



Linnæus University

The Department of Informatics

Master of Science Thesis in Informatics

Main field of study: Digital Business Development

Management of Software Assets

Challenges in Large Organizations



Author: Gabriel Mäder

Supervisor: Niclas Eberhagen

Examiner: Jan Aidemark

Term: Spring Term 2021

Subject: Informatics – Digital Business Development

Level: Graduate - Master

Course code : 4IL50E



Abstract

This thesis is a study about the difficulties managing software assets within larger organizations. Software Asset Management (SAM) is a fairly new practice which has started to be used by organizations in order to track and manage software assets throughout their life cycle. Existing literature states that organizations have challenges with the increasing complexity, which comes along when buying software products from manufacturers. However, the lack of academic research, due to the rapid development of technology has been limited. The purpose of this paper is to explore the challenges that large organizations are confronted with when managing software assets. A mixed study approach was conducted with main focus on a qualitative approach, where five persons with mainly long experience in Software Asset Management, were interviewed. In addition, a survey was sent out to employees who work with IT, to capture a general aspect on the topic. The findings of the study include the identified challenges of SAM, which are divided in four main areas. Further, the paper highlights the importance and success of Software Asset Management.

Keywords

Information Systems; Information Technology; IT Asset Management; ITAM; Management of Software Assets; software asset management; SAM; managing software assets; Software Asset Management (SAM); Organizations; Informatics



Acknowledgements

I would like to thank my supervisor Niclas Eberhagen for the support and assistance during the process of this research. The guidance has been valuable in order to complete and improve the thesis. Further gratitude goes to the participants of my study and for their time and contributions, which were the key to the findings of the thesis. In addition, I would like to thank the staff of the informatics department who conducted the seminars and gave me the fundamental knowledge which was needed to realize this paper. Finally, I would like to thank my family, friends and sisters who supported me since the beginning and encouraged me during the journey.

By that said, I wish you pleasant reading!

.....

Gabriel Mäder



Glossary & Abbreviations

Audit - An examination, investigation and verification of records.

Best Practices – is an industry process or practices considered to be most effective.

BSA - Business Software Alliance is a compliance agency or software member organization that represents the world's largest software vendors to uncover and report on copyright infringement for the members, including collecting evidence and conducting software audits

Cloud Computing - Cloud computing is a general term for anything that involves delivering hosted services over the internet.

Flexera - Is a software tool that provides a standardized and comprehensive solution for managing software licenses as well as inventory data.

Information Technology (IT) - The study, design, development, implementation, support, or management of computer-based information systems, particularly software applications and computer hardware.

Information Technology Asset Manager - The IT Asset Manager is the primary point of accountability for the lifecycle management of information technology assets throughout any organization.

Installs, Moves, Adds, Changes (IMAC) – are the actions of the technical staff managing a distributed organizational software asset environment.

Intangible - An asset or benefit where the value cannot be estimated based upon generally accepted standards of accounting.

Inventory (noun) - List of hardware and/or software products “discovered” either manually or electronically in an organizational environment.

ISO - The International Organization for Standardization aims to develop standards to ensure the quality, safety, and efficiency of products, services, and systems.

ISO/IEC - International organization for Standardization/International Electrotechnical Commission

ITIL - Information Technology Infrastructure Library

License - Legal document that is a binding contractual agreement between a software manufacturer and a software user that defines conditions of use

Lifecycle Management - is a process of managing assets from the moment they are considered until their disposal

Policy - Policies are rule statements that govern acceptable behavior and actions



Repository - Software database product that contains the historical ITAM data.

Software Audit - A review of assets conducted either internally or by an external compliance agency or software publisher in order to confirm compliance to copyright.

Software Asset Management (SAM) - The practice to combine people, processes, and technology to allow software licenses and usage to be systematically tracked, evaluated, and managed. The aim of Software Asset Management is to reduce IT spend, human resource overhead, and compliance risks that are inherent in owning and managing software assets.

Software configuration management – The management of tracking and controlling changes in the software

Software as a Service (SaaS) - A service-based software model that is an alternative to the traditional purchased software license model.

Subscription Based License - License in which the users renew the right to use the software on a defined time basis during a specified subscription period

On-premise – Software that is installed and runs on computers on the premises of the person or organization using the software. Instead at a remote facility such as a server farm or cloud

List of Tables

TABLE 1 : INTERVIEW PARTICIPANTS	28
TABLE 2 : OVERVIEW INTERVIEW PARTICIPANTS.....	32
TABLE 3 : INTERVIEW GUIDE & RELATION TO THEORY.....	54
TABLE 4 : CHALLENGES MENTIONED BY SURVEY RESPONDENTS.....	75

List of Figures

FIGURE 1 : IT ASSETS.....	11
FIGURE 3: RUDD, COLIN (2009) (ITIL V3 GUIDE TO SOFTWARE ASSET MANAGEMENT)	15
FIGURE 4: CREATING AN INVENTORY FOR SOFTWARE ASSETS (BEN-MENACHEM & MARLISS, 2004, P. 37)	17
FIGURE 5: CONCEPTUAL FRAMEWORK.....	19
FIGURE 6: ISO 19770-1 TIERED ASSESSMENT FRAMEWORK (ISO/IEC 19770-1, 2012)	20
FIGURE 7: COMPLIANCE PERFORMANCE.....	33
FIGURE 8: CLOUD STRATEGY	34
FIGURE 9: LIFE CYCLE.....	35
FIGURE 10: ROLES & RESPONSIBILITIES	38
FIGURE 11: AWARENESS SAM.....	40
FIGURE 12: PROCESS SOFTWARE ASSETS.....	40
FIGURE 13: SAM TOOL	42



Table of Contents

Abstract	2
Keywords	2
Acknowledgements	3
Glossary & Abbreviations.....	4
List of Tables	5
List of Figures	5
1 Introduction	5
1.1 Background	5
1.2 Topic Justification	6
1.2 Problem Statement.....	6
1.4 Purpose & Research Question	8
1.5 Delimitations	8
1.6 Target Group	9
2 Literature Review.....	10
2.1 Asset Management	10
2.2 Software Assets.....	12
2.3 Software Asset Management.....	13
2.4 International Standard Organization	18
3 Method.....	22
3.1 Methodological Tradition	22
3.2 Methodological Approach	23
3.3 Data Collection Methods.....	25
3.2.1 Selection	27
3.2.2 Transaction Interview & Survey Process.....	28
3.4 Data Analysis	30
3.5 Reliability & Validity	30
3.6 Ethical Considerations.....	31
4 Empirical findings & Analysis.....	32
4.1 Difficulties with the Management of Software Assets	32
4.1.1 Audit	32
4.1.2 Cloud	34
4.1.3 Inventory	36
4.1.4 Shadow IT & Costs	38
4.2 Importance & Success within SAM.....	39
4.2.1 Importance of Software Asset Management	39
4.2.2 Factors for successful Software Asset Management	41



5	<i>Discussion</i>	43
5.1	Identified Difficulties within Software Asset Management	43
5.2	Method Reflection	44
6	<i>Conclusion</i>	46
6.1	Conclusions	46
6.2	Future Research.....	47
	<i>References</i>	48
	<i>Appendices</i>	54
	Appendix A- Interview Guide/Questions.....	54
	Appendix B - Interview response P1, Company A	55
	Appendix C - Interview response P2, Company B.....	59
	Appendix D - Interview response P3, Company C	62
	Appendix E- Interview response P4, Company D	65
	Appendix F - Interview response P5, Company E	66
	Appendix G - Survey Questionnaire & Results	70
	<i>Survey - Master of Science Thesis in Informatics</i>	70

1 Introduction

In this chapter, the reader will be introduced to the background of the research area with the intention to give a basic understanding of the subject. In addition, further reasoning around the problem area will be presented and previous research. In the end of the chapter the research questions, scope and limitations will be discussed.

1.1 Background

Information technology (IT) has over the past 20 years contributed to the development of tools to support managing assets. At the same time, increasing difficulties are being made how these assets are managed since IT resources has evolved into more complex, fast, and constant technological advancements (McFee, 2004).

Assets have always been registered and managed and is defined as an “*item, thing or entity that has potential or actual value to an organization*” according to ISO/IEC 19770-1 (2017). Common examples on it are real estate, vehicles, furniture, and machinery. For many of these assets, there are good and well-developed systems, systems that are of great help to an organization. For example, all vehicles must be provided with a registration number or other identification number that is registered by the Swedish Transport Agency. Properties are registered with the Swedish Property Agency. The management of Software Assets, which this report will address, have proved significant more difficulties to register and manage (Gull & Wehrmann, 2009). The reasons can be several and the idea is to try identifying what causes value, complications and challenges.

Software has grown of importance in an increasingly global interconnected world where the need for information technology is increasing (Nil & II, 2009). Major changes in information technology have grown exponentially over the years and led to rising software costs. This is a reason for more organizations and companies can no longer ignore the costs and they begin to understand the importance of Software Asset Management (Silva, 2009). Resource management of software has become more complicated and there is a great need to improve the management process around software and licensing (Swahn, 2012).

In large organizations, there are situations when the organization consciously or unconsciously allows personnel and others who have access to computers to install unauthorized software. As a result, internal auditing requires more work and consideration for both risk and ethical exposure (Kaplan, 1994). In connection with software and license compliance however, it is not illegal use of software that is the biggest problem in organizations, but instead it is the shortcomings of systematic management of software in organizations (Fisher, 2009).

Data is a major asset for organizations, which generates essential information after being collected and processed (Demirkan & Delen, 2013). Data quality during internal auditing means having all the information needed when needed. Data must be complete, consistent, and current. Optimization of license and management of software is a viable way that can reduce application costs, but it is a big challenge. It requires new technologies and organizational processes that can handle a complex and heterogeneous licensing environment (Schmidt, 2011).

1.2 Topic Justification

The significant increase of software license audits, the increase of software costs and the and the endless number of software products that are used by each company is of importance to understand the issues in order stay successful within fast changing environment. Despite increased importance of software asset management, the amount of research has been limited. The current challenges within Software Asset Management has not been clearly established in research context, while the industry has.

A simple Google scholar search with the term "Software Asset Management" results in 1 220 000 entries. However, the gaps in the literature have not addressed the challenges within Software Asset Management in a academical aspect. There are few scientific articles which highlight the challenges in general applicable aspect. Mainly the articles are provided from the IT industry, where no academic research has been conducted. IT associations do not base there solutions on science and rather rely on different reports coming from the owners the software manufacturers.

The International organization for Standardization and the International Electrotechnical Commission have developed frameworks, concepts and best practices for organizations regarding SAM but no extended academic research for an overall general theoretical model has been presented for the organizations to use. Therefore, there is room for further academic research within the field.

There is a gap, where the existing literature does not dig deep enough and can't keep up to date with the rapid technological development to capture the current challenges and risks regarding software asset management. This means that there is further need and space for exploration regarding mapping current challenges and risks within software asset management. The following sections and chapters will present the existing research about the topic.

1.2 Problem Statement

Gull & Wehrmann (2009) state that many organizations often experience challenges in managing software assets. McAfee (2004) means that decisions and management of IT

resources has evolved into more complex, fast, and constant technological advancements, leading to lack in management of acquisitions. The shortage of standardized information in both the products needing for identification and the tools designed to provide service regarding software asset management lead to monotonous and manual tasks to stay accurate with the software inventory for license management.

Ben-Menachem (2008) means that methods to manage assets within software are lacking in required quality and leads to low information transferability between managers inside an organization. Further Ben-Menachem (2005) states, that inefficient management of software assets has contributed to a source of financial suffering for organizations. In other words, poorly managed software assets can be costly since a lack of overview is not available for cost optimization and tracking of cost. This leads to unpredictable future planning of budgets. Further vendors, which have experienced resistance in the past few years, have a higher focus on audits to increase revenue goals for non-compliance product or services (Riley, Len 2017). Further Gull & Wehrmann (2009) mean that a lack of license management can result in becoming over or under licensed, when unnecessary licenses are deployed.

A Flexera Survey Analysis (2013) states that 61% of company panels said that they experienced a minimum of one software license audit in the last one and a half years. A Gartner Survey Analysis (2013) shows a similar analyst finding of 68%. License audits seem to. Increased audits which software vendors generating seem to be a new revenue stream (Riley, Len 2017). These are forms of true up charges which are paid out in addition to the contract. The use of unauthorized software is a risk for companies and can impact companies with fines which results in higher costs.

Numerous organizations tend to underestimate the value of their software assets and the methods for tracking software usage on networks are often insufficient (Albert, Santos, & Werner, 2013; Varela et al., 2018). Varela et al., (2018) means that increased usage of tablets and smartphones has become more common among employees in organizations, which has ignored the current principles of SAM. The progress of using several devices has led to increased IT risks, costs, and an inability to determine what software is being used and where (Swartz & Vysniauskas, 2013). The change from traditional software model to new licensing models such as virtualization and on-demand services (cloud computing or software as a service) cause further challenges in license administration (Gull & Wehrmann, 2009). The new licensing models are based upon use, which for example is measured by counting the minutes for use of software or functions calls.

Bott (2000) states that software often is treated as an intangible asset, but that equipment is categorized as tangible asset, which causes difficulties to assign a value due to uncertainty of future benefits. Jakubicka (2010) means that software should be treated like any other asset in an Organization, such as a hardware or a property, because tangible assets are measurable assets that are used in a company's operations.

1.4 Purpose & Research Question

The purpose of this research is to identify, analyze, and clarify the new challenges of managing software assets and to identify the core capabilities that are necessary to deliver successful software asset management. This study is addressed in the business aspect of organizations, especially in large and medium-scale organizations. Studies and academic research conducted in this area are relatively poor in the rapid development of software development.

To understand the challenges of software asset management, this research will address the following research question.

What are the new challenges facing large organizations in managing software assets?

1.5 Delimitations

The study will focus on companies and organizations that are in the medium and large business segment as well as in the private and public sector. Interviews will take place with at least 5 companies. No other company-specific characteristics will be taken into consideration in the selection of companies to interview. These boundaries are chosen as it is more likely that smaller companies are more aware of their software asset management, as they have a smaller number of software assets which is easier to manage. This also results in decreased challenge in managing software assets.

In this study, Software Asset Management is discussed as an organization-wide policy with processes. The study addresses the organizational process and its roles to facilitate the software asset management process. Software asset management is a very large concept area and the time frame for this degree project is not enough for one more comprehensive description of the various parts that belong to the subject.

The report does not address discussions of the different types of licenses, license policies, software compliance. Further, the study does not deal with specific Software Asset Management tools such as Flexera, Snow Software, Cleanshelf or IBM tools. Instead, it is a method of accounting for all software assets in an organization, including those not authorized by IT management. Incidentally, the way these software assets are accounted for go beyond the discussion of this study. Further, the study will not look closer at the wider aspect of IT asset management such as the hardware aspects which is the broader business discipline that SAM is part of.

The theory chapter consists of previous studies found and scientific anchoring of the thesis. Descriptions and explanations of certain concepts or disciplines mentioned in the report are also available in the theory chapter. The discussions do not go deeper than the reader can get an overview of what it is about and using this as information support.

1.6 Target Group

The target group for this study are those who work with software asset management in medium and large organizations and IT – Departments. Companies and organizations with a heterogeneous software asset management environment might also be able to use the thesis as support tunderstand the challenges and values within software asset management. The contributions for the academic research is to recognize the main aspects of challenges that organization face in the daily business when it comes to managing software assets. Further aspects is to present the importance and factors of successful SAM.

2 Literature Review

This chapter aims to explain the definition, purpose and origin of Software Asset Management. The chapter provides descriptions and information about notions such as Asset, Asset Management, Software Assets and Software Asset Management. In addition, different parts of SAM such as processes, product lifecycle and inventory are presented.

2.1 Asset Management

The definition of the terms asset and asset management have been varied over the ages. Earlier the terms were mainly connected to accounting and the investments like funds, stocks, and portfolios to optimize costs and gain returns (Christopher, 1993). In addition, the terms were used to identify and manage risks of assets specially in the financial markets (Liyanage, 2012). The development into the current contextual terms have been diverse and there a several drivers behind the development. For example, The Institute of Asset Management (2014) mention two main reasons for the development of industrial asset management in addition to financial services terms. There were the issues related to management in the public sector in Australia and New Zealand and the Piper Alpha accident in the North Sea which shows that the terms spread into various sectors.

Generally, an asset can be defined as something valuable that the company owns and that is associated with risks and benefits.

Asset Management (AM) is the handling of physical assets such as the selection, maintenance, inspection, and renewal, which has as an important purpose when it comes to the operational performance and profitability of organizations. Further, asset management such as the scope of managing information, finance and competence is also included (Michaud, Richard O. 1998). Vanier, D. J. (2001) defines asset management by applying the below stated questions:

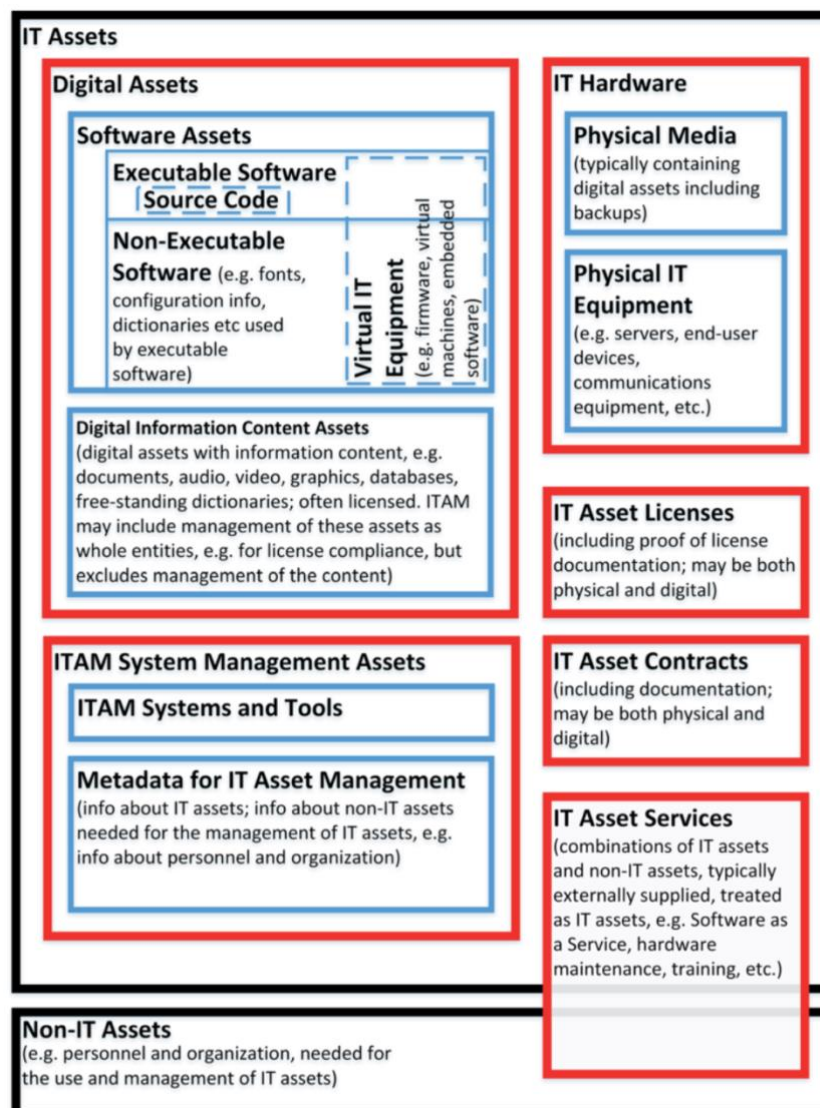
- What do you own?
- What is it worth?
- What is the deferred maintenance?
- What is its condition?
- What is the remaining service life?
- What do you fix first?

In the scope of Information Technology (IT), assets cannot be limited to equipment and software under the responsibility of IT management since the ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) which form the specialized system for worldwide standardization define an asset as an “*item, thing or entity that has potential or actual value to an organization*” (ISO/IEC 19770-1 2017). Further, the notion IT assets is specified and defined by software, media (physical and virtual), licenses (including proof of license) contracts and

IT asset management assets (incl. ITAM system and tools and the metadata needed to manage all IT assets).

This means that IT assets refer to the whole infrastructure including computers, servers, storage, device applications and support software etc. which leads to the observation that IT assets also cover hardware and software. ISO/IEC 19770-1 (2017) defined a wide variety of asset types in Figure 1 below, which present the principal IT asset types diagrammatically:

Figure 1 : IT Assets



Wang et al. (2015) means that IT assets don't have an impact on the development of the companies directly while the management of the assets is a strategic resource which can improve the competitive advantage and development of an organization.

2.2 Software Assets

IT Asset Management (ITAM) is defined by the collection of inventories, financial and contractual data to manage assets during the whole lifecycle. In the framework of ITAM, software assets of an organization are shaped by all software systems which support to complete the organizational goals. ISO/IEC 19506 (2012) defines a software asset as

“a description of a partial solution (such as a component or design document) or knowledge (such as requirements database or test procedures) that engineers use to build or modify software products. A software asset is a set of one or more related artifacts that have been created or harvested for the purpose of applying that asset repeatedly in subsequent contexts”

Rotella (2018) states three different types of software assets:

- Third-Party Software (TPS)
- Open-Source Software (OSS)
- Commercial-Off-The-Shelf Software (COTS)

Third party software (TPS) is defined by programs that are developed by companies other than the company that developed the computer's operating system. For example, any Macintosh applications that are not developed by Apple are considered third party applications.

Open-source software (OSS) is a kind of software in which source code is released under a license in which the copyright holder grants users the rights to use, study, change, and distribute the software to anyone and for any purpose (St. Laurent, Andrew M. 2004).

Commercial-off-the-shelf (COTS) software is a term for software products that are ready-made and available for purchase in the commercial market.

Rotella (2018) means that TPS and COTS make the majority of software assets in organizations and are the most significant bugs and IT risks. The cause for bugs and IT risks is that organizations often fail to carry out proper quality checks before integrating the new software with existing software components (Rotella, 2018). The issue with OSS, is that anyone can write and distribute the source code, and this can lead to severe IT risks such as corrupt data or the introduction of malware (Voas & Hurlburt, 2015).

Organizations have an organized purpose where varieties of small-scale to large-scale operations are executed, which can consist of hundreds of employees and numerous software assets (Ben-Menachem & Marliss, 2004). They all participate in the open market and rely on competitive advantages in the form of software assets to improve their business activities (Albert et al., 2013). The purpose is to improve customer relationships, outperform competitors, and ensure that supplier and business processes correspond to each other (Albert et al., 2013).

2.3 Software Asset Management

Albert et al., (2013) mean that Software Asset Management (SAM) is a method of tracking software assets that enables organizations to maintain and optimize their use of software. The purpose is to reconcile software usage with the correct license rights, which are provided by software suppliers, to mitigate IT risks associated with licensing non-compliance (Albert et al., 2013; Vion et al., 2017). For example, managing software assets could be the right to use some specific software, which is in turn documented in software contracts, license documentations, and receipts (Henttinen, 2018; Varela et al., 2018).

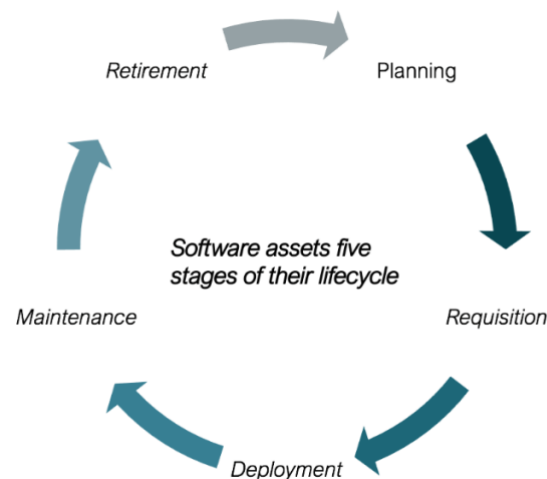
Rudd, Colin (2009) defines Software Asset Management based on The Information Technology Infrastructure Library (ITIL) as:

” All the infrastructure and processes necessary for the effective management, control, and protection of the software assets within an organization throughout all the stages of its lifecycle.”

The guide is aligned with ISO/ IEC 20000 (International standard for IT service management) and considered as a practical approach to the management of software assets in companies.

An additional functional advance of the notion SAM is described as: ” *SAM is the practice of effectively managing what an organization does and does not do with software. It is a set of managed processes and functional capabilities to manage the software assets throughout the five stages of their lifecycle (planning, requisition, deployment, maintenance, and retirement).* ”

Figure 2 : Software Assets Five Stages of their Life Cycle



Durbin, Keith (2018) applies the Software Asset Management practice on the Metropolitan Nashville Government’s Information Technology Services and explains the stages in the following way:

Planning – is about the process of internal planning sessions before acquisition of software assets for their operations. In addition, it is about justification of the purchase, analyzing the justification and approval of major software purchases in the departments and other agencies.

Requisition – a managed process to follow procurement regulations which works with other division on software budgets. The division managers approve the purchase orders, review invoices, and approve payments and receipts. Further, true-up process for products such as Microsoft enterprise agreements are executed. The process could be a starting point for software asset inventory and license tracking system.

Deployment – is the process where purchased software assets is ensured to be in productive use.

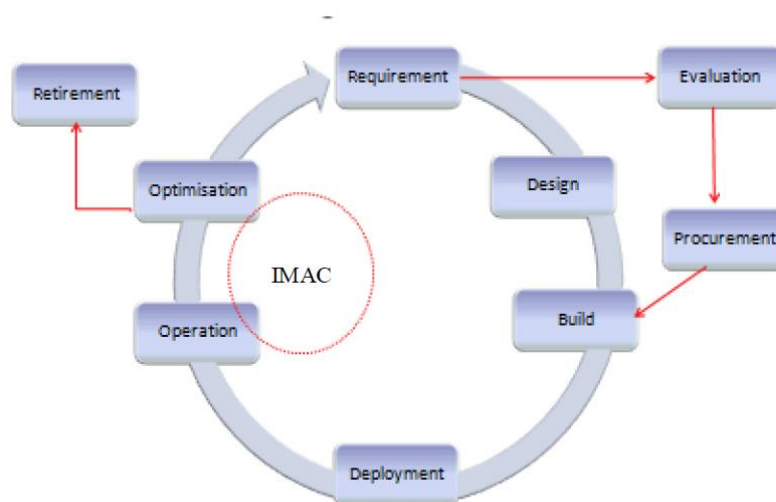
Maintenance – is about a managed change control process. Further it's about detecting, and monitoring programs installed on devices that are active and which one are nearing to the end of maintenance.

Retirement – is about documenting hard drive wipe and destruction process where software assets can be identified for license recycling.

Gartner Research Director Patricia Adams (Gartner a global research and advisory firm for leaders in IT functions) states that IT- Asset Management where SAM is included is depended on **robust processes**, with tools to automate manual processes. The data makes it possible for organizations to manage software assets portfolio from requisition through retirement by monitoring the assets performance throughout it is life cycle Gartner Inc (2012).

Kamal and Petree (2006) means that the concern to manage and protect software assets during the lifecycle is commonly referred to as the weighing to the grave, birth to death and acquisition to disposition of software. The cycle is about request, approval, order, receiving of order, installation/move/add/change (IMAC), refresh and disposition (software asset has formerly ended) . Further the author means that the support & maintenance phase plays a major factor of the life of a software asset in an enterprise organization. From the point of receiving the asset to the point of installation, through the installation and post installation changes during active production usage to potential mover and reinstallations to the stage of asset's life cycle. This varies and is challenging to manage due to the varieties of possible ways for installing, moving, adding, and changing events.

Figure 3: Rudd, Colin (2009) (ITIL V3 Guide to software asset management)



According to Holsing and Yen (1999), the primary goal of Software Asset Management is to make sure that the software license compliance through employee education and established purchasing procedures, while minimizing software expenses. The authors proposed a software asset probation model with an identification of five problem areas which push the need for software management. These are:

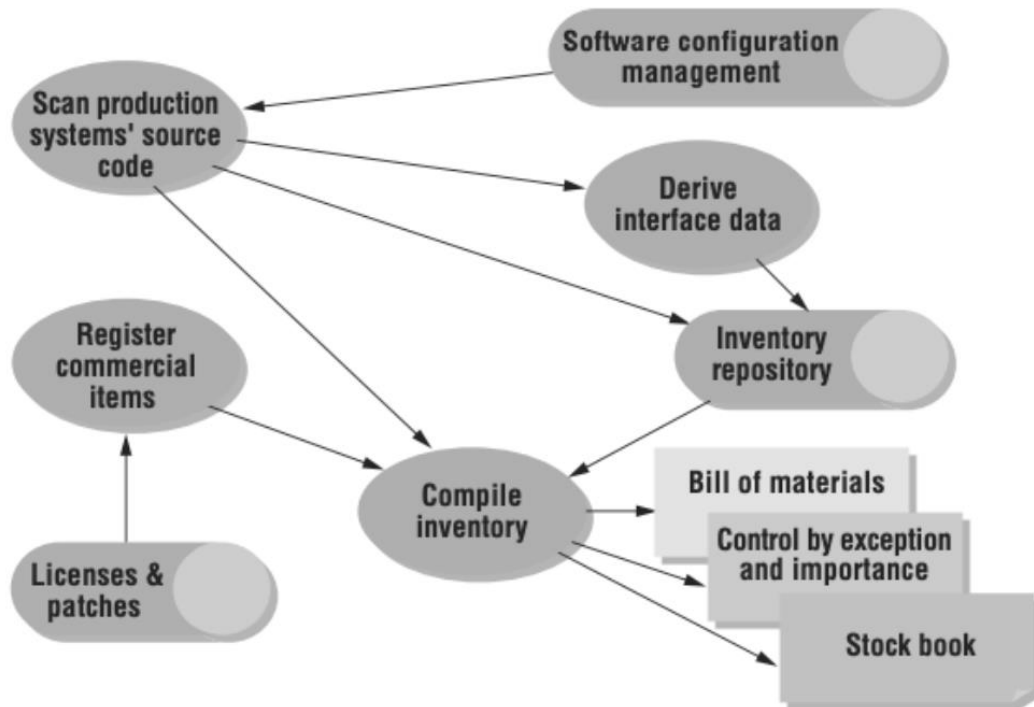
- Ethical (the respect of intellectual property rights)
- Legal (fake copies),
- Technical (monitoring)
- Margins and an economic issue such as true up costs
- (When above steps are identified) Lead implementation (of SAM) withing an organization from three different parties: end-user, employer, and software editor.

In addition, Holsing and Yen (1999) mean that the above stated risks/problems are triggers in driving the need for SAM and that they are based on the best interests of IT management, end-users, and software suppliers. According to Vion et al., (2017) SAM additionally enables organizations to gain a current view of installations and usages of software assets which can help complement cohesive risk management policies.

Ben-Menachem & Marliss (2004) presented the “paradigm of change” based on tools, methods, and procedure for a suitable overall IT inventory management. According to the authors the most significant failures of IT is the lack of systems to support, gather and provide information for managing software items. IT- professionals tend to think in terms of versions or configuration control license and patch management (providing updates to software). Version control systems and software configuration management systems have a purpose to manage versions of individual software objects. The Issues of controlling large amount of geographically purchased and paid software does not cover the information for managing software.

In addition, the authors mean that software systems are the only major organizational asset with no real support for managing software assets based on information technology. An IT inventory management facility is fundamental base of an integrated set of technologies designed to address constantly changing technologies and business processes. Therefore, an investment in creation and maintenance of software inventory is crucial to a proper long-term software asset management. M. Ben-Menachem (2005) defined a methodology for software control by importance and exception (SCIE) which allows optimization of software items as assets based on an organization’s software inventory and improve IT asset valuing to allocate development and evolution priorities.

Figure 4: Creating an inventory for software assets (Ben-Menachem & Marliss, 2004, p. 37)



McCarthy & Herger (2011) presented a solution in four parts to combine IT, processes and business in Software Asset Management:

Discover Software Assets

Agents automatically collect and discover software license assets on all applications running on desktops which are distributed within the organization. The Software licenses are linked to employee & workstation. The Scanned data populates asset database as discovered inventory and provides base line for audit compliance reporting.

Reconcile Purchased Assets

Focuses on combining software procurement inventory and the life cycle management of purchased 3rd party software licenses. Sustained asset reconciliation and compliance (what do we have what do we need to stay compliant).

Implement Contract Management

Captures the compliance with license terms & conditions and enables reuse of licenses through off-loading (attrition, allocation, entitlement). Enables governance and process automation.

Produce Business Intelligence Reporting

Is about audit readiness and compliance where focus lies on analyzing, tracking, & forecasting the global IT software spend. Presents the management reports proactively target audit and compliance risks.

The solution and experience turned out that the capabilities, the analytics, workflow automation and business controls helped an organization to achieve significant savings up to more than 5 million US dollars in the first year of deployment.

Further, McCarthy & Herger (2011) defined the following benefits of SAM:

- Cost savings from the recycled software licenses
- Better accurate forecast and planning data
- Readiness for audits from manufacturer

2.4 International Standard Organization

The notion Software Asset Management (SAM) is a specialization of IT asset management based upon software assets (ISO/IEC 19770-1, 2017). The International Organization for Standardization (ISO) is the largest and most recognized global standards-setting body. It is a joint technical committee of the International Organization for Standardization (ISO) and the International Electrotechnical Commission. In 2006 the first standard regarding Software Asset Management was published (ISO/IEC 19770-1, 2012) .

ISO's 19770 family of SAM standards represent the only global standard for SAM and is defined as *"the effective management, control and protection of the software assets within an organization, throughout all stages of their life cycle"* (ISO/IEC 19770-1, 2017). In 2012 an update was established with the foundation of the standard from 2006 and defined software assets by divide it into three main categories:

- Software use rights, with 100% ownership (in-house developed software) together with licenses (as for most externally sourced software, whether commercial or open source).
- Software for usage, which includes the intellectual property value of software (including original software provided by software manufacturers and developers, software builds, and software as installed and executed).
- Copies of media holding for software use e.g. such as software which is installed on a device.

The ISO/IEC 19770-1 (2012) established 27 processes for the conceptual framework of SAM, divided into three main categories which are:

- Organizational Management Processes
- Core SAM Processes
- Primary Process Interfaces for SAM

Organizational Management Processes defines the control environments for software asset management. It is about the establishment and maintenance of the management system in other processes, such as roles, responsibilities, policies, processes, procedures, corporate governance and the competence in SAM. Planning and implementation processes make sure that the appropriate preparation and planning is there for achieving the SAM goals.

Core SAM Processes is about the processes of inventory of SAM so that the management goals are being achieved e.g., software asset identification, inventory management and software asset control. The compliance and verification processes manage all exceptions, policies, processes, and procedures, which involve license use rights such as software asset verification, software asset compliance, software asset security compliance and conformance verification for SAM. Operations Management processes and interfaces involves processes of operational management functions which are there to serve and achieve the overall SAM goals and benefits. For example the relationship between contract management and licenses, the financial/commercial management for SAM (e.g. prices for deployment of software), service level management for SAM and the security management.

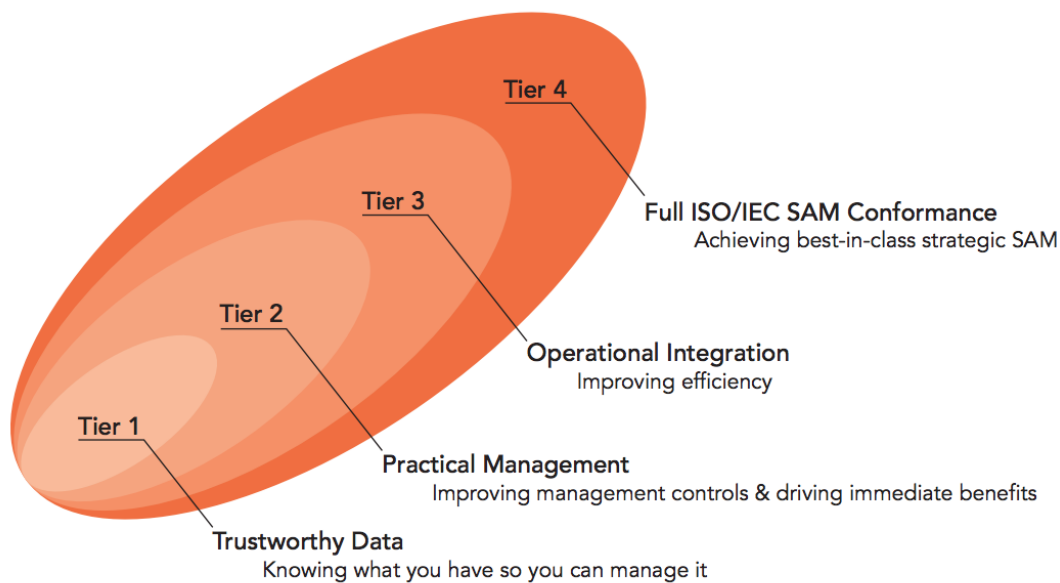
Primary Process Interfaces for SAM defines the life cycle process interfaces for SAM. Focus lies on the requirement for the life cycle process such as change management process, acquisition process, software development process, software release management process, software deployment process, incident management process, problem management process and retirement process.

Figure 5: Conceptual Framework

Organizational Management Processes for SAM			
4.2 Control Environment for SAM			
Corporate Governance Process for SAM 4.2.2	Roles and Responsibilities for SAM 4.2.3	Policies, Processes and Procedures for SAM 4.2.4	Competence in SAM 4.2.5
4.3 Planning and Implementation Processes for SAM			
Planning for SAM 4.3.2	Implementation of SAM 4.3.3	Monitoring and Review of SAM 4.3.4	Continual Improvement of SAM 4.3.5
Core SAM Processes			
4.4 Inventory Processes for SAM			
Software Asset Identification 4.4.2	Software Asset Inventory Management 4.4.3	Software Asset Control 4.4.4	
4.5 Verification and Compliance Processes for SAM			
Software Asset Record Verification 4.5.2	Software Licensing Compliance 4.5.3	Software Asset Security Compliance 4.5.4	Conformance Verification for SAM 4.5.5
4.6 Operations Management Processes and Interfaces for SAM			
Relationship and Contract Management for SAM 4.6.2	Financial Management for SAM 4.6.3	Service Level Management for SAM 4.6.4	Security Management for SAM 4.6.6
Primary Process Interfaces for SAM			
4.7 Life Cycle Process Interfaces for SAM			
Change Management Process 4.7.2	Software Development Process 4.7.4	Software Deployment Process 4.7.6	Problem Management Process 4.7.8
Acquisition Process 4.7.3	Software Release Management Process 4.7.5	Incident Management Process 4.7.7	Retirement Process 4.7.9

In order to simplify the standard (ISO/IEC 19770-1) for best practical practice the 27 processes for the conceptual framework of SAM were updated and converted into four tiers. This allows an easier implementation, assessment and recognition of software and related assets regardless of nature of software which can be used by organizations to achieve benefits (ISO/IEC 19770-1, 2012).

Figure 6: ISO 19770-1 TIERED ASSESSMENT FRAMEWORK (ISO/IEC 19770-1, 2012)



- Tier 1: Focuses on gathering trustworthy and reliable data which are all relevant information about software assets within an organization. Comprehends the basic sources for an efficient process of SAM, where focus lies on identifying what is available, to know how to manage and supply the basis in order to present the compliance of the software ownership right.
- Tier 2: Is about the practical management of the control environment which include policies, roles, and responsibilities. Serves for driving immediate benefit. Focus lies on recognition of lack of asset data, extension risk, improvement opportunities and economy. Through Tier 1 with reliable data insights improvements can be extracted.
- Tier 3: Focuses on the operational integration to improve the efficiency and effectiveness of SAM in an organization. Relies on the foundation of the two previous tiers, inserting integration processes with contract management, financial aspects through a security system for asset agreement, covering the acquiring, utilization and downloading phases of the software.

- Tier 4: Focuses in achieving the ideal ISO/IEC SAM conformance, which is integrated into the strategic planning of an organization. This means achieving the full strategic stage by allowing the process of software asset management to support the strategic business objectives, bringing reduction of costs, operational cycle optimization, production increase and competitive innovation. Tier four is the Optimized stage in the process of SAM.

Beyond the ISO/IEC 19770-1 there are other relevant standards/parts connected ISO/IEC 19770 series, these are:

- **ISO/IEC 19770-2** defines an ITAM data standard for software identification tags ("SWID"). Specifies SAM data, where software is tagged for identification and management. Provides a complete and up to date identification of installed software, which gains both software publishers and end-user organizations. Utilization of SWID tags enables organizations to quickly identify, software deployed within its environments. In an IaaS/PaaS environment, the establishment of selfcreated SWID tags allows organizations to differentiate their own software from software provided by Cloud Solution Providers or software of other customers. SWID tags, have become an increasingly part of SAM in all environments, but may become particularly relevant in facilitating the management of software assets in the cloud.
- **ISO/IEC 19770-3** established ITAM data standard for software licensing entitlements tags, including user rights, metrics, and limitations. Provides identifying information for licensing right ("ENT").
- **ISO/IEC 19770-4** defines a ITAM data standard for resource utilization measurement information (RUM)
- **ISO/IEC 19770-5** defines a common set of vocabulary for the ISO/IEC 19770 series

3 Method

This chapter presents the theoretical overview of methodological tradition and approach, methods for data collection, analysis, qualitative reliability and validity. Along with the theory, participants and interviewing process are introduced and practical overview of conducted research is presented.

3.1 Methodological Tradition

Information Systems is a scientific discipline with an interdisciplinary field study influenced by computer science, political science, psychology, operations research, linguistics, sociology, and organizational theory Gupta (2000). It is abroad field with fluid boundaries to other disciplines (Hirschheim & Klein, 2012).

There have been several attempts to categorize Information Systems research Orlikowski and Baroudi (1991) briefly describe these in terms of beliefs about social and physical reality (ontology), beliefs about knowledge (epistemology and methodology) and beliefs about the relationship between theory and practice (purpose and motifs of research).

Scotland (2012) developed and defined the categories further and summarised characteristics by the following:

- Ontology – What is reality? (lesson of what is existing)
- Epistemology – How do we know something about reality? (lesson about how we learn of what is existing)
- Methodology – How do we go about finding it out? (justification for using a particular research method)

The core of ontology is that there is an objective reality, and social world exist independent of human interpretations (Orlikowski and Baroudi 1991). Searle (2006) states a problem with social ontology:

” A peculiarly puzzling feature of social reality is that it exists only because we think it exists ”

Epistemology is defined as how “reality is perceived and described to be” by society and humans (Myers & Avison, 2002). Since ontology is objective in nature, while epistemology is subjective, the sciences allow researchers to choose the most appropriate of the two, in regard to aim and objectives.

Due to consideration on the human aspect and cognition, which is of importance to the thesis, epistemology is chosen for this thesis. In addition to these three categories, paradigms have been established and it is now common to refer to three major schools of thought in the Information Systems discipline: the Interpretive, the Positivist and the Critical. Each

school contributes to differing aspects of the Information Systems discipline (Galliers 1991; Avgerou 2000; Orlikowski and Iacono 2001).

Positivist is based on that reality as objective, which exists independent of humans. The reality is capable of being examined and an objective truth or fact can be reached.

Interpretive is the contrary to positivist, which assumes reality as to be understood through socially constructed phenomenas. The assumption of reality is being modified based on human interpretations. The worldview is defined by social realities which are not given, and reality can only be understood through the opinions people give it (Creswell & Creswell, 2018)

Critical research is the third paradigm of IS research and assumes reality to be historically and politically constituted, which is a product of humans from an earlier age.

The selected tradition for this thesis is interpretative paradigm due to the importance of the individual views, social constructions, and human interpretations to explain reality. It makes sure that the focus lies on individual opinions which provide deeper insights (Orlikowski & Baroudi, 1991).

3.2 Methodological Approach

Jacobsen (2002) believes that there are different interpretations of reality. These interpretations show how individuals handle theory and data collection in research. Jacobsen (2002) describes these as inductive or deductive approaches. An inductive approach is based on empirical data about reality, without any expectations or foundation in theory. From collected empirical data then the formulated relevant theories can be created. Jacobsen further explains that a deductive approach defines that the study is based on certain expectations about reality through existing theories, to then gather empirical data and see about reality in line with expectations.

This study has been based on a deductive approach since I have chosen to highlight the empirics with several different theoretical perspectives to be able to compare the significance of the chosen perspective. I want to understand how theoretical perspectives, can be used in practical application and development of activities by clarify challenges and values within SAM.

According to Creswell & Creswell (2018) there are three approaches to research, qualitative, quantitative, and mixed methods (combination of qualitative & quantitative).

Backman (2016) defines qualitative research methodology as the utilization of verbal communication which generates observations and results. Yilmaz (2013) means that

qualitative research is socially constructed, and reality is not static or fixed and that the goal is to understand the larger picture or process under investigation.

Quantitative research methodology on the other hand, makes use of measurements, mathematics, and quantification (Backman, 2016).

According to Bryman (2006) it has become more common to combine different data forms within research methods. Creswell & Creswell (2018) define mixed methods by the integration of qualitative and quantitative research and data in a research study. It enables wider observation on a population and at the same time deeper knowledge is preserved (Harrison och Reilly, 2011). Further the authors mean that an exploratory research approach is applicable in order to generalize qualitative findings on a wider range of a population and review a theory which is in the phase of development.

Mixed methods use both benefits of the methods (Tashakkori & Teddlie, 2003). Morse (2003) states that data which lacks with substantial weight can in combination with other data gain greater value. In order to complement the lack of a general result and give a greater depth in my research I have chosen to combine the qualitative research with quantitative element in form of survey within data collection in order to determine and define the characteristics of the challenges within Software Asset Management on a wider general range. Björkdahl Ordell (2007) highlights that the strength of survey studies show that most people are reached in a relatively short time, which benefits the small research projects as these usually have a limited time for carrying out the study. Jacobsen (2002) means that surveys are significantly more widely distributed and generate higher generalizability.

Patel and Davidson (2011) write that statistics are a separate science but can be used of statistics as a tool for processing and describing empirical data. Furthermore, the authors mean that there is two types of statistics; the descriptive (descriptive) statistics used to illuminate the research problem with numbers as well as the hypothesis-testing (analytical) statistics that researchers use to test different hypotheses. My research were quantitative elements are applied, is based on the descriptive statistics, which aims to add a general view on the research.

The descriptive statistics aim to describe the essential characteristics of the quantity of data collected. Commonly different types of graphics are used such as in figures in order to give the reader a clear a description as possible of the material. (Lantz, 2009).

This study has a mixed methodology approach but has primary been conducted with a qualitative approach. Jacobsen (2002) defines qualitative method by providing detailed data, which allows a deeper dive into a subject matter, unlike quantitative studies. The study uses semi-structured interviews which involve the interviewer to set parameters focusing on the subject at hand, while still allowing for a discussion by asking open-ended

questions (Creswell & Creswell, 2018). In addition, the authors mean that qualitative data tends to be open-ended without predetermined responses.

Bryman and Bell (2007) mean that qualitative research is a suitable approach for research in business and management administration.

Qualitative studies collect information in the form of words and are considered appropriate when we want a depth description of phenomena (Jacobsen 2002). Yilmaz (2013) states that qualitative research serves to answer ‘what’, ‘how’ and ‘why’ in terms of *quality* instead of *quantity*. A qualitative approach with interviews as the primary data collection method was chosen, since I was interested in seeing how employees actually work in the process to get a depth.

Understanding of how the process looks and works. I want to go deep into the employees working methods and knowledge to see the current state of the process. According to Jacobsen (2002) it is considered quantitative approach appropriate when the researcher has prior knowledge of the subject and that the information collected in the form of numbers. The quantitative approach is therefore to some extent suitable since I collect data in form of numbers and closed ended questions in order to apply the qualitative research on wider generalized range. A quantitative study gives a general result while a disadvantage with the qualitative research is that the approach is more difficult to generalize.

3.3 Data Collection Methods

Levy (2015) states the choice of a suitable data collection methods in research, is normally based on the research philosophy and methodology, as well as several logistical considerations. Conboy, Fitzgerald & Mathiassen (2012) explains that information system qualitative research serves to analyze a variety of sources such as interviews, observations, design efforts, interventions, and archival materials. In addition, the exploratory characteristic of qualitative research is useful for gaining an understanding of underlying reason, opinions, and motivations.

As stated in previous section, two data collection methods were used to collect the data, a quantitative survey with primary closed-ended questions and a qualitative research with semi structured interviews and open ended questions . Trost and Hultåker (2007) believe that the combination of qualitative and quantitative methods can strengthen each other, which can lead to a more holistic and nuanced perception of empiri. The purpose of it was to ensure that, the phenomenon can be carefully analyzed, that the context is sufficiently explored and help in answering the research question.

In the following section the two data collection methods are described:

Surveys

Simultaneously with the interviews, surveys were sent out with basic questions based upon the research question and the interviews. The survey served to validate and compare the results of the interviews and answer the research question by asking the questions to a broader range of participants which belongs to the target group. The survey was created using Microsoft Forms and distributed via LinkedIn to potential participants throughout Europe. This ensured that the thesis did not only reflect the opinions of a small range of organizations but also of participants from other regions and organizations, who may have different types of challenges or work in managing software assets.

Interviews

Creswell & Creswell (2018) state that in qualitative interviews, the researcher performs face-to-face interviews with participants, telephone interviews which was conducted in this study. Two main methods were used to get in contact with qualified interview participants. The primary and first method was finding people with the desired experience on platforms such as LinkedIn and then contacting them via mobile. The second method was by contacting companies through public communication email addresses that went to their customer service or service desk. I presented myself and wished to be forwarded to someone they thought could help. The interview participants I intended to get in touch with were those with experience in working with software asset management. Overall, five people were interviewed from a total of five different companies.

Creswell & Creswell (2018) define a qualitative observation by when the researcher takes field notes on the behavior and activities of individuals. Further, the authors mean these field notes which the researcher records, can be captured in an unstructured or semi-structured way. Also, Repstad (2007) emphasizes that qualitative interviews usually have a low degree of structuring, so that the interviewee is able to answer the questions in his own way, based on his own area of knowledge. On the base of the above statement Semi-structured interviews were the main source for collecting the required data. The interviews were audio recorded in order to analyze and transcribe the data to the highest possible level of detail.

3.2.1 Selection

The selection of organizations to interview and send out survey was made after the requirement that it should be a large company. According to the Swedish Companies Registration Office (Bolagsverket) a large company is defined by fulfilling two of the three criteria sated below:

- more than 50 employees on average during the financial year
- more than SEK 40 million in the balance sheet
- more than SEK 80 million in net sales

To select the relevant population to the study and to get a foundation to stand on when it comes to the problem of software asset management within organizations, 5 companies were interviewed about their software asset management. The companies are in several different cities as well as companies in both the public and private sectors were interviewed.

To increase the spread and safety of work, one additional consultant company with focus on helping clients with software asset management was added. The consultant company contributes with employee's which have long and deep knowledge within SAM since they work for numerous of clients supporting them within software asset management.

As software asset management is a sensitive subject, it has been important to ask ethically correct questions and treat all answers anonymously, which means that answers from companies will not be traceable back to this research. The selection of large organizations is in public and private sector and the interviews are conducted through visits, virtual meetings or by telephone. Due to covid-19 the interviews were conducted on the meeting form which suits the organization best. The interview questions have come to be formed by discussing what data is needed to answer the research question. The interview participants I intended to get in touch with within large organization were those with long and deep experience working with SAM such as License Management, License Administration, Software Administration, Configuration Management, Service Portfolio Management, Business Management, SAM Tool Administration (primary and secondary roles). An overview of the participants, where to find the interview and there alias for this thesis is presented presented in the **Table 1** on the next page.

Table 1 : Interview Participants

Appendix	Organization	Industry	Employees	Alias	Position	SAM Experience	Date	Method	Location
Appendix C	Company A	Software and IT Consulting	2000 - 2500	P1	Senior Software & Cloud Consultant Business Analyst	High	2021-04-23	IPI	Zürich, Switzerland
Appendix D	Company B	IT & telecommunications	100 - 150	P2	Technical Leader IT & Telecommunication	Low	2021-04-25	IPI	Wil, Switzerland
Appendix E	Company C	Automotive	100'000	P3	Software Asset Manager Governance Lead	High	2021-04-26	VCT	Virtual
Appendix F	Company D	Educational Service Sector	2000 - 2500	P4	Section Manager - IT Development & Maintenance Management	High	2021-04-28	VCZ	Virtual
Appendix G	Company E	Security	400'000	P5	Software Asset Manager	High	2021-04-29	VCZ	Virtual

SAM Experience in Years	
High	Over 5 years
Low	Less than 5 years

Abbreviations	
IPI	In person interview
VCT	Video Conferencing Microsoft Teams
VCZ	Video Conferencing Zoom
P	Person

3.2.2 Transaction Interview & Survey Process

Interview guide - Semi structured - Qualitative interview questions

Patel & Davidsson (2011) state that commonly when it comes to qualitative interviews is a low degree of structuring. By this they mean that the questions asked in the interview gives the interviewee space to respond in their own words.

When it comes to qualitative interviews, there is also a question about the degree of standardization. Patel & Davidsson (2011) name the degree of standardization as the order of interview questions the interviewer uses. They mean that the questions can be asked in a definite order, that is, a high degree of standardization, or put in the order that best suits the individual case, which is a low degree of standardization.

In the conducted interviews, I used a low degree of structuring and a low degree of standardization. I have completed an interview guide with different themes based upon the theories which was discussed with the interviewees, instead of using direct questions. At the beginning of the interviews, I presented the topic of the study to make sure that the interviewees understand what I want to discuss.

By clarifying the topic and then use the interview guide I have been able to control the interviewees minimally, but still made them stay within the framework of the

purpose. This has led them to discuss the subject based on their own area of knowledge. On the other hand, I received answers to our questions while not coloring the interviewees answer with own thoughts.

Bryman & Bell (2011) mention unstructured and semi-structured as the most common types of qualitative interviews. The semi-structured ones they explain an approach where the interviewer has a list of topics to discuss, but that the interviewee has a lot of space in how the answers can be given and that follow-up questions are adapted to the interviewee. Unstructured, they explain that the researcher usually only asks a question and then lets the interviewee speak completely free.

My interview method has been what Bryman & Bell (2011) call semi-structured in that we led the interviewees through the interview with the help of one on pre-constructed interview guide. Creswell & Creswell (2018) state that semi-structured interviews involve unstructured and generally open-ended questions that are few in number and intended to generate views and opinions from the participants. On the basis of this statement from Creswell & Creswell (2018) and Bryman & Bell (2011) an interview guide was designed containing 8 - 12 questions, of which the majority were semi structured open-ended questions. I aimed to state the questions in such way to be able to answer the research question of the thesis.

The reason for how I structured the interview questions/topics was the need for honest answers with high validity. Jacobsen (2002) proposes that open questions mean that an interview maintains high internal validity. Therefore, the goal was to create questions that are as open as possible.

Software Asset Management are subjects that include multiple possible interpretations and points of discussion. To ensure that the interviews were generated relevant which can be used to answer the research question, I based the interview questions on the literature presented in chapter 2.

The questions can be read in Appendix A - Interview questions.

Survey - Quantitative data – Close Ended Questions

In the design of the survey, the questions have been formulated in a concise and clear manner, according to Eliasson recommendations (Eliasson, 2013). In the creation of the survey, I aimed to avoid questions that require follow-up questions in order to clarify the answer or formulate questions that can be interpreted by the respondent, which is not suitable for use in a survey according to recommendations from Bryman & Bell (2013).

Further, I intended to keep the survey short with 11 questions where the answer options was limited so that the respondents would not lose interest (Bryman & Bell, 2013). It is important to construct questionnaires that operationalize the purpose and

uses the theories used to produce a useful result (Eliasson, 2013). In this study I based the questions in the survey upon to the used theories stated in chapter 2.

The survey questionnaire (see Appendix F) is designed with eleven questions where all have closed answer options except the last question. Trost and Hultåker (2007) recommends that open-ended questions should be added at the end of the survey where the respondent can add their own comments and thoughts. Because it can be difficult to motivate respondents at surveys, Patel and Davidson (2011) believe that the response options in the survey varies, the risk is less that they get stuck in a response pattern. Therefore, the survey has response options with 9 varied questions with yes, don't know/maybe, no, to no extent and to high extent and one open-ended question in the end

3.4 Data Analysis

As stated earlier, the thesis uses a mixed methodology approach but has primary been conducted with a qualitative approach. The interviews were recorded to allow deep analysis which was further used to pick up themes and concepts that otherwise could go be lost. Creswell & Creswell (2018) means that in a qualitative study like an interview, where the data often is compact, not all can be used for analysis. Then all interviews and answers from the surveys were read through to gather general impressions and to get an overview. The next step was the coding of all data, which was supported by the software NVIVO. Two main groups were formed, Challenges and Value & Benefits. The subgroups for Challenges codes were Audit, Cloud, Shadow IT and Inventory. The subgroups for Importance & Success codes were Importance, Benefits and Successful. Afterwards all the transcribed data could be coded sorted into the created named groups.

3.5 Reliability & Validity

Denzin & Lincoln (1995) mean that the empirical data collection, the setting of the study, the theories and models of the research need to be considered. To ensure the validity & reliability of this thesis, supporting literature and theories have been presented. The review of related academic publications allowed me to validate the interview findings against those described academic papers. Further, interviews with respondents had different roles and responsibilities within organizations, which allowed to gain confirmation of the findings through the convergence of different perspectives.

Further, the collected data, was after each session, a summary and discussion with the participant has been held, to ensure that the collected data corresponds with that was said during the interview. Since the participants' opinion and experience have been in focus, the time and setting for the interviewees have been placed where they would feel comfortable for them to answer honest and truthfully (Creswell, 2018).

3.6 Ethical Considerations

As mentioned before software asset management is a sensitive subject, where it has been important to ask ethically correct questions and treat all answers anonymously, which means that answers from companies will not be traceable back to this research.

Further, the trans scripted data from the interviews, was sent to each interview participant to ensure that the collected data corresponds with that was said during the interview.

4 Empirical findings & Analysis

In this chapter the empirical material and findings are presented. The results include a series of five interviews with individuals who work in IT and with a long experience of SAM. In addition, the results include a survey with respondents which was sent out to people who work in IT and to some extent have experience with SAM. The chapter is structured after the areas which in the data collection has been most relevant to the chosen research topic.

The section aims to describe the current situation, challenges and importance within Software Asset Management and is divided into two parts: Difficulties of SAM and Importance and Success of SAM. Only the empirical material that is relevant to the purpose of this thesis will be presented and this will also be related to the theoretical basis of the thesis. Abrahamsson, L. (2007) states that it is possible to present findings and analysis merged in the same chapter within qualitative approach, which I chose to do, since the study was mainly conducted in this way. The interview participants will be referred to person 1 – 5 (P1 – P5). In order to not having to go back to chapter 3, a short overview over the interview participants is presented below:

Table 2 : Overview Interview Participants

Appendix	Organization	Alias	Position
Appendix C	Company A	P1	Senior Software & Cloud Consultant & Business Analyst
Appendix D	Company B	P2	Technical Leader IT & Telecommunication
Appendix E	Company C	P3	Software Asset Manager Governance Lead
Appendix F	Company D	P4	Section Manager IT Development & Maintenance Management
Appendix G	Company E	P5	Software Asset Manager

4.1 Difficulties with the Management of Software Assets

4.1.1 Audit

Holsing and Yen (1999), proposed a software asset probation model with an identification of five problem areas, where one of them is margins and an economic issue`a such as true up costs from manufacturers when audits are executed. Increased audits which software vendors generating seem to be a new revenue stream (Riley, Len 2017). One respondent from the survey means that audit is a challenge organizations. P3 at company C confirms the picture of increased audits by saying that it is one of the reasons for why the SAM-Team was created since the company had a tuff audit in 2015. The person continuous with saying the organization had four audits from manufacturers within the last two years.

The description of P3 fits into the picture of P1, who means that past experiences from companies that already had negative experiences with an audit from manufacturers and received a fine/penalty as a result, started to a higher extent to manage their software assets. According to P1 it is like when you driving too fast with the car and you get caught on the speeding camera, which results in behaving and driving slower according to the limit of the laws that you just experienced.

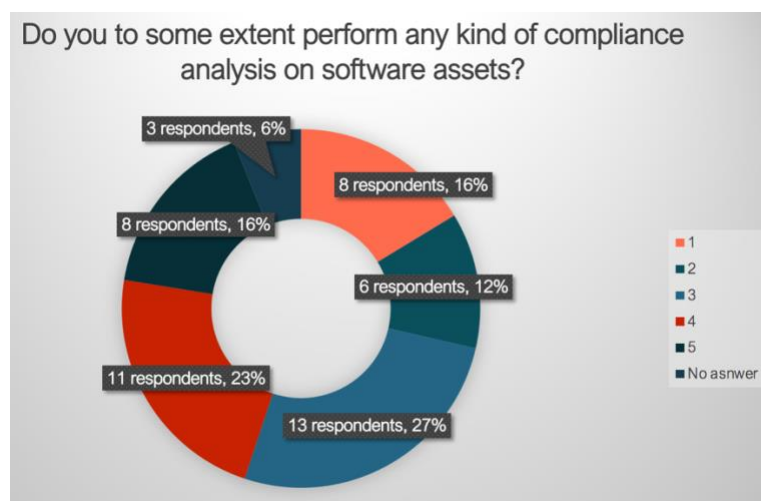
Further P1 states that it goes the same software asset management. Normally the company primary doesn't look on the licenses. Instead they look on it on a performance based view of the software assets. The company wants as much power and performance as possible from the software assets they deploy, where they can complete there working tasks as fast as possible in order to be efficient. Therefore SAM is valued secondary and as a cost trigger which is not paid attention to.

Schmidt (2011) means that data quality during internal auditing means having all the information needed when needed. Data must be complete, consistent, and current. In the survey I sent out 39% of the respondents (19 respondents) stated to have a high to very high extent in performing compliance over their software assets which can be interpreted that 39% will have the data ready for an audit when needed.

27 % (13 respondents) were performing it to some extent and 28% (14 respondents) had a low to none performance of compliance of software assets. 1 is low extent and 5 is the highest extent.

The individual different interpretations of reality in the survey, shows that compliance performance has an average of 3.11 which in percent is slightly over 60% when it comes to have the information ready in case of an audit from a manufacturer.

Figure 7: Compliance Performance

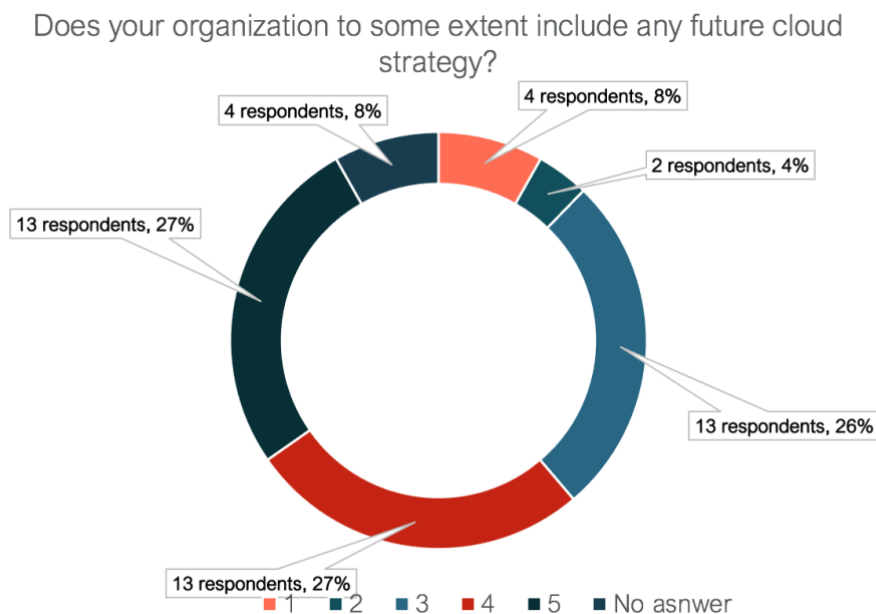


In relation to Schmidt, P3 means that the best scenario is to have information on what's installed. The one with the highest data quality on software assets owns the highest knowledge and can overcome the audit from manufacturers. The Optimization of license and management of software is a viable way that can reduce application costs but it is a big challenge. It requires new technologies and organizational processes that can handle a complex and heterogeneous licensing environment (Schmidt, 2011).

4.1.2 Cloud

In the survey I sent out, 54% of the respondents (26 respondents) stated to have a high to very high extent of future cloud strategy which means that organization tend to plan to move into the cloud. 26 % (13 respondents) were performing a future cloud strategy to some extent and only 12% (6 respondents) had a low to none performance in planning a future cloud strategy. 1 is low extent and 5 is highest extent. The individual different interpretations of reality in the survey, shows that planning a future cloud strategy has an average of 3.74 which in percent is slightly over 70% when it comes to have planning moving their software assets into the cloud.

Figure 8: Cloud Strategy



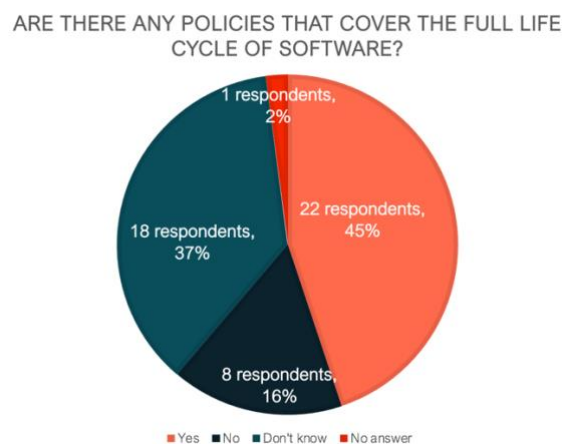
The change from traditional software model to new licensing models such as virtualization and on-demand services (cloud computing or software as a service) cause further challenges in license administration (Gull & Wehrmann, 2009).

P5 confirms by saying reality has shown that it has become more complex within SAM since cloud became part in the daily business. Nowadays they moved from license to subscription but what you buy is a usage right to use something which follows with a lot of conditions. It has not become more easier to manage subscription. Office 365 is one of the view applications which shows what kind of license the user should have. It is not sure if that user needs that license since there are so many other reasons in reality which needs to be considered in order to get the right application/license. You need to double check. There are so many ifs and buts. The delivered service still include a lot of manual work.

Kamal and Petree (2006) corresponds with the mark out of P5 by describing the concern to manage and protect software assets during the lifecycle is commonly referred to as the weighing to the grave, birth to death and acquisition to disposition of software. The cycle is about request, approval, order, receiving of order, installation/move/add/change (IMAC), refresh and disposition (software asset has formerly ended) . Further the author means that the support & maintenance phase plays a major factor of the life of a software asset in an enterprise organization. From the point of receiving the asset to the point of installation, through the installation and post installation changes during active production usage to potential mover and reinstallations to the stage of asset's life cycle. This varies and is challenging to manage due to the varieties of possible ways for installing, moving, adding, and changing events.

Regarding policies that cover the full life cycle of software the survey showed that 45% of the respondents (22 respondents) stated to have a policies. 37 % (18 respondents) didn't know if there were any policies and 16% (8 respondents) stated that there is no defined policies for it. This means that nearly half of the respondents stated to have a policies for managing the full life cycle of software for managing software assets. One respondent in the survey stated that there is a challenge with controlling the whole life cycle of software of assets which might indicate that there is still room for improvement regarding the lifecycle.

Figure 9: Life Cycle



4.1.3 Inventory

Ben-Menachem & Marliss (2004) presented the “paradigm of change” based on tools, methods, and procedure for a suitable overall IT inventory management. According to the authors the most significant failures of IT is the lack of systems to support, gather and provide information for managing software items. The Issues of controlling large amount of geographically purchased and paid software does not cover the information for managing software.

The above stated description of Ben-Menachem & Marliss (2004) correspond with the story of P5 at company E, who means that a struggle is to get the inventory system to state correct information. A challenge is to get a full and right picture of software assets of what is used. Within SAM it is not enough to just know the number of servers and the product description. P5 means that the most challenging regarding managing your software assets is be able to be up to date with what kind of software asset that are installed in the organization. Several respondents from the survey highlighting similar challenges by writing “*Keeping up to date with changes*”, “*Get the Data up to date...*”, “*frequent changes in the product-terms and license rules*”

P2 share a similar view by saying that one thing of importance is visibility, what do we have, what do we spend money on. In the past, you bought a piece of software that cost maybe 50,000 francs once. Today you have more and more amounts that disappear under the radar, because everything is charged via credit card. Maybe a software continues to run, which is no longer needed, but no one notices it because it was not recorded.

There is a need to know further details P5 continuous. For example what type of server? Is it developer or production servers? The measurement for a license is set up very differently. It is a challenge to make an inventory since the measurement of licenses differs from manufacturer and product. Several respondents from the survey confirm similar challenges by writing: “*Complex Licensing Models, to have a full overview about consumption and usage incl. contracts*”, “*To inventory all assets*” and “*Continuously changing software suitability / pricing / naming / licensing structure*”.

For example: Desktop Application = each installation one license to SAP Project Management Tool where license is defined on how much money flows through every project. That is what you are paying for. How should you be able to inventory those kinds of license? To get complete Inventory with information which you need to measure the license is the overall toughest challenge. IT requires a lot of work according to P5. Two respondents from the survey confirm similar challenges by writing to have the right knowledge about software assets and the other one meant to have the allocation of time and resources.

McCarthy & Herger (2011) presented a solution in four parts to combine IT, processes and business in Software Asset Management, where one part is to discover software assets. Agents automatically collect and discover software license assets on all applications running on desktops which are distributed within the organization. The Software licenses are linked to employee & workstation. The Scanned data populates asset database as discovered inventory and provides base line for audit compliance reporting.

In relation to McCarthy & Herger (2011) solution P5 means that no agents automatically could collect and discover software license assets since every subsidiary is treated as an own company were the parent company has difficulties to roll out an agent in order to collect get a proper inventory for software assets. P5 marks out that there is no insight of usage and where software assets are used. P5 needs to trust the stakeholders within the organization. Everything runs through email by contacting the license owner in the subsidiaries.

There is no insight in what is installed on devices or infrastructure since the organization has been so decentralized. The decentralized parts in the organization are very small. This means that subsidiaries were able to track the own software assets since they were not big and without system support.

A similar example is experienced and described from P1 at Company A where the person worked for an international beer brewer. The question that was asked at the beginning was how many devices that the organization had? The answer then was that they would work with 20- 100'000 devices. The international beer brewer asked after some time P1 how far P1 were with the data collection. The discrepancy was so big that P1 ended up with 30,000 devices. In the end, however, no one knew how many devices there really were. Once a device is switched off, it is not easy to find it. We would have had to search all the offices for devices. Hidden devices are hard to find. One respondent from the survey confirm similar challenges by writing: "*Getting all relevant data*".

Ben-Menachem & Marliss (2004) means that an IT inventory management facility is fundamental base of an integrated set of technologies designed to address constantly changing technologies and business processes. Therefore, an investment in creation and maintenance of software inventory is crucial to a proper long-term software asset management. In relation to P3, who means that a high quality data collection on software assets which can be applied on what's installed, can get your company really far.

Numerous organizations tend under estimate the value of their software assets and the methods for tracking software usage on networks are often insufficient (Albert, Santos, & Werner, 2013; Varela et al., 2018).

I think one thing is visibility, what do we have, what do we spend money on. In the past, you bought a piece of software that cost maybe 50,000 francs once. Today you have more and more amounts that disappear under the radar, because everything is charged via credit

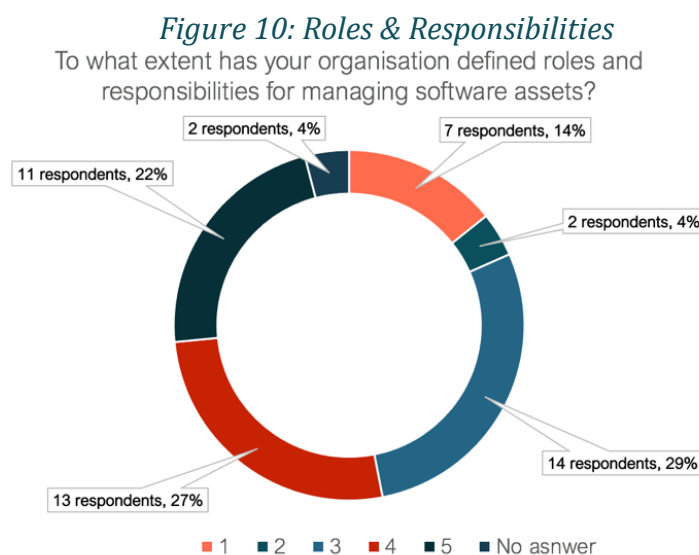
card. Maybe a software continues to run, which is no longer needed, but no one notices it because it was not recorded.

4.1.4 Shadow IT & Costs

In large organizations, there are situations when the organization consciously or unconsciously allows personnel and others who have access to computers to install unauthorized software. As a result, internal auditing requires more work and consideration for both risk and ethical exposure (Kaplan, 1994).

Kaplan's observation corresponds with the description of P1 who means that employees within companies sometimes have a credit card and can to a certain amount execute software orders, which is not under control. This can be done without any approval. Specially nowadays where an employee could trigger and start a cloud subscription. Then the employee generated recurring costs month for month and as long the cost is not exceeding the credit card limit no-one will in the first stage notice this. This is a bigger problem compared to the local administrator rights. Deployment generally.

In the survey I sent out 49% (24 respondents) stated to have a high to very high extent of future regarding defined roles and responsibilities for managing software assets. 29 % (14 respondents) had to some extent defined roles and responsibilities and 14% (7 respondents) had a low to none performance. 4% (2 respondents) didn't answer the question. 1 is low extent and 5 is highest extent. The individual different interpretations of reality in the survey, shows that defined roles and responsibilities for managing software assets has an average of 3.4 which in percent is slightly below 70%. To have defined roles and responsibilities for managing software has an impact on shadow IT. One of the respondent stated that a challenge is to define roles and responsibilities.



Gull & Wehrmann (2009) corresponds with P1's statement by saying that the change from traditional software model to new licensing models such as virtualization and on-demand services (cloud computing or software as a service) cause further challenges in license administration.

P3 corresponds with the challenge from p1 Gull & Wehrmann by describing the same issue by saying that if somebody finds a new software program somewhere then they could register it with their credit card. What is a license traditionally and what is a service when it comes to software as a service (SAAS)? We say what we should include SAAS solutions even if somebody says, no it's a service that has been bought. If you don't know the rules of licensing the cost could be very high. Then you need someone to keep track, partly on the rules of licensing and partly that users don't log on all the time to things you pay for. We have a standard that as soon as SAAS have been bought it must be connected to our AD. This doesn't always work and that leads to a risk that there are a lot of zombie users, that still costs money. Worst case scenario they will go to a competitor, bringing information to them. This is also a risk.

P2 describes that Shadow IT is not trackable since you don't know what is being downloaded. From the financial side, it's unmanageable. He means that today you have more and more amounts that disappear under the radar, because everything is charged via credit card. Maybe a software continues to run, which is no longer needed, but no one notices it because it was not recorded.

One respondent from the survey highlights similar challenges as P2 and P3 by writing: *"Shadow IT, lack of Standardization within customer environments (many different types of companies with different software)"*.

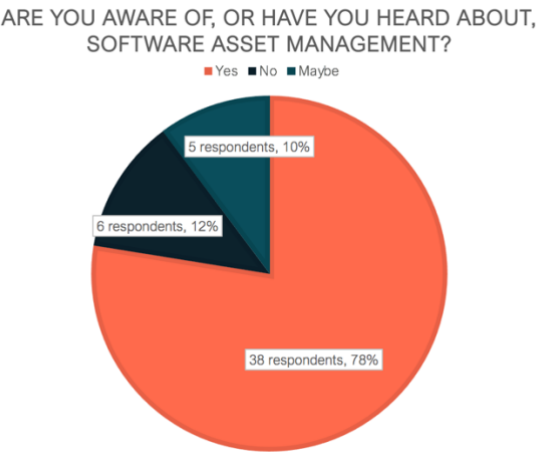
4.2 Importance & Success within SAM

4.2.1 Importance of Software Asset Management

Rudd, Colin (2009) defines Software Asset Management the whole infrastructure and processes which are necessary for the effective management, control, and protection of the software assets within an organization throughout all the stages of its lifecycle. In relation to Rudd, Colin (2009) P1 corresponds to some extent by saying that SAM is about the 3 P's, Processes, People & Policy and explains that this triangle needs to be in balance together and harmonize. The business is based upon people and interfaces between departments such as procurement IT-department or the business itself and needs to be regulated through policies & processes. Otherwise there is an imbalance in the triangle. The triangle needs to be balanced otherwise it doesn't work.

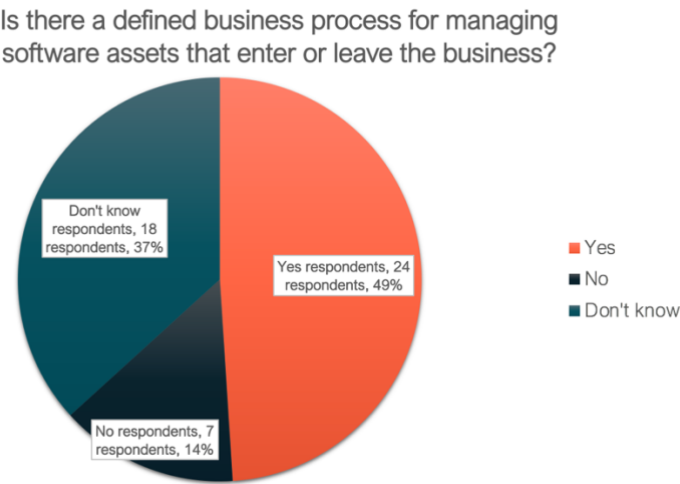
The survey showed that 78% (38 respondents) were aware or have heard about SAM, 12% (6 respondents) didn't and 10% (5 respondents) said maybe. That means that the majority of the people who work within IT who responded to the survey, have an awareness about software asset management.

Figure 11: Awareness SAM



Regarding processes for software assets, the survey showed that 49% of the respondents (24 respondents) stated to have a process for managing software assets that enter or leave the business. 37 % (18 respondents) didn't know if there was a process and 14% (7 respondents) stated that there is no defined process for it. This means that nearly half of the respondents stated to have a process for managing software assets.

Figure 12: Process Software Assets



4.2.2 Factors for successful Software Asset Management

McCarthy & Herger (2011) defined the following benefits of SAM by highlighting cost savings from the recycled software licenses, better accurate forecast and planning data, readiness for audits from manufacturer. P3 corresponds partly by stating that his ideal mission and vision for SAM is to ensure control and optimization of software license consumptions which is what they shall do.

As earlier mentioned in chapter 2 ISO/IEC 19770 defined four tiers for best practical practice for the benefits of SAM were Tier 1 focuses on gathering trustworthy and reliable data and is the fundamental core of successful SAM. P3 corresponds by saying that successful SAM is when you have information on what's installed. P3 states *“The one with the best knowledge wins. If we know that we have has high quality on data collection and that we can apply it on what's installed, then we got really far. It's also important that it plays along with CMDB that comes with the hardware information.”*

P5 agrees by saying that reliable fundamental information to measure / calculate licenses of software I crucial for efficient SAM. There is a need for a complete inventory of software, everything from hardware to software and to users. Then, the information needs to be summarized in a reasonable way. The data that is collected needs to be ensured to be correct and up to date.

The need to be able to calculate and know what kind of licenses there is also important for successful SAM. Good work within the what we call license office so that the stake holders turn to us for help were they want to purchase software through SAM rather than purchase it by themselves.

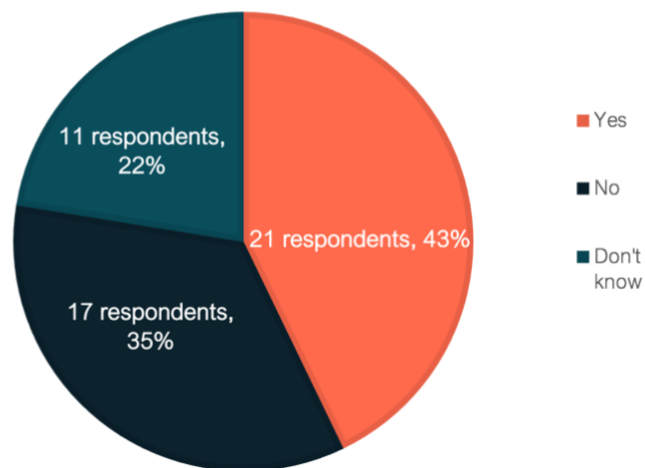
Gartner Research Director Patricia Adams (Gartner a global research and advisory firm for leaders in IT functions) states that IT- Asset Management where SAM is included is depended on robust processes, with tools to automate manual processes. Robust processes have similarities with the reasoning of P5 who means that a structural working way to tackle changes is of importance for beneficial SAM. It is a great advantage if the organization can develop an ability to be able to go into a new areas since technology is changing so fast. For example: The process of how the organization manages licenses. When a company has come that far then there is room for a lot of things such as optimizations and distribute licenses a more efficient way.

P1 has a similar story of a client, where the person describes that the best case was in a classic, project-based compliance survey. P1 says *“Within one day, we were able to collect the technical data. With Wake on Lan, we were able to activate all PCs. Within 2-3 hours we were able to install and capture everything. Normally, this process takes three to four months.”* Wake-on-LAN (WoL) is a computer networking standard that allows a computer to be turned on or awakened by sending a network message. P1 continuous and means that the client was very organized and structured regarding their data. It happened once in ten years. That's why the data collection was easy to handle.

Albert et al., (2013) mean that Software Asset Management (SAM) is a method of tracking software assets that enables organizations to maintain and optimize their use of software. In the survey 43% (21 respondents) stated to have some kind of SAM tools in order to manage software assets. 35% (17 respondents) stated that they didn't have a tool and 22% (11 respondents) that they didn't know.

Figure 13: SAM Tool

HAVE YOU IMPLEMENTED SPECIFIC SAM TOOLS TO HELP
MANAGE THE HARDWARE AND SOFTWARE
ENVIRONMENT



5 Discussion

This chapter provides an overview over the collected empirical findings from the interviews and the survey of the study and centers around the discussion on the themes that emerged during the data collection, transcription and analysis. Further, the chapter aims to answer the research question and how the findings relate to the previous literature in a concise manner.

5.1 Identified Difficulties within Software Asset Management

The research showed that there wasn't much previous research regarding the challenges within SAM as expected. The gathered challenges from interviews and survey varied but a common challenge within large organizations was the information availability for managing software assets.

Audit

The picture from previous literature reflects the empirical findings regarding audits of software manufacturers. Increased audits which software vendors generating seem to be a new revenue stream (Riley, Len 2017). Audits are one of the main contributors for the upcoming of software asset management execution within organizations. The area tends to grow but is mainly established within larger organizations. Some organizations tend to practicing SAM, as a result of past negatives experiences with audits and penalties from it. In order to be ready for an audit the empirical findings describe that the fundamental key for overcome an audit is to have the right information structured and ready according to the manufacturers requirements which previous literature confirms.

That means to have the right documents in place which proves that the software is paid for and that the organization has the approval to use the software asset. Additional findings were the complexity of license models and that the one with highest knowledge regarding the software asset which an organizations has wins the audit. It can be the auditor from the manufacturer or the organization that utilizes the software.

Cloud

The research showed that the majority of organization have a future cloud strategy and already have parts of their software in the cloud. Gull & Wehrmann (2009) state further challenges with cloud in license administration. The findings of the empirical data confirm the statement by saying that complexity within SAM has increased since cloud came in to the daily business. Software used in the cloud is not measured in the same way as the software which is in use in a on premise environment which has contributed to an increased work load by managing both cloud services and licensing on premise software.

Inventory

Ben-Menachem & Marliss (2004) states that significant failures occur when gather and provide information when managing software items. The findings confirm the description by stating the struggle to get the inventory system to state correct information. A challenge is to get a full and right picture of software assets. What software is used, what kind of software asset that are installed within organizations and how can software information be up to date. In addition, the measurement for a license is set up very differently. It is a challenge to make an inventory since the measurement of licenses differs from manufacturer and product. On top of that cloud subscriptions are added which makes the software inventory more complex.

Shadow IT

Employees within companies sometimes have access to credit cards and can to a certain amount execute software orders in order to use the software for operational purposes, which is not under control. Those purchase orders can be done without any approval. Employees could trigger and start a cloud subscription which causes monthly recurring costs without anyone noticing it. Another aspect that came up is that software assets is not trackable since software can be downloaded without the organizations knowledge which makes the software assets unmanageable since software disappears under the radar due to payments through different credit cards. Further software may run even though it is no longer used because the purchase wasn't recorded.

Importance & Success

Rudd, Colin (2009) defines Software Asset Management the whole infrastructure and processes which are necessary for the effective management, control, and protection of the software assets within an organization. The findings from the interviews show that the importance of SAM can be reflected in Processes, People & Policy and explains that this triangle needs to be in balance together and harmonize. The business is based upon people and interfaces between departments such as procurement IT-department or the business itself and needs to be regulated through policies & processes.

McCarthy & Herger (2011) defined the following benefits of SAM by highlighting cost savings from the recycled software licenses, better accurate forecast and planning data, readiness for audits from manufacturer. Findings revealed that the importance and value is to ensure control and optimization of software license consumptions. Further findings for successful SAM is when organization have the software information on what's installed. A structural working way to tackle changes is of importance for beneficial SAM. It is a great advantage if the organization can develop an ability to be able to go into a new areas since technology is changing so fast.

5.2 Method Reflection

A research needs to meet certain criteria's based on the validity and reliability. It implies measuring what is intended to be measured is of importance and at the same time the

measurement must be performed in a reliable manner (Patel & Davidsson, 2011). Based on prior knowledge working with SAM, the theoretical framework, an understanding of the problem situation has been created before the collection of empirical data took place to increase the validity. The theoretical framework has been processed in a recurrence process as patterns and categories have been identified in the empirical findings.

However, this may have limited the design of the first draft of the theoretical framework because other perspectives were not taken into account. Nevertheless, I believe that the semi-structured questions and the survey which was sent out, created opportunities for open and nuanced answers where the primary theories have been consistent in the recurrence approach.

The study was conducted with the aim of helping to identify, analyze, and clarify the new challenges of managing software assets and to identify the core capabilities that are necessary to deliver successful software asset management.

The starting point was to get an overall perspective with a strategic selection of respondents where both operational and strategic aspects were included together with prior knowledge and working experience within the area. Carrying out the study with a qualitative approach and with quantitative elements has been a method that has contributed to a nuanced picture and a deeper understanding of what new challenges are experienced in large organizations when managing software assets. Mixing methods have contributed to cover a deep and detailed description while the survey covered that challenge also exists on a wider and global range according to what has been stated in the presented literature in chapter two.

The semi-structured interviews generated space to ask follow-up questions for clarification and nuanced answers. The interview format gave the respondents the opportunity to describe their own view of the situation. I felt that the respondents gave a credible and honest picture, but that follow-up interviews could have nuanced the perceived situation.

Alvesson and Skoldberg (2008) mean that it is not the method itself that creates validity, but rather how the empirical findings are formulated and what it contains that creates credibility for the reader. Interpretations of the interview participants' stories, shape the authors' construction of the empirical data. This makes the reader understand what makes the study relevant. Individuals' actions, knowledge and how they perceive the world are reflected in the empirical data, which can make the study difficult to repeat as the truthful image may change over time. That is when the reliability decreases.

The theoretical model for the analysis was applied after collecting the empirical data to understand the different contexts and conditions that affect Software Asset Management.

6 Conclusion

The main objective of this chapter is to give a clear summary of the current study and present the answers to the research questions. In addition, the contributions of the present study will be presented in relation to the existing literature, which will serve as recommendations and ways for future research.

6.1 Conclusions

This research illustrates what new software asset management challenges large organization face in an increased digitized world. The purpose is to identify and present the current and new challenges that companies are confronted with while managing software assets in order to be as efficient. I performed a mixed study approach with a main focus on a qualitative approach. In order to achieve general applicable view, the qualitative approach was complemented with a quantitative element such as a survey that was sent out to employees working with IT. In order to create a theoretical background, I choose to review the existing literature on software asset management. It turned out that there is a lack of relevant academic research within the field, especially in the development of cloud solutions and the connected challenges with it for companies. There was also a lack of literature on software asset management, which resulted in reviewing and following the ISO/IEC 19770 standard for SAM.

I conducted five interviews and with people working in different aspect with software asset management. In addition, I sent out survey to 49 respondents who work with IT to capture a general aspect on the topic. After analyzing the results and connect it to existing literature my study concluded discussing the organizational challenges and benefits of SAM.

The major challenge that was identified within the study was the lack of transparency regarding information of software assets. The lack of information availability causes difficulties to have correct software inventory and information which is up to date. Manufacturers have complex and different licensing models for their products which causes a lot of work in order to capture right information in order to make a software asset inventory. Other challenges such as audits, new ways of consuming software (cloud subscription) and shadow IT are mainly caused by the core challenge of having the right information available in order to manage software assets.

Similar to challenges my findings regarding value bringing attributes of SAM generated a lack of information on the benefits in the existing academic literature, which resulted in reviewing and partly following the ISO/IEC 19770 standard for SAM. The findings of successful SAM is to be able to have structured software information which can be used for audits, optimization and prevents financial loss. By having clearly defined processes an organization will be able to track software, which leads to better cost control and compliance.

6.2 Future Research

There are many areas with a wide range of possibilities for future research. The relatively new area of Software Asset Management seems to have become of importance since increased audits from manufacturers. Future research should try to investigate how SAM is handled in various organizations resulting in an overall model with ISO/IEC 19770. Furthermore, an in-depth study should be conducted regarding the rise of cloud solutions and how SAM will be impacted by it.

References

Abrahamsson, L. (2007) 'Några skrivtips', Universitetstryckeriet, Luleå. Available at: <http://www.diva-portal.org/smash/get/diva2:1007112/FULLTEXT01.pdf> (Accessed: 03.03.2021).

Albert, B. E., Santos, R. P., & Werner, C. M. (2013). *Software ecosystems governance to enable IT architecture based on software asset management*. 2013 7th IEEE International Conference on Digital Ecosystems and Technologies (DEST). doi:10.1109/dest.2013.6611329 and Virtualization, 115-122. IARIA.

Alvesson, M. & Sköldbäck, K., 2008. *Tolkning och reflektion: vetenskapsfilosofi och kvalitativ metod*. 2., [uppdaterade] uppl. Studentlitteratur, Lund

Avgerou, C. (2000). "Information Systems: What Sort of Science Is It?" Omega 28.
Backman, J. (2016). *Rapporter och Uppsatser*. Lund: Studentlitteratur.

BDNA Research (2016), Does Software Asset Management really help the Software Audit Dilemma, Flexera, Published August 22nd, 2016, Analyst: Cathy Won, Available at <https://www.flexera.com/blog/data-platform/software-asset-management/>

Ben-Menachem, M. (2005). IT assets – control by importance and exception: supporting the “paradigm of change”. IEEE Software, 22(4), 94-102. doi:10.1109/MS.2005.99

Ben-Menachem, M., & Marliss, G. S. (2004). Inventorying information technology systems: supporting the “paradigm of change”. IEEE Computer Society, 21(5), 34-43.

Ben-Menachem, Mordechai (2008) *Towards management of software as assets: A literature review with additional sources*. Information and Software Technology, 50(4), pp.241–258.

Björkdahl Ordell, Susanne (2007). Att tänka på när du planerar att använda enkät som redskap. I: Dimenäs, Jörgen (red.). *Lära till lärare: att utveckla läraryrket - vetenskapligt förhållningssätt och vetenskaplig metodik*. 1. uppl. Stockholm: Liber

Bott, M.F., 2000. Software as a corporate asset. IEE Proceedings - Software, 147(2), p.31

Bryman, A. & Bell, E. (2013). *Företagsekonomiska forskningsmetoder*. 2:1 uppl. Stockholm: Liber A

Bryman, A. and Bell, E. (2007). *Business Research Methods*, 2 nd ed., Oxford: Oxford University Press.

Bryman, Alan & Bell, Emma (2011). Business research methods. 3. ed. Oxford: 63
Oxford University Press

CHRISTOPHER, W. F., THOR, C.G., (ED) 1993. Total quality: An integrating concept
by Earl C. Conway. Handbook of productivity measurement and improvement.

Conboy, K. Fitzgerald, G. and Mathiassen L., 2012. Qualitative methods research in
information systems: motivations, themes, and contributions. European Journal of
Information Systems. [e-journal] 21(2) pp. 113-118.

Creswell, J. & Creswell, D., 2018. Research Design: Qualitative, Quantitative, and Mixed
Methods Approaches. 5. ed. London: SAGE Publications, Inc..

Delen, D. and Demirkan, H., 2013. 'Data, information and analytics as services', *Decision
Support Systems*, vol. 55, no. 1, pp. 359-363. Available at: [https://doi-
org.proxy.lnu.se/10.1016/j.dss.2012.05.044](https://doi-org.proxy.lnu.se/10.1016/j.dss.2012.05.044)

Demirkan, H. and Delen, D., 2013. 'Leveraging the capabilities of service-oriented decision
support systems: Putting analytics and big data in cloud'. *Decision Support Systems*, vol. 55,
no. 1, pp. 412-421. Available at: <https://doi-org.proxy.lnu.se/10.1016/j.dss.2012.05.048>

Denzin, N. & Lincoln, Y., 1995. *Handbook of Qualitative Research*. Thousand Oaks: Sage
ltd..

Deployment (SEAD). doi: 10.23919/SEAD.2018.8472847

Durbin, Keith (2018), Chief Information Officer/Director of Information Technology
Services, Audit of Information Technology Services Software Asset Available at:
[https://www.nashville.gov/Portals/0/SiteContent/InternalAudit/docs/FY2018/20180502IT
SSoftwareAssetManagementFinalReport.pdf](https://www.nashville.gov/Portals/0/SiteContent/InternalAudit/docs/FY2018/20180502ITSSoftwareAssetManagementFinalReport.pdf)

Eliasson, A. (2013) Kvantitativ metod från början. 3:1 uppl. Lund: Studentlitteratur AB

Fisher, M. (2009). The end of DIGITAL piracy? ITNow, 51(6), 28.
doi:10.1093/itnow/bwp111

Galliers, R. D. (1991). Choosing Appropriate Systems Approaches: A Revised Taxonomy,
Amsterdam, North Holland.

Gartner Inc (2012), Characteristics of IT Asset Management Maturity G00227267
available at:
https://www.gartner.com/imagesrv/mediaproducts/pdf/provance/provance_issue1.pdf

Gartner Survey Analysis (2013) : Software Audits are on the rise and your Enterprise
might be Next, 2013 Published: 30 April 2013, ID: G00249225 Analyst: Jane B. Disbrow,

L. Samolsky Available at: <https://www.gartner.com/en/documents/2464115/survey-analysis-software-audits-are-on-the-rise-and-your>

Gull, Daniel & Wehrmann, Alexander (2009). *Optimized Software Licensing – Combining License Types in a License Portfolio*, *Business & Information Systems Engineering*. Vol. 1: Iss. 4, 277-288 available at <https://doi.org/10.1007/s12599-009-0063-2>

Gupta, U. G. (2000), Information Systems. Success in the 21st century, Prentice-Hall, New Jersey

Harrison, R.L. & Reilly, T.M. (2011). “Mixed methods designs in marketing research”, *Qualitative Market Research: An International Journal*, Vol. 14 No. 1, pp. 7-26.

Henttinen, H. (2018). Improvement of information security management system in media x corporation (Master’s thesis). Available at :

Hirschheim, R. & Klein, H., 2012. A Glorious and Not-So-Short History of the Information Systems Field. *Journal of the Association for Information Systems*, 13(4), pp. 188-235.

Holsing, N.F. & Yen, D.C., 1999. Software asset management : Analysis, development and implementation

Holsing, N.F. & Yen, D.C., 1999. Software asset management : Analysis, development and implementation analysis, development and implementation. *Information Resources Management Journal*, Volume 12 Issue 3, pp. 14-26
<https://www.theseus.fi/bitstream/handle/10024/151489/Henttinen%20Harri.pdf?sequence=1>

IEEE/ACM 1st International Workshop on Security Awareness from Design to Independent Journal of Management & Production, 9(2), 301-320
doi:10.14807/ijmp.v9i2.730

ISO/IEC 19506:2012(en) Information technology -Object Management Group Architecture-Driven Modernization (ADM) - Knowledge Discovery Meta-Model (KDM) 2012. Available at: <https://www.iso.org/obp/ui/#iso:std:iso-iec:19506:ed-1:v1:en>

ISO/IEC 19770-1:2012(en) Information technology — Software asset management — Part 1: Processes and tiered assessment of conformance. 2012. Available at: <https://www.iso.org/obp/ui/#iso:std:iso-iec:19770:-1:ed-2:v1:en>

ISO/IEC 19770-1:2017(en) Information technology - IT asset management - Part 3: IT asset management systems - Requirements. 2017. Available at: <https://www.iso.org/obp/ui/#iso:std:iso-iec:19770:-1:ed-3:v1:en>

Jacobsen, D-I. Thorsvik, J. (2002). Hur moderna organisationer fungerar. 2 uppl. Lund: Studentlitteratur

Jacobsen, D. (2002). Vad, hur och varför. Lund: Studentlitteratur.

Jakubipka, M., 2010. Software asset management. 26th IEEE International Conference on Software Maintenance, pp.1–2.

John R. Searle (2006) Social Ontology: Some Basic Principles Available at:
<http://mba.eci.ufmg.br/wp-content/uploads/Searle-Social-Ontology-Some-Basic-Principles.pdf>

Kamal, M., & Petree, R. 2006. The economics of information technology asset management. The Business Review, 6(2), 325-330.

Kaplan, J. M. (den 1 December 1994). Software compliance auditing. The Internal Auditor, 51, 18. Available at:
http://kq3er2xz6l.search.serialssolutions.com/?ctx_ver=Z39.88-2004&ctx_enc=info%3Aofi%2Fenc%3AUTF8&rft_id=info:sid/summon.serialssolutions.com&rft_val_fmt=info:ofi/fmt:kev:mtx:journal&rft.genre=article&rft.atitle=Software+compliance+auditing&rft.jtitle=T den 13 April 2015

Lantz, B. (2009). Grundläggande statistisk analys. Lund: Studentlitteratur.

Levy, D., 2006. Qualitative Methodology and Grounded Theory in Property Research. Pacific Rim Property Research Journal. [e-journal] 12(4) pp. 369-388 .

LIYANAGE, J. 2012. Smart Engineering Assets Through Strategic Integration: Seeing Beyond the Convention. In: VAN DER LEI, T., HERDER, P. & WIJNIA, Y. (eds.) Asset Management. Springer Netherlands.

M.McCarthy, L.M. Herger (2011) Managing Software Assets in a Global Enterprise. IEEE International Conference on Services Computing, pp. 560-567.

MCAFEE, A. (2004). *Do you have too much IT?* MIT Sloan Management Review, v. 45, n. 3, p. 18-22.

Michaud, Richard O. (1998). Efficient asset management: a practical guide to stock portfolio optimization and asset allocation . Boston, Mass.: Harvard Business School

Myers, MD, & Avison, DE (eds) 2002, Qualitative Research in Information Systems. SAGE Publications, London. Available from: ProQuest Ebook Central. [29 January 2020] nce=1&isAllowed=y [Retrieved April 4]

Nil, A., & II, C. J. (den 3 Maj - Juni 2009). Global Software piracy: Trends and strategic considerations. *Business Horizons*, 52(3), 289-298. doi:10.1016/j.bushor.2009.01.007

Orlikowski, W. J. and C. S. Iacono (2001). "Research Commentary: Desperately Seeking

Patel, Runa & Davidson, Bo (2011). *Forskningsmetodikens grunder: att planera, genomföra och rapportera en undersökning*. 4., [uppdaterade] uppl. Lund: Studentlitteratur Productivity press,.

Repstad, Pål (2007). *Närhet och distans: kvalitativa metoder i samhällsvetenskap*. 4., [rev.] uppl. Lund: Studentlitteratur

Riley, Len (2017) Software Audits Continue To Rise, Available at: <https://www.cio.com/article/3208346/software-audits-continue-to-rise.html> (Accessed: JUL 18, 2017 9:34 AM PDT)

Rotella, P. (2018). *Software security vulnerabilities: baselining and benchmarking*. 2018

Rudd, Colin (2009). *Itil V3 guide to software and it asset management*. Tso

Schmidt, S. (den 31 Oktober 2011). Optimizing license management for the data center. Hämtat från Network World: <http://www.networkworld.com/article/2182727/tech-primers/optimizinglicense-management-for-the-data-center.html> den 13 April 2015

Scotland, J., 2012. Exploring the Philosophical Underpinnings of Research: Relating Ontology and Epistemology to the Methodology and Methods of the Scientific, Interpretive, and Critical Research Paradigms. *English Language Teaching [e-journal]* 5(9)

Silva, V. (den 9 December 2009). Firms keen on software asset management: KPMG. Hämtat från Network World: <http://www.networkworld.com/article/2240072/software/firms-keen-onsoftware-asset-management--kpmg.html> den 9 April 2015

St. Laurent, Andrew M. (2004). *Understanding open source & free software licensing*. Sebastopol, Calif.: O'Reilly

Swahn, A. (den 18 Juni 2012). Gartner ITAM Core Skills Report shows the needed skills are mostly about license management. Hämtat från Network World: <http://www.networkworld.com/article/2189457/tech-primers/gartner-itamcore-skills-report-shows-the-needed-skills-are-mostly-about-licensemanage.html> den 10 April 2015

Swartz, J., & Vysniauskas, P. (2013). Software asset management in large scale organizations: exploring the challenges and benefits (Bachelor's thesis) Available at: <https://gupea.ub.gu.se/handle/2077/38602> [Retrieved April 4]

Tashakkori, A. & Teddlie, C. (red.) (2003). Handbook of mixed methods in social & behavioral research. Thousand Oaks, CA: SAGE Publications
THE INSTITUTE OF ASSET MANAGEMENT. 2014. Asset Management -An Anatomy. [Accessed 2015.04.20]

The Swedish Companies Registration Office (2019) (Bolagverket) available at: <https://bolagsverket.se/ff/foretagsformer/aktiebolag/arsredovisning/delar#storre-mindre-foretag>

Trost, J. & Hultåker, O. (2007). Enkätboken. (3. rev. och utök. uppl.) Lund: Studentlitteratur.

Vanier, D. J. (2001). Why Industry Needs Asset Management Tools. Journal of Computing in Civil Engineering, 15(1), 35–43

Varela, A. M., Méxas, M. P., & Drumond, G. M. (2018). The scenario of software asset

Vion, A., Baillon, N., Boyer, F., & De Palma, N. (2017). Software license optimization and cloud computing. The Eighth International Conference on Cloud Computing, GRIDs,

Voas, J., & Hurlburt, G. (2015). Third-party software's trust quagmire. Computer, 48(12), 80- 87. doi: 10.1109/MC.2015.372

WANG, Y. et al. (2015). The interaction effect of IT assets an IT management on firm performance: A system perspective. International Journal of Information Management, v. 35, n. 5, p. 580-593. DOI: 10.1016/j.ijinfomgt.2015.06.006

Yilmaz, K. (2013) 'Comparison of Quantitative and Qualitative Research Traditions: epistemological, theoretical, and methodological differences', European Journal of Education. John Wiley & Sons, Ltd (10.1111), 48(2), pp. 311–325. doi: 10.1111/ejed.12014

Appendices

Appendix A- Interview Guide/Questions

Table 3 : Interview Guide & Relation to Theory

Organization & People	Theory
1. How would you describe your current responsibilities?	The ISO/IEC 19770-1
2. How does your organization define roles and responsibilities for managing software assets?	The ISO/IEC 19770-1
3. How would define Software Asset Management?	The ISO/IEC 19770-1 Albert et al., (2013) Rudd, Colin (2009)
Process	The ISO/IEC 19770-1
4. What kind of Policies, Rules, Guidance, Conduct do you have regarding software asset management?	The ISO/IEC 19770-1
5. How does your company currently administer the purchase and maintenance of its software assets (lifecycle process)?	Durbin, Keith (2018) Kamal and Petree (2006)
6. Is there a total overview of software and hardware spend?	The ISO/IEC 19770-1
7. What is the registration process when software is purchased?	Holsing and Yen (1999), McCarthy & Herger (2011)
Technology	
8. Do all users have local administrator rights on their devices?	Riley, Len 2017
9. Do you proactively or reactively perform any kind of compliance analysis?	Riley, Len 2017
10. Does your IT strategy include a future cloud strategy?	Gull & Wehrmann (2009)
Challenges & Possibilities	
11. What are the primary challenges you perceive in managing your software assets?	Ben-Menachem (2008) Riley, Len 2017
12. Why do you think Software Asset Management is important and valuable?	Holsing and Yen (1999) McCarthy & Herger (2011)

Appendix B - Interview response P1, Company A

How do companies that you work with define roles and responsibilities for managing software assets?

It differs a lot from company to company. On the one hand side some might assume that when there is a larger company, the business would have control over the assets since there are more resources to put in to manage. But it doesn't have to be like that either.

Commonly the trigger for defining roles and responsibilities is based upon past experiences. The companies that already had negative experiences with an audit from manufacturers and a fine/penalty as a result started to a higher extent to manage their software assets. This is like when you driving to fast with the car and you get caught on the speeding camera which results in behaving and driving slower as the legislation is defined.

The same goes for software asset management. Normally the company primary doesn't look on the licenses. Instead they look on it on a performance based view of the software assets. The company wants as much power and performance as possible from the software assets they deploy where they can complete there working tasks as fast as possible in order to be efficient. Therefore SAM is valued secondary and as a cost trigger which is not paid attention to.

Are there any patterns?

General the sensitivity for SAM has increased in the past years but there is space for more.

Do you have any examples for roles within SAM?

Commonly the roles is done on top of a normal IT-employee. It is carried out as a task. In some cases for shore you need a certain company size with enough employees in order to have a SAM role. But these are companies with 5000 – 1000 employees or more. Most companies don't have dedicated software asset manager instead the IT-manager makes this parallely.

What kind of Policies, Rules, Guidance, Conduct do you have regarding software asset management?

There are best practices from ITIL, BSA and ISO but this is by far not being lived within the companies. Many times the companies say that it is not our core competence. For example a healthcare insurance needs to take care of their customers and look that they have an insurance. It is not their core business. Many companies buy this know – how for SAM externally through partner firms or a consultant firm.

Same goes for processes. The companies have the purchase process halfway under control. But here there also exists the so-called shadow IT. Where the users have an own credit card and can execute own purchases on software assets. Then all of the software asset

management is useless since you don't know what is purchased. Process driven companies are very view.

Do all users have local administrator rights on their devices?

There are both existing. The topic with the administrator rights on their devices the longer the less a problem since the companies have recognized in the past years that it can lead to complications since the installations will not be known by the organization. This issue seems to be under control by the companies. What is not under control is that someone has a credit card and can to a certain amount execute software orders. This can be done without any approval. Specially nowadays where an employee could trigger and start a cloud subscription. Then the employee generated recurring costs month for month and as long the cost is not exceeding the credit card limit no-one will in the first stage notice this. This is a bigger problem compared to the local administrator rights. Deployment generally.

Does your IT strategy include a future cloud strategy?

Cloud journey is rather conservative in Switzerland since data security is higher. To some extent companies are forced to move into the cloud since the manufacturers only offer the software as a cloud subscription. Sometimes the offer is there but you pay much higher price for it in order to operate. For larger companies sometimes an on-premise is worth it in order to have control over data. But smaller companies will not be able to get around the cloud. General there is no other way since the Manufacturer forces the client to move to the cloud. There is no other alternative.

How do companies currently administer the purchase and maintenance of its software assets (lifecycle process)?

Many ways. Commonly is that companies base costs from previous years and add 10% on the budget. Companies tend to not checkup if they only pay for what they use and if they have installed the software that they actually use. Normally there is a lack of know-how and a understanding of the context. Companies tend to say that currently my software environment runs and if I do change something then the companies take a risk that the environment doesn't work anymore. That's why the companies are ready to take into account to pay 10% more on licensing rather than savings.

For the complete lifecycle not all have a software asset management tool. Many tend to manage software assets in excel. When a company registered this in excel it is better than having nothing. Many companies don't have a SAM solution.

How would you define Software Asset Management?

3 P, Processes, People & Policy and this triangle needs to be in balance together(harmonize). The business is based upon people and interfaces between departments such as procurement IT-department or the business itself and needs to be regulated trough policies & processes. Otherwise there is an imbalance in the triangle. The triangle needs to be balanced otherwise it doesn't work.

It is important to define process so that all involved parts have the same definition of SAM. The persons involved need to know based upon the processes how to manage software assets and what will happen with handovers if people leave and new people start. It is not one person who executes the process normally several people are involved. Employees need to know if they are allowed to purchase software even if it causes costs for the company. Can they do it or do they need to get an approval from the management. There is a wide range of companies. Some companies have defined very well and some who say I haven't got any penalty from manufacturers. Why should I change something in the process if it worked?

Audits of manufacturers - is the size of the company relevant?

I would not say that. Basically, when a customer completely breaks away from a manufacturer, they audit whether they have licensed it correctly, which is what the customer bought later. Many manufacturers have stopped auditing because they often must pay the amount anyway. Often, they don't do the audit, but they give a mandate to an auditor who does the audit. However, if the auditor finds nothing, the company still must pay the auditor for his efforts. That is why manufacturers, like Adobe, have decided that they do not do audits anymore. They invest the money so that they can delight customers with the cloud. But that is again very dependent on the manufacturer.

What are the challenges of software asset management?

On the one hand it is the knowledge about Software Asset Management- there are many different definitions. As long as there is no need, even from an economic point of view, there is no need to strive for change. But if there is a surplus or an additional need, a change has to be made.

Do you feel that customers are having difficulty staying within budget for software asset management?

It depends on the budgeting. What you can say, if you don't administer it per portfolio then you can budget 20% more every year. If there is no audit coming, that can work. But it can be that an audit comes and destroys your plans. We are talking about seven-figure sums here.

Are customers more reactive or proactive in this approach?

It varies a lot - it depends on the customer's situation. The customer tends to know exactly whether they are in the gray area or not. If the customer is pretty sure, they can lean out further. In this sense, the auditor must tell the customer what he can do and what he is not. Or, the customer may mention that he is under-licensed and thus not allowed to upset the auditor. Software contracts are always different-no two are the same. So it can happen that you sign a contract with one company and pay more than the other representative of your own company. This is an absolute matter of negotiation.

Sometimes a classic contract is more of a "lawyer's fodder". It is not the core business of the customers. An auditor would very likely not audit a law firm. It would be too big a risk for the auditor.

In what area of software asset management have you had success?

The best case was in a classic, project-based compliance survey. Within one day, we were able to collect the technical data. With Wake on Lan, we were able to activate all PCs. Within 2-3 hours we were able to install and capture everything. Normally, this process takes three to four months.

Is it a technical challenge to get the information?

Yes. Let's take a closer look at the notebook. Advantage: You are very mobile. Disadvantage: You're mobile, but you're not always connected to the network, so you can't always be reached if you want to know the exact status. This does not make it easier for the administration of these devices. As soon as the device is stolen, the complications arise. This doesn't happen with the desktop because it stays put.

Why was this customer such a success?

This customer was very organized and structured. It happened once in ten years. That's why the data collection was so easy.

Is there also a negative case?

That was an amusing case. This was an international beer brewer. I would like to emphasize that this is not in the core business of the company. The question that was asked at the beginning was how many devices that they had that? The answer then was that they would work with 20- 100'000 devices. The customer asked after some time how far we were with the data collection. The discrepancy was so big that we ended up with 30,000 devices. In the end, however, no one knew how many devices there really were. Once a device is switched off, it is not easy to find it. We would have had to search all the offices for devices. Hidden devices are hard to find.

What challenges do you see in the commercial part?

Primarily, it's not centralized. The shadow IT is also very big here. In the company, the customer can run Excel spreadsheets without your knowledge and you still order software licenses. This means that there are double bookings. That means, if something is uninstalled, it is thrown away. The new software is then booked.

Should software asset management be decentralized?

This is certainly one of the main issues of software asset management, to gain visibility. Centralization is a buzzword: it is a centralization of the know-how, i.e. creating responsibilities or even information.

What about all the conditions regarding the cloud?

There is a strict myth that says if I am in the cloud, I don't need a software asset manager - that is not true in this case. You do have the centralization in the cloud for this case, but you still have to check whether I need the software I bought or not. If the process doesn't work, people leave the company but they still have clouds, it's a cost factor on the one hand and secondly it's a big security factor because the employee has access from anywhere because he is still authorized. From a compliance point of view, this is a reputational or a big financial damage.

Appendix C - Interview response P2, Company B

Position description

I work as a technical manager in information technology/telematics. The company is a SME service company. We want to improve and renew offers for existing customers. Originally we were an electronic installation company, $\frac{3}{4}$ of the employees work in building services, planning, electrical installation and automation. These areas are merging more and more with informatics, there are no clear boundaries anymore. Security areas need to be constantly updated. New technologies/interfaces (network, software, server systems) must be better utilized. Working with the cloud is still difficult for some customers, but in some cases they don't know how it works.

What is your future strategy regarding the use of the cloud? Current status

We are still in the early stages of this. Internally, as well as with our customers, Microsoft 365 is gaining more and more presence. But there is more and more software that we also use from third parties ourselves. The question is whether to install the software on an existing server in the business or to install it externally (Exchange). Sometimes customers are still hesitant about security. For example, a lawyer, a trustee or a small business are afraid that the data will be publicly accessible. The customers have too little knowledge of how to actually use a cloud. Larger firms seem much more confident in cloud transformation.

How familiar are you internally at the company with using the cloud?

We still use servers. But the data storage is given externally (Sharepoint). So it can be accessed via teams. In the end, we are also a showcase for our customers. Because that's the only way we can explain to customers how to use Microsoft 365, if we can see the added value. But we certainly have some catching up to do there.

Is the company aware of the fact that you have to act as a showcase?

Yes, I don't think there is any clear awareness yet. At the end of the day, it costs the company money. Someone would have to be held responsible for this job. Maybe the management is also not yet aware enough that working with the cloud brings many advantages. There are seven people in the management team who are also partners in the company. There is no operational management and no board of directors. This makes implementation much easier than with a large company.

How are you organized in the company regarding software asset management?

¼ of the employees work in the IT area, taking care of customers in IT and telematics. Our internal IT is managed by one person. However, this person also works on customer projects. There is no 100% position that is only responsible for internal IT.

How is it organized when a new employee is hired?

The first thing is to make sure that he gets all the software he needs to work. In a small company this is less of an effort than in a startup or in a large company where five new people start every month. These work tasks are distributed within the company.

What is the process for renewing contracts with software vendors?

We have someone without a technical background who is in charge of the internal IT department. The own software licenses for the company is the smaller effort. We do a lot of recall of licenses for our customers, are market software licenses but also Cisco, HP, Juniper licenses. We are building a new industry solution. At the moment everything is recorded with an excel table, which is reviewed every year. This license capture is charged to the customer. We don't have a solution for this tool, i.e. for license management. We buy many licenses from ALSO. We have good conditions there. Nevertheless, we still keep track of our excel table.

What happens when a license expires? Is the customer made aware of this?

We inform the customer that the license is about to expire. In the best case, the customer buys licenses from us again.

Is the IT distributor responsible?

No, it is our responsibility. It is in our interest that the customers will sign license contracts with us again.

Do your employees have local administrator rights?

Yes, the IT employees do, but the electrical installation employees do not.

Are there any guidelines or rules in the area of software asset management?

There is no clearly defined process flow. With software, it's business driven. When someone needs software, the first thing they look at is whether it adds value to the company. Then the installation takes place. Electro installation has its own tools and planning software. For a larger project, the management always decides how the software will be offered.

Could each of you subscribe to Microsoft?

Yes, actually. We need that as well. Sometimes you have to be able to apply for licenses for the customer immediately. For example, with ALSO. This is always done via the same account.

Do you have a limited budget for software expenditure?

I think there is. Unfortunately, I can't give more detailed information about it.

Does Excel have an administration process?

Software, recurring licenses, warranty- once a year the invoices of the customers are created, based on the excel spreadsheet and the other one is done manually by the office staff. This way the customers are informed about new offers so that the license can be renewed.

What do you think is the main challenge in software asset management?

I am now looking at it from the technical side. Shadow IT is not tangible. In part, we don't know what else is being downloaded. From the financial side, it's unmanageable.

I also believe that license capture could be optimized. Our customers usually have between 10-100 employees. With 10 employees, you have 10 Microsoftoffice licenses. There is not much more you can optimize. The question is whether there would be a better optimization at the large companies - cost savings.

Why do you think software asset management is so important?

I think one thing is visibility, what do we have, what do we spend money on. In the past, you bought a piece of software that cost maybe 50,000 francs once. Today you have more and more amounts that disappear under the radar, because everything is charged via credit card. Maybe a software continues to run, which is no longer needed, but no one notices it because it was not recorded.

Have you ever come in contact with an audit from a vendor?

Not so far with the new position. This is a good question. No so far not a big one. With the Microsoft 365 it's not such a big issue anymore. At the end of the day, you need a license so that the user can log in. We have never had an audit in that sense. We received a similar product 10-15 years ago, which was too little for us to do, but was almost a gift.

A successful software asset management - what would it look like?

It would be of great advantage if we had a tool in which we could recognize the recurring licenses, but also the customer could log into this portal. Of course, the customer would only see his own licenses. The customer could then also independently, when a new employee would start, actuate that a new license would have to be solved. The customer would immediately see how much he would have to pay per year. On the one hand, the customer, as well as we should have access to the tool of the licenses.

Appendix D - Interview response P3, Company C

How would you describe the responsibilities at your current position?

We are a team that's responsible for "so call on software management". In our team we manage the four big suppliers, Microsoft, SAP, IBM and Oracle. We own the connection to these companies and are helping out with license compliance with the other suppliers. We always front i audits.

In your team which roles are there and how many are you?

Today we are four people, I'm the team leader, a general role. I also own the SAM-process. Then the other three are supplier specific. We one for SAP, one for Microsoft and one splits the time between Oracle and IBM.

You mentioned that you owned the SAM-process, interesting for me. This means that you defined the SAM-process?

Yes, it's foremost the wheel. You can see what you need, how to buy it, how to measure it, lifecycle management and then follow up. Then it continues like that. This together with the audit process we have.

How did you put this process together?

It was done right before I started, I was hired to get this group going where we have the ones responsible for the suppliers and where I work horizontally and as a support. I own our SAM-tools.

What kind of tools do you use?

We use Aspera's or USU is their new name, SmartTrack. They change name, I think it's called License control. There we can keep track of our use. Connected to SmartTrack eighteen different sources of information. We have from AD, IBM, SAP. From our scanner tools SCCM, ILMT and so on. This to cover as much of the picture as possible on devices and what's installed. We have an agent based scanning environment in SCCM and ILMT. Then we used an agentless scanning device in iCloud. Because then the agents are on, that we detect, but when we have shadow IT that are not configured and we collect that with the agentless. Even if we cannot scan those computers we can see that there is something we are not scanning. This makes it just as important.

What's the challenge about this?

The challenge is that everybody, in a simple way, could buy a cloud solution or SAAS. In a worst case scenario they can do it with their credit card and then we have no idea if they

exist. It's easy to start up new environments that start chewing license from day one. As easy as that is it's hard to take down environments then they are not used. If there are not any basic routines in place it could derail pretty fast, that's the challenge. Also at the same time as we are going more towards cloud we still have the old systems that are locally installed. The world doesn't become any easier but more complex keeping track of licenses.

Can employees activate it or is it centralized?

If you look at the Microsoft agreement it's centralized. But let's say somebody finds a new SAAS somewhere then they could register with their credit card. What is a license traditionally and what is a service when it comes to SAAS? We say what we should include SAAS solutions even if somebody says, no it's a service that has been bought. If you don't know the rules of licensing the cost could be very high. Then you need someone to keep track, partly on the rules of licensing and partly that users don't log on all the time to things you pay for. We have a standard that as soon as SAAS have been bought it must be connected to our AD. This doesn't always work and that leads to a risk that there are a lot of zombie users, that still costs money. Worst case scenario they will go to a competitor, bringing information to them. This is also a risk.

Are there processes or should employees know what's required?

Yes, we have an IT directive that describes how to buy software, services and so on. Maybe knowing about the IT directive is not top of mind for people. At the same time we moved towards a more agile organization. We did a large transformation in October last year where we started to work with product teams. The product team is very autonomous. Some of them think they could do whatever they want with no guidelines. It's a challenge with information, telling them they need to follow the basic guideline.

How far has your organization come in using the cloud?

It's cloud first, if it doesn't work we can use an internal data center.

And how far have you come with using the cloud? Is it step by step?

At this moment we are moving at a pretty fast pace and it should be done this summer. This moving project has been going on for a year. Although we will still have systems that are stored in our data center, you can't move everything.

You mentioned audits, do you simulate audits? Is it more reactive or proactive?

When we use audit it means that an external comes and does something with us. Otherwise we call it internal reviews when we ask product teams if they are keeping track of their licenses. So we have started to do internal reviews with suppliers that we know have audit risks. I'm in a big SAM-network in Europe. Through the network I get info about which suppliers that are auditing. This makes us want to test ourselves and see how we are. We have a short list that states that under this half year we should control these licenses.

Do you have any experience in audits?

That is the reason why we got this group. We got pretty tufted in audits in 2015. The last two years we have had four audits. It has been pretty calm now for eight months but then it came four in a close sequence.

Do you do everything internal or do you sometimes get help externally?

The ones that are really good on licensing, in some licensing areas, we use them if necessary. Because that level of detail is hard for us to handle internally. We shall work on a more strategic level. So for example in the ILMT area we have a dedicated SAM but she uses help to bundle in ILMT so she can focus on the strategic part. We also use help to translucent big contracts.

How should successful software asset management look according to you?

The best is to have information on what's installed. The one with the best knowledge wins. If we know that we have high quality on data collection and that we can apply it on what's installed, when we got really far. It's also important that it plays along with CMDB that comes with the hardware information.

How does it work with divestment? Does it come up in the tool, now you need to prolong this or how do you track it?

We buy much of the software from Software One (? 18:10). Then they monitor the purchases for us.

If we look at license utilization we have formed a 90 day rule. If the software is not used in 90 days we don't count the license as active. Then it's taken away from our compliance reports. We don't trust everything that's stated in CMDB, the process is manual and takes a lot of time, sometimes.

How would you define software asset management?

I will give you a bullet while I think about that. I'm thinking about open source components in software that is self-developed. The thought behind open source is that you should share with others. Some open source is free to use for private individuals but not for companies. Some open source components, when used in your own code, it means that you need to publish the source code to your whole system. For example BMW used open source code and used a license. The conditions means that if you use an open source code then you are forced to make the whole source code for the system public. What would happen if you use an What would happen if someone finds out that a car manufacturer have used open source software for a self-driving car? This is a new area for us to look into, open source. Even if it's free to use it could cost you a lot, your IP for example.

You think that this will be in the software asset management area?

It's software licenses. How you are allowed to use a license. What happens when you buy a company and they have developed program code. What if they used open source in that code? Is it something you need to take into account?

Was it this year that you encountered the open source dilemma?

We started to look into this two years ago, because we got different companies and software within the group. We developed, more and more internally and we need to check how it's used.

To get back, our mission, vision for SAM, "Ensure control and optimization of software license consumptions" that's what we shall do.

Are you able to see how you spend on software?

Yes, maybe not 100% but that's where I want to go. And then how much software do we buy and how much do we use. Then you need to check product for product. Is there something that we are over consuming? Should everybody use it? If the answer is yes then we need to buy more licenses. Our goal is to always be correctly licensed. If that means that we should use the software less or increase licensing it's not up to us to decide. It's up to the people that pays.

Appendix E- Interview response P4, Company D

How would you describe your current responsibilities?

I am Section Manager for IT – Department where we have 4 sections. 160 within the departments. I am in the Section for Development and Maintenance Management. We are managing the system that are central to the organization.

What type of task do you have?

We work with a manage model so called E3 which is used by larger organizations. It means you bundle your systems. For example, you have 100 systems. Then you bundle them up such as financial system is one area for example. HR is another. We have 14 basket and for these baskets there is a responsible person who runs drives the basket forward. I am also running a basket.

How does your organization define roles and responsibilities for managing software assets?

Most systems are bought through external players. Sometimes we coordinate and collaborate with other educational organizations to purchase software assets. We have system developers which develop our systems. Mainly these are systems on our internet platform which are systems that we have bought.

Do you negotiate directly with software Manufacturers regarding software?

No since we are under the law of public procurement (offentlig upphandling). There are different condition that are defined such as price and more in order to purchase software. We work together with other educational organizations towards the software manufacturers when we negotiate new agreements such as the Microsoft Office Family. It is a joint public procurement. It gives more negotiation power. You need to agree with other educational organizations regarding terms to negotiate. If this is not achieved there will be no joint procurement of software.

What kind of Policies, Rules, Guidance, Conduct do you have regarding software asset management?

Procurement of software is according to public procurement (offentlig upphandling) which is normally 3 years then 2 years and additional 2 years. Sometimes we are forced to switch

software supplier due to laws or other factors. We try to define processes around systems as management friendly as possible, so it is easier to change and replace systems and software in the future. When it comes to settlement of a system, we normally have a settlement period before the system is disposed. But we normally don't replace systems often.

Does your IT strategy include a future cloud strategy?

We have a mix between cloud and on-premises. A trend is that we are moving towards the cloud. There are some Laws which makes it challenging to move everything into the cloud. But long term it will be a part of our strategy. Maintain Servers is costly since you need employees to maintain the servers. If you have a cloud service, you can get a 24/7 service which is not possible with on-premises solution. This is possible because there are so many who use the service. The factor which makes us move into the cloud are service, competence and of course economical.

How is your overview regarding IT – costs?

We have complete control over the costs. Costs are important. Every Basket is budgeted under spring for the next year. There we look at what we should developed, dispose, or purchased and if we need what kind of money, we need for it which is included in the ordinary budget. In the budget process every department presents their needs and then it is decided what will be done and what not. We have one-year plans.

Do all users have local administrator rights on their devices?

No, we have a very good structure and process of who gets the administrator rights. Of course, we have different levels of administrator rights and every year we go through the users and see if every user has the right rights and remove the ones which are not up to date.

What are the most important processes regarding systems?

Mainly it is the regulatory framework of PM3. Then we have the processes from ITIL for the daily business. Incident issues which we follow. PM3 was developed for Swedish authorities. A way to organize.

How does your organization define roles and responsibilities for managing software assets?

We are good in management of software assets.

What are the primary challenges you perceive in managing your software assets?

We spend a lot of time thinking about how the digital reality will look like after corona. How will we use software in our educations? What kind of role will application like zoom and teams play? How will the classroom look like? Will we have students on physical lectures? This is a big discussion. How will the digital and physical technology towards students will look like in the future. I am not sure if students will return.

How would successful & efficient Software Asset Management look like?

I think that is more on the human level. It would be nice to be more agile between management of software and projects. Be more independent and digitize by our own. We are a good IT Management with stability. We are able to jump on project which drives in this country. You need to take risk but a little flexibility would be good for our organization.

Appendix F - Interview response P5, Company E

How would you describe your current responsibilities?

High and low. Sometimes very complicated. Need to read and understand license models and how to count them regarding their conditions. What rules are there for using a license. Simple things like getting an offer.

How many employees are there?

We are serving 800 around the world, but we are serving all other within the corporate. Within SAM we are two employees. It is far away enough resources to do a good performance. We can do part efforts. Choose the parts that are important to work with. Go after the value of the contract such as Microsoft, Oracle, IBM, Service Now the big dragon. Or you go after complexity and risk. But there is now chance to get an overall overview and get a result like “now we have picture about our IT compliance”. You need to choose your fights.

What kind of battle has been of importance?

You need to balance what kind of risk you have. How many licenses are we buying? How is the manufacturer? Are they likely to execute audits? Is the license model complex which means that the customer struggle with keeping track over the licensing model? Of course, the value of the software asset also needs to be included. Since we use a lot of Microsoft the focus automatically ends up on that manufacturer. IT is a balance is it worth it or not? Balance risk and value.

Sometimes I compare Software Asset Management with Finance department because we are doing accounting in a way because we are counting how much we use compare this with how much we have bought. It is a quite good comparison but at the same time we have accepted the conditions when we signed an agreement or bought a license. But when it comes to legal conditions then it is not as clear within SAM as it is in finance. Yes, there are copyrights that you need to have a look on. But there is not the same focus due to unclear conditions.

What kind of Policies, Rules, Guidance, Conduct do you have regarding software asset management?

In our organizations there is almost nothing. The cause for it is that our organization has not been centralizing IT. It just started 3 years ago. Before it has been locally on the market that we are acting at. Often it has been in form of the countries that we are active in. But now there is an insight to centralizing it to get at global perspective. There was a SAM role before but more for licensing conditions. I am working on defining processes, function, and activities to gain more structural working ways compared to before. Currently we have a process called License Office which is an administrative function to manage licenses and register license and have a register. Do purchases, do offers, make reminders for renewals. Manage invoices and costs and make costs distributions. We are buying licenses in Sweden and distribute these to the one in the organizations which have ordered it.

The other part which is developing the SAM function is called SAM service design. It is a structural way to have a look on an agreement, a license, unit business, a country. SAM service design is about what agreements do we have, how does it work, same goes for licenses. What do we need to do to

find out about the data that we need to measure licenses we use? How should work with this running in order in operations in order not to redo this the future.

License Office = Department for procurement. Transfer the work from the ones who need the license to a centralized and specialized function. You need to offer value. The purpose is to simplify the order process and have control over licenses.

The IT function has been shared between three subsidiaries in Sweden, which has led to lack of knowledge in what has been bought and to who and who has the right to use them and who has been paying for them. The part where you track and have a register over what has been bought and the purpose of use is of great importance.

Do you use any Software Asset Management Tool?

No, everything is manual. Everything is in excel. The registers that we have is about what kind of licenses we have and who is the owner of it. There is no insight of usage and where it is used. We need to trust our stakeholders. Everything runs through email by contacting the license owner. No insight in what is installed on devices or infrastructure since the organization has been so decentralized. The decentralized parts in the organization are very small. This means that subsidiaries were able to track the own software assets since they were not big and without system support.

Do you have control over the agreements?

Yes, the licenses that we monitor, there we have control over licenses, agreements, and the owner (who bought the licenses).

Does your IT strategy include a future cloud strategy?

A while ago Architect said to me that cloud solutions will make the activities of software asset management disappear since no license model disappear are require and everything turns into subscriptions.

But reality has shown that it is opposite is ha become more complex within SAM. Nowadays we moved from license to subscription but what you buy is a usage right to use something which follows with a lot of conditions. It has not become more easier to manage subscription for example office 365 compared to an on-premises licensing model. The need of Software Asset Management functions has become he more you go into cloud. The delivered these services still include a lot of manual work. For example, office 365 is one of the view applications which show what kind of license the user should have. It is not sure if that user needs that license due to many other reasons. You need to double check.

To what extent are you planning to move to the cloud?

I have not seen any plan yet. But we as an organization are not heavy weighted or dependent on IT since our core services do not depend on it. Many of our employees run the business with a pen and paper. We do not need IT to operate. We do not have old systems which we need to get rid of, which is an advantage, it gives us opportunity to choose between solutions which gives freedom since we are do not need to consider old IT.

Do you proactively or reactively perform any kind of compliance analysis? If so, which kind?

No audit has been occurred. We use our decentralization if a manufacturer wants to do an audit which would for the manufacturer is time consuming since the group has many subsidiaries, and every subsidiary runs their own software asset management.

What are the primary challenges you perceive in managing your software assets?

The most challenging regarding managing your software assets is to be able to be up to date with what kind of software asset that are installed in the organization. This is the biggest challenge. There are so many if and buts. A struggle is to get your inventory system to state the right things. A challenge is to get a full and right picture of software assets of what is used. Within SAM it is not enough to just know the number of servers and the product description. You need to know more than that. What type of server for example? Is it developer or production servers? The measurement for a license is set up very differently. It is a challenge to make an inventory since the measurement of licenses differs from manufacturer and product. For example: Desktop Application = each installation one license to SAP Project Management Tool where license is defined on how much money flows through every project. That is what you are paying for. How should you be able to inventory those kinds of license? To get complete Inventory with information which you need to measure the license is the overall toughest challenge. IT requires a lot of work.

How would successful & efficient Software Asset Management look like?

A reliable fundamental information to measure / calculate licenses of software. We need complete inventory of software. Everything from Hardware to software and to users. Then we need to summarize this information in a reasonable way. We need to be sure that the data we collect is correct and up to date.

We also need to be able to calculate and know what kind of licenses we have. Good work within what we call license office so that the stake holders turn to us for help where they want to purchase software through SAM rather than purchase it by themselves.

A structural working way to tackle changes. Develop an ability to be able to go into a new area. Example. This the process of how we will manage these licenses. When you have come that far then you can do a lot of things such as optimizations and distribute licenses a more efficient way. Reuse licenses in order

More resources to find answers. You need time to understand all the condition from the manufacturers.

Appendix G - Survey Questionnaire & Results

Survey - Master of Science Thesis in Informatics

Hi everyone. I am conducting a small survey project for my master thesis for my class I'm taking at Linneaus University. It's only 11 questions and I think it should take you no more than 3-4 minutes. Your responses are anonymous and will not be identified with you in any way. You may skip any question that you find intrusive or offensive, but it will help me if you respond to as many questions as you feel comfortable with.

Thank you. I really appreciate your

help! Gabriel

Management of Software Assets | Linneaus University | Gabriel Mäder | gm22bb@student.lnu.se

1. What is your current position?

2. Are you aware of, or have you heard about, Software Asset Management (SAM)?

- ☐ **Yes**
- ☐ **Maybe**
- ☐ **No**

3. Does any Software Asset Management/IT Asset Management function exist within your organization?

- ☐ **Yes**
- ☐ **Don't know**
- ☐ **No**

4. To what extent has your organization defined roles and responsibilities for managing software assets?

	1	2	<input checked="" type="radio"/> 3	4	5	
No Extent	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>	<input type="radio"/>	High extent

5. Are there any policies that cover the full life cycle of software?

- ☐ **Yes**
- ☐ **No**
- ☐ **Don't know**

6. To what extent do these policies cover the full life cycle of software?

	1	2	<input checked="" type="radio"/> 3	4	5	
No Extent	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>	<input type="radio"/>	High Extent

7. Have you implemented specific SAM tools to help manage the hardware and software environment?

- ☐ **Yes**
- ☐ **No**
- ☐ **Don't know**

8. Is there a defined business process for managing software assets that enter or leave the business?

- ☐ **Yes**
- ☐ **Don't know**
- ☐ **No**

9. Do you to some extent perform any kind of compliance analysis on software assets?

No Extent **1** **2** **3** **4** **5** **High Extent**

☐ ☐ ☐ ☐ ☐

10. Does your organization to some extent include any future cloud strategy?

No Extent **1** **2** **3** **4** **5** **High Extent**

☐ ☐ ☒ ☐ ☐

11. What are the main challenges you perceive in managing your software assets?

Det här innehållet har inte skapats och stöds inte av Microsoft. Data du skickar kommer att skickas till formulärets ägare.

 Microsoft Forms

Forms(<https://www.office.com/launch/forms?auth=2>)

Survey - Master of Science Thesis in Informatics

49

Svar

19:39 Aktivt

Genomsnittlig tid för att slutföra

Status

1. What is your current position?

48

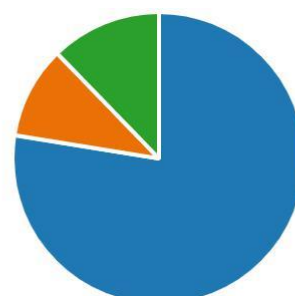
Svar

Senaste svar

"Finance Manager"**"Credit Administration"****"Data Product Specialist"**




2. Are you aware of, or have you heard about, Software Asset Management (SAM)?

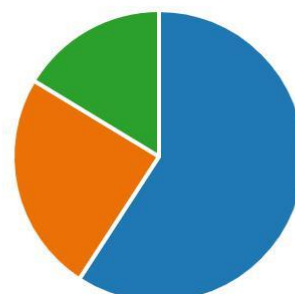
 Yes	38
 Maybe	5
 No	6



3. Does any Software Asset Management/IT Asset Management function exist within your organisation?

Insights

 Yes	29
 Don't know	12
 No	8



4. To what extent has your organisation defined roles and responsibilities for managing software assets?

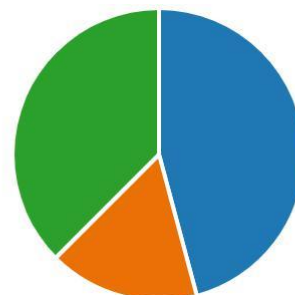
Insights
47
Svar

3.4
Genomsnittligt tal

5. Are there any policies that cover the full life cycle of software?

Insights

Yes	22
No	8
Don't know	18



6. To what extent do these policies cover the full life cycle of software?

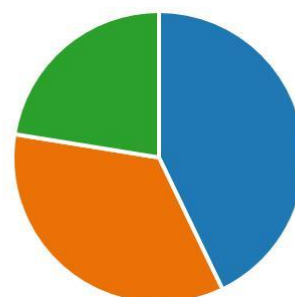
Insights
42
Svar

3.12
Genomsnittligt tal

7. Have you implemented specific SAM tools to help manage the hardware and software environment

Insights

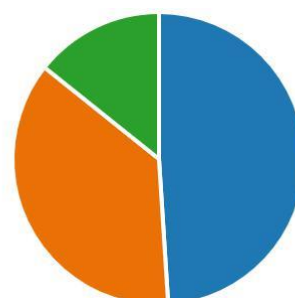
Yes	21
No	17
Don't know	11



8. Is there a defined business process for managing software assets that enter or leave the business ?

Insights

Yes	24
Don't know	18
No	7



9. Do you to some extent perform any kind of compliance analysis on software assets?

Insights

46

Svar

3.11

Genomsnittligt tal

10. Does your organisation to some extent include any future cloud strategy?

Insights

45

Svar

3.64

Genomsnittligt tal

11. What are the main challenges you perceive in managing your software assets?

27

Svar

Senaste svar

Table 4 : Challenges mentioned by Survey Respondents

The amount of memory any given software uses from a limited HDD
Shadow IT, lack of Standardization within customer environments (many different types of companies with different software)
Yes the Challenge is That you get a suitable Software For the best price
Customer responsiveness
Keeping up to date with changes
My knowledge about software assets.
I dont know what it is
Getting speedy access to new software when needed
Lack of ownership for legacy/ old software
Decommission of unused software and audit
Get the Data up to date...
Continuity and knowledge of the staff and cost of the SAM tool.
-
frequent changes in the prodcut-terms and license rules
Global Reach, Local Oraganizations, Discovery, load of publishers, knowhow
lack of Ressources or defined roles and responsibilities
Complexe Licensing Models, to have a full overview about consumption and usage incl. contracts
Most of the productivity software we use are online services (like google docs, for example). Licensing is completely transparent to me, so I really don't know how that is managed.
allocation of time and ressources
Overview of which tools are actually used and for what
None
Getting all relevant data
n/a
Controlling the whole lice cycle of software assests
Continuously changing software suitability / pricing / naming / licensing structure.
Continuous control
To inventory all assets

