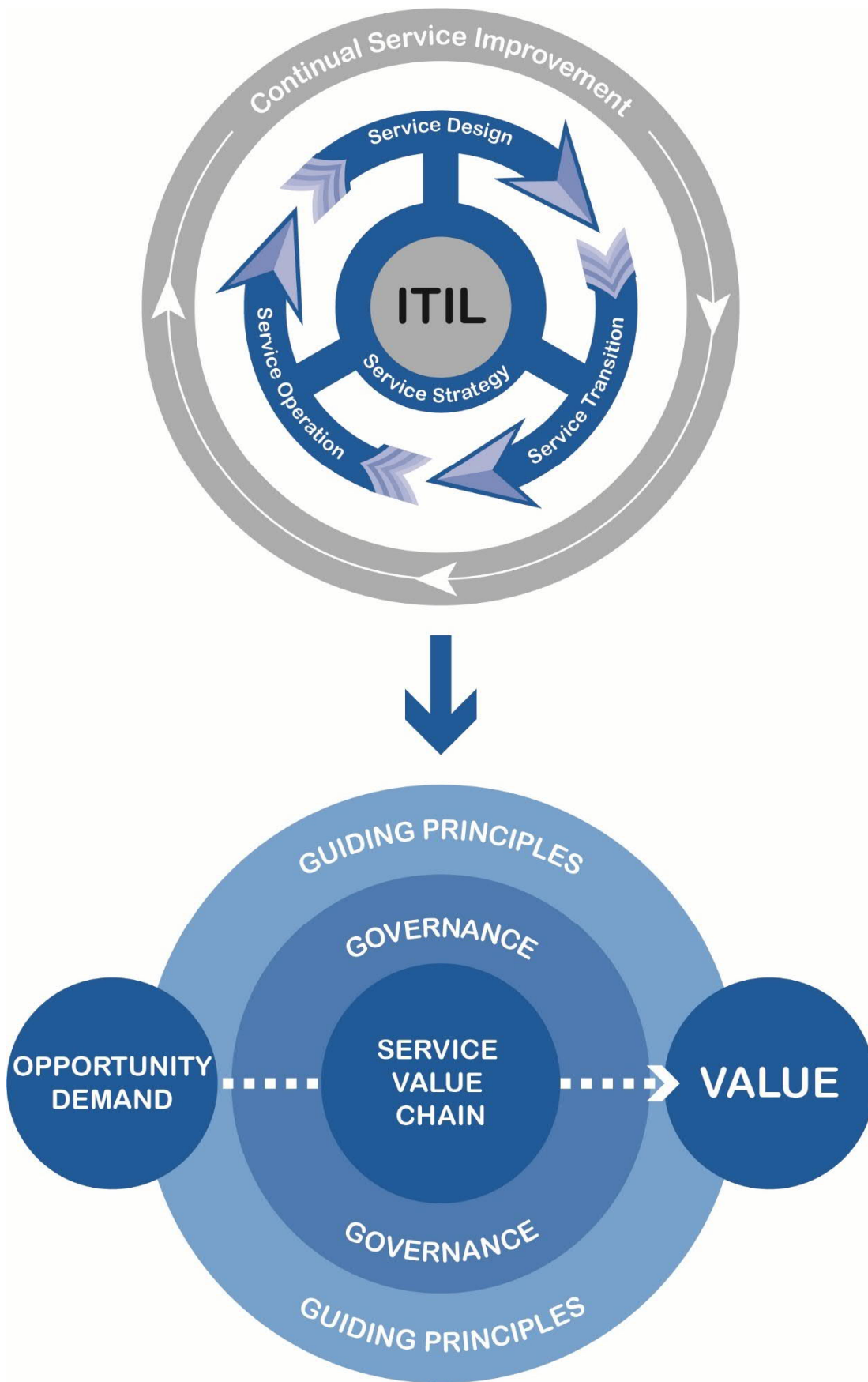
Figure 1. ITL v3 to ITIL v4 (adapted from ITSM Wiki, 2021).

Figure 1 also shows visible the main concepts of ITIL 4. This latest model of ITIL focuses heavily on the aspects of value creation to the customers/users, and on the quality of the whole end to end IS services. There are four aspects in which according to ITIL v4 needs to be considered when aiming to provide valuable service management:

- Organizations and people is the first dimension targeting to provide defined organization structure and management practices. It requires that the separate roles and their responsibilities are clear and align with the business strategy and operating model. Also, the required systems of authority and communication needs to be in place to support service management practices. (Agutter, 2020, p.52-54)

- Information and technology dimension contain the necessary information and knowhow required to manage each service practice. It also contains the technologies needed, it could as example be some analytical tool, or inventory system, required to perform the service. (Agutter, 2020, p.54)

- Partners and suppliers dimension involve all the different relationship to partners and vendors who are involved providing the relevant IS service. The partner can be involved in any of the steps, from design, development to support part. (Agutter, 2020, p.57)

- Value streams and processes dimension contain the activities, procedures etc. required from the organization to gain the defined objectives (OwlPoint, 2021).

Opposite to the ITIL 3 framework ITIL 4 does not focus so much on the processes, but instead on the elements required to create value for the customers. This is covered with the mentioned ITIL 4 service value chain system and the four dimensions model. (YASM 2019; Axelos 2019, p. 2).

2.3   Information Technology Service Management Metrics

Information technology service management metrics can be used to measure the benefits gained from the ITSM practices as well as to monitor continually how well they operate. This is important information for all the stakeholders as the goal of IT service management is to manage the IT infrastructure as one of a company resources and simultaneously optimize the IT services to provide the best possible business satisfaction, but still at the same time control the costs (Clinton, et al., 2014).

In this thesis two different metric models from academical paper by Anna et al., (2020) were reviewed to give baseline for the more operational aspect of measuring ITSM on the operative level as well as give necessary information to the management to base their IT service initiatives on.

The first ITSM metrics model is from Steinberg and it contains the operational metrics that can be used to make the necessary ITSM decisions (figure 2). The process starts with the more operational metrics which are the basics behind the ITSM service management practices. One example of this type of operation report could be the incident resolution time which is important to the incident management service practice. For this operation, a suitable tool is required with defined to capture and provide outcome of these observations.

These observations are then used to define the Key Performance Indicators (KPI). These KPI's are used to show the performance level of each IS service practise or process. For the calculation there is necessary to have data from one or more operational metrics. Each of the KPI's used in the IT service management practise should have one or more Tolerance Thresholds assigned to it.

These tolerance thresholds give the boundaries where the KPI values can alter according to defined targets set with the business. Key Performance Indicators then are basis for the Critical Success Factors (CSF). These CSFs then presents how successfully the IS

process or service is performing from the business perspective. Outcomes are then key indicators of general risk areas example security breaches or similar threats/weakness the organisations ITSM practices try to protect business against. Finally, the Dashboards are then the visual layer where ITSM metrics are presented to managements. Example of this could be the balanced scorecard which would present the ITSM situation from the customers, capabilities, operational, financial, and regulatory aspects. (Steinberg, 2013, p. 22-27).
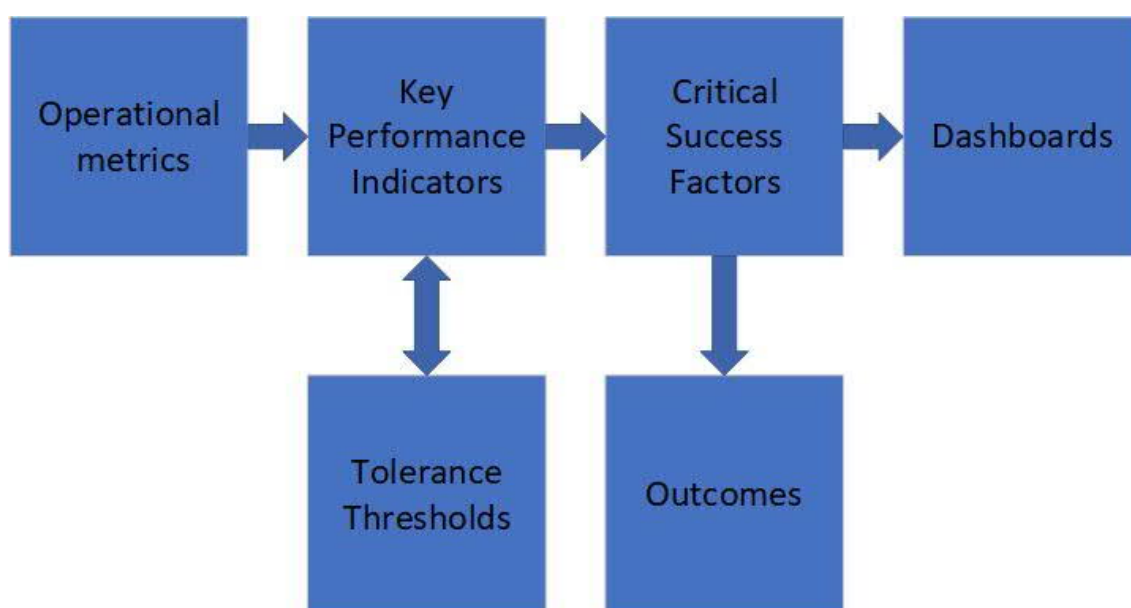
Figure 2. ITSM Metrics Model by Steinberg (Steinberg, 2013).

The second metrics model in the article from Anna et al., (2020) is then collected by Rumburg and are even more from the practical perspective. According to that empirical study only eight metrics are truly required:

1) Cost per ticket, which would give the best efficiency of support service.
2) Customer satisfaction, which would give the best effectiveness result.
3) First-contact resolution, which according to the studies affects most the already mentioned customer satisfaction.
4) Technician utilization which measures well the labour efficiency.
5) First-level resolution, which reflects the total cost of ownership and the overall IT support efficiency rate.

6) Mean time to resolve gives the average time required to close the ticket.

7) Technician job satisfaction equals with the level of how well other service and support metrics are performing. The higher the satisfaction the better other support measurements are.

8) Balanced scorecard gives then the overall measure of performances.

When considering the different ITSM metric models it is visible that there is no sole source of truth to ITSM metrics. There must be a company wise viewpoint on the metrics they consider to be the best fit their organization and the ITSM framework they follow. There is example a wide array of ITIL metrics provided alongside the ITIL 4 framework.

There are some matters, that can still be highlighted to be quite a common requirement for the ITSM metrics. There evidently needs to be a balanced scorecard combined with a set of KPI's. These KPI's would then give the management level view of the organization's IT service management practices. That balanced scorecard would also be a straightforward way to monitor performance and used as evidence method to any upper management level in case resources on the ITSM practices improvements are required. Similarly, the customer satisfaction is an incredibly important ITSM metric as it presents the voice from the business. That metric can be used both on the management level but also at the more operational level by each Service Manager/ service owner. Also, per each ITSM process, or as in ITIL version 4 practices uses , three different types of metrics could be used to evaluate their achievements: First are the effectiveness metrics which can be used to evaluate the performance level of each defined attribute against to a business target or ITSM standard. Second metric type would be the capability metric as it would show the distribution of the attribute's performance. The final type would be the efficiency metrics, which would then show the cost of delivering that IS service in question, by the amount of resources and time it consumes. (Mcnaughton, et al.,2010).

2.4   ITIL 4 framework

ITIL 4 framework consist of the Service value system (SVS) and the four-dimension model. The service value chain presented in the figure 3 describes how organizations components and activities work jointly as a single system to create value to the business (Axelos, 2019, p. 38).
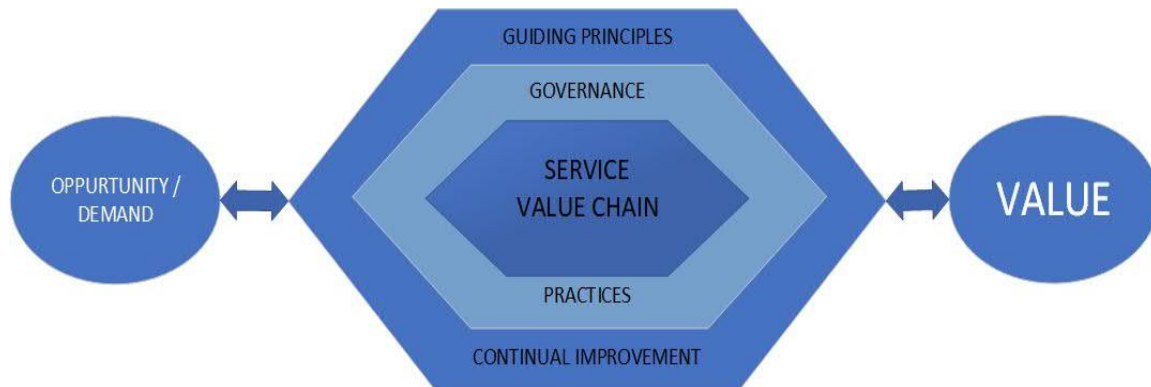
Figure 3. ITIL 4 Service Value System (Axelos, 2019, p. 38).

Opportunity and Demand section means the business side inputs. It can example be either an opportunity to add value to the stakeholders, or other completely new demand for a new product or service. These needs can be received from either the internal or external customer. (Axelos, 2019, p. 38).

Guiding principles in figure 3 is the one system element with all the ITSM recommendations, targeting to help the organisation in their IT service management activities. One example of these ITIL v4 principles is: the importance of organizations activities to provide value to either to itself, customers or then to any other relevant stakeholders (Axelos, 2019, p.39-40).

Governance in the ITIL 4 framework means the organizations governing body which is in the charge for directing, monitoring, and controlling the organization activities, also the service management part. These governance activities can be performed at different levels, depending on the relevant businesses' organization model. The common thing for a governance level body is that it should continually look for ways to improve the IS

services to keep delivering the maximum value to its stakeholders. (Axelos, 2019, p.56-57).

As in the figure 3, the service value chain is in the middle of everything. The service value chain is the operating model and it includes all the key activities needed to fulfil the value proposition. In ITIL 4 there are following key activities counted as a service value chain activity: plan, improve, engage, design and transition, obtain and build, deliver and support. These activities are interconnected with each other and use different ITIL practices to compose that relevant IS activity. (Axelos, 2019, p.57-58). With the key inputs and outputs for each of these activities, the company should be able to provide valuable service for its customers. This all with the ITIL 4 framework providing the necessary service management guidance for the modern IT service environment (Axelos, 2019, p.2).

One separate aspect which needs to be considered when talking about ITSM, is the importance of continual improvement. For this aspect the ITIL v4 continues to offer the already familiar ITIL continual improvement aspect; known as continual improvement model, which can then be adjusted as required to manage the organizations improvement initiatives (Axelos, 2019, p.67).

Practices section in the service value chain (figure 3) are the set of organizations service management resources performing relevant objective. These practices listed in the table 1. There are 14 general management practices, 17 service management practices and then three technical management practises (Axelos, 2019, p74-76). These practices have replaced the previously used ITIL 3 processes, but those ITIL 3 processes can still be used as valid baselines when setting up organizations service management practises. ITIL 4 just emphasizes the idea of "keeping things simple and practical" and allows business to make their service management processes according their own needs (Yasm, 2019). Meaning that the suitable aspects from Agile or DevOps etc., can be incorporated to the

company's service management setup, to best suit that specific business organizational setup.

Table 1. ITIL version 4 Service Management Practices (Axelos, 2019).

General management practise	Service management practises	Technical management practises
Architecture management	Availability management	Deployment management
Continual Improvement	Business analysis	Infrastructure and platform management
Information security management	Capacity and performance management	Software deployment and management
Knowledge management	Change enablement	
Measurement and reporting	Incident management	
Organizational change management	IT asset management	
Portfolio management	Monitoring and event management	
Project management	Problem management	
Relationship management	Release management	
Risk management	Service catalogue management	
Service financial management	Service configuration management	
Strategy management	Service continuity management	
Supplier management	Service design	
Workforce and talent management	Service desk	
	Service level management	
	Service request management	
	Service validation and testing	

2.5 Service Management Practice

Availability management practices target is to provide the IS service availability at the level agreed with the service users (customer). In this activity the service provider must first gain the understanding on the users' availability needs for each of the services. After the relevant service availability requirements are agreed with the customer, the service provider must then design the application and all relevant infrastructure components accordingly, to be then able to deliver at the promised service availability levels. To operate each service properly, it does also require that the necessary availability

measurement components, like a monitoring tool, are implemented into production. These measurement components are then required for the availability reporting and monitoring actions. Depending on the service, the measurements can be anything from user outage minutes, number of lost transactions or business value, or then the commonly used user satisfaction surveys. Similar to all of the ITIL activities, also with the availability management process, it requires continual improvement mindset from the respective service owner to make sure that it is possible to provide improvements on the service availability and in this way then increase the value this service practice offers to the customer. (Axelos, 2019, p. 112-114).

Business analysis practice focuses on listening of the customer needs. These different demands from the customers can be relate to already existing services or need for new IS service. Business analyst interacts with the customer to collect the requirements and vice versa then makes recommendations about the possible technical solutions corresponding to these needs. This business analysis practise considers the whole business big picture, with all the alterations on the processes, used technologies, strategies and for the overall organization. This practise requires intensively skilled persons with good collaboration skills, as the deep interactions with different parties are required when analysing the needs and the viable solutions. (Axelos, 2019, p.114-115).

Capacity and performance management practice aims to guarantee that the IS services are performing as agreed with the business, this with the focus on performing with cost -effective methods. Capacity and performance management practices do not only oversee service performance, but also any other required service support elements regardless, if it is infrastructure, third party services or application related. Sometimes this practise also includes managing personnel related capacity and performance aspects. (Axelos, 2019, p. 117).

Change enablement practice is used to manage the IS service or product changes without causing unnecessary disturbances to the business processes. To have a smoothly

operating change enablement process, organization should have a clear and timely methods in place to be able to address the risk levels for all the changes. Depending on the change object, only relevant and authorized expertise's should oversee the change enablement. ITIL framework divides change to three different categories, with the pre-defined change management procedures. First are standard changes which are usually service request or minor operational changes, which have been pre-authorized and evaluated to cause no or minimal risk for the business continuity. Second is the normal changes, those require more expertise assessment by the authorized person. These types of changes can be anything from the low-level risk component modifications to a major level changes to the business services or products. These changes are then deployed according to the defined change schedule to avoid any unnecessary availability issues to the business. Third change type is an emergency change, and these can occur unexpectedly due to some major incident, or security concern in the operational IS services. These are implemented outside of the pre-defined change schedule for immediate deployment. Authorization for these type of emergency changes is usually done by the more senior experts. (Axelos, 2019, p. 118-119).

Incident management practices goal is to avoid the disturbances on the IS daily operations and to be able to quickly return to the normal service levels when problems occur. It is important to accept issues in the operations, as incident are part of the normal everyday operations, but the process and speed to recover from them should be planned and operative. This means that all incidents should be recorded to agreed tool and customers should be conscious of the expected resolution times. The resolution times should be categorized according to the impact the issue has on the business processes. This way the user satisfaction results should not be affected as both parties have a realistic assumption when to expected solutions. In most cases, the incident takes place on the operational level, and there can be several different parties involved in this specific incident management resolution process. For this reason, it is important to have a clear incident management practise in place, so that all the relevant stakeholders from the ServiceDesk front-end to the possible third party vendors, are aware what is

expected from them and a good communication is managed between respected parties until incident resolved. (Axelos, 2019, p. 121-123).

IT asset management practice handles the IT assets lifecycle. IT assets can be anything from the user software to the business cloud services. Key aspects of this ITIL practice are to guarantee optimal value to the organizations, manage costs related to owned assets, handle asset related risks, manage asset lifecycle actions like disposals, and in overall, guarantee that all the possible regulatory asset related demands are met. Alongside these, IT asset management plays a key role in understanding the use of valuable resource, it provides inventory information to any other service management practises like incident management practises. For this reason, it is important to have an up to date asset register with a full lifecycle view on the company IT assets. (Axelos, 2019, p. 124-125).

Monitoring and event management practices is about managing the IS services events during the service lifecycle. The aim is to minimize or even prevent, the negative effect any unexpected disturbance on the IS component might have on the business processes. For this reason, the focus is heavily on the monitoring aspect and preparations to have correct event management practises in place to act on these monitoring notifications. Regardless, that there are usually a lot of automated procedures in place, to oversee monitoring component, the human interactions are crucial to plan, and manage the correct event management practices and alignments with other interconnected service management practises. (Axelos, 2019, p.128-129).

Problem management practices should not be mixed up with the incident management practises even though these two practises are closely interconnected. As it is not realistic to expect that there is an IS service/product which does not have a single error when business starts production usage, problem management tries to manage these types of errors. This makes the distinction with incident management; problem management tries to detect root causes for the even more complex reasons for repeating incidents

and provide workaround methods for any known issues. According to the ITIL framework, problems are root reasons from incidents and can require deep knowledge and collaboration with different parties to find a permanent resolution. This way the problem management function aims to prevent and reduce the number of incidents taking place in the production environment. One important aspect is that not all known problems can be fixed. It could be, that the resolution for the problem would be too costly for the business to implement, and it is better to continue operating with a workaround method. Analysing root causes and providing workaround methods can be a time consuming and require a deep level of subject matter expertise. For this reason, problem management practises are seen to require knowledgeable, and high level of expertise, from the people involved. (Axelos, 2019, p. 130-132).

Release management practices takes care of moving any new or modified services or products to production usage. This means that there are agreed release windows with the business side representatives. There are different methods to manage releases, companies can use a traditional waterfall methodology or then more modern Agile or DevOps ways to manage release deployments. Regardless of the release methodology it is important to have a collaborative working method with all the necessary parties to have a well-managed release process. (Axelos, 2019, p.133-136).

Service catalogue management practices makes sure that the business knows what type IS services and products company have to offer to its users. In this practise the relevant information of services or products are updated according to the need and this valid information is available for all interested parties. There usually is a different type of views for different interest groups, even though there is only one source system. Example busines users can be simply interested to know what type of service offerings are available, but IT persons that want more technical information of the actual service delivery. (Axelos, 2019, p. 137-138).

Service configuration management practices takes care of having a valid information about each IS service configurations or configuration items. This means that there is a clear picture what are the IS configuration items, which could then be a hardware, a software, documentations etc., which are then required to set up a business IS services. Service configuration management also explains how these different services are connected to each other. In most cases companies have their own configuration management systems to collect and present this configuration data. This configuration data is then used example in the incident management and change enablement processes as a data source. (Axelos, 2019, p.139-140).

Service continuity management practices are there to manage business IS services during any disaster cases. This means, that there is an existing framework in place, to restore IS services at the pre-agreed timescale, in a case some disaster hits the services. For each business the critical business continuity services varies, so a good practise is to perform a business impact analysis for each service to collect information about the critical ones. For those important services there should be a ready disaster response and recover plan in place. It is not enough that the disaster recovery plans exist, they should also be evaluated on a regular basis to guarantee that everything works according to plans when a real situation takes place. (Axelos, 2019, p. 142-144).

Service design practices aims to design IS services or products to fulfil the customer needs to deliver value to the business. These practices are not only used when some new solution is being designed, but also in cases when the existing artefact is changed, or decommissioned. According to the ITIL framework, even minor changes should involve some level of service design activities. This way the customer is on the focus and the whole demand to the delivery process could be smooth and provide the best possible outcome. In this practise a more modern aspects like customer experience, user experience and design thinking, play a key role in making sure that the focus stays on the customer. (Axelos, 2019, p.145-147).

Service desk practices are taking care that there are formal ways, a single contact point, to collect incidents and service requests from the users. As ServiceDesk is a key front for the business users, it is important that there is a good collaboration with all the other IS service support teams operating behind. This way it is possible to provide smooth resolutions to user's questions, problems or demands. Servicedesk is being the front of IS and has also a major impact on the user satisfactions levels. (Axelos, 2019, p.149-150).

Service level management practices guarantees on having defined service levels for each IS services. These levels, known as service level agreements (SLA), are set together with the business, according to their needs. Service level management also makes sure that the services are reaching to these defined levels by monitoring and managing them. (Axelos, 2019, p. 151-152).

Service request management practices takes care that any service requests coming from the business users are delivered as agreed to them. These service request can be anything from information request to order of a new IS product like mobile phone. The common factor is that these are pre-defined to be part of IS services. Also, in these modern digitalized times, most of the service requests could be fully automated, from which software delivery process to users PC, is a good example. (Axelos, 2019, p.156).

Service validation and testing practices aims to satisfy customers' needs for any new or altered IS services or products. This is overseen with properly defined assurance requirements for the service validation phase and then performing testing to secure that criteria from users are met. The testing activities can include different type of testing, depending on the use case. There can be unit testing, integration testing or other more technical testing types like user acceptance testing and security testing to confirm the more non-functional aspects of the new or altered IS artifact. (Axelos, 2019, p. 157-158).

2.6   Maturity model

2.6.1   IT Maturity

Companies must evaluate their current IS service performance levels to be able to meticulously plan for any future investment areas to guarantee correctly decide improvement areas. For this the evaluation of existing situation, the maturity models are implemented. With these tools the organization tries to find the areas where their used IS service practices and processes require improvement efforts. (Pereira & Serrano, 2020).

IT maturity models have existed around 40 years and the number of different models is high (Pereira & Serrano, 2020). The true origin according to Cusick (2019) lies on the process improvement methods, as the maturity models are an outcome of the process improvement approaches. The process improvement methods, and its cyclical processes, are defined against baseline for structuring the capabilities into categories with diverse levels of maturity (Cusick, 2019). As mentioned, the actual term maturity, is in academical papers, usually defined as stages or levels of improvements, around that specific studied area (Anderssen & Henriksen, 2006). IT maturity can be used to define how well organizations are using their IT resources. Usually this maturity model has distinct levels according to the readiness of the ITSM practices in the organization. The more the organizations competences and processes improve, the higher maturity level organization can achieve (Knapp, 2010, p.56-58). These levels present the different stages, which present the evolution path of the organization's methods and processes (Aguiar et.al., 2018).

There have been studies performed to understand the benefits companies can achieve after implementing ITIL. These cost savings, improvement in technical service quality, deeper knowledge sharing with stakeholders and better customer satisfaction are mentioned to be ITIL achievements to organizations. It is not imminent that immediately

after ITIL implementation project is completed the company can achieve these benefits. The level of gained benefits can be seen dependent on the ITIL maturity level withing the organization (Alojail & Corbitt, 2014). The more mature the ITSM practices are, the more benefits you may expect to achieve. In here the ITIL maturity level models come in hand. With the help of these models an investigation on how deeply the ITIL adaptation has been done to the organizations IS processes and how integrated they are in the organization culture.

According to Mcnaughton et al. (2010), the more repetitions of the ITSM evaluation are done the more valuable the diagnosis will be. With time you can get more results around performance measurements, understanding of gained benefits from ITSM framework implementations as well as inputs to be used when deciding on how to manage the always limited IS resources. This means that there would be important to have ITSM evaluation done prior the ITSM framework implementation to gain understanding of the baseline. Then also during the ITSM framework implementation project and after completion of that project similar evaluation should be used to evaluate that the implemented ITSM processes bring expected value to the organization. Similarly, it would keep the focus on the continual improvement aspect. (Mcnaughton et al., 2010). Having the ITSM evaluation in place prior any ITSM framework implementation is not always possible, especially if the company in question is smaller one. With global companies these types of evaluations prior any IT initiative are common due to the size and cost involved for the implementation program. Regardless of lack of baseline ITSM evaluation the ITSM maturity evaluation will give valuable input for the companies.

To help in evaluating the ITIL maturity levels, some know tools can be used. Example of the most well-known of them are the is Capability Maturity Model (CMM), Capability Maturity Model Integration (CMMI) and Process Maturity Framework (PMF) (de Sousa Pereira& Da Silva,2010). Regardless the amount of different maturity models, the one thing in common with most of them is, that they usually assess qualitatively people/culture, processes/structures, and objects/technology (Cusick, 2019).

According to Alojail &Corbit (2014) it might take a longer time before ITIL processes are utterly understood and part of frequent practice in the organizations ITSM. Only after this full implementation has taken place the best outcome of ITIL framework will be gained. For this reason, it would be beneficial to the organization to continually perform IT maturity evaluations to find out where they are with the practices and plan their ITSM improvement actions accordingly.

2.6.2   Process Maturity Framework

Process Maturity Framework (PMF) presented in figure 4, was initially provided along with the ITIL version 2 published in the year 2000. PMF can be used to assess single service management process or cover the whole business and it's ITSM process maturity level. (Knapp, 2010, p. 58). It was further developed in year 2013 and renamed as Axelos or ITIL Maturity model, but in academical papers and studies the Process Maturity Framework has been used also in recent years.

There are five different level of maturity in PMF model (figure 4):

- Initial is the lowest level. In this level the IT service management processes have been collected but there are little or no true ITSM activities. There is also no real documentation, resources or focus on the organization to manage ITSM processes. There is no commitment from business or understanding on the IS service provider side on the business needs or their requirements for the service levels. (Knapp, 2010, p.60).

- Repeatable is the second level and in this the ITSM processes have been recognized but still with minor resources or acknowledge from the business. There is still unclearness about the objectives or who is responsible of this process. In most cases the ITSM activities are still lacking planning and coordination, so activities are more reactivities. (Knapp, 2010, p.62).

- Defined processes are then the Level 3. There are focus and documented processes but still no agreements about SLA's or focus from the business. In this level there is a named process owner and defined objectives and targets for the service. Also, there are allocated resources taking care of the process and includes more focus for the process improvement area. It this level customers' needs are considered making the user satisfaction levels increasing. (Knapp, 2010, p.64).

- Managed is the fourth level with defined processes and defined objectives as well as targets aligned with business. These proactive ITSM practises are well documented, and all known interfaces with other IT processes are listed. (Knapp, 2010, p.66).

- Optimizing is the fifth and final level. In these processes are defined and have objectives and targets based on the business strategies. Everyone involved in the process knows their tasks and the continual process improvements activities are part of common practise. (Knapp, 2010, p.68).
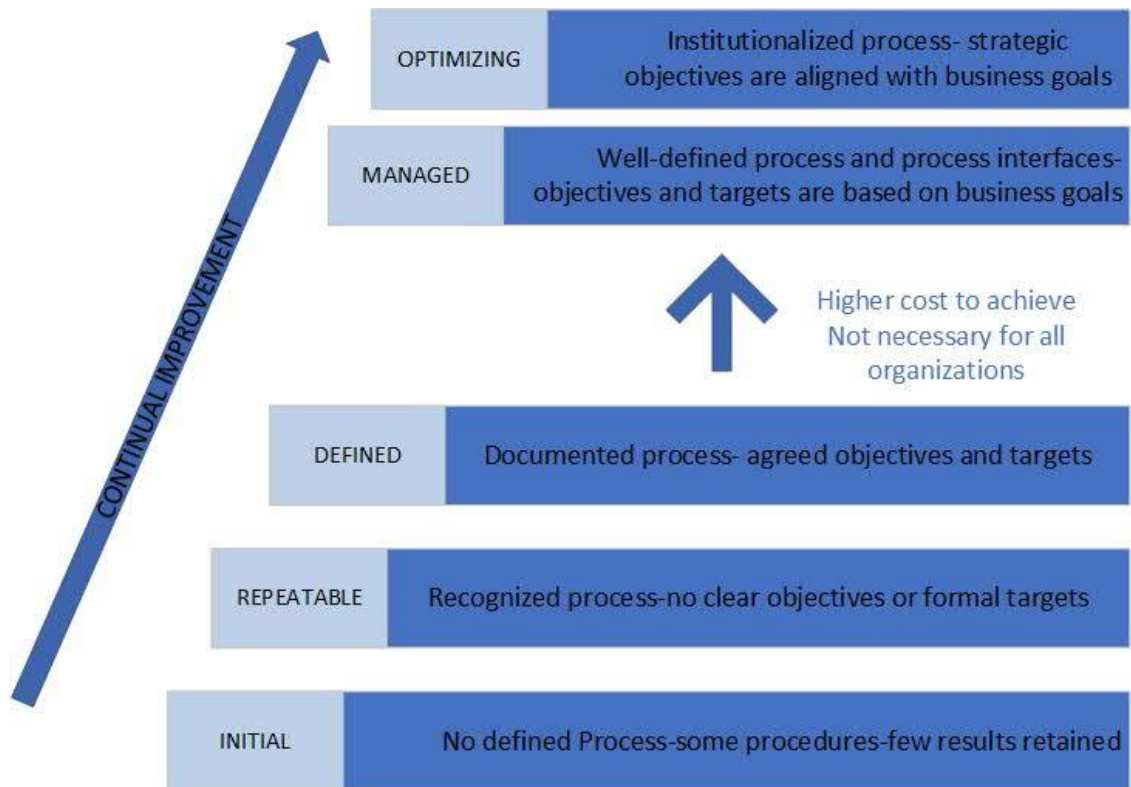
Figure 4. ITIL Process Maturity Framework (Knapp, 2010).

2.6.3 AXELOS

AXELOS was developed in year 2013 based on the previously described ITIL Process Maturity Framework. The re-development was due to the release of ITIL version 3 and its process-oriented model. At the same time, it was renamed as Axelos but also the term ITIL Maturity model is widely used. With the ITIL 3 this maturity model considers the ITIL service lifecycle and its processes and functions (Aguiar et.al., 2018) as visible in the figure 5.
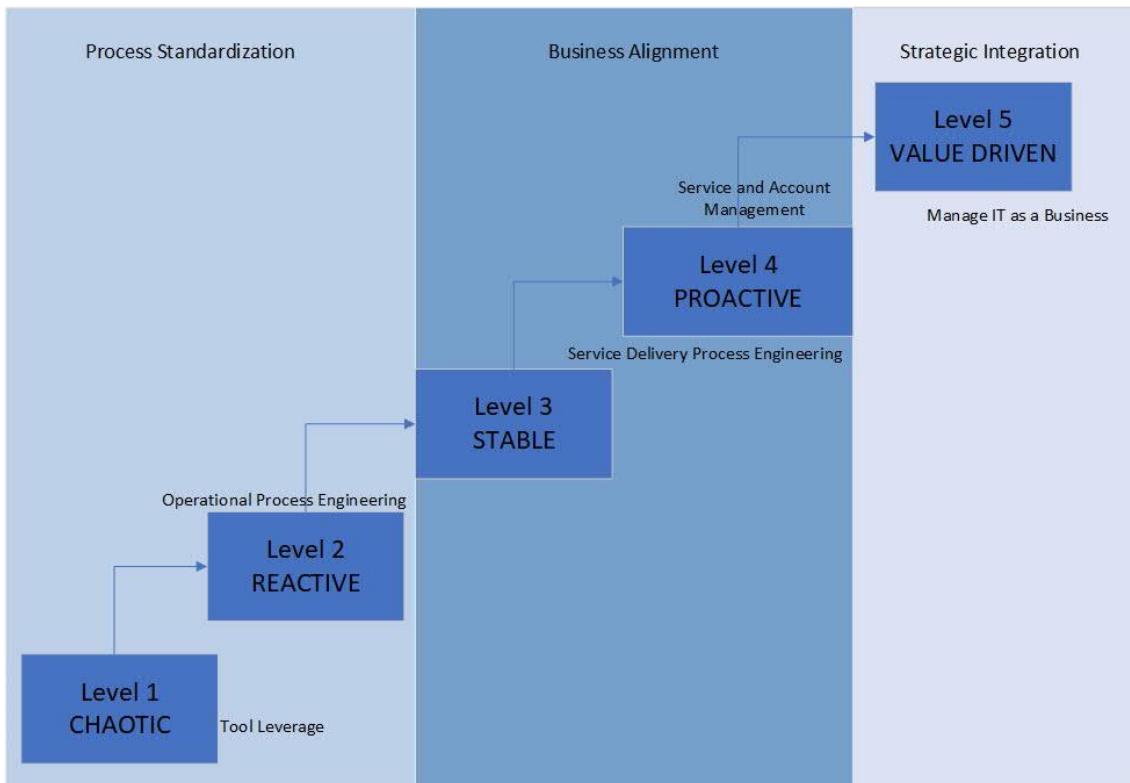
Figure 5. ITIL Maturity model adapted from Cusick (2019).

2.6.4 The Capability Maturity Model

The Capability Maturity Model (CMM) is the one of the first maturity level models designed by the Software Engineering Institute by the request from the US Department of Defence. This model from year 1987 has five levels aiming to be used to evaluate the organizations software development process maturity stage (Humphrey, 1988). It has five process maturity levels (figure 6) from initial to optimized, similar to the ITIL Process Maturity Framework. With the CMM the focus is on effective processes and they ways to improve these processes.

Figure 6. The five level of process maturity (Humbrey, 1987).

Nowadays the usage has widened with the more enhanced CMM models. Even though the CMM model is one of the oldest, it can still be used for any organizations providing IT services. This model covers the full organization and not only a single IS service or process evaluation (de Sousa Pereira& Da Silva,2010).
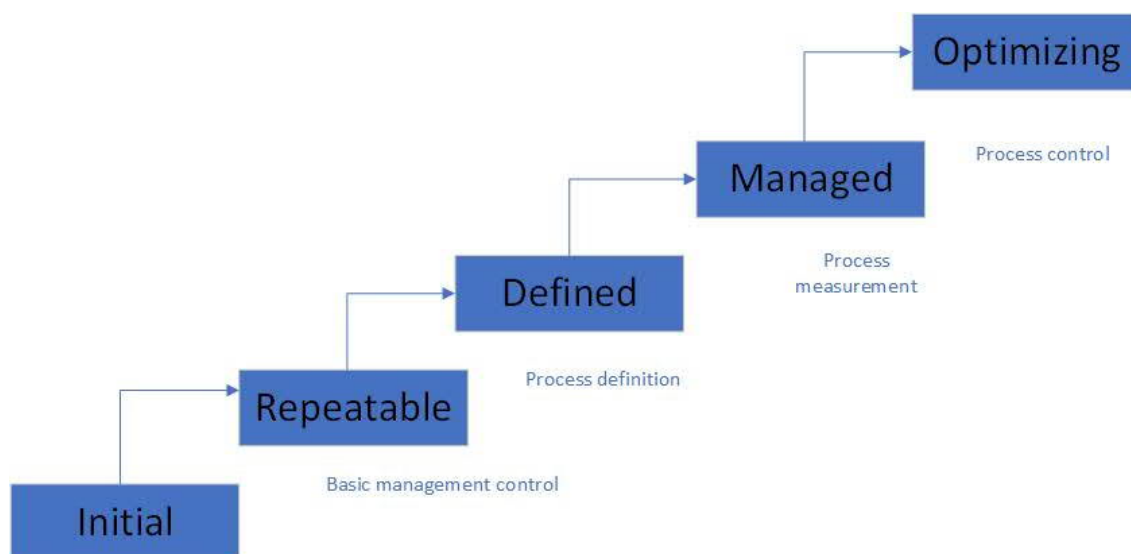
2.6.5 CMMI

Capability Maturity Model Integration (CMMI) in figure 7, was an outcome of the development rounds of CMM and it was introduced in year 2009. CMMI target is to be used alongside companies process improvement initiatives. This especially when there is need to review the process of developing and improving the software product (Handoyo et al, 2019). The CMMI model can be used either as a staged or continues ways making this flexibility more attractive to business than the original CMM (Cusick, 2019). Like model name suggest this model defines capability levels for company's core processes and then accordingly companies are placed to different maturity levels (Handoyo et al, 2019). Even if this look simple with its five levels, the CMMI maturity evaluation does, according to Cusick (2019), require a lot of efforts from the organization. Because the model is complex and requires a lot of process preparation work and usually support from external certified assessor.
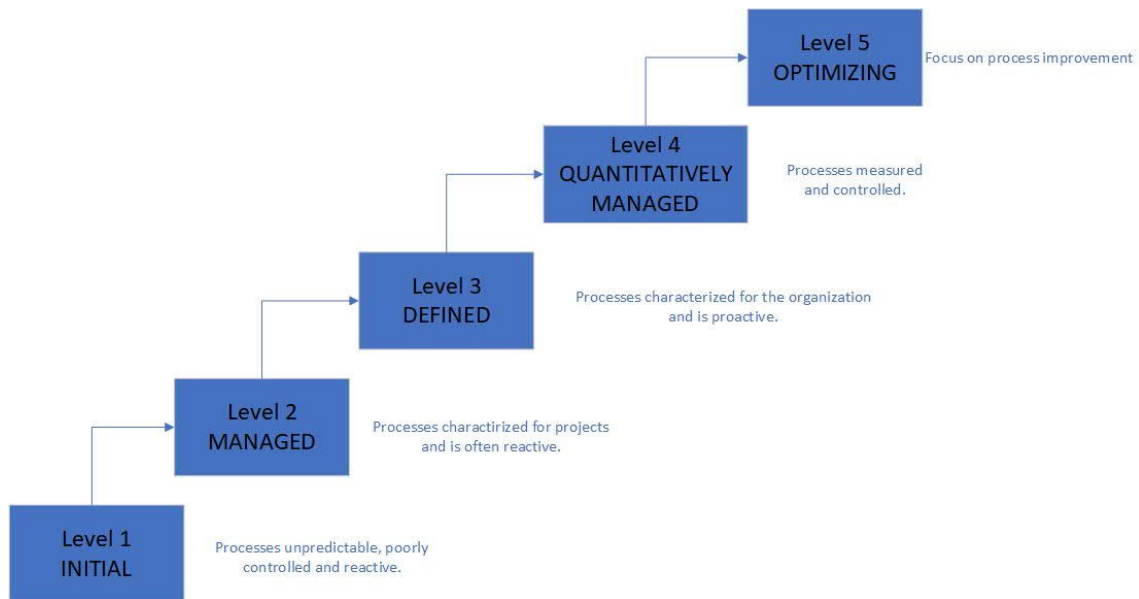
Figure 7. CMMI maturity levels (Cusick, 2019).

2.6.6 Other Maturity models

Another enhanced version of the CMM is the Capability Maturity Model Integration for Services (CMMI SVC) which is aimed also to IS provider companies. It contains all the activities required when establishing, delivering of managing services and can be used with wide are of different services (Kundu, et al, 2011). It aims to improve the overall matured services and improve the user satisfaction part by reducing the delivery time as well as defects and service operation costs (de Sousa Pereira & Da Silva,2010). This framework is among the most used ones with its five maturity levels (Aguiar et.al., 2018).

One maturity model specifically aimed for the software development industry is the Bootstrap. This methodology has its root in the CMM, and it is especially used in the process improvement cases. Similarly, the Trillium model also focuses especially on the embedded software development area (de Sousa Pereira &Da Silva,2010).

These are just some of the examples from the wide array of existing IT maturity models. According to the study performed by Von Wangenheim and others (2010), there was around 50 different software maturity models developed, with most of them having the Capacity Maturity Model (CMM) as a source. That study is already ten years old, so the number of models can be expected to be more. Outside of these academical articles containing ITSM maturity models, there are army of IS consultants working in this ITSM field. There are a lot of IS companies offering to provide ITSM maturity evaluations and they have own methods and even models in place. One example of this type of service is the COBIT Process Assessment Model (PAM). It is one of the most used maturity models which external consultants use to provide their ITSM evaluation support. This model can be used to evaluate organizations COBIT processes maturity levels. The latest version of COBIT is version 5 and its processes are divided between governance and management areas. The actual PAM has then these two dimensions included, and six different maturity levels can be then received (Aguiar et.al., 2018).

2.6.7 Maturity models summary

Summary in the table 2 visualises the most used maturity models levels making it visible that there are similarities. The number of levels is usually five and their names are somewhat identical. In this thesis the developed maturity model will contain the common five level scale. It will include the definitions and criteria per level which are then according to the ITIL version 4 literature. This model is explained in the chapter 4.4.

Table 2. Summary of different maturity levels.

Level	COBIT PAM	CMMI	AXELOS
Level 0	Incomplete	--	--
Level 1	Performed	Initial	Initial
Level 2	Managed	Managed	Repeatable
Level 3	Established	Defined	Defined
Level 4	Predictable	Established	Managed

Level 5	Optimizing	Optimizing	Optimizing

There are plenty of other ITSM maturity models, example Trillium, Bootstrap, IT Service Capability Maturity Model (ITSCMM). According to de Sousa Pereira and Da Silva (2010), the problem with these maturity models are that they are not that precisely documented or even defined. Other than mentioned PMF or Axelos, maturity models are more common to be suitable to be used with any of the ITSM practise and not specifically developed to be used with ITIL. When reviewing the ITIL 4 articles there were not yet any available maturity models designed to be used with that framework. There was also evident related to the problematic mentioned by de Sousa Pereira and Da Silva (2010) with any of the maturity model's evaluation methods behind each of them are not that clearly described in the academical papers.

3 Research method

3.1 Design science research

Design Science Research (DSR) is a research methodology model which is especially usable with information science research projects. The methodology's target is to create a suitable information system artifact that would solve organizations problems. Design science research considers both the technical aspect, in this case information system, and the organization and their actual business strategy. Figure 8 shows the important interconnection between organizational design and information system design. (Hevner et al., 2004).
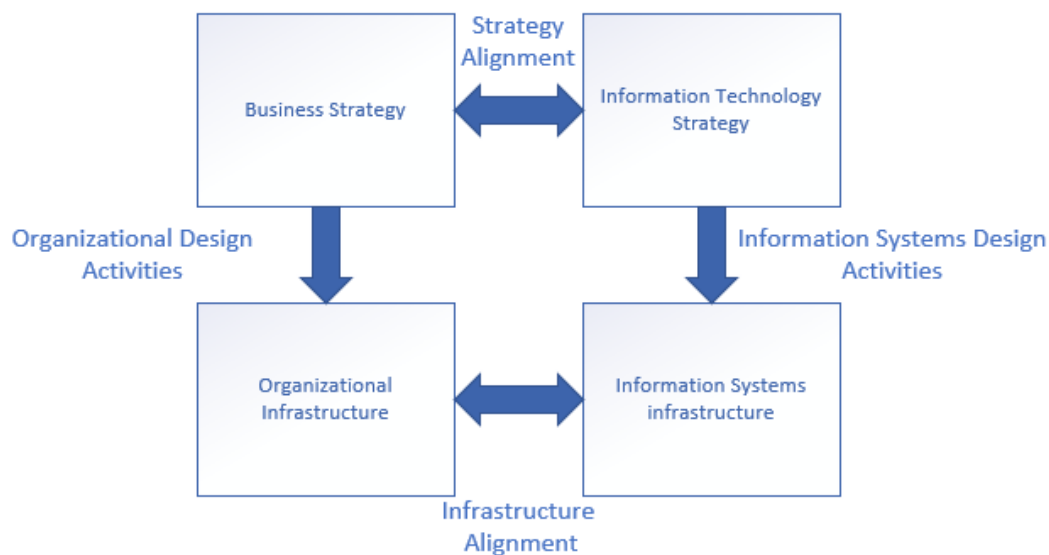
Figure 8. Organizational Design and IS Design Activities (Hevner et al., 2004).

As the design science research considers both behavioural-science paradigm and design-science paradigm it can produce information system artifacts that is both useful and effective (Hevner, et al., 2004). The information system research framework is presented in Figure 5. It contains different components and information how they are connected.

The Environment contains the business environments people, organization, and information technologies (Hevner, et al., 2004). This Environment aspect gives then the

actual business demands for the IS research part. These needs are an outcome of the people's perceptions and are evaluated against organizations strategies and targets. Already in this point it is evident that the IS artifacts must be "realistic" to be implemented in practice as the demands are based on real-life need and would fulfil a purpose.

IS research (figure 9) then contains the actual information system artifact development process. IS research can relate to infrastructure, application, or other technological aspect, as long as the need comes from the business. IS research is using then the behavioural science method with development and justification aspects to investigate business requirements. This is called Relevance cycle where the business requirements are collected and testing of IS artifact is performed. Alongside the design science method uses build and evaluate- practices to evaluate artifacts utility. This design cycle also performs solution evaluation during IS artifact development. (Hevner, et al., 2004). This step is important as design science research emphasizes the importance of providing IS artifacts with outcomes that are valid and realistic for the business.

Finally, the IS research does utilize and update relevant knowledge base foundations, example with new or modified theories or frameworks. The methodologies part means using a suitable guideline for the justify/evaluate these DSR steps. This rigor cycle alongside with usage of knowledge base information makes sure that the findings from the IS research steps are updated to the knowledge base. (Hevner, et al., 2004).
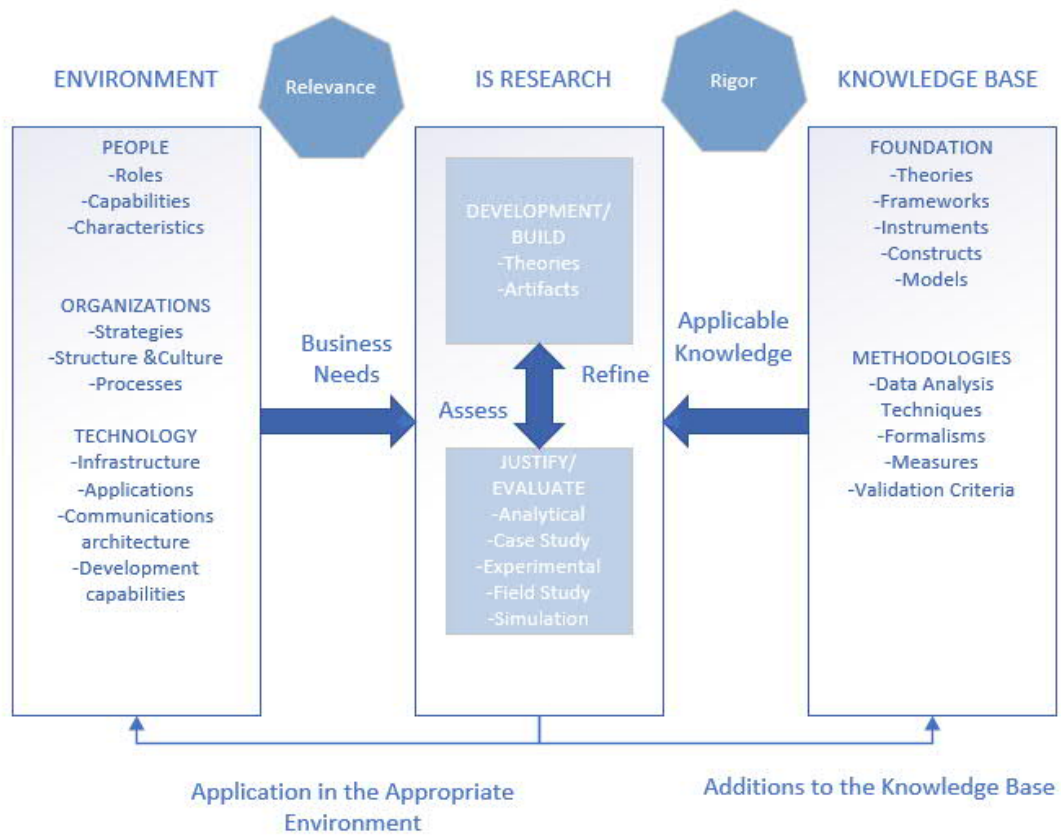
Figure 9. Information System Research Framework (Hevner et al., 2004).

3.2 Design science research process

The Design Science Research methodology contains six phases from Peffers et al. (2007) which are presented in the figure 10.
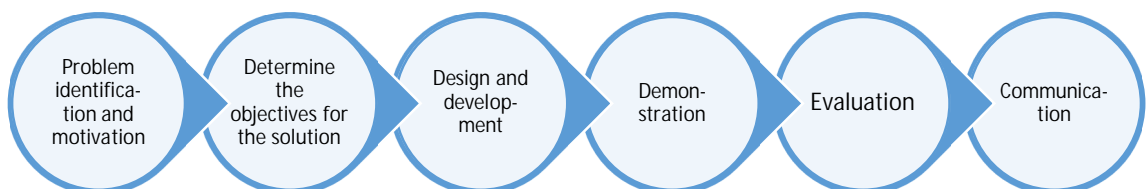

Figure 10. Design Science Process (Peffers et al., 2007).

The first, and maybe the most important, step is the problem identification and motivation in which the research problem is defined with explanation of solutions importance to the stakeholders. In some complex cases, it might be time consuming, but anyways beneficial, to get a clear understanding of the need and any surrounding aspects. Also, with a proper justification a real understanding of the business problem and the need for solution to it can be achieved. (Peffers et al., 2007).

Determine the objectives for the solution is the second step. The objectives can be either quantitative or/and qualitative. The important aspect is that they should be based on previous step and that solution is realistically possible to be implemented. (Peffers et al., 2007).

After objective definitions comes design and development activity. In this third step the wanted IS artifacts functionalities with relevant architecture are defined and the actual artifact is created. (Peffers et al., 2007).

Following fourth step is based on these developed artifacts, as in this the demonstration step takes place. There are several different methods to perform this step, as these methods are based on the current artifact, options examples are to perform a case study, simulate activity with proof of concept method or other suitable method for demonstration purposes. (Peffers et al., 2007).

After demonstration follows evaluation step, where received results against listed objectives are compared to. Based on the use case the evaluation methods can alter, it can be anything from user satisfaction surveys to system performance measurements or comparing artifacts outcome functionalities against defined solution objectives. The most suitable measurement style for DSR case should be selected, requirement is that the selected method would offer empirical evidence or logical proof. If the outcome of evaluation is acceptable, process can move forward to the last step: communication. In case the results are not acceptable, and there is a need to improve the IS artifact,

researchers can reverse in the process and go back making some necessary artifact improvements. (Peffers et al., 2007).

In the communication step the gained knowledge from the DSR will be shared with other interested stakeholders, example with the interested internal or external research community (Peffers et al., 2007).

4 Artefact development and the final artefact

4.1 Design science research guidelines

In this thesis the Design Science research method is followed with guidelines from Hevner et al., (Aguiar et al., 2018). The table 3 summaries the guidelines applied to this thesis and chapters 4.1.2-4.1.7 describes the DSR process activities used in this thesis.

Table 3. Hevner et al. DSR guidelines adapted from Aguiar et al., 2018.

Guideline	Description	This thesis
Design as an Artefact	Design science research must produce a viable artefact in the form of a construct, a model, a method, or an instantiation.	The proposed maturity model is the artefact
Problem relevance	The objective of design-science research is to develop technology-based solutions to important and relevant business problems	Existing maturity models not reviewed against ITIL v. 4
Design evaluation	The utility, quality, and efficacy of a design artefact must be rigorously demonstrated via well-executed evaluation methods	Interviews assessment based on questionnaires and thesis evaluation
Research Contributions	Effective design-science research must provide clear and verifiable contributions in the areas of the design artefact, design foundations, and/or design methodologies.	A new artefact added to the IS knowledge base
Research Rigor	The search for an effective artefact requires utilizing available means to reach desired ends while satisfying laws in the problem environment.	Literate review of existing studies and articles around ITIL maturity models.
Communication of Research	Design-science research must be presented effectively both to technology-oriented as well as management-oriented audience	Thesis shared with case company. Assessed and saved to Osuva.

4.2 Problem identification

Information Systems Instructure Library (ITIL) is a widely implemented Service management practise which aims to provide value to customers with correctly defined and running IS service processes. As ITIL framework contains several different service aspects, with their own recommendations, it takes time to implement every aspect of that model. There might be also other reasons, example lack of knowledge, that not all

IS service operating models are introduced. Similarly, there are cases where initially implemented practises are not followed since initial implementation for unclear reasons. Alongside there can be lack of commitment or the lack of documentation, like work instruction, which are common issue for companies to face after the ITIL implementation. Also, sometimes the importance of continually reviewing the ITIL practices inside the IS service management practises are forgotten. It is too often thought that after the initial effort made to implement the ITIL framework, organization can just relax and not to focus on the IT Service management aspects. (de Sousa Pereira & Da Silva,2010). This surely is not the case in the constantly changing business environment where IS must continue to find ways to provide value to the business.

The implementation of different ITIL best practises does reserve business resources and commitment to be fully operational. After initial implementation phase it would be beneficial to companies to investigate with a simple model how well their service management processes are operating when measured against ITIL best practises and recommendations. (de Sousa Pereira, Da Silva,2010). With a simple maturity model business could with ease get an understanding on the IS service level and the possible areas where to locate resources to make improvements. It is known that there is no single source of truth on how ITIL processes should be implemented as every organization is unique and the perfect fit for each of them needs deep internal knowledge on the company and possibly support from the external expertise. (de Sousa Pereira, Da Silva,2010). For this support part this thesis aims to answer with a simple review model of ITIL 4 service management practices. The maturity model considers the latest ITIL version 4 aspects.

4.3   Define objectives

Research objective is to try to develop a simple ITIL maturity model.

This will be performed by investigating the theoretical ITIL version 4 framework and existing academical articles done around ITIL maturity. Based on the collected information a maturity model would be constructed to answer following question:

- How to evaluate organisations IT Service management maturity level?

This thesis tries to build up a model for the business Service Manager to evaluate the status of his/her IT services management practices. This is a way to provide a simple viewpoint on the areas which would need some investigation if wanted to follow ITIL 4 models best practices. During this DSR research a set of recommendations for ITSM maturity evaluation practice was produced.

4.4 Design and development

Theoretical background is the ground layer when developing the ITSM maturity model. Addition to the theoretical background of maturity models and ITIL version 4 framework, some more practical perspective is required when defining the questionnaire to be used in the IT Service management evaluation process. There must be way to collect data to be used with the maturity model.

The ITIL 4 service management practices selected for this thesis purposes are: Availability management and Business analysis. The availability management was a process already in the ITIL version 3. The business analysis service management practice is a new practice in ITIL version 4. There was no similar process in the ITIL version 3 (Yasm, 2019).

Maturity model focuses on the ITIL 4 service management practices aspects. The target is to create a questionnaire per service management practice where service owner can select the appropriate answer reflecting on his/her service. The questionnaire base is in the excel format and used AXELOS ITIL 4 foundation book to develop questions per ITIL dimension model. To make the assessment for this thesis purpose more valuable the

questions were reviewed together with the IS Service Manager. This interview method gave more possibility to open the questions and to gain feedback from the recipient. The target audience for this questionnaire are IS Service Managers or Process owners, who could then base on the questionnaire outcome, get a better understanding on how deeply the ITIL 4 best practices around service management area have been implemented in their service. This assessment model does not give any direct recommendation on priorities or steps the IS Service Managers should take, but it gives a viewpoint on the current maturity level against ITIL version 4.

The developed maturity model has five levels and it has the focus of ITIL version 4-dimension models. These dimension models are organization and people, information and technology, partners, and suppliers and finally value streams and processes.
Figure 11 contains the maturity levels.

- Level 1 is Initial. In here there is a low knowledge level on the ITIL 4 concepts or ITSM practices in overall. The processes or functions are working at a more of ad hoc-model and reactively. There is also no formal definition of the processes or other guidelines to be followed in a standard method. There are also no formal methods to monitor how the service is performing or more importantly how the customer is experiencing the service. The co-operation with the customer to understand the value this service provides to them is non-existing. This low level of co-operation is also valid with any third-party vendor or supplier collaboration.

- Level 2 is Repeatable. In this level the processes of functions have been to some extent defined. There is some knowledge of ITIL version 4 framework, and its best practices, especially from the previous ITIL versions have been implemented to some extent. Procedurals or guidelines are not that well standardized or shared in between organization, but they do for main part exists. There is named person owning this service and responsible service management practices. The services focus point is still missing the customer aspect, even though some service

measurement have been implemented. The focus of value delivery perspective is on the minimizing of the costs, not delivering on the value or focusing on the customer experience.

- Level 3 is Defined. In this level the collaboration level inside the organization, between partners and suppliers, and especially with the customer is noticeable. The focus is more on delivering valued service to the customer. There are also suitable key metrics in place to collect user experience/customer feedback which can be used to improve the service. The process practices, guidelines and tools follow the defined organizational model and are according to ITIL v. 4 best practices. ITIL version 4 knowledge is at satisfactory level, and usually most of the resources are either had ITIL version 4 training or are certified.

- Level 4 is Managed. In this level the processes are measured and controlled to provide best possible valued service to the business. There are regular, at least yearly, defined goals which are according to the customer needs. There are initiatives to continually improve the service. It can be said that there is in place an end to end ownership for this service regardless how many external vendors or partners are involved delivering it. There is deep knowledge of ITIL version 4 and level of certified resources are high.

- Level 5 is Optimizing. In this level the focus in even more in the ways to provide quality and valued service to the customer. There are ways to incorporate Lean or Agile methods in the service management practices. This as an example of constant efforts put on in ways to improve the customer experience. There are also interest and eagerness to try initiatives around new technological trends, example on Artificial Intelligence or Service design, to find out innovative ways to improve the service. There is also a deep level of trust between the resources involved with the service regardless is that internal or external partner. They are also urged to make innovative customer experience initiatives. There is a deep

interaction with the business and future expectations of customer needs are well known and discussed jointly internally and with partners.
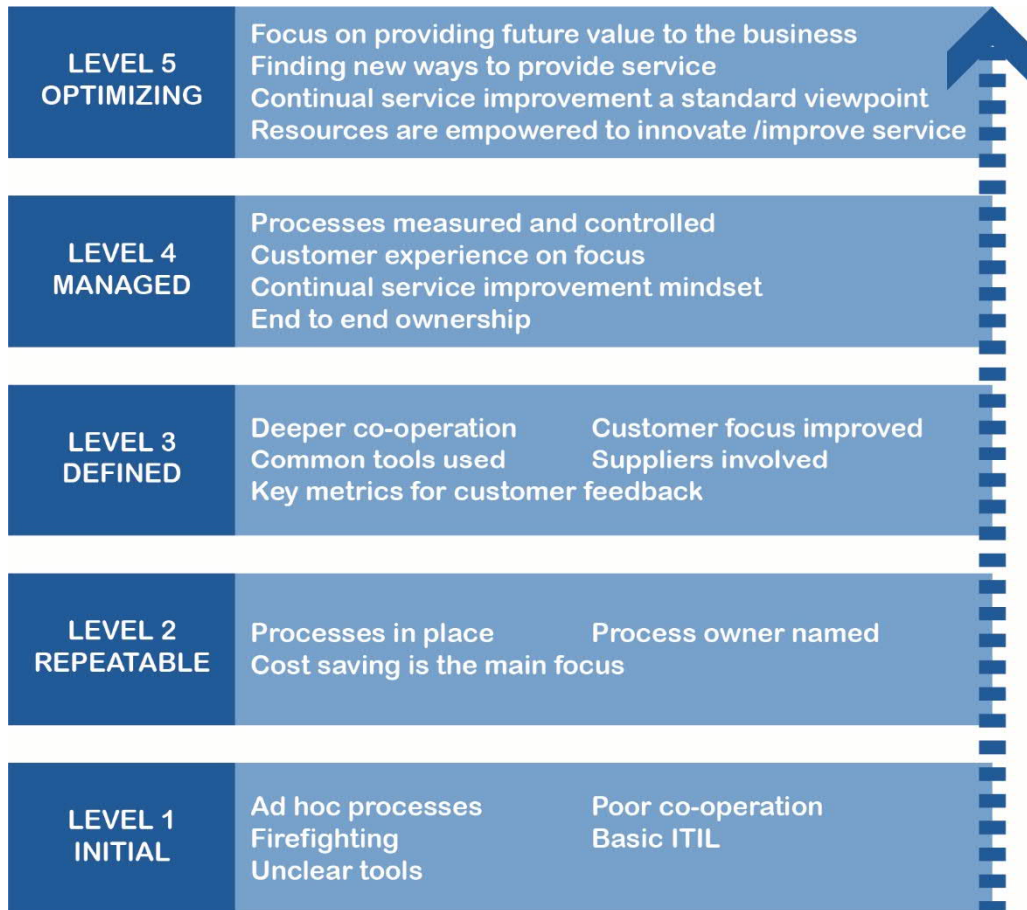
Figure 11. Maturity levels.

4.5 Demonstration

Demonstration phase was performed side by side with the design and development phase. Maturity model was piloted with the case company's IS Service Managers by interviewing them using the defined questionary as basis for the ITSM evaluation. Additionally, there were few questions to get feedback which are present in next chapter. All the four IS Service Managers were from the same central IS function owning different IS application services. All of them had several years of experience around Information Technology, and IT service management. Similarly, all of them were familiar with the

previous ITIL v3 framework and owned the initial ITIL v3 level certifications. The knowledge of ITIL 4 framework varied. One of them had some ITIL 4 knowledge, another one had ITIL 4 foundation trainings, and two of them had estimated deeper ITIL 4 knowledge with the ITIL 4 foundation certification (table 4).

Table 4. Interviewed IS Service Managers background details.

Role	Years in IT	ITIL 4 knowhow level (self-estimated 1=low 10 =high)	ITIL 4 certification
Service Manager 1	16	8	Only ITIL3
Service Manager 2	14	6	Only ITIL 3
Service Manager 3	16	9	ITIL4 foundation
Service Manage 4	8	9	ITIL 4 foundation

Figure 12 present the outcome of maturity evaluation with the developed model. The service in question has Level 4 in availability management practices. According to the developed maturity model this practice is professionally managed with defined process and procedures shared widely within the organization. There are ways to regularly capture user experiences and standard methods to monitor the availability statistics and predict future availability needs.

The business analysis practice was not as well matured but still it got outcome of level 3 from the maturity model. Level 3 means that there are defined tools and the customer is on focus. There is not that deep constant interaction with the business but in this actual service in question it can be because the service has been running for over ten years. The service itself is highly valued by the business as it serves a definitive purpose and it is seen as a way to provide value to the business.

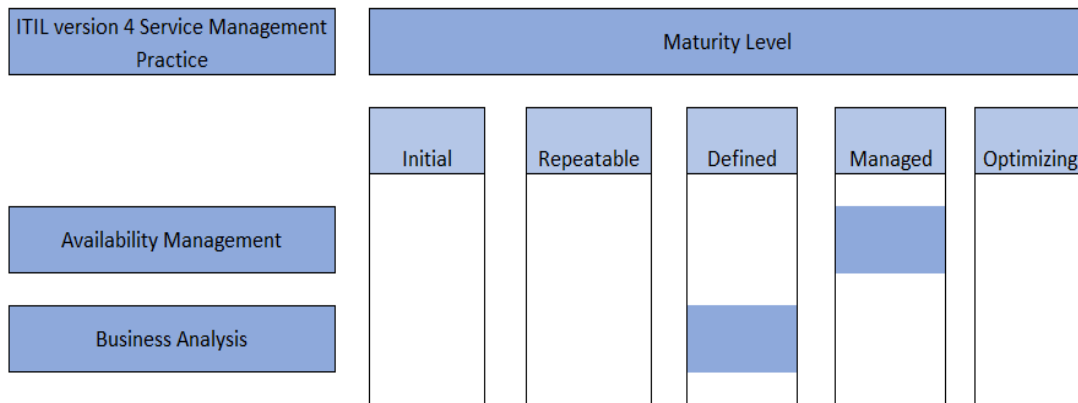| ITIL version 4 Service Management Practice	Maturity Level				
	Initial	Repeatable	Defined	Managed	Optimizing
Availability Management				▨	
Business Analysis			▨		

Figure 12. Maturity evaluation with SM1.

Similar type of maturity evaluation with the developed model was done with the help of IS Service Manager 2 (figure 13). For both of the service management practices evaluated an outcome of maturity level 3 was received. According to the developed maturity model this means that the practices are managed with defined processes and tools. In case of this IS service the availability management is handled mainly by the third-party vendor, but there are tools and processes in place. Both are just defined by the vendor as they provide the service components. There is a good co-operation with the vendor to improve any of the processes according to the need from customer. As the ITIL 4 highlight there is a focus on the customer and communication tools. There just is no constant co-operation with the business to collect their demands. This evidently can be seen to be down to the service in question. This IS service has been running for several years now, and it fulfils the more legislative business need. That might be the reason for lower level of demands or changes on this service. It is enough that the service operates and fulfils the basic needs, no special need to make constant improvements. There is a connection with the customer but more on the term of business. When they have a change need, they contact the Service Manager.

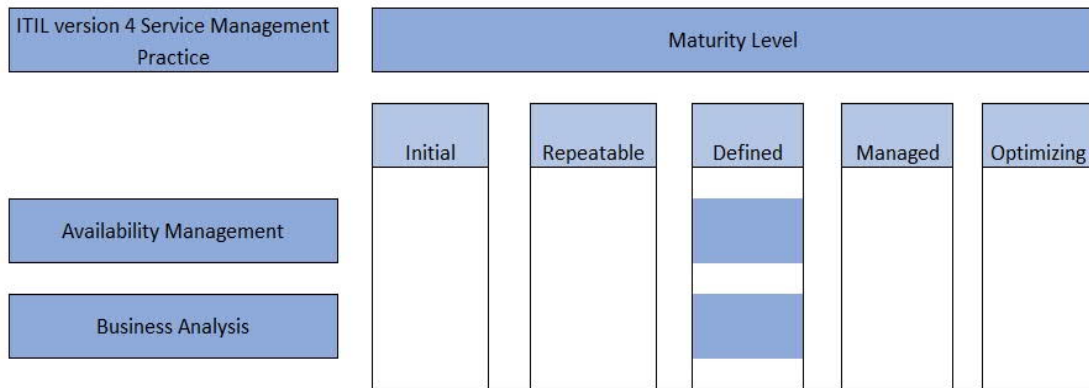| ITIL version 4 Service Management Practice	Maturity Level				
	Initial	Repeatable	Defined	Managed	Optimizing
Availability Management			▓		
Business Analysis			▓		

Figure 13. Maturity evaluation with SM2.

The third maturity evaluation demonstration was performed with the support of third IS Service Manager from the same company. The results were somewhat aligned with the previous cases with outcome of maturity level 4 (figure 14). In this service the availability management practices were professionally managed with common ITSM practices and the co-operation with both the business and with the vendor involved in the process delivery, was well constructed. There were also shared customer satisfaction metrics in place and the customer feedback and needs were collected constantly. This same customer co-operation was visible with the methodical interaction with the business and means to collect the required changes on the service. The service in question has been in use for several years now, and the common ITSM practices based on ITIL were followed in the processes and measurement aspects. This service also had deep collaborative ways to operate with the vendors involved. One of the partners in question is a major global outsourcing partner which most likely increased the maturity of used practices.
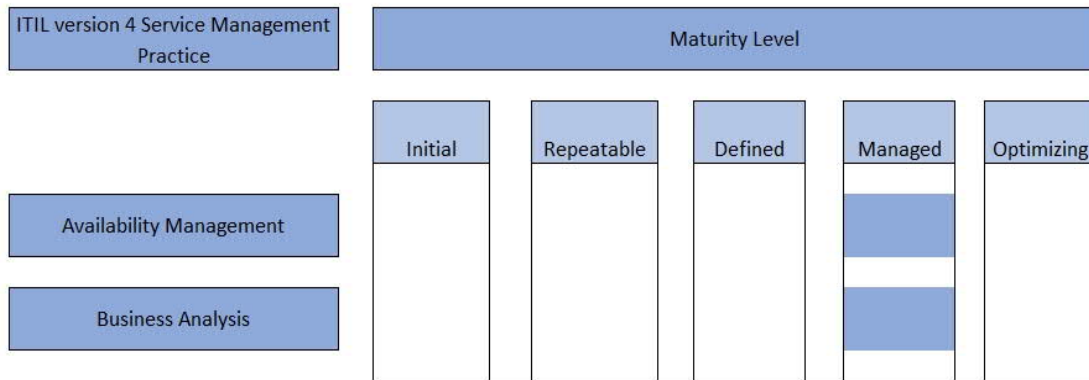
Figure 14. Maturity evaluation with SM3.

The final maturity evaluation demonstration was performed with the support of fourth IS Service Manager from the same company (figure 15). In this service the availability management practices maturity was at level 2. This repeatable maturity level means, that the processes and functions are to some extent defined but the customer aspect is somewhat open. One example of this is that there really is no ITSM metrics in place, especially in the availability area. The business analysis practise outcome was level 3 which equal defined maturity. There is customer focus in place, just due to the outdated software version, not that many needs from the business received. The service in question is struggling with an outdated software version which reflects on many of the ITSM aspects. Also, the knowhow level of the used partner causes glitches on the service delivery. After the version update has been completed it is likely to have positive side effects also on the ITSM practises perspective.
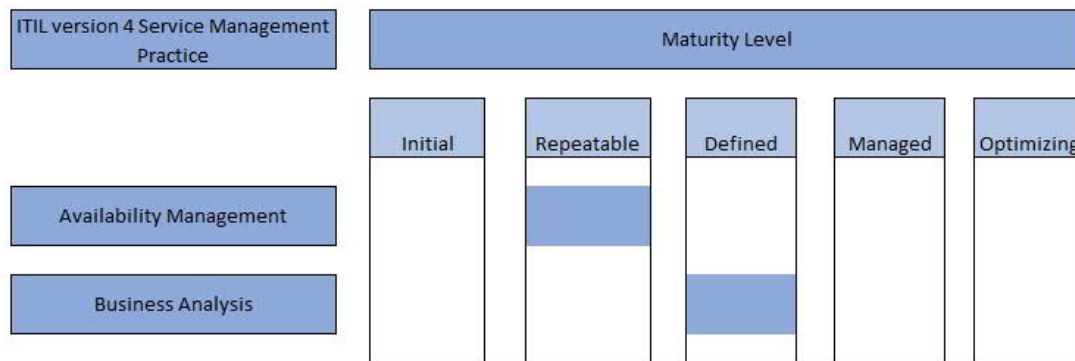
Figure 15. Maturity evaluation with SM4.

4.6 Evaluation

Evaluation of the designed maturity model was done against the defined thesis objective, and against the data collected from Service Manager interviews. The develop maturity model developed during the DRS, is presented in the figure 16. It contains the maturity levels named according to the older ITIL Process Maturity Framework. There are five level maturity aspects, with the first level (Initial) being the lowest level, and the level five being the highest optimized level. These and others are explained in the chapter 4.4.

Figure 16. ITIL v4 Maturity Model.

ITIL v.4 service management practices are reviewed from the dimension models viewpoint. These dimension models are organization and people, information and technology, partners, and suppliers, and finally value streams and processes. This way the maturi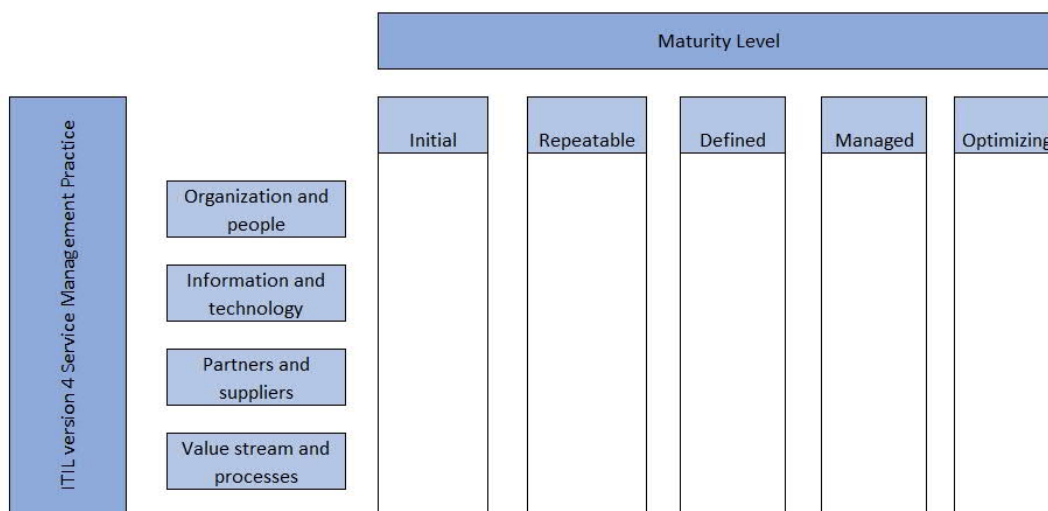ty level per ITIL 4 dimensions can give viewpoint to the service owner to investigate, what actual improvement steps could be taken to improve that service management practice. This is according to the objective to develop a maturity model to be used with ITIL version 4 framework.

4.6.1 Collected feedback from the IS Service Managers

Questions listen in this chapter, were used during the demonstration of developed ITIL version 4 maturity model. This was done to collect feedback on the developed artifact, and around the ITSM maturity aspects in overall. Answers from the IS Service Managers are summarized per question.

1. Do you see that there is a need and benefit to be gained by performing an ITSM maturity evaluation?

The interviewed IS Service Managers were all supportive on the idea of performing ITSM maturity evaluations. According to them, it would give the understanding of the current situation per service management practice and give inputs on points requiring more deeper investigation (A; B).

> *"There is a definite need and benefit to be gained, but it requires support from the management level to gain the best outcome. "(A)*

> *"It makes you think on points you otherwise would not consider." (B)*

2. Do you perform ITSM evaluations with your IS Service?

When asking about their used ITSM evaluation methods, the more practical and operational side of the ITSM was visible, by most of them utilizing different ITSM metrics. One Service Manager had performed ITSM evaluations in the previous workplace but that was more than five years ago. There were different ITSM metrics implemented, most of them were provided by the external vendor managing a part of the ITSM practices (C; E).

"Not involved with this type of evaluations… Practical reports are delivered by vendor and also by group ITSM tool from where similar type of reports can be gained…" (C)

There was also several similar metrics used, due to the same supporting tool implemented, example for the incident management practice. For this reason, similar reports and calculations were used. The ITSM metrics used varied somewhat on the calculation and visuality perspective, and according to one of the interviewees there would be more value gained from streamlining the operative metrics, than by performing regularly ITSM maturity evaluations (D).

"Streamlining and implementing metrics which would really give insightful information on the service would be more needed and provide more value to the business. The metrics needs to be useful to be valuable." (D)

When discussed about the ITSM metrics, the need of streamlined and improved ITSM metrics, were pointed out (D; E; F). It might be beneficial to develop a more management style dashboard. It would be a simple visual way to present each service situation to any relevant stakeholder, with the same set of KPI's.

"… On more practical matter the service is monitored with metrics reports delivered by the vendor. There is ongoing development with this partner to future improve the metrics for this service." (E)

"... Not really good metrics situation, honestly it would require more common team focus to have similar KPI's even though sources alter..." (F)

3. Do you think that the used model and its questionaries would be useful in practice?

There were some variations in this part. The usefulness of this developed model was seen in overall as beneficial, especially from the management perspective, but it was also seen that it would require more analyzation to provide concrete practical benefits (G; H).

"Depends on the target, from the management perspective yes, the model would be useful." (G)

"Model is quite practical, but it requires analyzation and actions to make true difference. Management commitment is required to get any real benefit... "(H)

There was also comment about the lack of service management practices to be evaluated in this maturity model questionnaire. There was interest on having in place all the questionaries for the 17 different ITIL version 4 service management practices(I).

"Practical but would have been better to have all the processes in the questionnaire to pick then the most important ones for my service. There is no point on focusing on availability as my service has not really had issues on that aspect..." (I)

4. Are the terms and concepts used in this maturity models clear?

In this question the level of background knowledge level about ITIL version 4 might affected the answers. One of the IS Service Managers commented that the terminology

of ITIL 4 and its concept, is not that clear, and that the questions required more discussion about their meaning (J). Others were more cleared with the used terms and concepts (K).

> *"Need to know ITIL4. There is too heavy terminology behind the ITIL framework."*
> *(J).*
> *"Common matters which should be known to all involved with IT service management work..." (K)*

Collectively it can be mentioned that all of them had worked a long-time alongside IT service management practice. If the participants would have been more juniors, the model could have required more explanations. It was also commented that the case company had recently offered ITIL version 4 foundation training as an online method, which all of them had at altered level participated. Couple of them completed that training path. This suggests that the terms and concepts were also clearer to them all due to this recent ITIL 4 training.

5. Is the model usable as self-assessment method or would you prefer other evaluation methods?

All the IS Service Managers commented that even though in overall the maturity model is a promising idea, the used self-assessment method is not enough. In their opinion these types of evaluations would be more beneficial if performed jointly (L; M). One supported the idea to do the ITIL v 4 evaluations as a team effort (L) and one would have preferred the external consultancy to guide and perform the evaluation, this way to gain more expert and unbiased viewpoint on the maturity levels(N).

> *"...Doing the evaluation together with the team would give the best discussion*
> *forum and more mature answers." (L)*

"Depends on the situation. Not needed to be performed on a yearly basis with the partner or team. Self-assessment gives a good start on this topic." (M).

"Maybe I would prefer some external opinion as I might be too close on the real-life practice… maybe externals would be more neutral as not that close my service" (N)

4.6.2 Findings

During the development and demonstration of the developed maturity model, it was evident, that some guidelines should be involved when performing the IT service management maturity evaluations.

- Management commitment is always required. There needs to be support from the management team to allow ITSM evaluations to take place, as it can too easily be seen by the participants as a judgement practise. It should be highlighted by the leaders that the ITSM maturity evaluation is not performed to find any guilty persons, or faults on the service, or with the current practices used. It should be promoted as a method to find innovative ideas on how to improve the ITSM practices and deliver more value to the business. Management commitment is also required to allow the necessary resources to spend time their time on the evaluation work.

- Suitable maturity model and method selection. During the literate review there were findings suggesting that there usually is no single ITSM framework in used by organization (Aguiar, 2018). These overlapping of ITSM frameworks should be reviewed when starting to perform the evaluation. There are also many different maturity models out there and finding the most suitable one for each organization is important. Especially if there is no existing ITSM practice in place but the organization is starting to implement an ITSM framework. In these cases,

there is the management decision required to guide the organization about which ITSM framework the organization leans to and wants to follow. Accordingly, the most suitable maturity model can be then used. Already in this phase there is a possibility to take the support from any external partner to manage the maturity model evaluation. There are plenty of companies available offering this type of support, of course against an extra fee, but it could easily be money well spent. There are of course some less pricey self-assessment-based questionnaires available, but then the objectivity of results be more questionable. It is quite common subjectivity issues might be faced when performing these type quantitative self-assessment surveys. In that sense a more outsources assessment methods performed by trustful external interviewers can give more objective results.

- Review the ITSM framework concept. Prior starting any ITSM maturity evaluation work it would be extremely beneficial for all to review the selected ITSM framework concepts and terminologies. This way the technical terms and concepts are familiar and guarantees that matters are understood the same way. This is obvious with example the ITIL version 4 terminology. There are lot of unfamiliar terms and practices, which requires knowledge by the personnel. This review of ITSM framework is beneficial, also when there is a newly published version of used framework available. This review of concept does not necessary mean that deep learning is mandatory down to the certification degree, but at least foundation recap is a clever idea.

- Focus on the IS services proving the most value. There definitely are different level of IS services from business point of view and when the resources are limited it is beneficial to start evaluation from those services and practices which provide the most value to the business.

- Involvement of both the internal resources and possible third-party vendors and partners gives better outcome. Nowadays there are seldom any IS services running purely with internal resources. Outsourcing has been a running trend for years in the field of IT, and there are usually at least one external partner providing part of the services. Joining the forces with them could be fruitful. It would also be beneficial to find a way to get the customers voice heard and possible participate in the ITSM maturity evaluation phase.

- Focus on continually evaluating the ITSM practices. Even though the maturity evaluation does consume resources it does provide valuable information on the ITSM service levels and should be performed regularly. If it feels that the maturity model assessments are too heavy, then putting more efforts on continual service improvements could be more worthwhile. With the constant efforts, set on improving the customer value by monitoring and adjusting the underlying service management practices, are never wasted. This of course also needs time and repetition, which is also visible in the literate review of the older ITIL framework evaluations. This section also highlights the importance of having well designed ITSM metrics in place, for this the chapter 2.3 would give some design guidelines.

4.7 Communication

Communication phase covers sharing the developed maturity model inside the case company for any further usage. The thesis will also be uploaded to the Vaasa University library's Osuva-database to provide wider access.

5   Discussion

IT service management focuses on providing valuable and high quality IS service for the business, collaborating with them, and in overall operating the IS processes according to the defined processes and set SLA's (Eikebrokk & Iden, 2017). This underlines the importance for the IS organization to focus on the relationship with the customers. To provide this high quality of IS services, the company can use the ITIL 4 framework. With the help of this type of ITSM practices, the IS function can truly provide the required value to the organization (Eikebrokk & Iden, 2017). Before this true value can be given, the basic IS services needs to be professionally operated. Only after this baseline is in place, the organizations IS function can start to take the necessary actions with ITSM practices to provide added value to the business (Eikebrokk & Iden, 2017). To help organization to evaluate their ITSM practices they can use maturity models. For this type of need, the developed artifact in the form of ITIL version 4 maturity model and listed guidelines, tries to provide a method.

5.1   Reflection on contributions

The objective for this master's thesis is to investigate for a method to be used when wanting to evaluate the IT service management maturity levels. To provide an answer to this question a literate review was performed, targeting to investigate the theoretical background and previous studies performed around ITSM maturity models. There were several different level of maturity model studies performed with the ITIL version 3. As there were no earlier studies performed or available around ITIL version 4 maturity model, this thesis focused on that ITSM framework. ITIL version 4 is also the latest ITIL framework model published in the year 2019, which also explains why only limited amount of academical papers available around that framework. The outcome of this Master thesis is the ITIL version 4 maturity model. Additionally, some guidelines to be used alongside ITSM maturity evaluations were provided. The developed maturity

model is described in the Evaluation chapter, combined with the findings collected from the practical demonstrations.

In this thesis the artifact was piloted with four IS Service Manager to gain understanding on the usability of the model. It highlighted the importance of making IT service management practices suitable for that relevant organization and that specific IS service. The ITIL version 4 strongly reverence on those aspects and highlights the importance of combining suitable parts from other practices, example from Lean or DevOps. It was evident from the ITIL version 4 literature that this new technological era with all the digital services and practices, are something the ITIL version 4 aims to help business to embrace. This continual digital progress makes it important to have the IT organization trained about the newest IT Service Management practices, in addition to other latest trends and technological advancements in the IT industry.

The environment where each of IT function operates varies widely, differences are visible even between the different IS services provided by the same IT function, depending on the business' perspective on the services importance. This business viewpoint on the value they receive and expect from each IS service or product, is crucial aspect to evaluate. It provides the answer to the question on where to focus the always limited IS resources. Therefore, this highlights the important prerequisite to have the mission critical IS services identified and having the focus on providing the highest necessary ITSM maturity level on those. After that, the ITSM improvement efforts could be set for the more business supportive IS services. It could be also argued that not all IT service management practices need to reach the highest level of maturity if their value to the business is not important enough. These important value providers from the business point of view should always have the highest focus from the management and that reflected accordingly to the organisations ITSM practices.

It can be argued that the IT function still requires more focus on their service provider aspect. More focus should be set to the customer experience, and the ways IS could

future increase the value it provides to the business. This was something evident when piloting the artefact and reviewing the ITIL version 4 literatures. Hopefully, the developed IT maturity model could be used when wanting to provide more value to the business in the form of IT service management practices.

The IS service field in the case company contained several outsourced sections, which different third-party vendors were responsible for. This is quite a common scenario in the field of IT services. As these partners are usually major IT vendors and follow ITSM practices like ITIL, it makes the service management practices easier to be defined. When performing ITSM maturity evaluation it would require participation from both parties to better achieve the true result about the ITSM maturity level. This would simultaneously allow the continual improvement of services to take place, as both parties would collaborate and plan ways to jointly improve the ITSM practices to shift the maturity level upwards and provide more value to the customer. It might even be constructive to involve the business representant when analysing the ITIL maturity level outcomes, as this way the business needs and expectations would be better captured.

After the initial ITIL implementation efforts, the continual ITIL maturity evaluation is usually forgotten. That was something visible both during the artifact piloting and when reviewing the relevant ITIL academical papers. There is a room for more academical papers around ITSM maturity researches and to increase the knowledge of these models in the companies and their IS management level. Regular trainings of the updated frameworks and practices would be also beneficial for the IS organization and this way to the whole company.

5.2 Limitations

Limitations of this study are related to the amount of IT Service Manager practices investigated and with the empirical part on qualitative methods used to study the artifact usage with IS Services. The empirical part relied heavily on the developed

assessment questionnaire filled during the interview sessions along with user experiences collected with interviewing the IS Service Managers. In this study only two of the total 17 different IT Service management practices were used, and four different IS Service Managers were interviewed to demonstrate the developed maturity model and to gain feedback from.

5.3   Future research

For the future research topic, it would be interesting to further developed this ITIL version 4 maturity model by incorporating all the remaining IT Service Management practices into it and investigate the outcome. During the literate review there were no paper found which would contain maturity model evaluation covering all the ITSM practices. This is something new which could be done with this developed model. Only downside is, that it would require a lot of work to cover all the different service management practices, but surely the findings would be interesting.

Another future research topic could be to pilot the developed artifact with different companies IS services. In this thesis only one case company was used for the demonstration, so the underlying organizational environment was same to all interviewed IS Service Managers. There might be different findings when using different company sizes or geographical locations. When adjusting these surroundings, surely some interesting alteration requirements might be needed on the artifact itself.

It would also be interesting to research more deeply on how the operational IT service management practises are monitored, and what improvements could be done on that area to guarantee valuable service for the business. As these maturity model evaluations are not done that regularly, investigation on the operational practice around the ITSM metrics would be an interesting topic. Maybe a dedicated research on this topic could provide valuable information and practical guidelines to the business, on how to use the ITSM metrics when offering valuable and high quality IS services to the business.

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Appendices

Appendix 1. Questionnaire related to Availability Management Practice

ITIL 4 Availability management

1.Is there a configuration management database with relevant service configuration item details listed? With relationships with relevant service configuration items?

- ○ Yes
- ○ No

2.Is there a formal IT service availability plan which is also regularly reviewed with relevant stakeholders?

- ○ Yes
- ○ No

3.Are there process to test new or changed configuration items against availability requirements before implemented to production?

- ○ Yes
- ○ No

4.Are the persons responsible for availability management aspect had relevant training?

- ○ Yes
- ○ No

5.Are the responsible person or team identified whose responsibility it is to handle availability management tasks?

- ○ Yes
- ○ No

6.Are there implemented a method or tool to identify availability issues?

- ○ Yes
- ○ No

7.Are a working method to communicate to relevant stakeholders (e.g. Customers) that the service is unavailable?

- ○ Yes
- ○ No

8.Are the tools implemented to collect availability measurements? Or to identify availability issues?

○ Yes

○ No

9.Are there methods implemented to analyse availability results?

○ Yes

○ No

10.Are the methods to share availability results to interested stakeholders?

○ Yes

○ No

11.Are there methodical methods to evaluate improvement needs related to availability?

○ Yes

○ No

12.Are the customers involved in setting up the availability targets?(like MTBF/MTRS)

○ Yes

○ No

13.Are the service provider aware of the customers peek availability times? Example specific dates during a month

○ Yes

○ No

14.Have the maintenance windows been agreed with the customer?

○ Yes

○ No

15.Do service provider know the services importance to the business processes? Aware of the impact the application failure could have to the business?

○ Yes

○ No

16.Are the a regularly performed failover and recovery testing in place? With evidence

○ Yes

○ No

17.Are there a valid recovery document in place? Instruction on steps and roles etc.

○ Yes

○ No

18.Are there measures &procedures to identify trends and to forecast future service availability levels?

○ Yes

○ No

19.Are there a communication channel with the Problem management to manage IT service downtime issues? Or root causes for service disturbances

○ Yes

○ No

20.Are there a communication channel with the Capacity and performance management practices to manage system improvement needs on that capacity sector? (memory, CPU, etc)

○ Yes

○ No

21.Is there a communication channel with the Change enablement practices prior to proposed changes? To make sure availability will not be affected

○ Yes

○ No

22.Does the availability management interact with Servicedesk to receive feedback on system availability complaints from users?

○ Yes

○ No

23.Is there a method to collect user feedback on system availability?

○ Yes

○ No

24.Is there a procedure to monitor that business value perception from this availability service is received?

○ Yes

○ No

Appendix 2. Questionnaire related to Business Analysis

ITIL 4 Business Analysis

1.Is there a holistic method on approaching business needs? Relevant to this application from viewpoint of needs occurring to business systems/processes/services and architectures

○ Yes

○ No

2.Is there are formal way to identifying improvement areas in service value systems?

○ Yes

○ No

3.Is there way to evaluate and propose required improvement actions?

○ Yes

○ No

4.Is there a formal way to document the business improvements required for the services?

○ Yes

○ No

5.Are these documents stored in place where required persons have access to?

○ Yes

○ No

6.Are these documents shared with relevant stakeholders?

○ Yes

○ No

7.Are recommendations which are the outcome of business analysis practice shared with stakeholders to gain validation?

○ Yes

○ No

8.Are the business analysis process managed in a timely manner acceptable to the customer?

○ Yes

○ No

9.Do the business analysis process include co-operation with operations and support teams to collect information on how the production service is operating?

○ Yes

○ No

10.When required is there collaboration with relevant business units?

○ Yes

○ No

11.Does the business analyst have access to relevant service documentation, process documentation, work instructions, policies, metrics?

○ Yes

○ No

12.Is there a formal tool or tools used in this practise?

○ Yes

○ No

13.Is the business analyst collaborating along the customer also with relevant other service value partners?

○ Yes

○ No