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SOFTWARE ASSET MANAGEMENT IN AN ORGANIZATION

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Abstract

This thesis presents a project conducted to assess software asset management (SAM) maturity, through the usage of a SAM maturity model, in a Portuguese group, composed of six companies of different business sectors, in order to understand if the group was taking all necessary measures to prevent software non-compliance risks whilst maximizing SAM benefits. The SAM maturity model adopted was based on the Microsoft SAM Optimization Model (SOM) and comprised the assessment of ten core competences, each considering a total of four different maturity levels.

The results show that despite the recent group efforts to improve SAM maturity the overall conclusion is that the group is still at Basic Level and vision, goals and objectives to be achieved with a global SAM still need to be approved. This project was the first enterprise initiative to promote SAM awareness in the group under the sponsorship of the Board of Directors and has allowed to understand the current SAM maturity, for the group and each of the six companies, define the desired SAM maturity and also determine all initiatives that must be implemented to achieve the target maturity within the next twelve months.

Key-words

Software Asset Management (SAM), Software Piracy, Intellectual Property (IP), SAM Optimization Maturity Models (SOM)

Executive Summary

Software vendors, as investigated by Flexera & IDC (2013), are continuing their aggressive practices of auditing their customers for software license compliance with 63% of companies been audited in the last 18-24 months. This is not an isolated incident as 37% of the companies claim to have been audited two or more times over the last 18-24 months, with a focus on large companies (i.e., a third being audited three times or more). Besides the significant effort that these audits represent to the companies (16% took more than 6 months to complete), according to Express Metrix (2013), they also represent significant non-planned costs for the companies (with 10% of the companies claiming to have paid over 500.000€ for each contract year),

Furthermore, considering that software costs are increasing every year and represent nearly 25% of the IT budget of companies (Forrester, 2013) and that compliance with legal and contract requirements are mandatory for each organization it is clear that this should become a top level management.

Nevertheless, the endless number of software products, the different hardware platforms where these are installed, the different license metrics and the contract and different and specific licensing rules are a challenge when a company needs to perform a compliance reconciliation with the cost of implementing an asset management program being significantly less than the out-of-compliance and additional license fees (Gartner, 2009), especially if no processes, teams and automated solutions exist to support the SAM function.

Aware of this concern but also the challenges and the potential benefits that SAM management can provide it was agreed with a Portuguese economic group (hereafter called “GAS” and not disclosed as agreed with the group) to investigate how all of their six companies (of different business sectors) are performing SAM and to determine the current level of maturity, considering the Microsoft SAM Optimization Model (SOM), which was assessed in all its ten core competences, either at group or company level.

This project was performed with the support of the Board of Directors of the company that will lead the SAM in the group and has allowed to conclude that the group is at Basic Level, with a total of seven core competences/ variables at this level (in a total of five companies) and five for

Company 4. It is also relevant to mention that five companies have already three core competences/ variables at Standardized Level and Company 4 has already five, meaning that some efforts have been given to rapidly allow the group to increase its global SAM maturity.

A total of forty SAM risk were also identified according to the processes defined by ISO 31000:2009 for a high-level risk assessment, considering the current SAM overall maturity of the group.

Considering the same SAM maturity model it was also defined the target maturity level for each core competence with a total of nineteen initiatives have been identified that need to be implemented, and the time required for each within a twelve months period, in order to allow the company to move to the "next level" whilst maximizing SAM benefits and reducing SAM risks.

This project has allowed the group to be more aware of their current strengths and weaknesses, especially at executive level, and was considered as the first step to create a corporate awareness for this topic and reinforcing the need to have a dedicated SAM function for the group. Such visibility and consciousness is highly important as "… generally organizations that have made an effort related to SAM appear to have started by assigning SAM roles and responsibilities throughout the organization" as verified by KPMG in their latest survey in 2008.

Resumo

A presente tese consiste no projecto que foi efectuado para aferir a maturidade da gestão de activos de *software*, tendo por base um modelo de maturidade de gestão de activos de software, de um grupo Português, composto por seis empresas que actuam em diversos sectores da nossa economia, a fim de compreender se o grupo estava a tomar todas as medidas necessárias para prevenir os riscos de não cumprimento legal e regulamentar associados à temática do software e para obter o máximo de benefícios associados à gestão dos activos de software. O modelo de maturidade de gestão de activos de software adoptado teve por base o Microsoft SAM Optimization Model (SOM) que contempla um total de dez competências, cada um com quatro níveis de maturidade distintos.

Os resultados obtidos permitem concluir que apesar dos recentes esforços por parte do grupo para melhorar a maturidade nesta área o grupo ainda está no nível Básico e não existe uma visão e objectivos a atingir aprovados que permitam definir o caminho a seguir. Este projecto foi, no entanto, a primeira iniciativa transversal para promover o tema de forma corporativa, com o apoio da Comissão Executiva, e permitiu aferir o nível de maturidade actual, no grupo e em cada uma das seis empresas, bem como o nível de maturidade desejado para o grupo e o conjunto de iniciativas a implementar no período de doze meses de modo a atingir o estágio pretendido.

Palavras-chave

Gestão de Activos de Software, Pirataria Informática, Propriedade Intelectual, Modelos de Maturidade de Gestão de Activos de Software

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Table of Acronyms

The following table describes the significance of various abbreviations and acronyms used throughout the thesis. Nonstandard acronyms that are used in some places to abbreviate the names of certain white matter structures are not in this list.

Abbreviation	Meaning
ADAPSO	Association of Data Processing Service Organizations
BSA	Business Software Alliance
CMDB	Configuration management database is a repository that acts as a data warehouse for IT organizations
COBIT	Control Objectives for Information and Related Technology
FPP	Full package product
IP	Intellectual property
IT	Information technology
ITIL	Information Technology Infrastructure Library
ISACA	Information Systems Audit and Control Association
ISO	International Organization for Standardization
OEM	Original Equipment Manufacturer
OGC	Office for Government Commerce (now known as Axelos that is a joint venture set up in 2014 by the Government of the United Kingdom and Capita)
PMM for ITAM	Process Maturity Model for IT Asset Management
SAM	Software Asset Management
SOM	SAM Optimization Model
SEI	Software Engineering Institute's
SOX	Sarbanes–Oxley Act, is an Act to protect investors by improving the accuracy and reliability of corporate disclosures made pursuant to the securities laws, and for other purposes
SPA	Software Publishers Association
WIPO	World Intellectual Property Organization

1. Research Problem

Recently a significant increase of software license audits has been broadly reported by the media, organizations, industry analysts and SAM tool / providers. The increase of software license audits, usually required by the owners of the software intellectual property (hereafter called software producers), has led to significant non-compliance findings that can represent substantial non-planned costs, besides legal, brand, operational and relational impacts and costs.

Furthermore, and also considering that software budgets are increasing at a very high pace every year, companies are turning to SAM in a more proactive approach in order to maximize their return on investment and also reduce the above mentioned risks, through all software lifecycle stages (i.e. requirement, evaluation and procurement (or design and build if needs to be developed), deployment, operation, optimization (or retirement if no longer needed)) as defined by ITIL V3 guide to software asset management (Rudd, 2009).

Nevertheless, the endless number of software products that are used by each company, the many different hardware platforms where each software product can be installed, the range of different license metrics that one single software product can be licensed and the many contract and licensing rules that are established by the software producer (that can also change over the years) can turn a software license compliance reconciliation into a daunting and very demanding initiative, not only regarding the time needed to complete it but also the financial and human resources that need to be allocated, that could have been assigned to other more added value initiatives.

Therefore, and despite all companies acknowledges that software contract clauses and rules must be strictly respected as it is a legal responsibility and even if some companies have already implemented SAM teams, processes and tools the average non-compliance software costs are still, in more than 50% of the cases, over EUR 100.000 (Flexera & IDC, 2013).

The research problem that the current project aims to respond was to assess how a group of six companies, of a Portuguese economic group (hereafter called “GAS” and not disclosed as agreed with the group), manage their SAM processes, tools and people and to determine recommendations to improve SAM overall maturity in order to reduce risks of non-compliance of current and future software contracts as well as to optimize software costs by acquiring/ maintaining only the software needed.

2. Literature Review

Intellectual Property

Intellectual property (IP) refers to creations of the mind, such as inventions; literary and artistic works; designs; and symbols, names and images used in commerce. IP is protected in law by, for example, patents, copyright and trademarks, which enable people to earn recognition or financial benefit from what they invent or create. By striking the right balance between the interests of innovators and the wider public interest, the IP system aims to foster an environment in which creativity and innovation can flourish, as defined by the World Intellectual Protection Organization (WIPO).

Over the last decades mankind has done scientific as well as technological progresses that are now part of every day's life of man. This evolution is applicable to products that were invented many years ago, and are being improved continuously, or to new products to respond to emerging needs/ concepts, in all business sectors. This continuous and rapid advancement is even more significant in the information technology and communication area.

Still, managing software IP poses different challenges because what is sold is the use of the software by granting a license, rather than the software product itself, and the license can include the software but also the technology, the hardware (e.g. OEM) and/ or specific components. (Chavez *et al*., 1998; Rice, 1990). It also includes source code, assembly code and object code and even firmware (Bently and Sherman 2009).

Software, being widely accepted as an intangible asset as it is written (and can be readable) like a book, also differs from other intangibles as it can perform work like an invention and is governed by legal agreements called software license (Douglas, 2011), and is both privately owned and publicly distributable (Nancy, 2008).

Over the last decades several legislations, concerning software protection, have been released in order to clarify and protect intellectual property, being the most relevant ones the following: (i) Copyright, Designs and Patents Act by USA in 1998, (ii) Violation of Copyright and Related Rights Regulations by USA in 2003, (iii) European directive on the enforcement of intellectual property rights (2004/48/EC) and (iv) Action Plan to address infringements of intellectual property rights in

the EU and a Strategy for the protection and enforcement of IP rights (IPR) in third countries by the EU in 2014.

On the economic side this is also an actual concern as it is proven that the countries that are more able to produce and protect their intangible asset are the ones better suited to face and handle economic turmoil (Hamister and Braunscheidel, 2013). The USA is referred as the best example as they are the largest world economy, the country with the largest investment in R&D globally, the 6th country in R&D per capita, with 8 companies in world top-20 (Strategy&, 2014) and one of the countries with the lowest software piracy rates worldwide (The Software Alliance, 2011).

In Portugal, the IP of software is considered part of author's rights clauses, allowing the legal protection of software products, as software is considered an intellectual creation, and therefore may be protected by copyright as long as it is creative in nature. This is defined by the Council Directive of 14th of May of 1991, concerning legal protection of software programs (91/250/CEE), and the Council Directive n. º 93/98/CEE of 29th of October of 1993. More recently the European Directive n. º 2004/48/CE was transposed to Portugal through the Law n. º 16/2008 of 1st of April of 2008.

Nevertheless, the latest result published by the Business Software Alliance (BSA*)* in 2011 estimates a software piracy rate of 40% in Portugal, meaning that there is still a long way to progress regarding intellectual property protection, knowing that this is also heavily influenced by each country wealth and national culture (Hamister and Braunscheidel, 2013).

Software Piracy

"Software piracy is theft" (Aminmansour, 1996) is a widely and commonly accepted statement. BSA estimates that lost revenues due to piracy amounted to over $63 billion in 2012 and one in five copies of business software is pirated.

Nevertheless, the complexity around intellectual property protection, as explained in the previous section, plus the social factors and social structure of the society (individualist *vs* collectivist), high software price, risk of penalties and moral factors at an individual level and the lack of domestic software industry and economic wealth at a social level are the most supported factors behind software piracy (Karakaya and Ulutürk, 2011) and can help to explain the high software piracy rates in each country.

Indeed, most people would never consider stealing something that did not belong to them but those who use software without authorization are, in fact, stealing intellectual property. They are breaking the law, even though many of the users are not really aware of this crime as they may think that when they purchase software they become owner of the copyright, allowing them to make several copies, install it in several machines or loan it to others. This is not the case and what is bought is the right to use the software under certain restrictions imposed by the copyright owner, described in the documentation accompanying the software — the license (Loughlan, 2007).

Software producers also play a critical role in this turmoil as companies and users need a constant and clear communication, through training, of the different licensing models (e.g., freeware, *freemium*, GPL, trial), contracts (e.g., subscription, yearly, monthly, perpetual), license metrics (e.g., user, socket, device, core, processor) and the constant changes that can occur, even during the contract term, besides legal remedies (Athey and Plotnicki, 1994; Subhani, 2012).

Still, over the last decades, companies are more aware of the problem and made important efforts to solve it, even though acknowledging that the eradication of the problem will be hard to achieve (Micossi, 1985; Express Metrix, 2013; Belleflamme and Peitz, 2014). More recently, compliance with software license contract clauses by the companies has become a top level management issue with several initiatives (e.g., internal audits) being rolled out in several companies around the world, leading to the conclusion that companies are now in an “unconscientious software piracy stage”, as, despite all the efforts over the last two years, companies had, in more than 50% of the software audits, non-planned costs of over EUR 100.000 (Flexera and IDC, 2013).

Research by Express Metrix (2013) has determined the main reasons that explain companies difficulties in dealing with SAM, being the most common challenges, as described in Figure 1, the difficulty to interpret/ understand contract agreements, complex IT environment (that was detailed as presented in Figure 2 with the most relevant constraints being the diversity of software portfolio, company size and virtualization), control/ metering of what is in use and by who and the difficulty to create and maintain a license position (i.e., ensuring that software deployments is aligned with software entitlements).

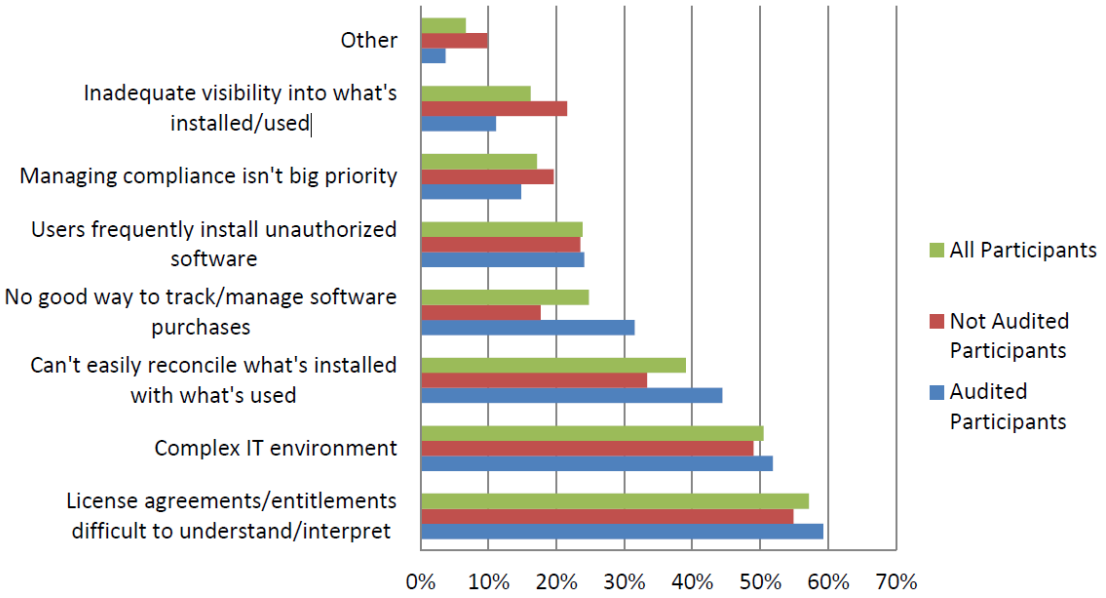

FIGURE 1 - SOFTWARE COMPLIANCE CHALLENGES IN AN ORGANIZATION (EXPRESS METRIX, 2013)

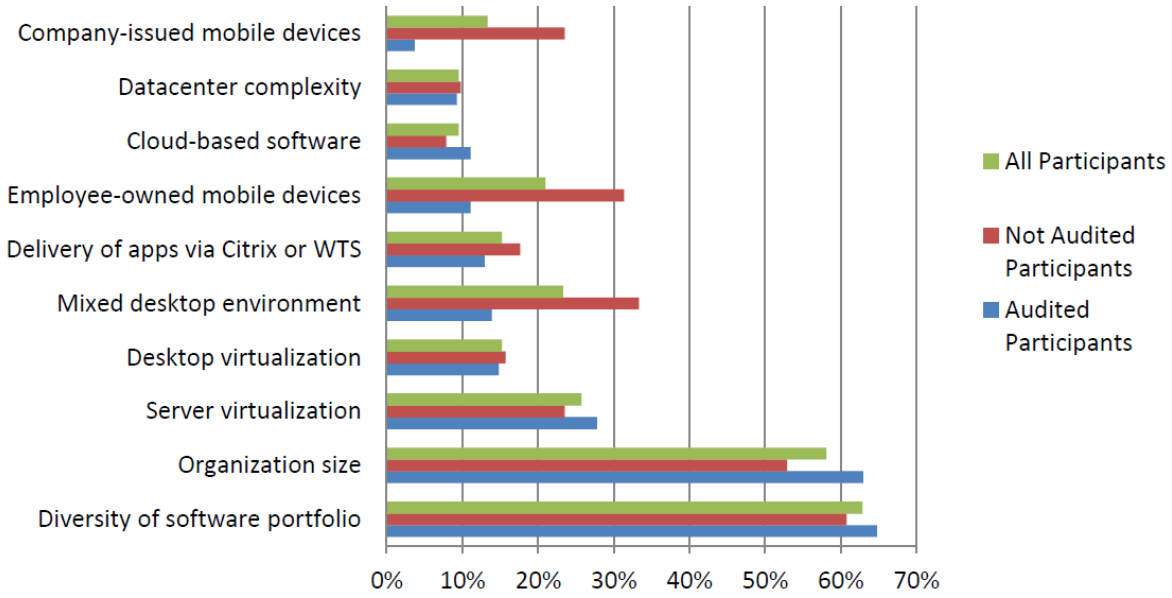

FIGURE 2 - TECHNICAL CONSTRAINTS ASSOCIATED WITH SOFTWARE COMPLIANCE (EXPRESS METRIX, 2013)

Software Audits (internal and external)

To address top level management concerns internal audit departments have begun to conduct software training/ awareness and software audits on a regular basis (Kaplan, 1994), in order to promote software compliance with their "end-users" – the employees. The same principle has been followed by the software producers that, in 1961, decided to be more proactive and created the Association of Data Processing Service Organizations (ADAPSO) that together with Software

Publishers Association (SPA) (later on changing the name to Business Software Alliance – BSA) begun to conduct software training/ awareness and software audits on a regular basis with their "end-users" – the companies – through their Compliance departments.

These compliance departments usually establish Compliance Programs that ought to be applied to all companies on a regular basis (e.g., every 3 or 4 years) with the reasoning that compliance is now widely accepted in several geographies around the world (e.g., North America, Europe, Asia and Australia), even though it is also a fact that revenues are declining for software producers and these are seeking to supplement their bottom line with new licensing fees, threats of audits and law suit and even raids on businesses causing disruption or shutting down operations (Kamal and Petree, 2006).

As determined by a specific contract clause (that defines how the Compliance Program is to be applied) the software producer demands customer, using their own teams or with the support of external auditors, to provide a license position, which can be a very painful exercise depending on each company software asset management maturity (Wesche and Disbrow, 2009).

Flexera & IDC (2013) has determined that the time and effort spent in a software audit is mentioned as the major concern (nearly 70% of the cases) and in average a software audit takes more than 3 months to be completed (nearly 45% of the cases). Therefore, it is critical that companies are able to duly prepare themselves to face an external software audit as, according to the survey conducted by Flexera & IDC (2013), more than 50% of the companies had to deal with an external software audit over the last two years, with Microsoft being the most likely software producer to activate the audit clause (nearly 70% of the cases).

Software Asset Management Standards

It was in 2006 that the International Organization for Standardization (ISO) published the first standard (i.e., ISO/IEC 19770-1:2006) regarding SAM and defining it as the "effective management, control and protection of software assets within an organization, and the effective management, control and protection of information about related assets which are needed in order to manage software assets". Later updated in 2012 (i.e., ISO/IEC 19770-1:2012), this standard establishes a baseline for an integrated set of processes for SAM, divided into tiers to allow for incremental implementation, assessment and recognition of software and related assets, regardless of the nature of the software, and that can be implemented by organizations to achieve immediate

benefits. This standard also encompasses other fours parts, namely: (i) ISO/IEC 19770-2, provides an ITAM data standard for software identification tags ("SWID"), (ii) ISO/IEC 19770-3, provides a technical definition of a schema that can encapsulate the details of software entitlements, including usage rights, limitations and metrics ("ENT"), (iii) ISO/IEC 19770-4, provides a standard for resource utilization measurement information (RUM) structures and (iv) ISO/IEC 19770-5 provides the overview and vocabulary.

In 2009 the Office for Government Commerce (OGC) published ITIL[1] version 3 (later updated in 2011), including for the first time an appendix specific about SAM (i.e., ITIL V3 Guide to Software Asset Management), aligned with ISO/ IEC 20000[2] and considered as a practical approach to the management of software assets in companies.

There are other IT governance frameworks that mention SAM indirectly. One of these framework is COBIT, that is published by ISACA, as is a comprehensive framework to achieve governance and management objectives for enterprise IT. COBIT can be used to link strategic enterprise goals back to the day job via processes and procedures. The following COBIT processes could be used to map the maturity of your SAM processes (ITGovernance, 2005; ITAssetManagement, 2014):

- ME3 Monitor compliance with external regulations
- DS2 Manage third party services
- DS9 Manage the configuration
- PO3 Determine technological direction
- PO4 Define the IT organization and relationships
- PO5 Manage the IT investments
- AI1 Identify automated solutions
- AI2 Acquire and maintain application software
- AI6 Manage changes
- AI7 Install and accredit solutions and changes

Common to all of these standards is the concern to manage and protect each software asset during their entire lifecycle, commonly referred to as cradle to grave, birth to death and acquisition to disposition. The cycle involves: request, the request approval, the order, receiving of the order, installation/move/add/change (IMAC), refresh and disposition (Kamal and Petree, 2006).

[1] Information Technology Infrastructure Library
[2] International standard for IT service management.

The support/ maintenance phase represents the major portion of the life of the asset in the enterprise. From the move of the asset from the point of receiving to the point of installation, through the installation and post installation changes during active production usage to potential moves and reinstalls this stage of the asset's life cycle is extremely varied and is hard to manage simply due to the variety of possible IMAC events (Kamal and Petree, 2006).

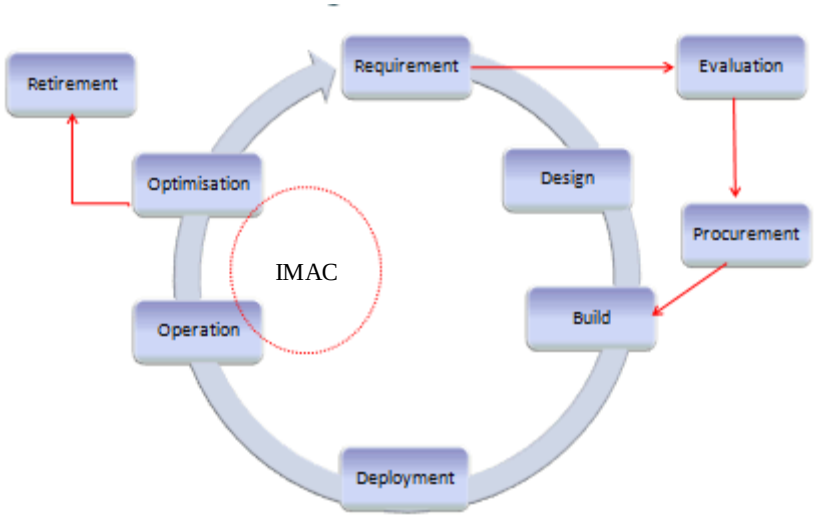

FIGURE 3 – ITIL V3 SOFTWARE ASSET LIFECYCLE (ITIL V3 GUIDE TO SOFTWARE ASSET MANAGEMENT)

The adoption of standard by the companies is still at an early stage as stated by Garther (Meehan, 2002) where nearly 30% of the companies have classified themselves in the lowest level (i.e., Chaotic) and 45% on the next level (i.e., Reactive), from a scale of 5 stages. KPMG has reconfirmed this figures in 2008 where 60% of the companies have classified themselves in the lowest level (i.e., Basic), meaning that in 6 years little progress have been achieved by companies in order to reduce the legal and reputational risks as well as non-planned costs that can derive from an external software audit, besides not taking the full potential of the benefits of SAM.

Software Asset Management Benefits

There are several direct and indirect benefits that a company can obtain when they adopt SAM. These can be grouped into five different categories (KPMG, 2013):

- Optimize IT Management as an accurate hardware and software tracking provides a deeper insight into current architecture allowing a company to better plan their IT strategy and also anticipate and mitigate software risks (e.g., older versions without the latest security

updates, software not authorized, software not certified). There are also labor cost savings and/or reduced application complexity and maintenance and support costs – Gartner estimated in 2003 that nearly 50% of the time spent by a helpdesk technician on a call is spend trying to understand hardware/ software configuration.

- Better negotiating position are also an advantage as companies can create a more proactive and strength position by negotiating discounts on products they actually need (currently and for the future in line with the IT strategy), instead of buying what they believe they need/ will need. At the same time companies will also be better prepared to evaluate service offerings and negotiate price, allowing them to choose what is best for the company according to the real needs. Finally, companies, especially large groups, can obtain significant large discounts if purchases are made as volume purchase agreements or bundled services, instead of "ad-hoc"/ project/ department oriented purchases.
- Improve and ensure compliance is also promoted as only authorized and licensed software is installed/ in use allowing companies to be better prepared to respond to an external software audit, reducing the time and effort required to complete the audit but also reducing the potential non-compliance findings. At the same time companies are also less likely to face an external software audit – the perception, by the software producer, that the return on investment from the software audit is likely to be small due to the fact that the company has SAM in place might explain the reason that such companies have been 32% less audited than companies without SAM (Flexera and IDC, 2013);
- Clearer understanding of needs and usage as only the software needed is installed/ in use and access is given to those that really need it, allowing also an improvement regarding IT security/ access controls, besides the fact that through a regular monitoring of the software in use companies can achieve significant savings on hardware and software – IDC Research estimates that good practices around the lease/buy decision, standards of acquisition, authorizations, requisitions and receiving yield a 160% cost advantage to the practicing enterprise (Kamal and Petree, 2006), being this topic more and more relevant today with software costs representing nearly 25% of the IT Budget (Forrester, 2013).
- There are other side benefits to change management processes, as it ensures that the CMDB is updated and contains all relevant software details, which is critical to software development and IT administration, and at the same time provides valuable inputs to

Business continuity management, simplifying the tracking of applications that support critical processes, and that will need to be recovered in cases of an incident, besides ensuring that disaster recovery solutions are the same that the production ones.

Software Asset Management Maturity Models

The maturity model concept comes from SEI Capability Maturity Model, based on the process maturity framework described by Watts Humphrey in 1989. The basic idea of this concept is that organizational processes will become more mature over time and each maturity level will lead to higher efficiency and effectiveness.

This principle is applicable to many areas, including SAM, and the next stage yields savings that can lead to lower costs, improved asset usage, and lower risks. One stage delivers logical blocks that are needed for the subsequent stage, as an evolutionary process. Each provides a descriptive state of the processes while also establishing actions that can be taken to move to the next stages, in order to achieve a higher maturity. Failing to go through each stage might lead to failure or greater difficulty to achieve the desired benefits (Adams, 2003).

Distinct SAM Maturity Models have been adopted by companies over the years. Some of these models focus on the maturity of the asset itself – from purchase to retirement – while others focus on the maturity level of the company and its ability to successfully manage software assets. This later models provide a clear and not so technical perspective of how a company should handle SAM from a global perspective, being more easily adopted and understood by the top level management (Adams, 2003).

Despite no publication have been found regarding what are the most used SAM Maturity Models most of these are built around the Microsoft SAM Optimization Model – SOM, which was developed together with KPMG as part of a Microsoft sponsored initiative and the Process Maturity Model for IT Asset Management – PMM for ITAM, proposed by Patricia Adams in 2003.

The SOM provides a framework to evaluate the maturity of SAM processes, policies and tools. The model maps to the ISO/ IEC SAM standard 19770-1 and is based on the Infrastructure Optimization model. SOM outlines four stages of maturity and allows a company to determine its maturity level based on a total of ten key competences, besides also determining the requirements to achieve the next maturity level for each key competence.

FIGURE 4 – MICROSOFT SAM OPTIMIZATION MODEL (SOM) LEVELS

	BASIC	STANDARDIZED	RATIONALIZED	DYNAMIC
SAM Throughout Organization	Project Manager assigned but SAM roles & responsibilities not defined	Direct SAM responsibility is identified throughout organization	Each functional group actively manages SAM	SAM responsibilities defined in job descriptions across organization
SAM Improvement Plan	No SAM development or communication plan	SAM plan is defined and approved	SAM Improvement is demonstrated	SAM goals part of executive scorecard; reviewed regularly
Hardware & Software Inventory	No centralized inventory or < 68% assets in central inventory	> 68% - 95% of assets in inventory	> 95% - 98% of assets in Inventory	> 99% of assets in inventory
Accuracy of Inventory	Manual inventory; no discovery tools	Inventory sources reconciled annually	Inventory sources reconciled quarterly	Dynamic discovery tools provide near real-time deployment details
License Entitlement Records	Procurement manages contracts; not accessed by IT managers	Complete entitlement records exist across organization	Entitlement records reconciled with vendor records	SAM entitlement system interfaces with vendor entitlement to track usage
Periodic Evaluation	IT operations managed on ad-hoc basis	Annual sign-off on SAM reports	Quarterly sign-off on SAM reports	System reconciliations and ITAM report available on demand
SAM Operations Mgmt & Interfaces	SAM not considered part of M&A risk plan and company integration	Operations manages separate asset inventories	Operations manages associated asset inventory	All business units follow the same strategy, process & technology for SAM
Acquisition Process	Assets purchased on a per project basis; without a review of current availability	Software purchases use approved vendors	Software purchases based on deployment/entitlement reconciliation	All purchases are made using a pre-defined asset catalog; based on metered usage
Deployment Process	Assets deployed by end-users in distributed locations; no centralized IT	Only approved software is deployed	Software deployment reports are accessible to stakeholders	Software is dynamically available to users on demand
Retirement Process	Software is retired with hardware and is not harvested or reassigned	Unused software is harvested (where the license allows) and tracked within a centrally controlled inventory	Centrally controlled inventory of harvested licenses is maintained & available for reuse. Deployment & license records are updated	Automated process w/ centralized control & tracking of all installed software, harvest options, internal reassignment and disposal

FIGURE 5 – MICROSOFT SAM OPTIMIZATION MODEL (SOM) COMPETENCES

The PMM for ITAM defines a total of five levels of maturity and the attributes and goals of each (i.e., chaotic, reactive, proactive, service-oriented and value creation), as can be observed in Table 1.

Step	Attributes	Goals
1. Chaotic	No processes, dedicated people or tools No assigned accountability or accounting for changes Unpredictable services, support and costs	"Just want to know what we own, where it is, and who is using it" One-time activity rather than systematic process

Step	Attributes	Goals
Uncontrolled environment	Purchasing is ad hoc Unused hardware and software are not controlled Success depends on quality of people, not processes Sub-optimization of efforts occurs	
2. Reactive Limited accountability	Focus is on asset counting Employs physical inventory and some auto discovery recorded on spreadsheets or in a database Accountability lies with IS organization but there is ineffective change accounting Hardware and software viewed separately, not as single complex asset	Perform annual physical inventory and periodic spot audits Report on asset counts, but cannot produce solid detail data to identify and resolve problems
3. Proactive Life cycle focus	There is an IT Asset Program and manager with dedicated staff that reports to IS and finance organizations. ITAM with auto discovery tools is integrated with service desk Use of cross-functional teams for major asset management projects Life cycle management process goes from requisition, to deployment, to retirement Inventory system linked to financial and contractual data	"Clearly defined processes with accountability that detail the practical application of people, processes and tools that support the ITAM Program" Effective change and configuration management processes ITAM projects use repeatable processes that are well defined, adhered to, reviewed, and re-engineered when necessary. ITAM operations manual with asset taxonomy produced and maintained
4. Service Oriented Service level management	Metrics are available to measure program value Services are delivered according to SLA-based plans TCO processes in place Automated requisition is integrated with purchasing and ERP systems Just in time inventory practices used	Create SLAs for asset management and use them as a basis for planning Conduct periodic reviews of service delivery quality Institute an enterprise technology refresh plan for replacement and retirement of equipment
5. Value Creation	There is a cost recovery process Repository, auto discovery and asset-usage tools all in place Seamless integration with strategic systems like HR, accounting, ERP, purchasing, network and systems management, IT service desk, problem and change management tools, and business continuity process Decision support and analytic tools available for mining asset information	Continuous process improvement with improving metrics ITAM data used for problem prevention ITAM is a core business process and business enabler Measurement of efficiency (employee productivity) and effectiveness (customer satisfaction) of business processes across all IT assets in the enterprise.

TABLE 1. PROCESS MATURITY MODEL FOR IT ASSET MANAGEMENT (ADAMS, 2003)

Software Asset Management future challenges

The recent trends in software licensing, that will impact SAM, seem to point to more and more subscription basis or Software as a Service (SaaS) – available only during a determined period in time, with almost all major software producers already offering this type of licensing (cloud based or not, even though cloud based solutions are likely to be the next generation architecture as cloud computing has changed the way the enterprises – especially the small and medium enterprises – look at their business solutions as instead of investing their capital in purchasing the traditional,

stand alone on-premises hardware, software and other infrastructure and hiring trained professionals for the job, the cloud services available over the Internet, are utilized as explained by Sharma and Sood (2011)). Whilst this license metric might be very good to reduce software piracy it might also create additional challenges as it will impact software license metrics, terms of use and pricing, that will need to be communicated in a clear and helpful manner so that companies know exactly what their rights are and how much they will pay.

Another challenge that the software producers are already facing is the resale of software (or second-hand software) by companies that have upgraded their software to more recent versions and possess perpetual licenses of older versions of software no longer needed. These older versions are company assets and as such should be allowed to be sold to another company that does not require the most recent versions. Being a fairly new concept there are already favorable decisions in Europe, as according to the Court of Justice of the European Union (2012), once a software producer sells a copy of its computer program, it loses its exclusive rights to distribution. This ruling is based on an interpretation of Directive 2009/24/EC of the European Parliament and of the Council, dated 23 April 2009. Naturally, software producers are still trying to prevent this decision to become widely accepted (not only on Europe but around the world) as it will drastically reduce sales (Nancy, 2008).

A final challenge worth mentioning is Bring Your Own Device (BYOD) architecture that has evolved rapidly and has become widely accepted as one of the key initiatives from enterprise IT services towards the path to be virtual enterprise. It triggers various issues and challenges in term of technical and user behavioral with impacts, amongst others, in software licensing regarding whether it should be genuine and who should bear the cost of the license (Boon and Sulaiman, 2015).

3. Conceptual Framework

Once we have established that software, independent if it is a tangible or intangible asset, is a strategy and valuable company asset and that each company is corporately responsible to ensure software producers intellectual property is duly protected, the main question to be asked is if GAS is taking all necessary measures to prevent software non-compliance risks whilst maximizing SAM benefits? This question was split into three more focused and practical questions, namely:

- International standards can facilitate trade, spread knowledge, disseminate innovative advances in technology, and share good management and conformity assessment practices as they are created by experts in the subject drawn directly from the industrial, technical and business sectors that have identified the need for the standard, and which subsequently put the standard to use, by defining rules, guidelines or characteristics for activities or their results (as defined in ISO/IEC Guide 2:2004), besides also easing benchmarking between companies and facilitating the adoption of lessons learned (and avoid previous pitfalls). Adopting an approach that is based on an international standard, and specifically an approach that integrates a maturity model, will allows companies to have an organized strategy for continuous improvement, facilitating the consensus between management and the professional staff on what is the evolutionary path and the stages that compose these path, ordering these so that improvements at each stage provides the foundation on which to build improvements undertaken at the next stage (Humphrey, 1988). Therefore, and considering a SAM maturity model that is based on an international standard, the first question is what's the group current SAM maturity level?
- Considering that nearly all software producers are adopting software audits as their main compliance mechanism, leading to a significant decrease of time elapsed between audits, and the significant collateral impacts, financial and non-financial, that most of the time arise from these audits the second question is what are the risks that the group faces due to poor software asset management?
- Finally, based on the same specific SAM Maturity Model, the last posed question is what's the desired maturity level that the group aims to be, regarding their capability to deal with SAM, and the initiatives that need to be implemented and the effort required for each initiative to allow the group to reach the "next level"?

4. Methodology

GAS

GAS's operations in Portugal started in the 19th century and is today one of the largest Portuguese economic groups, with a wide portfolio of operations in several vital sectors of the Portuguese economy, ranging from infrastructures, mobility, industry, energy, environment, transport and logistics, chemical industry, public and private health care, senior care and home care, besides other participations in smaller companies operating in other areas, with more than 13.000 employees.

The group is composed of six companies, each acting in different business areas, all managed under a holding. GAS's strategy is that each company should be, as much as possible, managed independently and this strategy encompasses also Information Technology area, meaning that there are a total of six IT departments, each with different teams, infra-structure, applications and processes.

An overview of each company, from an organization point, of view is described in Table 2, and from an IT perspective is presented in Table 3.

Organizational Overview	Area/ Sector	Geographic Distribution	Number of Employees	Turnover/ Net Profit[3]
Company 1	Holding	Headquartered in Lisbon in one single building. Manages also four other smaller companies.	Not available	€1.721M/ Not available
Company 2	Infrastructures and mobility	Headquartered in Lisbon area. Manages three different buildings. Manages also ten smaller companies	2.327	€559.6M/ €54M
Company 3	Health care	Headquartered in Lisbon area. Manages 5 hospitals, 5 clinics and other medical facilities around Portugal	6.000	€482.4M/ €12.6M
Company 4	Industry/ Energy	Headquartered in Porto area.	4.500 (worldwide but agreed scope was only Portugal)	€692M/ €90.5M.

[3] Group public indicators from 2013

		Manages 3 buildings in Portugal and 2 outside Portugal		
Company 5	Infrastructures and mobility	Headquartered in Lisbon area. Manages 1 building.	185	€54M/ €78.8k
Company 6	Chemical	Headquartered in Lisbon are. Manages three buildings around Portugal.	336	329.5M/ €2.7M.

TABLE 2. GAS ORGANIZATIONAL OVERVIEW.

IT Overview	Size of IT Department	Number of Datacenters	Number of Domains	Number of Assets[4]
Company 1	4	1	1	291
Company 2	19	1	5	1.332
Company 3	10	1	4	3.046
Company 4	Not determined	1	6	3.481
Company 5	6	2	1	190
Company 6	10	1	3	370

TABLE 3. GAS IT OVERVIEW.

The main reasons to choose GAS for the current project were: (i) group interest in developing a project to assess and improve current SAM maturity, (ii) group size and relevancy in the Portuguese economic context, (iii) being a company with a decentralized IT management and the vision of the customer to develop a more centralized, efficient and cost-effective model to manage software assets (i.e., one single company would need to have the global overview and manage SAM for the entire group).

Research methodology

Maturity models are seen as models that reflect certain aspects of reality, often called capabilities, and define qualitative attributes which are used to classify a competence object into one of several clearly defined classes. These classes are typically brought into a sequential order (Kohlegger *et*

[4] Based on the agreed scope and considering the hardware inventories approved by each company

all, 2009). The choice to apply a Maturity Model implies the usage of a qualitative investigation. The focus of this type of investigation lies in comprehension of words, opinions, experiences and evidences instead of figures, besides being more focus on individuals as well as more inductive and subjective as the investigation is impacted by the context and the subjects background.

When choosing the research methodology two concepts need to be considered, namely reliability and validity. The first one refers to whether a replication of the process with different subjects or with the same subjects in different conditions would provide the same outcome (Silverman, 2006). In qualitative interviews it might be a challenge to ensure reliability as the outcomes are a reflection of the circumstances of the interview and how it was conducted (Pole and Lampard, 2002). Silverman (2006) suggests mechanisms to promote a solid qualitative research that has been respected by this thesis. First, the process should be transparent so that it can be observed, understood and replicated and second the researched should have access to the results obtained. This was followed on this thesis as the interview guide was provided prior to the interview (as explained in the next section) and a meeting note was provided to the interviewed after the meeting was held. The method and instrument was not pre-tested as they were already used in several other similar projects.

The second topic is validity meaning that the question is if the study is able to assess what is intended to measure (Silverman, 2006). As the project was performed using methods and instruments that are used in several other similar projects, and therefore likely to be "well-grounded conceptually and empirically", and this promoting the validity required (Pole and Lampard, 2002).

The instrument and variables

The project was based on a descriptive and comparative analysis considering a SOM used by my company on similar projects encompassing a total of ten core competences, each aiming to obtain a specific goal, aligned with the ISO 19770-1 and grouped into five sections (i.e., Organization Management, SAM Inventory, SAM Verification, SAM Operations Management and Interfaces and Lifecycle Process Interfaces). Table 4 presents a summary of the ten core competences/ variables and its goals/ central topic, grouped into the five ISO 19770-1 sections.

ISO 19770-1 Sections	#	Core Competence/ Variables	Goal / Central Topic
Organization Management	**P01**	a. SAM Throughout the Organization	SAM is actively managed across the organization in the individual groups

ISO 19770-1 Sections	#	Core Competence/ Variables	Goal / Central Topic
	P02	b. SAM Improvement Plan	Proven SAM Optimization
SAM Inventory	**P03**	a. Hardware and Software Inventory	The hardware and software inventory covers a large part of the costs calculated.
	P04	b. Accuracy of Inventory	The hardware and software inventory covers a large part of the costs calculated.
SAM Verification	**P05**	a. License Entitlements Records	Entitlements are compared with the suppliers data
	P06	b. Periodic Evaluation	Regular audits of SAM reports
SAM Operations Management and Interfaces	**P07**	a. Operations Management Records Interfaces	IT manages a consolidated resource inventory
Lifecycle Process Interfaces	**P08**	a. Acquisition Process	A gap analysis is performed between the deployments and the entitlements before the purchase of software,
	P09	b. Deployment Process	A gap analysis is performed between the deployments and the entitlements before the purchase of software,
	P10	c. Retiring Process	Retiring Software is re-used.

TABLE 4. ISO 19771 AND SOM MAPPING.

For each core competence several closed (e.g., Is there a central inventory? Is the use of the Software recorded?) and open (e.g., Which tools will be used for inventory and how?, How often is used software compared with the existing licenses purchased?) questions are to be made in order to define the current maturity level of the group/ companies, considering the SOM predefined maturity levels (i.e., Basic, Standardized, Rationalized and Dynamic).

Each maturity level also determines the requirements/ guidelines for the next desired maturity stage, helping GAS to determine the initiatives that will need to be implemented to evolve in the short/ medium and long term.

As previously explained, GAS internal structure lead to the fact that several of the ten core competencies/ variables where being managed by each company and in some cases were managed by one single company, that liaised with all the others, creating the need to a taylor made approach. As such, it was agreed that some key competencies were to be address at group level (i.e., with Company 1 as the key contact point) while others ought to be addressed at company level, as described in Table 5. One core competence/ variables was agreed to be evaluated at group and company level.

ISO Criteria	#	Core Competence/ Variables	Evaluation Approach	Reason
Organization Management	**P01**	SAM Throughout the Organization	Group	Company 1 was assigned as responsible for managing SAM across the group
	P02	SAM Improvement Plan	Group	
SAM Inventory	**P03**	Hardware and Software Inventory	Company	Hardware and software inventories are managed by each company
	P04	Accuracy of Inventory	Company	
SAM Verification	**P05**	License Entitlements Records	Group	Company 1 was assigned as responsible for tracking of all licenses purchases across the group
	P06	Periodic Evaluation	Group / Company	Periodic evaluations are conducted by each company every year. Company 1 is also responsible to consolidate results at group level, special at contract renewals periods.
SAM Process Management and Interfaces	**P07**	Operations Management Records Interfaces	Company	Integration with other functions are done by each company
Interfaces to the lifecycle process	**P08**	Acquisition Process	Group	Purchases (for major contracts) are made through Company 1
	P09	Deployment Process	Company	IMAC events are managed by each company
	P10	Retiring Process	Company	Software removal or reutilization is managed by each company

TABLE 5. SOM CORE COMPETENCES EVALUATION MODEL.

The instrument used for data collection was a questionnaire[5] that is proprietary of my working company and designed to be used on SAM projects and that leverages knowledge and experience from previous similar projects. As previously explained, and due to customer structure, it was required to adapt the questionnaire in order to: (i) create an introductory section so that each company would provide their context/ overview, regarding their organizational structure but also their IT structure – a total of 6 questions; (ii) split the questionnaire considering only questions that would be evaluated at a Group level – a total of 6 questions and (iii) split the questionnaire considering only questions that would be evaluated at Company level – a total of 6 questions.

[5] A sample of the questionnaire is presented in Appendixes.

To evaluate each variable closed questions (e.g., Are there any policies, job descriptions, responsible and processes for SAM?, Is there a SAM budget? Is SAM part of the IT strategy?) were initially used and if the answer was affirmative then an open question (e.g., Which tools will be used for inventory and how?, How is the software resource management implemented in the each infrastructure groups?) was made to better understand the answer provided and ensure alignment to the SOM guidelines. Furthermore, and whenever possible and available, data requests were made to the group or companies (depending on how each core competence/ variable was to be analyzed) to allow the test of effectiveness of the measure in place, according to the SOM guidelines.

As part of the SOM a risk analysis should also be performed for each core competence/ variable to help companies better understand the risks of not performing SAM. As the project agreed scope was not focused on risk management this investigation was only performed at high-level and based on ISO 31000:2009 standard, considering that risk is the "effect of uncertainty on [SAM] objectives".

This standard defines that the first step of a risk management process is to establish the context taking into consideration the external context (e.g. legal/ regulatory/ financial national and international legislations as well as external stakeholders), internal context (e.g., organizational/ strategic and operational objectives, policies/ standards adopted by the organization) and also risk management process context (e.g., objectives, scope, responsibilities, methods and risk criteria).

As there was not risk management process in place for the group that could be used for this project it was agreed that the project would only focus on risk identification. As such, and as defined by the standard, the project aimed to find and depict [SAM] risks that might affect the achievement of the [SAM] strategic/ operational objectives, considering the context previously established.

Data collection

Qualitative investigation suggests several methods to collect data, including but not limited to, interviews or focus groups. On this project it was decided to perform interviews as it allowed closed-ended questions initially and then open-ended question in order to better understand the details of the previous question.

Semi-structured interviews were chosen, as described by Pole and Lampard (2002), as it allowed the use of an interview guide to ease the orientation of the interview, based on the questions that are part of the questionnaire.

Preference was given to face to face meetings with each Head of IT to obtain questionnaire answers, but due to availability and/ or distance it was agreed than for two companies conference calls would be used instead.

Questionnaire was shared in advance with the Head of IT of each company as well as with GAS designated responsible to provide answers at group level. This method would allow not only that the company Head of IT would be better prepared to provide valuable and updated feedback to the meeting but also to collect, analyze and coordinate with any other area of the group or company.

The external and internal context, needed for the risk identification, were assessed during the interviews with each Head of IT and also with the support of the GAS designated responsible to provide answers at group level.

Data Analysis

The reasoning method applied for the research was inductive of nature as it starts with observations and analyses before finally developing a theory, explanation or determining patterns. Even though inductive projects might bring an open-ended quality and uncertainty into a project the use of pillar questions helps reduce the uncertainty and retain the open-ended nature by providing a degree of structure and connection to relevant literature or frameworks (Shields and Rangarajan, 2013).

The SOM defines, for each core competence/ variable, what is the central topic to be investigated (i.e. ill-defined topic) as well as several key or pillar questions that will help explore and circumscribe the research topic. It also provides the guidelines to fit the facts/ findings and analysis into one of the four predefined SAM maturity levels and the requirements to achieve the next desired maturity level.

5. Results and Recommendations

This chapter is divided into two sections. On the first section the SAM Maturity Model assessment results are presented, with a detailed explanation of the evidences that support the assigned maturity level for each of the ten core competence/ variable, besides a list of potential risks that the group faces.

The second section of this chapter aims to present, based on GAS vision, goals, objectives, resources and limitations the set of recommendation that should be implemented by the group and each company in order to achieve the desired maturity state, as discussed and agreed with GAS.

1. Current State

P01 – SAM throughout Organization

Goal

The first two core competences/ variables are focused on organization management level. The first core competence/ variable aims to assess if SAM was actively managed across the organization and how such management was performed, by each of the relevant stakeholders of the company. It was also a goal to understand the amount and sufficiency of the resources allocated to SAM as well as the coverage and accurateness of the SAM.

Findings

This core competence/ variable was evaluated at group level. All data requests were made to the company that is currently responsible for the SAM across the group. Based on the documentation and the information provided it was possible to verify that:

- SAM is now a priority for GAS and all companies, being this project the first global initiative to promote SAM awareness in the group and all its companies;
- Currently each company is responsible for the software in use/ licensed in each company, according to a memo issued by GAS Board of Directors;
- There is no assigned SAM Manager, either at group level or at company level, and polices, process and roles and responsibilities are yet to be defined;

- SAM is not considered at organizational level or IT level and tends to be considered a side-effect of projects – meaning that it is a responsibility of each project manager to ensure licensing of all required software considering only the project scope;
- Each company is independent regarding SAM strategy, even though there is some alignment concern at annual reporting period;
- SAM is a responsibility of each company Head of IT, even though this responsibility is not part of the formal job description;
- Each company Head of IT requests support from more technical / operational staff to collect SAM metrics (e.g., software in use) but these elements have limited experience and knowledge of licensing rules;
- There are no budgets for SAM, either at group or company level;
- There are no metrics defined to assess how SAM benefits throughout the organization;
- There no regular SAM summary reports/ organization charts being created/ shared throughout the organization to help promote SAM awareness.

Risks

When considering the outcomes of this first core competence/ variable assessment several potential risks were identified:

P01.1. There is no Board of Directors level formal sponsorship for SAM, meaning that this topic might not have the proper priority and importance within the Organization;

P01.2. There is no budget defined to promote SAM in the group meaning that not all required initiatives might be possible to be implemented;

P01.3. Lack of clarity, accountability and ownership of the responsibilities (especially considering group structure) causes confusion and overlaps on how to handle SAM;

P01.4. Without defined SAM policies and training people will not be suitable to properly handle SAM;

P01.5. Lack of standardization across the organization leads to non-consistent implementation of key aspects of SAM.

Conclusion

According to the SOM guidelines this core competence/ variable was determined to be at **Basic Level**, as there are no SAM-defined roles/ responsibilities and the allocated resources are not sufficiently trained or experienced in relation to SAM. Nevertheless, it is important to state that the group has already taken some steps to achieve the next level (i.e., Standardized) as for each infrastructure group within the organization a contact with direct responsibility for SAM is already appointed (even though not formally and not part of the job description), all critical locations are identified and an estimated quantity of each hardware platform at each location already exists.

P02 – SAM Improvement Plan

Goal

Regarding the second core competence/ variable the purpose is to understand if there are any actions in place or planned to promote SAM Optimization throughout the organization, by understanding the previous SAM optimization level, the risks and actions defined to mitigate/ enhance SAM and the metrics that would allow to understand the progress obtained.

Findings

Once again this core competence/ variable was evaluated at group level. All data requests were made to the company that is currently responsible for the SAM across the group. Based on the documentation and the information provided it was possible to verify that:

- No group or company SAM improvement plan exists, meaning that scope, schedules and resources/ budgets for SAM are not defined;
- There are no SAM focused improvements actions, either at group level or at company level;

- No group or company SAM communication plan exists. This might mean that there are no alignment with the corporate-wide strategies and goals or even though it exists that alignment is not be clear and thus the effect of the “big picture” might be lost;
- Some recent initiatives taken by the group might have a positive impact on SAM (e.g., enterprise anti-virus), not only helping better tracking software assets but also demonstrating that corporate tools can be technically implemented and provide significant economies of scale, without interfering with companies IT independency;
- There are no Key Performance Indicators (KPI) that allow the group to understand any potential weaknesses or progresses made over a period of time;
- Communication with the software producers usually only takes place on true-up / renewal periods (i.e., annual) , with only the major ones being managed at a central level while all others are managed at company level;

Risks

When considering the outcomes of this second core competence/ variable assessment several potential risks were identified:

P02.1. As there is no group vision, goals, and objectives for SAM the group cannot define the areas to improve and therefore cannot create a "roadmap" to improve SAM;

P02.2. Without a SAM Improvement Plan, the SAM Program might lose its focus and importance in the organization;

P02.3. The lack of KPI means that the group might not be able to identify weakness or improvements made and resources might be allocated to areas where these are not critical (compared to others).

Conclusion

According to the SOM guidelines the second core competence/ variable was determined to be at **Basic Level**, as there is no SAM optimization plan. Similar to the previous core competence/ variable, it is important to state that the group has already taken some steps to achieve the next level (i.e., Standardized) considering the fact that one of the outcomes of this project is to define a

SAM improvement plan that will include a scope and a schedule for each initiative to be implemented. Based on the set of initiatives that will be presented the group will need to define the funds and resources for each initiative.

P03 – Hardware and Software Inventory

Goal

After an analysis at a higher level (i.e., Organization Management), the next two core competences/ variables will focus on SAM Inventory as "*Measurement,* or tracking of relevant assets, *is the first step that leads to control and eventually to improvement. If you can't measure something, you can't understand it. If you can't understand it, you can't control it. If you can't control it, you can't improve it*", as stated by H. James Harrington (CIO, 1999). As such, it is critical to understand if, how and to what extent hardware and software assets are being managed by the group.

Findings

As software asset management are being managed by each company this core competence/ variable was evaluated with the support of each Head of IT, and as such all data requests were requested to them. As the guidelines for this core competence/ variable required an exact percentage of the assets being managed (i.e., Basic < 68%, 68% > Standardized <95%, 95% > Rationalized < 98% and Dynamic > 98%), a detailed assessment for the major software producer was performed, with the results presented below per each company:

Company	Total number of assets[6]	Number of Assets under management	SAM Tool	Asset Coverage
Company 1	291	158	Active Directory (just hardware)	54,3% (81,4% if mobiles devices are excluded)

[6] Based on the agreed scope and considering the hardware inventories approved by each company

Company	Total number of assets[6]	Number of Assets under management	SAM Tool	Asset Coverage
Company 2	1.332	801	Software producer tool (just hardware)	60,1% (88,7% if mobiles devices are excluded)
Company 3	3.046	2.688	Active Directory (just hardware)	88,3% (97,7% if mobiles devices are excluded)
Company 4	3.481	2.429	In house development (hardware and software)	69,8% (97,6% if mobiles devices are excluded)
Company 5	190	138	Active Directory (just hardware)	72,6% (84,7% if mobiles devices are excluded)
Company 6	370	208	Software producer tool (hardware and software)	46,7% (56,2% if mobiles devices are excluded)

TABLE 6 - SOFTWARE ASSETS UNDER MANAGEMENT OVERVIEW

Based on the data requests and the information provided it was possible to verify that:

- On Company 1 hardware inventory is based on Active Directory, with an asset coverage of 54,3%, and there are no software inventories available;
- On Company 2 hardware inventory is based on a software producer proprietary tool and on Company 3 and Company 5 hardware inventory is based on Active Directory, with 60,1%, 88,3% and 72,6% asset coverage respectively. Regarding software inventory new inventory

tools are being implemented but at the moment inventory is performed manually and metering is not assessed;

- On Company 4 hardware and software inventories are available and centralized through the use of a SAM tool with a very high coverage for the most common devices (i.e., nearly 98%), even though the tool failed to cover all relevant assets types/ setups. Metering is not performed;
- On Company 6 hardware and software inventories (including metering) are available through a software producer proprietary tool but with low coverage (i.e., 46,7%);
- Inventory of virtual machines/ environments are not integrated with any SAM tool and managed only through the usage of the hypervisor console on all companies.

Risks

When considering the outcomes of the third core competence/ variable assessment several potential risks were identified:

P03.1. Without the ability to track hardware assets the risk of theft or loss of these increases;

P03.2. The use of pirated/ illegal software increases as well does the risk of non-compliance;

P03.3. The use of deprecated or non-supported software increases the risk of security incidents and operational stoppages with potential severe impacts for business;

P03.4. Without an updated software inventory several functions within the organization might face unnecessary challenges, such as help-desk (e.g., additional time to understand the software/ edition/ version installed when a help-desk request is made) or business continuity (when a major incident occurs and alternative facilities/ solutions need to be up and running but not clear what was the software/ edition/ version installed on the production infra-structure).

Conclusion

According to the SOM guidelines the third core competence/ variable was determined to be at **Basic Level**, for all companies except Company 4 as despite all of them have a centrally managed hardware inventory with a high asset coverage there is no centrally managed software inventory (for a total of four companies) or the coverage of the software inventory is below 68% (for one company). Company 4 has achieved **Standardized Level** as it possesses a centralized software inventory representing between 68% and 95% (i.e. 97% on workstations and 90% on servers, excluding mobiles) of software deployments from all hardware in the hardware inventory.

In line with the initiatives taken by Company 4 and Company 6 all other companies are planning to implement SAM tools to track software assets which will allow them to rapidly achieve one or two levels above as hardware coverage is quite high and thus allowing for a significant overall improvement of the group SAM maturity.

P04 – Accuracy of the Inventory

Goal

Relying on a SAM tool to manage hardware and software assets might mean that not all relevant assets are properly identified due to complexity and volatility of an IT environment. As such, it is critical to ensure that, on a regular basis, hardware and software inventories are compared to other sources to identify potential discrepancies (e.g., anti-virus deployments for hardware inventory, user accounts for software usage) and ensure completeness. Not only it is important to ensure that hardware and software inventory encompasses all relevant assets but it is as important to ensure that any changes are rapidly identified through regular updates to ensure accuracy of these inventories. Finally, it is also critical to understand to what extent changes are captured and how are these changes reflected in the inventories.

Findings

Similar to the previous core competence/ variable inventories are managed by each company and therefore this analysis was performed with the support of each Head of IT and all data requests were addressed to them. Based on the data requests and the information provided it was possible to verify that:

- Inventory hardware update is made on a regular basis as new machines needs to be added to the Active Directory before they can access any other IT resources of the each company. Nevertheless, removal of old or unnecessary objects (e.g. when an employee's leaves the firm or a machine is decommissioned) is not performed on a regular basis. Below is presented a table with all deprecated objects found in each company:

Company	Total number of assets[7]	Number of non-relevant assets	Average number of deprecated days (*)
Company 1	291	288	396
Company 2	1.332	2.971	1.102
Company 3	3.046	740	214
Company 4	3.481	1.993	1.520
Company 5	190	159	2.545
Company 6	370	372	1.102

TABLE 7 - NON-RELEVANT AND DEPRECATED SOFTWARE ASSETS

- Inventory software is updated on an annual basis, being most of the work done manually and mostly for reporting/ renewal purposes;
- Details as environment classification (i.e., production, test and development), primary owner of machine, developer information and environment, user accesses are manually tracked;
- Only one company was able to provide evidences that a previous hardware and software inventory had been created.

Risks

When considering the outcomes of the fourth core competence/ variable assessment several potential risks were identified:

[7] Excluding objects with more than 3.000 days considering the average time when each company Active Directory was deployed

P04.1. When a company undergoes a merger, acquisition or divestiture failing to have updated hardware and software inventories (and also licenses) might represent significant loss of value (Wesche and Disbrow, 2009) and also create issues for the future (e.g., consolidation of overlapping platforms, applications, contracts, products);

P04.2. Inaccurate hardware or software inventories (and also licenses) might lead to over or under purchasing/ renewal of software and exposure to fines and deterioration with the software producers;

P04.3. Difficulty to apply the most cost-effective metric to the software as it is not possible to determine what are the software products in use, by whom and how (e.g., some licenses are specific for non-production environments, some software can be reused by several users with some limitations);

P04.4. A great risk of over spending on software maintenance and support, even on software that is not really in use.

Conclusion

According to the SOM guidelines the fourth core competence/ variable was determined to be at **Standardized Level** for all companies as once a year inventory is updated, even though this exercise is mainly manual on four companies, very time consuming (meaning that sometimes several assumptions have to be made as it is not possible to timely obtain all relevant data) and does not include comparison with other sources of data.

In line with the initiatives taken by Company 4 and Company 6 all other companies are planning to implement SAM tools to track software assets on a regular basis (i.e., agents will provide updated information every month) which will allow them to rapidly achieve one or two levels above as hardware coverage is quite high and thus allowing for a significant overall improvement of the group SAM maturity.

P05 – License Entitlement Records

Goal

Having dealt with one side of the equation (i.e., deployments) it is now critical to ensure that the same above stated concerns are also considered on the other side of the equation (i.e., entitlements), in order to allow that regular SAM verifications can be performed. Even though a company should request and validate entitlements declaration of each of its software producer (comparing to what was purchased/ agreed) rely that a software producer's inventory of licenses is accurate is not sufficient, as the software producers frequently have the same problems tracking license sales and product name changes that a company has in tracking license purchases. As such, it is critical that licenses records are properly managed and proof-of-evidence is timely recorded to allow regular reconciliation between entitlements and deployments, as it is contract stated, when considering the standard contracts signed with the major software producers, that the company that uses the software is responsible to produce documentation that verifies that it has properly licensed the software it is using (e.g., Microsoft MBSA, IBM Passport Advantage Agreement).

Findings

This core competence/ variable was evaluated at group level and as such all data requests were requested to the company that is currently responsible for the SAM across the group. Based on the data requests and the information provided it was possible to verify that:

- The centralized team has records of purchases made through enterprise/ volume agreements but inventory of older licenses is not complete, meaning that it was not possible to compare group entitlements inventory with software producer inventory;
- The central software entitlements database is excel based;
- Centralized team updates records of purchases manually on an annual basis ;
- While a centralized procurement team exists it was never verified, prior to this project, if there were purchases being done without central team control;
- During the project a single additional licenses (i.e., not managed by central procurement team) was identified (excluding OEM licenses on workstations);

- A total of 582 licenses not eligible to be used on a corporate environment (e.g., academic, training, domestic use) were also identified;
- Contract management is performed by the centralized procurement team in a close coordination with each company Head of IT;
- Several cases detected where the most cost-effective licensing model was not chosen, even though the decision of the metric was done with the support of the Head of IT and the software producer (e.g., device instead of user for some companies/ products);
- Identification of all relevant companies/ contracts/ purchases was a time consuming exercise, having being identified a total of 108 affiliates with licenses since 1997;
- Several purchases made with company's full name while others were made using a subsidiary, alternative business name or previous company name making hard to ensure that all entitlements were properly identified, as described in the table below:

Company	Total number of different contracts for the major software vendor
Company 1	16
Company 2	9
Company 3	13
Company 4	19
Company 5	6
Company 6	1

TABLE 8 - SOFTWARE CONTRACTS DISTRIBUTION

- Identified one small company that was sold in 2006 and that licensed transfers had not been properly agreed with the software producer (as the hardware assets were still under group management there was some effect on licensing terms).
- Due to contract / product/ metric rules changes over the years several issues have arise with the software producer to clearly understand what were the group’s entitlements under the new product/ metric (e.g., metric per installation to metric per processors or cores).

Risks

When considering the outcomes of the fifth core competence/ variable assessment several potential risks were identified:

P05.1. When a company undergoes a merger, acquisition or divestiture failing to have updated entitlements records (and also hardware and software inventories) might represent significant loss of value (Wesche and Disbrow, 2009) and also create issues for the future (e.g., consolidation of overlapping platforms, applications, contracts, products);

P05.2. Inaccurate entitlements records (and also hardware or software inventories) might lead to over or under purchasing/ renewal of software and exposure to fines and relationship deterioration with the software producers;

P05.3. Despite a centralized purchase process exists the lack of all relevant controls (e.g., only enterprise software can be purchased, all purchases must be approved by the central team) and regular verification to the process increases the risk of having an inaccurate entitlements database;

P05.4. Rely on software producer entitlements declaration to track licenses purchases increases the risk of having incomplete or missing entitlements (especially for older products) and also fail to understand and apply the proper requirements/ restriction of usage for each license/ product;

P05.5. Without a complete and detailed central software entitlements database and regularly maintained it might be a very time-consuming and difficult exercise (e.g., when an external audit is requested) to verify information dating back years, due to company, product and metric changes over the years.

Conclusion

According to the SOM guidelines the fifth core competence/ variable was determined to be at **Basic Level** as, even though contracts are managed by a centralized procurement team with the proper support of each Head of IT, a complete entitlements records database across the organizations does not exists.

P06 – Periodic Evaluation

Goal

Even though one might think that once a complete deployments and entitlements inventory exists then determining company license position should be an easy task. In fact, for some products and metrics (e.g., installation based) and considering the same edition/ version of the product, it is a straightforward equation. But, due to the product migrations, upgrades, downgrades, product use rights, license transfers and several different product metrics for the same product determining if under or over licensing exists might be a challenging undertaking.

Therefore, it is very important that each organization performs regular internal software compliance activities (e.g., as part of the internal audit) and creates SAM reports that are provided and reviewed by all relevant SAM stakeholders and approved by management/ Board of Directors.

Findings

This core competence/ variable was evaluated at group level and also at company level, as software compliance activities are led by Company 1 and performed by each company. As such all data requests were requested to the company that is currently responsible for the SAM across the group and also to each Head of IT. Based on the data requests and the information provided it was possible to verify that:

- There are no regular internal software compliance activities performed at group or company level. Deployments reporting is performed by each company once a year and Company 1 consolidates such data without performing any kind of verification due to time and technical restrictions;
- No evidence of software reconciliation/ license position reports (periodic or otherwise) being produced at group level or company level. The only evidence of any software reconciliation/ license position relates to the excel database (mentioned on the previous core competence/ variable), that is used to support renewal process of the major contracts made at group level;
- No evidence of stakeholder review or sign-off of reports at group level or company level.

Risks

When considering the outcomes of the sixth core competence/ variable assessment several potential risks were identified:

P06.1. Without proper identification of the license metric and product use rights the risk of not properly determining the most cost-effective licenses increases;

P06.2. Without an accurate license position regularly determined the group might over or under purchase/ renew software and maintenance/ support and be exposed to fines and relationship deterioration with the software producers;

P06.3. Without stakeholder or execute review and sign-off of reports SAM efforts might lose its visibility and importance within the organization.

Conclusion

According to the SOM guidelines the sixth core competence/ variable was determined to be at **Basic Level** as, even though a basic evaluation is made every year, the depth of this exercise is time consuming, potentially scope limited and very manual, as there are no tools to support the process, making any discrepancies identification very hard to achieve. Furthermore, there is little involvement of the executive sponsors (even though they are the ones that approve contract renewals/ purchases) and no SAM reports are created, either at group or company level.

P07 – SAM Operations Management & Interfaces

Goal

Having a complete and accurate hardware, software and entitlements inventories is not only relevant for a SAM function but many other functions in the organization might benefit from an integrated and consolidated perspective of the company assets (e.g., procurement, finance, governance, HR, audit, compliance, help-desk, IT security). Nevertheless, the most common is that each function will have their own toolset and unlikely to be integrated or even sharing a common dataset, meaning that each function might be looking at different information and acting in siloes with a lot of redundancy and outdated data. As such it is important to understand what and how functions use and what and how are other systems integrated with SAM processes, team and tools.

Findings

Even though the vision of the group is to have, as much as possible, a common and centralized SAM process, teams and solutions supporting and integrated with all companies, this has not been possible so far, meaning that the evaluation of this core competence/ variable has been agreed to perform at company level, with the support of each Head of IT and all data requests were addressed to them. Based on the data requests and the information provided it was possible to verify that:

- There are no SAM tools implemented on Company 1, Company 3 and Company 5 (just hardware inventory tools);
- On Company 2 and Company 4 SAM tools are integrated with Enterprise Resource Planning (ERP) tools (even though this is not a seamless integration);
- Company 4 also has some level of integration with Human Resource (HR) and also incident management tools;
- No evidence of a SAM aligned or consistent strategy involving several functions operations across the organization;
- Software installations is controlled by the IT Department of each company, through ticketing system, preventing unauthorized upgrades or use of software on all companies except Company 5;
- Standard images are used by Company 1 and Company 3, considering the needs of each function of the company. On Company 1 if an employee moves to a new function or leaves the company (information provided by HR) then software changes are made directly on the machine. On Company 3 machine is formatted and a new image is placed;

Risks

When considering the outcomes of the seventh core competence/ variable assessment several potential risks were identified:

P07.1. Without a centralized and accurate repositories different functions will have access to inconsistent and incomplete data (e.g., detail, readiness);

P07.2. Increased cost and time to implement and maintain all different repositories;

P07.3. Adoption of different or not centralized methods and architectures to address similar processes (e.g., incident management) for each company, thus loosing potential scale economies.

Conclusion

According to the SOM guidelines the seventh core competence/ variable was determined to be at **Basic Level** at company level, as process management functions are not subject to a common SAM strategy that that promotes function integration and the usage of SAM inventories by other functions in each company.

P08 – Acquisition Process

Goal

Finally, the last three core competences/ variables will assess how SAM is integrated in all of the stages of the software lifecycle (i.e., requirement/ evaluation/ procurement (or design/ build if needs to be developed), deployment/operation/optimization and retirement). The eight core competence/ variable aims to understand how software procurement is managed and what are the controls in place to prevent that non-planned, non-needed or non-approved purchases are made within the group.

Findings

This core competence/ variable was evaluated at group level and as such all data requests were requested to the Company that is currently responsible for the SAM across the group. Based on the data requests and the information provided it was possible to verify that:

- Demand management is not based on SAM inventories neither considers software real usage/ metering;
- To determine future needs each company considers last year figures and also major changes occurred over the last year and also major projects planned for next year;

- Software producers and resellers lists are defined and approved for the major software producers;
- During the project a single additional licenses (i.e., not managed by central procurement team) was identified (excluding OEM licenses on workstations);
- No evidence of an approved software list in any company;
- Personal licenses (e.g. owned by the employees) is not authorized and software installations are made only by the IT Departments;
- Purchase process is managed by a central procurement team taking into consideration each company needs (after consolidation and analysis by Company 1 to determine group needs and thus allowing for potential scale economies) and with the support of the software producer;
- Contract renewals are approved by Board of Directors of Company 1.

Risks

When considering the outcomes of the eight core competence/ variable assessment several potential risks were identified:

P08.1. Incomplete or outdated training to the SAM and procurement teams on software compliance (e.g., licensing rules, product use rights) increases the risk of not adopting the metric with the best cost-effective considering the type of usage of each company/ area;

P08.2. Software that is purchased outside the centralized procurement system may not be properly accounted for (e.g., OEM, bundled licenses);

P08.3. The lack of an approved software list increases the risk of non-approved purchases;

P08.4. Increase risk of over or under purchases of software as no gap analysis is performed between the deployments (considering metering) and the entitlements before the purchase of software.

Conclusion

According to the SOM guidelines the eight core competence/ variable was determined to be at **Rationalized Level** at group level, as purchases are based on periodic (i.e., annual) deployment/ entitlements reconciliation exercise (even though done with limited detail) and the percentage of licenses tracked is nearly 100% (excluding OEM licenses on workstations).

P09 – Deployment Process

Goal

The ninth core competence/ variable aims to understand how software is deployed, managed and monitored during what represents the major portion of the life of the asset in the organization and where all IMAC events happen (installation/move/add/change). This is a critical core competence/ variable due to the fact that *"… from the move of the asset from the point of receiving to the point of installation, through the installation and post installation changes during active production usage to potential moves and reinstalls this stage of the asset's life cycle is extremely varied and is hard to manage simply due to the variety of possible IMAC events.*" as described by Kamal and Petree (2006). As such, it is fundamental to understand how the organization manages the installations and tracking of the software in order to be able to properly respond to any IMAC event that can happen and at the same time optimize costs and risks of non-compliance.

Findings

As software installations and administration is done at company level this core competence/ variable was evaluated with the support of each Head of IT, and as such all data requests were requested to them. Based on the data requests and the information provided it was possible to verify that:

- Software installations are controlled by the IT Department of each company, through ticketing system, preventing unauthorized upgrades or use of software on all companies except Company 5;
- Standard images are used by Company 1 and Company 3, considering the needs of each function of the company. On Company 1 if an employee moves to a new function or leaves

the company then software changes are made directly on the machine. On Company 3 machine is formatted and a new image is placed;

- Validation of available licenses before deployment of the software is excel based on all companies, except Company 4 and Company 5 that rely on their SAM tool reports;
- Software installed in each company is tracked and documented (according to the above mentioned statement) every time there is a request to installation/ remove software and updated on a yearly basis, for true-up/ renewal purposes;
- No evidence of an approved software list for deployment;
- Nevertheless, and based on the detailed assessment made for the major software producer the non-compliance percentage was determined to be 27,32%. The major causes identified were:
    - Mismatch between edition purchased and deployed;
    - Usage of products that were not allowed under the current contract (but were allowed on the previous contract and were not removed to this date);
    - License metric changes (e.g., installation to processor/ core);
    - Excessive of privileges of the development teams to install software on their machines;
    - Adoption of a group metric instead of the metric with the best cost-effective considering the type of usage of each company/ area;
    - Usage of non-enterprise licenses;
    - Features that were activated by the IT teams without full understanding of the licensing impacts.
- Software metering is not performed in any company to determine the real usage of the installed software;
- After approval of the installation the process is done manually at Company 1, Company 2 (for installations only as for updates a central distribution software tool is used), Company

4, Company 5 (if the number of installation is considered low as otherwise a central distribution software tool is used) and Company 6;

- Even on companies that use central distribution software tools not all areas (e.g., development) or assets (e.g., mobiles or some platform types) are covered by these kind of tools;
- Software tests (e.g. to detect any potential security issues) before it is deployed is not performed on any company, except when some massive deployment that might need to be performed (to be decided case by case).

Risks

When considering the outcomes of the ninth core competence/ variable assessment several potential risks were identified:

P09.1. Without a complete and accurate license position the risk of approving/ install software without the proper license increases;

P09.2. Granting IMAC privileges to some functions (e.g., development) increases the risk of installation of non-approved/ non-licensed software;

P09.3. The lack of an approved software list for deployment increases the risk of non-approved software to be deployed;

P09.4. Absence of a central distribution software tool increases the time to deploy changes (e.g., install new versions) and also the risk of having non-authorized/ non-licensed software installed (e.g., after a decision to remove it has been given);

P09.5. Incomplete or outdated training to the IT teams on software compliance (e.g., licensing rules, product use rights) increases the risk of changes to the software that might require a different license.

Conclusion

According to the SOM guidelines the ninth core competence/ variable was determined to be at **Standardized Level** on all companies as software deployment are controlled through policies

established by each Head of IT and deployed by each IT Department. Nevertheless, and even if in broad terms only approved software is deployed the test effectiveness of this core competence/ variable has detected some improvement areas (e.g., development environment, usage of products only authorized on the previous contract, software changes made by IT teams with impacts on the licensing rules). The percentage of software that is either installed through centralized sources or through a controlled distribution environment was not determined.

P10 – Retirement Process

Goal

The tenth and last core competence/ variable aims to understand how software is removed from the hardware where it is installed because it has reached its end of life support, is to be replaced by a newer version or even a different software, is to be allocated to a new user or machine or simply because the software no longer fits its business purpose.

As such, it is fundamental to understand how the organization identifies the software that is either on machines that are to be decommissioned or software that is no longer needed to allow its re-usage, according to the product usage rights (e.g., some software producers determine a quarentine period unless there is a hardware failure).

Findings

As software withdrawal / recycling / renewing is done at company level this core competence/ variable was evaluated with the support of each Head of IT, and as such all data requests were requested to them. Based on the data requests and the information provided it was possible to verify that:

- No structured retirement process is implemented in any of companies, except on Company 4, meaning that even if harvesting is done there is no certainty that the pool of available licenses will be proper and timely updated;
- On Company 4 there is some integration with HR tools that triggers an alert to IT to harvest the software in use by the employee that is moving to a new function or leaving the company (these alerts/ tickets are registered on the SAM tool);

- Company 4 SAM tools is able to properly track the software removed for the majority of the cases and to update the pool of available licenses in a proper and timely manner, except on development environments;
- None of the companies has controls to ensure that reused software will be applied under the correct product use rights;
- None of the companies has control or takes into consideration, when defining IT strategy, products lifecycle (i.e., released, new updates/ versions, end of support).

Risks

When considering the outcomes of the tenth core competence/ variable assessment several potential risks were identified:

P010.1. Lack of a structure process for withdrawal / recycling / renewing of software, duly supported by a tool that can properly identify all details of the software product deployed, increases the risk of having non-approved and non-licensed software in place, besides increasing the time to perform such tasks;

P010.2. Without a complete and wide retirement process the risk of over licensing increases, as the group might be purchasing additional licenses for software that is no longer installed and thus increasing the cost of software;

P010.3. Absence of controls to ensure that all products use right and products restrictions are correctly applied increases the risk of non-compliance;

P010.4. Failing to timely and proactively identified software that should no longer be installed (e.g., end of life support) increases the risk of having security issues, non-supported and non-licensed software.

Conclusion

According to the SOM guidelines the tenth core competence/ variable was determined to be at **Basic Level** on all companies, except one, as software on discarded computers is not tracked or detected. Withdrawal process is not structured and there is no unified control / regular procedure for withdrawal of IT resources. On Company 4 this core competence/ variable was determined to

be at **Standardized Level** as upon retirement of hardware software on retired asset is removed and tracked within a centrally controlled system.

Overview

The assessment of all ten core competences/ variables provided a detailed overview of the group SAM maturity, allowing us to understand that the group is mainly at Basic Level, with a total of 7 core competences/ variables at this level (in a total of 5 companies), even though several efforts have been given or are planned to rapidly allow the group to increase its global SAM maturity. All other three core competences/ variables (five on Company 4) are already at an higher level, meaning that the group / each company has made some efforts in this area, mainly around operational areas (i.e., hardware and software inventories and activities around the five stages of the software lifecycle – requisition/ buy, deploy/ manage and retirement).

	BASIC	STANDARDIZED	RATIONALIZED	DYNAMIC
SAM Throughout Organization	Project Manager assigned but SAM roles & responsibilities not defined	Direct SAM responsibility is identified throughout organization	Each functional group actively manages SAM	SAM responsibilities defined in job descriptions across organization
SAM Improvement Plan	No SAM development or communication plan	SAM plan is defined and approved	SAM Improvement is demonstrated	SAM goals part of executive scorecard; reviewed regularly
Hardware & Software Inventory	No centralized inventory or < 68% assets in central inventory	> 68% - 95% of assets in inventory	> 95% - 98% of assets in Inventory	> 99% of assets in inventory
Accuracy of Inventory	Manual inventory; no discovery tools	Inventory sources reconciled annually	Inventory sources reconciled quarterly	Dynamic discovery tools provide near real-time deployment details
License Entitlement Records	Procurement manages contracts; not accessed by IT managers	Complete entitlement records exist across organization	Entitlement records reconciled with vendor records	SAM entitlement system interfaces with vendor entitlement to track usage
Periodic Evaluation	IT operations managed on ad-hoc basis	Annual sign-off on SAM reports	Quarterly sign-off on SAM reports	System reconciliations and ITAM report available on demand
SAM Operations Mgmt & Interfaces	SAM not considered part of M&A risk plan and company integration	Operations manages separate asset inventories	Operations manages associated asset inventory	All business units follow the same strategy, process & technology for SAM
Acquisition Process	Assets purchased on a per project basis; without a review of current availability	Software purchases use approved vendors	Software purchases based on deployment/entitlement reconciliation	All purchases are made using a pre-defined asset catalog; based on metered usage
Deployment Process	Assets deployed by end-users in distributed locations; no centralized IT	Only approved software is deployed	Software deployment reports are accessible to stakeholders	Software is dynamically available to users on demand
Retirement Process	Software is retired with hardware and is not harvested or reassigned	Unused software is harvested (where the license allows) and tracked within a centrally controlled inventory	Centrally controlled inventory of harvested licenses is maintained & available for reuse. Deployment & license records are updated	Automated process w/ centralized control & tracking of all installed software, harvest options, internal reassignment and disposal

FIGURE 6 - COMPANY 1, COMPANY 2, COMPANY 3, COMPANY 5 AND COMPANY 6 SAM MATURITY OVERVIEW

	BASIC	STANDARDIZED	RATIONALIZED	DYNAMIC
SAM Throughout Organization	Project Manager assigned but SAM roles & responsibilities not defined	Direct SAM responsibility is identified throughout organization	Each functional group actively manages SAM	SAM responsibilities defined in job descriptions across organization
SAM Improvement Plan	No SAM development or communication plan	SAM plan is defined and approved	SAM Improvement is demonstrated	SAM goals part of executive scorecard; reviewed regularly
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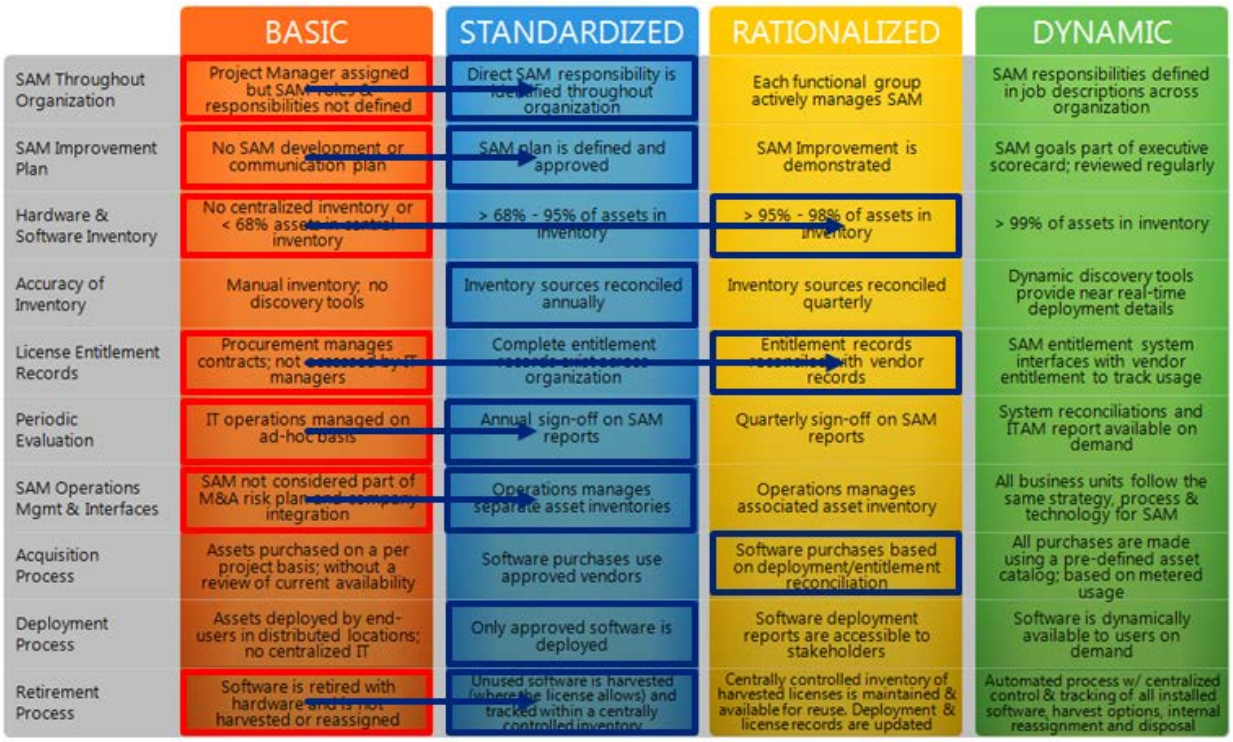
Retirement Process	Software is retired with hardware and is not harvested or reassigned	Unused software is harvested (where the license allows) and tracked within a centrally controlled inventory	Centrally controlled inventory of harvested licenses is maintained & available for reuse. Deployment & license records are updated	Automated process w/ centralized control & tracking of all installed software, harvest options, internal reassignment and disposal

FIGURE 7 - COMPANY 4 SAM MATURITY OVERVIEW

2. Future State

The main purpose of the SAM Maturity assessment is to make a complete an accurate diagnostic of the group SAM maturity, allow the group to know "*where we stand now*", based in factual findings with a corresponding qualitative risk analysis, but also provide guidelines to help the group determine the "*where we want to go in the future*", by helping to define the vision, objectives, goals and initiatives to promote an increase of the overall group SAM maturity in a short, medium and long term perspective.

Based on the guidelines established for each level of each core competence/ variable a desired SAM maturity was established and an initial set of initiatives, per each core competence/ variable, were presented to the group to be discussed with the support of the project leaders of the company that is currently responsible for SAM across the group, in close alignment with the Head of IT of each company.



	BASIC	STANDARDIZED	RATIONALIZED	DYNAMIC
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SAM Improvement Plan	No SAM development or communication plan	SAM plan is defined and approved	SAM Improvement is demonstrated	SAM goals part of executive scorecard; reviewed regularly
Hardware & Software Inventory	No centralized inventory or < 68% assets in central inventory	> 68% - 95% of assets in inventory	> 95% - 98% of assets in inventory	> 99% of assets in inventory
Accuracy of Inventory	Manual inventory; no discovery tools	Inventory sources reconciled annually	Inventory sources reconciled quarterly	Dynamic discovery tools provide near real-time deployment details
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Periodic Evaluation	IT operations managed on ad-hoc basis	Annual sign-off on SAM reports	Quarterly sign-off on SAM reports	System reconciliations and ITAM report available on demand
SAM Operations Mgmt & Interfaces	SAM not considered part of M&A risk plan and company integration	Operations manages separate asset inventories	Operations manages associated asset inventory	All business units follow the same strategy, process & technology for SAM
Acquisition Process	Assets purchased on a per project basis; without a review of current availability	Software purchases use approved vendors	Software purchases based on deployment/entitlement reconciliation	All purchases are made using a pre-defined asset catalog; based on metered usage
Deployment Process	Assets deployed by end-users in distributed locations; no centralized IT	Only approved software is deployed	Software deployment reports are accessible to stakeholders	Software is dynamically available to users on demand
Retirement Process	Software is retired with hardware and is not harvested or reassigned	Unused software is harvested (where the license allows) and tracked within a centrally controlled inventory	Centrally controlled inventory of harvested licenses is maintained & available for reuse. Deployment & license records are updated	Automated process w/ centralized control & tracking of all installed software, harvest options, internal reassignment and disposal

FIGURE 8 - GROUP TARGET SAM MATURITY

The outcome of the brainstorm sessions held with the group and each company resulted in the identification of nineteen initiatives that are explained in detail in the next section.

Recommendations

This set of initiatives embraces the vision that the group has defined to consolidate the SAM function in Company 1, whilst maintaining the IT independence of each company, meaning that each initiative has the same objectives for each company and similar impact and effort is estimated for each company – even though in some cases the starting point for Company 4 is higher than the others as changes will have to occur in all processes, tools and teams at most what is implemented can be used as a starting point for all other companies.

R.1. Identify an executive sponsor to champion the SAM Program. This sponsor should be an executive of the Board of Directors of Company 1 and with direct access to other executive members of group and each company, to ensure proper empowerment of SAM across organization;

R.2. Create a SAM team that combines all relevant skills, namely a group SAM manager, company SAM managers, IT administrators, technology/ architecture strategy experts, licensing exports, contract/ procurement negotiators, financial experts and legal advisors;

R.3. Implement a SAM program, policies and procedures and assign SAM roles in each company aligned with a SAM central team. The SAM program must also provide training to the following:

- key personnel (especially the SAM team) on SAM related roles and responsibilities;
- SAM team on licensing rules;
- Technical teams to ensure that they are aware that some features / changes might impact licensing rules;
- end-users need SAM awareness training on the overall mission of the SAM program and SAM policies and rules (e.g., proper use of software, only authorized software may be installed on company computers).

R.4. Create a SAM improvement plan, based on the assessment outcomes described in the previous section, and considering the established future maturity levels. It must be clear how, when and by who SAM improvement plan is to be updated and the role of senior management's in the SAM program;

R.5. Establish a SAM budget based on the approved SAM improvement plan as well as Key Performance Indicators (KPI) that can be tracked and monitored throughout SAM improvement plan implementation;

R.6. Establish a SAM communication plan that provides periodical inventories, license positions, reports/ dashboards to all relevant stakeholders (at group level and for each company) to promote SAM awareness. Stakeholders should include end-users, software producers and resellers to demonstrate commitment of the group towards compliance;

R.7. Implement a SAM tool, through a requirement analysis, request for proposal and selection process, tool configuration/ loading and testing. The SAM tool should:

- be multivendor, covering, at least, the most relevant software producers that are deployed on the group;

- allows different types of metric, not only for devices but for all relevant others (e.g. users);
- manages (or integrates with tools that manage it) all stages of the software lifecycle considering a decentralized approach;
- a pilot is considered as part of evaluation of the new SAM tool, especially to see how it will integrate with complex and non-centralized environments;
- a phased approach is considered instead of "all or nothing" approach;
- data is validated before it is loaded into the tool to help ensure that reporting and analysis is based on accurate data;
- existence of a centralized inventory of entitlements (allowing a vision at group level as well as per company);
- "Loose" purchases (e.g., OEM, FPP) entitlements are also accounted for.

R.8. Review hardware and software inventory processes to ensure that all relevant assets are tracked by the new SAM tool on a regular basis (at least annually), considering all hardware and software lifecycle stages;

R.9. Review approved software lists for purchasing and deployment and upload it on the SAM tool to prevent use of non-approved or non-licensed software;

R.10. Request each software producer entitlements declaration and validate it with procurement data, to see if any entitlements are missing or no correlating purchasing documentation is found and upload approved contract and entitlements list into the SAM tool;

R.11. Create a process to ensure SAM tool completeness and accurateness on an annual basis by comparing inventories and license position created by the SAM tool with inventories and license positions manually created for each major software producer (one was created during this project). This process should be sample based to avoid waste/ duplication of resources and be completed before SAM periodic reconciliation process;

R.12. Define in policies and processes what IT assets are to be tracked by an IT asset tag;

R.13. Implement the policies and process related to tagging assets;

R.14. Conduct a physical inventory to account for hardware assets and assign asset tags to required assets without tags;

R.15. Review SAM periodic reconciliation process. This process should:

- be based on the reports provided by the new SAM tool;
- allow the reconciliation of licenses to deployments to determine a license position for all relevant software producers;
- be performed on an annual basis;
- allow classification of the software based on risk, helping to prioritize efforts on high risk software first;
- help detect inefficiencies (e.g. entitlements with no deployments, deployments with no entitlements) and help determine actions;
- ensure SAM executive sponsor reviews and signs-off the periodic reconciliation reports and approved actions proposed.

R.16. Review group and each company strategy process to ensure that SAM strategies / objectives/ results are integrated and aligned. This process should:

- ensure integration with Human Resources department to ensure that any job change (including leaving the group) is timely communicated to the SAM team to assess potential software changes needed;
- ensure integration with Financial Department to ensure that all assets (e.g., hardware, software, contracts, licenses) are duly accounted for;
- mergers and acquisition activities take into consideration value of owned hardware and software assets and entitlements (the same should also be applied to hardware, software and entitlements of a company being acquired);
- ensure integration with Help-Desk, Incident Response and Business Continuity teams to ensure they have access to all hardware and software details in order to ease problem solving;

- ensure integration with IT Security teams to ensure that this team has access to hardware, software details in order to ease detection of security issues and also improve IT security;

R.17. Review the SAM procurement process. This process should:

- be defined at corporate level while integrating all companies particularities;
- be business aligned and the benefits of the software are demonstrated;
- contemplate an approval process;
- guarantee that it is auditable (e.g., ticket based);
- be based on an enterprise tool that supports the full procurement process and also an integration with the financial system;
- prevent software to be purchased outside the centralized procurement system (e.g. p-card, expense reports);
- contemplate chargeback mechanisms, as it tends to reduce software spending but also helping to demonstrate to each function the amount of software in use and the corresponding costs;
- certify, based on approved software producer and software lists, that only approved software is purchased;
- contemplate product lifecycle, allowing the group to understand, amongst others, release dates, end of life support and migration paths;
- ensure a communication of the process and its results on a regular basis across the organization, especially with SAM executive sponsors.

R.18. Review the SAM deployment process. This process should:

- be defined at corporate level while integrating all companies particularities;
- state and enforce a software deployment policy that only authorized IT personal can deploy software;

- implement a self-service portal where pre-approved software is available to be installed by the IT teams and end-users;
- be based, as much as possible, on profile images that should be created according to business units/ teams needs (even for development teams);
- contemplate an approval process;
- guarantee that it is auditable (e.g., ticket based);
- be based on an enterprise tool that supports the deployment and management process and also an integration with any other relevant support systems (e.g. CMDB, incident management);
- ensure that software is properly tested before it is released to avoid security or operation disruption issues;
- enforce that the software deployed is part of the approved software list;
- ensure a communication of the process and its results on a regular basis across the organization, especially with SAM executive sponsors.

R.19. Review the SAM retirement process. This process should:

- be defined at corporate level while integrating all companies particularities;
- define what and when (i.e., in alignment with group strategy but also with product lifecycle) software is to be harvested from retiring hardware;
- define the process by which retired hardware is checked for software that can be harvested and how to document/ track software that is harvested;
- contemplate an approval process;
- guarantee that it is auditable (e.g., ticket based);
- be based on an enterprise tool that supports the harvesting process and also an integration with any other relevant support systems (e.g. update self-service portal so that other users can reuse harvested software, as long as product use rights are duly observed);

- ensure a communication of the process and its results on a regular basis across the organization, especially with SAM executive sponsors.

Roadmap

These initiatives were designed to be completed within a 12 months period, considering the feedback of the group on resources availability. However, if additional resources (internal or external) are available and assigned these initiatives might be possible to be completed in a shorter timeframe.

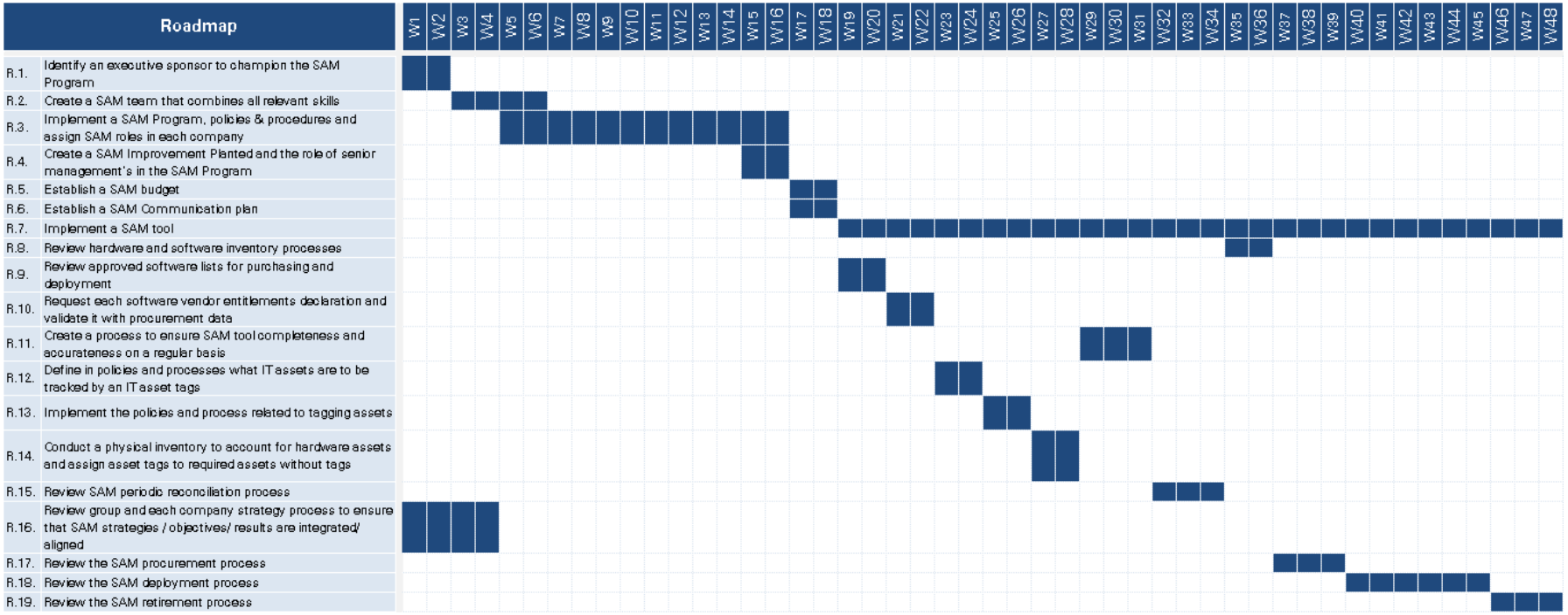

FIGURE 9 - SAM RECOMMENDATIONS

Conclusions, Limitations and Future Steps

Based on the results obtained and presented in the previous chapter it was possible to obtain the following conclusions:

Concerning maturity level:

The assessment of all ten core competences/ variables provided a detailed overview of the group SAM maturity, allowing us to conclude that the group is at Basic Level, with a total of seven core competences/ variables at this level (in a total of five companies) and five for Company 4, which is aligned with the results obtained by KPMG in 2008 on their latest SAM survey where it was identified that the majority (i.e., 59%) of the companies were at Basic Level. A distribution per company comparison, with the KPMG survey results, was not performed as half of the core competences/ variables where evaluated at group level, not allowing to create a distinct company profile that would allow a more accurate and detailed analysis between them.

Still, it is relevant to mention that five companies have already three core competences/ variables at Standardized Level and Company 4 has already five, meaning that some efforts have been given or are planned to rapidly allow the group to increase its global SAM maturity. This is also aligned with the results obtained by KPMG in 2008 that suggested that large organization (considering group size in the Portuguese economic context) tend to be more mature than small organization. The fact that software producers are more likely to audit larger customers (KPMG, 2008) and due to the fact that organizations that have SAM function place report a 32% lower audit rate within the last two years than organizations with no SAM function (Express Metrix, 2013) might explain why these companies are more proactive in reducing software license compliance risks and in making SAM a priority.

According to KPMG 2008 SAM Survey there were five core competences/ variables (i.e., P03, P04, P06, P08, P09) that appear to be a good predictor of overall maturity. This was only verified on core competences/ variables P03 and P06. The explanation for P04 is due to the fact that hardware and software inventories were created as part of the project (and this is what was evaluated) as if we had considered the available inventories prior to project start Basic Level would have been assigned, meaning that it continues to be a good predictor. The explanation for P08 is that the procurement process (including software procurement even though this decision has been

made prior to this project) is already centrally managed by the company that is also responsible by SAM across the organization, which has allowed the group to achieve a higher classification on this core competence/ variable than the overall group maturity. Finally, and regarding P09 the explanation is that each company of the group has already in place policies that prevent end-users to install non-approved software meaning that, from a design perspective, group is at Standardized Level but when considering effectiveness of these policies the group is likely to be at Basic Level, as a 27% non-compliance has been identified for the major software vendor and meaning that this core competence/ variable continues to be a good predictor.

Concerning risk analysis:

An assessment of the risks that the group might face due to poor software asset management was another purpose of this project, as organizations that manage risks effectively are more likely to protect themselves and succeed in growing their business with the challenge for any organization being to integrate good practice into their day-to-day operations and apply it to the wider aspects of their organizational practice.

A total of forty risk were identified according to the processes defined by ISO 31000:2009 for a high-level risk assessment. From these it is relevant to mention that 20% are linked to the core competence/ variable “SAM throughout the Organization” meaning that risk global perception is higher on issues that are related to Top Level Management.

Concerning recommendations and future steps:

The answer to the last posed question that was to determine the desired SAM maturity of the group and the initiatives that would need to be implemented, and the time required for each, which has led to the identification of a total of nineteen initiatives to be implemented, within a twelve months period, in order to allow the company to move to the “next level” whilst maximizing SAM benefits and reducing SAM risks. From these a third is related to the core competence/ variable “SAM throughout the Organization” as even though it is important to involve all group’s employees from the start a successful change management initiatives must be driven from the top by a dedicated and strong group of executives acting in close alignment and with the sponsorship of the CEO (Pettigrew and Whipp, 1993). Furthermore, every enterprise initiative must have a clear and communicated strategy (that includes vision, goals and objectives) as everyone needs to know

where they are going and why (Peters and Waterman, 1982). Also according to Peter and Waterman (1982) the second hard component addressed by the proposed initiatives are the "*systems*" that will support the SAM function across the organization (i.e. structure), meaning that corporate processes and procedures, duly based on a corporate tool, must be (re)defined while accommodating group and companies specific requirements and group culture (i.e. style) and shared values. Finally, all other initiatives are related to the staff and skills that must be considered when creating the SAM team that will lead SAM across the organization.

Concerning software non-compliance prevention:

Regarding this general topic it was possible to verify that SAM is now a priority for GAS and all its companies, being this project the first global initiative to promote SAM awareness in the group under the sponsorship of one of the Board of Directors members of the Company 1, assigned to lead SAM across the organization.

Nevertheless, a clear definition of the vision, goals and objectives to be achieved with a global SAM initiative is still missing and this should be the first initiative to be addressed by the group, followed by the formal creation and assignment of a SAM Manager and SAM team that encompasses all relevant skills aligned with the group structure. This leader and team will then be responsible by creating a SAM Program, policies & procedures and to implement the most cost-effective systems to support SAM across the organization, under a clear, approved and well communicated plan, and with a specific budget to effective implement and maintain such plan.

This project has allowed the group to be more aware of their current strengths and weaknesses, especially at executive level, and was considered as the first step to create a corporate awareness for this topic and reinforcing the need to have a dedicated SAM function for the group. Such visibility and consciousness is highly important as "… generally organizations that have made an effort related to SAM appear to have started by assigning SAM roles and responsibilities throughout the organization" as verified by KPMG in their latest survey in 2008.

3. Limitations and future steps

During the course of the project some factors have been identified that created some limitations to

obtain the most relevant data and conclusions. These limitations are listed below and some future steps are also presented, not only regarding this project but also regarding future studies.

Regarding the literature review, within my knowledge, a limited number of scientific publications exist, specifically around what were the most widely used software asset management methodologies and also benchmark results. A new KPMG SAM survey is being planned for 2015 which will provide an updated and wider view (as the 2008 survey was limited to US only) of SAM around the world. This survey might also include Portugal which will provide an insightful information about SAM in our country and companies.

The instrument used was developed for SAM assessment of a single company and not for a group of companies, besides being more focused on the diagnostic phase and less on the improvement phase, even though it provides some guidelines to what to achieve for each predefined level. A significant number of unanswered questions, the fact that for some of the answers the requested evidences were not provided and the fact that only one major software producer was in scope limited the validation of each answer and conclusions obtained.

No risk analysis, evaluation, treatment was performed due to project scope but also due to the fact that no risk management process was in place to allow for a qualitative or quantitative risk criteria to be defined and applied. To overcome this limitation a risk criteria should be defined and agreed with the organization, based if possible on historical data of the group but also other similar organizations, allowing a fact and objective determination of consequence and likelihood of each risk while also helping the group to determine what risks should be treated under the SAM improvement plan or can be acceptable or tolerable.

Similarly, a detailed qualitative or quantitative (to determined cost and time of each initiative) analysis of each improvement SAM initiatives should be performed, besides a risk mapping to each initiative, to support the selection of the most cost-effective initiatives to be implemented.

Due to time constraints it was not possible to assess if the initiatives proposed will, indeed, allow the group to achieve the SAM benefits and SAM risk reduction as estimated. A follow up study should be made in order to assess if the objectives and the KPI – that would also need to be established and approved – would be attained and thus allowing the group to reach the desired maturity level.

Finally, future studies on this topic should be extended to a wider range of software producers (within the group) and other organizations (for several software producers), if possible with different structures, sizes and cultures, as this could lead to an interesting set of different conclusions that are hard to obtain within a single group and focused on a single software producer.

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Appendixes

SAM Questionnaire

The instrument used is KPMG proprietary, and therefore not possible to be shared, and was designed to be used on SAM projects and that leverage knowledge and experience from previous similar projects. Due to customer structure it was required to adapt the questionnaire in order to create three sections (i.e., introduction, group questions and company questions). Below is an example of the introduction section plus the questionnaire used to assess core competences/ variables P03 and P04 (done at company level).

Software Asset Management (SAM)
Company Assessment

Company Name:		Company POC Name:	
Company Headquarters:		Company POC Position:	
Company Total Employees/ IT		Customer POC Phone / E-mail:	
Company Locations (including technical locations):			
Company and IT background Overview:			

ISO 19770-1 Categories	Core Competence	Goal(s)	Questions	Data Request	Test of Efectiveness
SAM Inventory	a. Hardware and Software Inventory	The hardware and software inventory covers a large part of the costs calculated.	• Is there a central inventory? • Which tools will be used for inventory and how? • What percentage of PCs and servers are currently collected and maintained by a tool to manage the hardware and software? • How detailed are the software / hardware records? • How is the inventory of virtual environments managed? • Is the use of the Software recorded?	• Get the devices to run software and hardware inventory of all hardware infrastructure in all groups. • The data are limited to machines on which contract-relevant software is installed. • The hardware inventory should contain all the key data that are relevant for the software license (number of CPUs, CPU type, etc.). In the case of virtual servers, the underlying hardware should be reported.	• Evaluate the software and hardware inventory by comparing several independent sources for the same inventory content. Determine records that do not match. Prerequisite for "Standardized": > = 90% of the hardware inventory of the organization must be included in the inventory source that is used for SAM and> = 80% of the software inventory of the organization must be included in the inventory source that is used for SAM. Prerequisite for "Rationalized": > = 98% of the software and hardware inventory of the organization must be included in the inventory source that is used for SAM.
	b. Accuracy of Inventory	The hardware and software inventory covers a large part of the costs calculated.	• How often is the software inventory compared with other sources to verify the accuracy of the license details (for example, user counts on the Basic of personal data)? • What are the intervals at which these take place? • How are the development / test machines and the production machines distinguished ? • Is there a hardware-assisted tracking with barcodes or RFID?	• Collect sample data from software and hardware on risky devices where 1) one or no software is reported in the inventory, or 2) the information is based on manual estimates. • The data collected must include all the details that are required to determine the relevant software license metrics (user, simultaneous / concurrent users, number of CPUs, CPU type). The collection of the sample data can be obtained either with tools or other inventory source (eg personal data, Active Directory, LDAP e-mail lists). • Collect evidence that an internal review of the correctness of the SAM inventory has occurred.	• Compare the software inventory with other independent sources , to ensure that it reflects all relevant data relating to the software and hardware correctly , which are necessary together with the license entitlements to identify the balance between the available and used software. • Evaluate the software inventory by comparing several independent sources for the same content and identify records that do not match. Draw on sample tests to support or confirm the assumptions of the inventory. (For example, if Office is installed on a desktop which is recognized only to the Active Directory , for example, or check whether servers , which are listed only in the software inventory, contain an average of 2 CPUs , for example, or whether the data of the personnel master organization with the need for user CALs match .) Prerequisite for "Standardized": The organization resembles the inventory at least once a year from other independent sources to ensure the accuracy. Prerequisite for "Rationalized": The organization resembles the inventory at least once per quarter from other independent sources to ensure the accuracy.