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ALEKSI LEHTOVIITA
ASSET MANAGEMENT AND ASSET TRACKING IN FINNISH
HEALTHCARE
Master of Science Thesis

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ABSTRACT

ALEKSI LEHTOVIITA: Asset Management and Asset Tracking in Finnish Healthcare

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The healthcare sector globally has been in a challenging position due to the growth and aging of the population and the constantly rising demand. Furthermore the improvements in technology and changes in behavior generate additional challenges. In addition to trying to cope with these challenges healthcare organizations have to perform with limited resources and be cost-effective. Asset management and asset tracking systems act as tools to solve these challenges.

The aim of this master thesis was to identify the current market situation in the Finnish healthcare sector regarding products related to asset management systems and asset tracking systems. To figure this out an empirical market research was conducted including each of the 20 hospital districts in Finland. Interviews were performed to gather information on what asset management and asset tracking systems customers are using, what capabilities these systems have and whether customers are satisfied with their current situation. The reason for the interest of the current market in this field was that GE Healthcare has products both for asset management (*AssetPlus*TM) and asset tracking (*AgileTrac*TM) but whilst performing these interviews neither product had any installations in the Nordic countries.

The study revealed that the asset management market in the Finnish healthcare sector is dominated by a certain product. 12 out of 20 customers were using a product called *Mequsoft* for asset management while the rest were using some other products. Based on the interviews the interviewees were not completely satisfied with their current situation and many were interested in what else the market has to offer. The asset tracking market situation on the other hand was totally the opposite; only 1 out of the 20 interviewees was even using asset tracking.

As a summarization, the Finnish healthcare asset management market is of interest to GE Healthcare opening up a possibility for *AssetPlus*TM to penetrate the market. As for the Finnish healthcare asset tracking market the timing is not favourable for either GE Healthcare or *AgileTrac*TM.

TIIVISTELMÄ

ALEKSI LEHTOVIITA: Toiminnanohjaus- ja laitepaikannusjärjestelmät Suomen terveydenhuollossa

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Terveydenhuoltosektorilla on maailmanlaajuisia haasteita. Terveydenhuollossa on meneillään jatkuva kysynnän kasvu ja se on kohdannut teknologian ja käyttäytymistapojen muutoksia. Resurssit ovat rajallisia, joten organisaatioiden tulisi toimia kustannustehokkaasti. Lisäksi myös Suomessa haasteena ovat suurten ikäluokkien ikääntyminen ja terveystalveluiden riittävyys. Toiminnanohjaus- ja laitepaikannusjärjestelmät ovat työkaluja näiden haasteiden ratkaisemiseksi.

Tämä diplomityö selvittää Suomen terveydenhuoltosektorin toiminnanohjaus- ja laitepaikannusjärjestelmien tämänhetkistä markkinatilannetta. Selvitystä varten tehtiin empiirinen markkinatutkimus Suomen 20 sairaanhoitopiiristä. Haastattelujen avulla kerättiin tietoa siitä, mitä toiminnanohjaus- ja laitepaikannusjärjestelmiä sairaanhoitopiirit käyttävät, onko näiden järjestelmien avulla mahdollista suorittaa tiettyjä toimenpiteitä ja ovatko haastateltavat tyytyväisiä omiin järjestelmiinsä. Selvityksen ja markkinatilanteen kartoituksen lähtökohtana oli se, että GE Healthcarella on tuotteet sekä toiminnanohjaukseen (*AssetPlus™*) että laitepaikannukseen (*AgileTrac™*). Huhtikuuhun 2015 mennessä kumpikaan tuote ei ollut vielä saavuttanut markkinoita Pohjoismaissa.

Tutkimus paljasti, että Suomen terveydenhuollon toiminnanohjausmarkkinoita dominoi tuote nimeltään *Mequsoft*, jota 12/20 haastateltavista käytti toiminnanohjaukseensa. Lopuilla haastateltavista oli erinäisiä muita tuotteita. Kaikki haastateltavat eivät olleet tyytyväisiä järjestelmiinsä ja monet olivat kiinnostuneita markkinatarjonnan mahdollisuuksista. Laitepaikannusjärjestelmien markkinatilanne ja käyttöaste ovat erilaiset verrattuna toiminnanohjausjärjestelmiin. Vain yksi haastateltavista käytti laitepaikannusjärjestelmää.

Yhteenvetona voidaan todeta, että toiminnanohjausmarkkinat tarjoavat markkinapenetraation mahdollisuuden GE Healthcaren *AssetPlus™* -tuotteelle. Laitepaikannusjärjestelmien Suomen markkinat ovat tällä hetkellä heikot. Tästä johtuen myöskään GE Healthcaren *AgileTrac™* -tuotteelle ei toistaiseksi riitä kysyntää.

PREFACE

This study was carried out in the Service Sales team of GE Healthcare Finland Oy in Helsinki. The thesis was started in the spring of 2015 with the aim to provide insight into the asset management and asset tracking market in the Finnish healthcare sector.

First I want to thank my supervisor from GE Healthcare, Niklas Lindberg for giving me an opportunity to work with such an interesting subject. I am thankful for the support and guidance but also the faith Niklas had in me. In retrospect I could not have wished for a better supervisor. From the Tampere University of Technology I want to express gratitude to Professor Minna Kellomäki for inspecting my thesis and Professor Saku Mäkinen for giving me instructions along the way.

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Aleksi Lehtoviita

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APPENDIX B: STATISTICS OF HOSPITAL DISTRICTS

LIST OF SYMBOLS AND ABBREVIATIONS

CAGR	Compound Annual Growth Rate
CMMS	Computerized Maintenance Management Systems
ECRI	Standard international nomenclature/computer coding system
ERVA	Regional Hospital Group (Erytisvastuualue)
GPS	Global Positioning System
PAS 55	Publicly Available Specification
PM	Preventive Maintenance
RFID	Radio Frequency Identification
ROW	Rest of the World
RTLS	Real-Time Location System
SWOT	Strengths, Weaknesses, Opportunities, Threats
UWB	Ultra Wideband
CAREA	Hospital District of Kymenlaakso
EKSOTE	Hospital District of South Karelia
EPSHP	Hospital District of Southern Ostrobothnia
ESSHP	Hospital District of Etelä-Savo
KSSHP	Hospital District of Central Finland
HUS	Hospital District of Helsinki and Uusimaa
ISSHP	Hospital District of Itä-Savo
KAINUU	Hospital District of Kainuu
KHSHP	Hospital District of Kanta-Häme
KPSHP	Hospital District of Central Ostrobothnia
LHSP	Hospital District of Lapland
LPSHP	Hospital District of Länsi-Pohja
PHSOTEY	Hospital District of Päijät-Häme
PKSSK	Hospital District of North Karelia
PPSHP	Hospital District of Northern Ostrobothnia
PSHP	Hospital District of Pirkanmaa
PSSHP	Hospital District of Pohjois-Savo
SATSHP	Hospital District of Satakunta
VSHP	Hospital District of Vaasa
VSSHP	Hospital District of Southwest Finland

1. INTRODUCTION

This chapter presents the subject of this thesis and the background of the research. The introduction provides the reader with the objectives of the work, how the thesis has been outlined and what the structure of the work is. Additionally this chapter features a short presentation of the target company.

1.1 Background

The need for healthcare will grow significantly during the near future due to the aging and increasing population and the rise in general standards that follow the advances in technologies. In practice this means that hospitals and other healthcare facilities must provide top-notch service with limited resources and for a lower price. This challenging situation will not be resolved only by increasing resources but also by optimizing the daily operations of an healthcare organization. The aim must be shifted to more efficient process controlling to maximize benefits and minimize drawbacks. Asset management and asset tracking systems enable this by bringing clarity and order into the healthcare business.

The need for asset management and tracking systems in hospitals is significant and will become even more significant in the future. Therefore it is necessary to evaluate the current market situation by assessing hospitals also of the Finnish healthcare. Only recently the healthcare business has been growing awareness of what benefits both operationally and financially a working asset management and tracking system can provide. A market research of supply and demand of these systems is in place.

1.2 Target company

General Electric (GE) is an American multinational company and by market value one of the world's largest. The company operates internationally in several different fields of business including healthcare, infrastructure, power production, aviation, transportation and oil and gas. (Forbes) GE was founded in 1878 by a great inventor and businessman Thomas Alva Edison. GE is currently the only company in the Dow Jones index that also belonged to the original index back in 1896. Today GE operates in over 170 countries and employs more than 300 000 people. The current CEO of the entire GE organization is Jeffrey R. Immelt. (GE History 2015)

GE Healthcare is a subsidiary of General Electric focusing on healthcare products and has annual revenue of about \$18 billion dollars. GE Healthcare is the only subsidiary of

GE, which has its headquarters outside the United States in the United Kingdom. GE Healthcare Finland specializes in patient treatment and monitoring solutions, clinical information systems, imaging devices, medical diagnostics, and life science products. The GE Healthcare main office of Finland, which is situated in Helsinki, is one of five centers of expertise in patient monitoring in the world and the only one in Europe. Globally GE Healthcare employs over 50 000 people of which about 700 work at GE Healthcare Finland in Helsinki and a small amount in Kuopio. (GE Healthcare 2015)

1.3 Objectives and outlines

The Service Sales department of GE Healthcare Finland is interested in evaluating the current market situation in hospital districts throughout Finland regarding asset management and asset tracking products. This thesis is a market research of the subject. The main goal of this work is to gain more knowledge of the market situation of asset management and tracking solutions in the Finnish healthcare sector and to understand what the future needs of customers are. Additionally GE Healthcare has its own asset management (AssetPlus™) and asset tracking (AgileTrac™) systems and wants to know whether there is a potential market share in Finland for these products.

This work is outlined to only a market research and gaining a general understanding of asset management and tracking systems especially in the healthcare sector, mainly hospitals. The objective is not to obtain a final decision from customers but rather gather vital information to help decide on how to proceed with the next steps.

The theoretical part of this research mainly consists of literature reviews and knowledge from within the company. The empirical part focuses on the interviews done during customer meetings with members of different hospitals of Finland.

1.4 Structure

The introduction is followed by chapters 2 and 3, which present asset management and tracking in general, what they bring to an organization, how they work as part of an organization especially in healthcare business, and why they are beneficial to an organization. Additionally chapter 3 will introduce the asset management and tracking products of GE Healthcare; AssetPlus™ and Agiletrac™. Chapter 4 goes through the process of performing a market research. In this chapter the market research process framework is introduced after which market sensing and go-to-market strategy are discussed. Chapter 5 consists of the empirical part of this thesis. In this chapter the market research process discussed earlier is implemented. The chapter contains data from the interviews and analyses of them. A few case examples are also introduced. The last chapter provides a discussion of the results and conclusions of this master thesis.

2. ASSET MANAGEMENT AND ASSET TRACKING

2.1 Asset management

The term asset management has slightly different meanings depending on the context in which it is used. For example in the information systems sector asset management is understood as the barcode labeling of computers and peripherals to track location and monitor their status. On the other hand, in the financial services sector it is used to express the management of investment portfolios. (HFS 2012)

The ISO 55 000, an international standard covering management of physical assets defines asset management as the “coordinated activity of an organization to realize value from assets” (IAM). Activities associated to these involve identifying required assets, recognizing funding requirements, acquiring assets and providing support for assets regarding logistics, maintenance, disposal and renewal. Thus asset management does not only include the basic maintenance of assets which is primarily known as keeping equipment in operating condition but also a broad range of other activities. (Hastings 2010) Assets on the other hand are defined as “an item, thing or entity that has potential or actual value to an organization” (IAM). The Asset Management Council of Australia defines asset management as “the life cycle management of physical assets to achieve the stated outputs of the enterprise”. The Publicly Available Specification on Asset Management (PAS 55) by the British Standards Institute describes asset management as “systematic and coordinated activities and practices through which an organization optimally and sustainably manages its assets and asset systems, their associated performance, risks and expenditures over their lifecycles for the purpose of achieving its organizational strategic plan”. (Hastings 2010)

All the definitions have the same message; asset management represents the technical and financial aspects in deciding what assets are needed to meet the business goals and then acquiring those assets and carrying them over their life cycle until disposal. When talking about the healthcare business and especially when considering larger institutions like hospitals two connotations of asset management are most relevant;

1. operation, which purpose is to align the property portfolio together with the objectives and mission of an organization also known as property asset management
2. operation, which is aligned to optimize the control of facilities and equipment known as enterprise asset management (HFS 2012)

In his text “An introduction to Asset Management” former President of the Institute of Asset Management, Robert Davis has gathered the main points followed below to address the question on why asset management is important;

1. Reduce the total costs of operating their assets
2. Reduce the capital costs of investing in the asset base
3. Improve the operating performance of their assets (reduce failure rates, increase availability etc.)
4. Reduce the potential health impacts of operating the assets
5. Reduce the safety risks of operating the assets
6. Minimize the environmental impact of operating the assets
7. Maintain and improve the reputation of the organization
8. Improve the regulatory performance of the organization
9. Reduce legal risks associated with operating assets (Davis 2012)

The solution for performing good asset management is to optimize the benefits mentioned above. More specifically, it is balancing the desired performance of the assets with the costs, risks, and opportunities in order to acquire the best blend to achieve organizational objectives. This is illustrated in Figure 1. (Davis 2012)

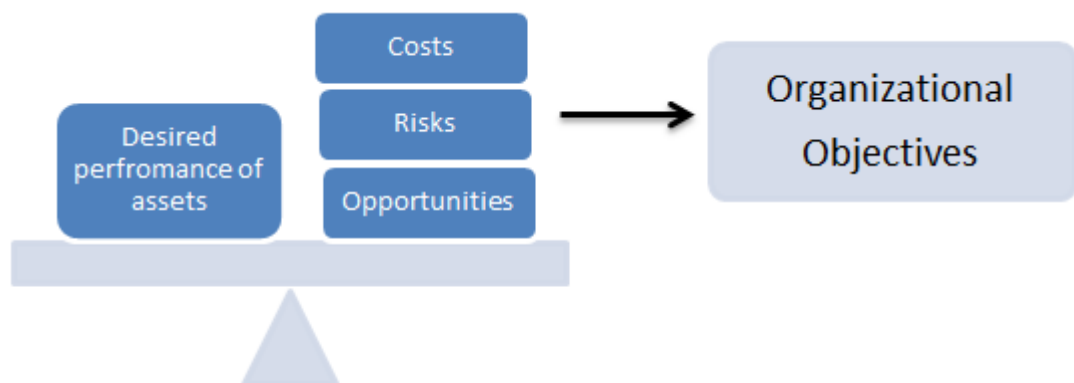


Figure 1. *Optimizing benefits to achieve organizational objectives (adapted from Davis 2012)*

Each organization is unique and has different organizational objectives. Thus the desired performance of assets, costs, risks and opportunities also differ between different organizations.

2.2 Asset tracking

Asset tracking is defined as different activities in order to maintain order of equipment, reduce time to search for them and minimize the loss/disappearance of them. Additionally asset tracking can include optimizing the use of equipment and scheduling for example maintenance. All these activities aim at increasing efficiency of an organization.

(HFS 2012) Different technologies are available for location tracking with Radio Frequency Identification (RFID) and Real-Time Location System (RTLS) being the most widely used (OATSystems 2013). An overview of different technologies including their benefits and drawbacks are represented in chapter 2.2.3.

2.2.1 RFID –technology

RFID -technology is based on automatic and wireless recognition and data acquisition. The technology is fairly new; the first applications based on it were introduced in the 1980s. The RFID technology is based on the utilization of radio signals to identify, trace and control physical objects such as devices, humans and animals. Compared to barcode labeling technology RFID does not require physical contact or line of sight since identification of physical objects happens at the item level instead of category level. Furthermore processing of multiple tags simultaneously is possible, the capability of data storage is enhanced, and data can move both ways (so-called read-and-write). (Castro et al. 2013) RFID has been broadly used amongst different industrial applications such as manufacturing, transportation, logistics and even in the military. Lately RFID technology has been incorporated together with asset management systems to provide a collaborative working system. (Meng et al. 2008) In Figure 2 the basic concept of a RFID system with the main components is shown.

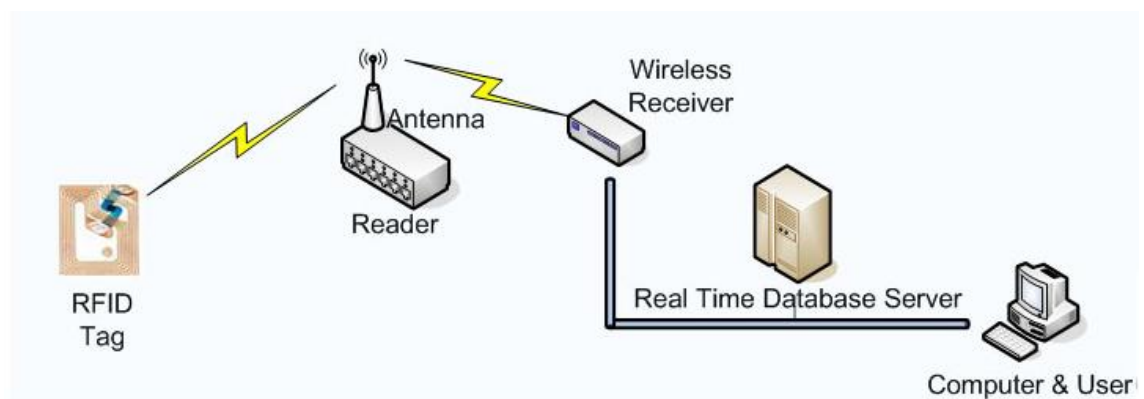


Figure 2. A RFID system and the main components (adapted from *RFIDHY Technology*)

A RFID system consists of three main components: RFID identifiers (tags), RFID readers and RFID middleware (Figure 2). Typically RFID tags are constructed of a microchip and an antenna. RFID systems can be divided into two groups: active and passive systems. The tags used in active systems contain their own energy source, which is usually a built-in battery. Due to their internal energy source active tags send a more powerful signal and thus readers can detect signals from further away (20-100m). However, an in-built energy source also makes active tags larger in size and price ranges higher. Active tags function at higher frequencies due to their energy source. (Vo et al. 2011)

Passive tags, on the other hand, require an external energy source for example readers. They are cheaper because their structure is considerably simpler and also smaller. Due to the fact that passive tags do not have the capability to transmit signals, readers suited for passive tags must send signals continuously. When the signal from the reader reaches the passive tag, it stores the energy from it into its capacitor and sends a signal back to the reader when enough energy has been stored. Passive tags are suitable for shorter distances and tracking of cheaper assets due to lower energy levels and smaller memory capacity. (Vo et al. 2011)

RFID readers consist of one or more antennas through which information is received and sent with RFID tags. RFID readers have two tasks. First of all they produce an electromagnetic field so that passive tags can use the energy to send information. Secondly, their task is to receive and process the information sent by the tags. Even though they are called readers and one might think they can only read information, readers can actually also delete and edit information of the tags with their electromagnetic field. (Vo et al. 2011)

2.2.2 RTLS –technology

Real-Time Location System (RTLS) is often confused with RFID and even used interchangeably but as a matter of fact they are completely different solutions. As mentioned previously RFID is used to describe the use of radio signals via electronic tags to wirelessly retrieve identification codes. The RFID method was developed to solve shortcoming issues with the traditional barcode reading. RTLS does not only retrieve the identification of tags but also provides real-time location by pinpointing. Compared to RFID the signal of the tag is captured by multiple sensors from different locations in order to calculate location either by triangulation or multilateration. Confusion between RFID and RTLS comes from the accurate definition of what location information means. A way to differentiate RFID from RTLS is to imagine RFID as a fixed still camera and RTLS as a panning video camera. RFID provides snapshots of the state and location of what is going on but a video camera provides a live feed of real-time information all the time. “A Real-Time Location System is any system using a network of sensors to determine the coordinates of a tag in real-time, anywhere within an instrumented area”. By this definition we can separate location coordinates such as “on the 2nd floor” or “passed the door a minute ago” into the RFID category and coordinate example “on shelf B3 on aisle 4” and “entering through door and turning towards hallway B” into RTLS. (Ubisense 2012)

2.2.3 Other technologies

In addition to the RTLS and RFID (active or passive) there are also other technologies that can be used for asset tracking. For example Global Positioning System (GPS) and

Ultra Wideband (UWB) are other possibilities for asset location tracking. GPS uses the help of satellites to measure latitude, longitude and altitude of a receiver. Usually GPS receivers are embedded into devices to ease the use of them. Due to the fact that GPS is not suitable for indoor use, GPS is not a relevant alternative for hospitals regarding inside use. UWB uses radio frequencies just as RFID but across a broader range. Tags also have to be compatible with UWB. This technology is fairly new and does not have as much reference as other technologies. Table 1 gives an overview of the main technologies used in asset tracking. (Mallick & Teskey 2007; Clarinox 2009)

Table 1. *An overview of technologies used in asset tracking with their benefits, drawbacks and common uses. (adapted from Mallick & Teskey 2007; Clarinox 2009)*

Technology	Benefits	Drawbacks	Common uses
Real Time Location System with WiFi (RTLS)	<ul style="list-style-type: none"> - utilizes existing Wi-Fi infrastructure - real-time X,Y data 	<ul style="list-style-type: none"> - precise location requires multiple Wi-Fi access points - cost of tags 	<ul style="list-style-type: none"> - tracking hospital equipment and staff - warehouse applications
Active RFID	<ul style="list-style-type: none"> - does not require Wi-Fi environment - provides opportunity to incorporate other sensor data (ex. temperature) - flexibility in hardware configuration 	<ul style="list-style-type: none"> - technology proprietary in nature; costs might alternate depending on features incorporated and vendor 	<ul style="list-style-type: none"> - tracking of specialized/costly equipment in hospitals - applications where both location and state is essential (e.g. cold chain)
Passive RFID	<ul style="list-style-type: none"> - utilizes existing RFID system/ knowledge - flexibility in hardware configuration - low-cost tags 	<ul style="list-style-type: none"> - no visibility of assets in blind spots (between read points) - choke-point level visibility 	<ul style="list-style-type: none"> - tracking of lower-cost assets - checkpoint recording
Ultra Wideband (UWB)	<ul style="list-style-type: none"> - Wi-Fi network not required - very accurate location tracking 	<ul style="list-style-type: none"> - fairly new technology; user experience limited 	<ul style="list-style-type: none"> - market not completely defined - suitable for applications with high location precision
Global Positioning System (GPS)	<ul style="list-style-type: none"> - investment only in receivers, no need to maintain reader infrastructure 	<ul style="list-style-type: none"> - not suitable for indoor applications - location can differ up to 8-10 meters 	<ul style="list-style-type: none"> - consumer driving - military - outdoor use

Based on the needs different technologies suit each purpose individually. However for the healthcare sector RFID and RTLS have been most commonly used.

3. ASSET MANAGEMENT AND ASSET TRACKING AS PART OF AN HEALTHCARE ORGANIZATION'S OPERATIONS

3.1 Background of the healthcare industry

The healthcare industry is one of the major sectors in many economies around the world and an industry, which will always have a significant role. For example in the United States the healthcare industry makes up a multi-trillion dollar system, having created as many as 14.3 million jobs by 2008 and is estimated to add 3.2 million jobs more by 2018. (Wamba et al. 2011) The worldwide expenses on medical equipment and devices increased from US\$145 billion to US\$220 billion between 1998 and 2006 and are expected to keep on growing (Castro et al. 2013). However the healthcare industry currently has challenges ahead since operating costs are increasing, the amounts of medical errors are growing and an aging population is rising. All of these factors increase pressure on healthcare expenditure. Additionally with the instability of the finance world and the effects of the economic crisis still present several healthcare organizations are facing the difficulties of providing service. (Wamba et al. 2011)

By looking closer at a few statistics we notice what the future trend of the healthcare industry is and why products related to asset management and asset tracking would be useful. An investigation by the GE Healthcare Asset Management team was done compiling 45 hospitals across the United States. Statistics were gathered from two time spans, from 1995 to 1997 and from 2008 to 2010. The changes between these time periods were measured in three different categories: service costs per device, distribution of cost per bed and distribution of inventory per bed. Each category was represented in different percentiles and the mean of these percentiles. (Horblyuk et al. 2012)

Over the time span of 15 years the mean service costs per device including labor and spare parts costs rose on average by \$40 from \$210 to \$250, which equals to a 19% increase (Figure 3). What can be noticed also is that depending on the size of the hospital the rise in service costs per device varies. For example the 25th percentile has a rise of almost 38% (162-223) compared to the 75th percentile which grew by 5% (250-263). In conclusion amongst the three categories having been measured the rise of service cost per device is modest since the costs have roughly stayed around the rate of inflation. (Horblyuk et al. 2012)

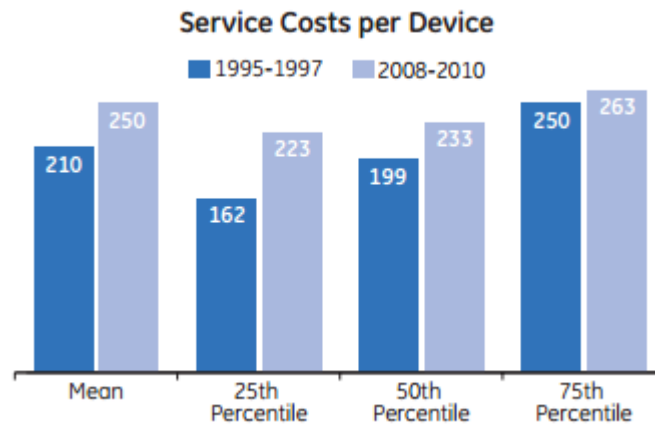


Figure 3. Service costs per device (adapted from Horblyuk et al. 2012)

The average amount of devices needed to treat a patient has grown on average 62% in a time span of 15 years. When inventory of a hospital bed was around 8 in the 1990s, 15 years later in 2010 the amount had reached 13 devices per patient (Figure 4). When coupling this statistic with the fact that the average utilization rate of mobile devices per year is 42% concerns arise. (Horblyuk et al. 2012) Furthermore another study shows that in the current healthcare environment up to 58% on average of assets in hospitals are idle (Health Imaging 2015). It is clear that technology advances have increased the amount of different types of devices but at the same time more functionality is being combined into a single device. When in the past monitors measured only blood pressure, nowadays pulse oximetry, EKG, temperature and other vital signs can be measured with the same device. (Horblyuk et al. 2012)

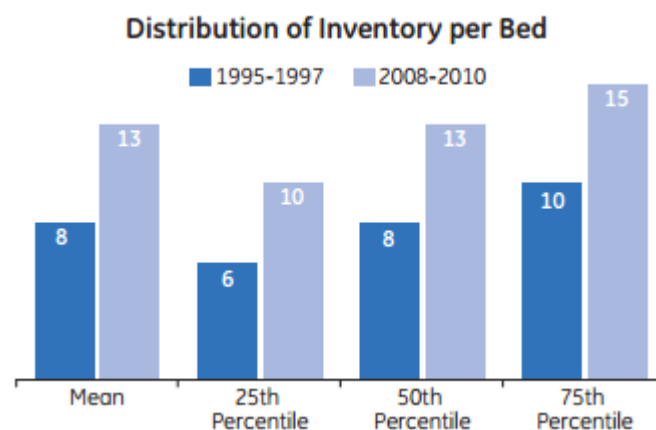


Figure 4. Distribution of inventory per bed (adapted from Horblyuk et al. 2012)

In addition, the reduction in the cost of medical devices and changes in accounting policies may have a role in the incline. Before assets of over \$500 would be capitalized, now the level is at the range of \$1000-\$1500. This results in treating lower valuable assets as consumables with a “throw-away” mentality. Many hospitals also believe that it is less costly to rent, lease or acquire more assets rather than optimize the use of existing assets. In reality additional assets pile up the system and drives increasing costs. As

a result the number of devices per bed is rising at a concerning level. (Horblyuk et al. 2012)

The most alerting statistic is the costs per bed meaning the service and maintenance costs of mobile devices per bed. On average the rise has been over 90% from \$1656 to \$3144 per bed. In smaller hospitals (25th percentile) the rise has been the steepest, a staggering 120% (Figure 5).

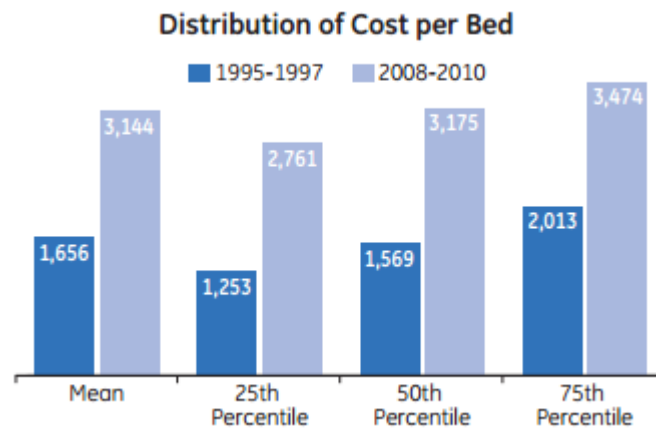


Figure 5. *Distribution of cost per bed (adapted from Horblyuk et al. 2012)*

Considering the fact that the service costs per device remained quite modest, the large increase of distribution cost per bed relates directly to the inflated inventory of hospitals. In addition, the results of this study were on the low side; the analysis that provided these statistics was done focusing only on costs associated with service and maintenance of assets, in the form of labor and spare parts. Other costs such as the cost of acquisition, consumables, software agreements, installations and training were not taken into account. Thus in general the results could be even more alarming if these factors were also considered. (Horblyuk et al. 2012)

3.2 Asset management and asset tracking in healthcare

In today's hospitals computerized maintenance management systems (CMMS) are necessary to keep control and manage assets and their maintenance. A CMMS or asset management system is not only to provide scheduling for preventive maintenance, it offers much more. At best a CMMS enables the user to create asset logs to record events linked to a certain asset, schedule work orders automatically or manually, follow authorized use of assets, and track and record statistics of maintenance history, parts inventory, downtime of devices, employee training history, purchase orders and much more. (Kullolli 2008)

As an example the Middlesex Hospital in Connecticut, USA found the following points important when choosing a CMMS system to improve efficiency of their organization:

- ease of use
- create tasks and planned events
- dynamic/adaptable over years
- 24/7 technical support
- training included
- run quick reports, manage reports, create customizable reports
- work order request over the web by clinicians
- automatic alerts and recalls
- integration with possible asset tracking
- close work orders instantly by e.g. barcode scanner (Kullolli 2008)

Asset tracking systems are also advantageous in hospitals and other healthcare organizations due to several factors. The main reason is that because many assets are mobile they have a tendency to end up in “wrong places”. Knowing where each asset is located in a matter of seconds reduces the need to search for them and allows the time to be used for something else, e.g. spending more time with the patient. Furthermore if existing processes do not provide an asset to the user when needed, users tend to hoard equipment in advance to ensure its availability when possibly needing it. Many hospitals still tend to handle assets randomly without any systematic processes in order to ensure that a nurse can find a clean working hospital bed for a patient when needed. Another huge problem on the other hand is the utilization rate of assets in a hospital. On average the utilization rate is only 42% of mobile devices meaning that equipment is not being used in full capacity. It is expected that the healthcare industry will become the next industry that will apply and invest heavily on RFID technology to overcome these barriers. (Castro et al. 2013)

3.2.1 Asset knowledge

Asset knowledge comprises the knowledge of the assets of an organization including the current base of assets, the role of each asset, and the possible need for assets in the future. In order for managers to make wise decisions regarding their business they must be aware of several factors. In his book *Physical Asset Management*, Hastings has compiled a summary of points of information what an asset manager of an organization may need to figure out. These points are represented in Table 2. (Hastings 2010)

Table 2. *Points of information for an asset manager (adapted from Hastings 2010)*

1. What assets have we got
2. Where are they located
3. What is the business significance of our major assets
4. What is the profit and loss position of our major assets
5. What is our asset utilization including peak load and seasonal factors
6. Are there gross imbalances – that is, major shortages, surpluses or misallocations of equipment or personnel
7. What is the condition of each major asset
8. Are reliability or availability issues significant
9. How much longer can specific assets last
10. Are there significant risks
11. Are maintenance costs a significant factor
12. What asset related developments and market opportunities exist
13. What has the market got to offer in terms of assets that we might usefully acquire

The more answers an organization can provide on the points mentioned in Table 2 the more probable it is for the organization to have success in asset management.

3.2.2 Asset life cycle

The essential point of asset management is the understanding of the asset life cycle. The asset life cycle diagram (Figure 6) represents the different phases an asset goes through its life span. The phases include identifying the need, designing the solution, procuring the assets, maintaining and monitoring performance, modifying or upgrading the assets and decommission, redeployment or disposal of assets. Sometimes identifying the need, designing the solution and procuring the assets are all designated as part of acquiring an asset. (Davis 2012; Mass 2015)

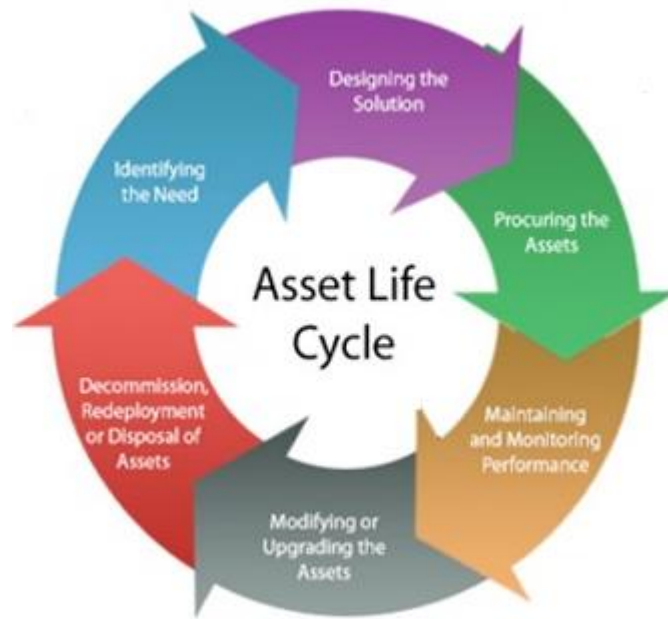


Figure 6. *The Asset Life Cycle (adapted from Mass 2015)*

Identifying the need is the first phase of the asset life cycle. A need is a gap between what is and what should be. Before any new asset acquisition occurs there needs to be consideration of what is needed. Usually a need becomes timely when a new goal is set. For example if a healthcare organization's goal is to expand and provide more and better infant care, it is more probable that there is a need for maternal-infant care products. (Davis 2012; Mass 2015)

Designing the solution takes place when the need has been identified. It is simply solving out the specifics of how the need is fulfilled by answering questions such as; which product and how many, what is the timeframe of the acquisition and ownership and whether to rent or lease. After the specifications of the asset have been determined the next phase is to procure the asset. This phase is simply about obtaining the designated asset. The commission of the asset can also be included into the procurement phase. This covers the installation or in some cases creating/building the asset and ensuring that it is fully functional. (Davis 2012; Mass 2015)

The next two phases, maintaining and monitoring performance and modifying or upgrading the assets, both belong to the operational side of the asset life cycle. These two make up the bulk of the whole cycle providing the main function of what the asset is designed for. For many assets these two phases can be measured even in decades. Maintaining and monitoring performance follow along the use of the assets whilst modifying or upgrading assets is timely when changes in conditions or operational requirements occur. (Davis 2012; Mass 2015)

The last phase of the asset life cycle consists of the decommission, redeployment or disposal of the asset. This phase is at the same time a key period within an asset's lifetime and a phase that is often overlooked. In addition to performing one of functions mentioned, other key activities of this phase are planning the replacement of the asset (if necessary), determining the operational requirements based on how it has functioned, and acknowledging possible failures and flaws. (Davis 2012; Mass 2015)

Related to the asset life cycle model (Figure 6) the following Figure 7 represents strategic factors. Based on factors such as profitability, condition, criticality etc. actions have to be made. Actions include acquiring, retaining, replacing or disposing an asset. Depending on whether it is acquisition, operations or maintenance there are different responsibilities and interests as can be seen in Figure 7.

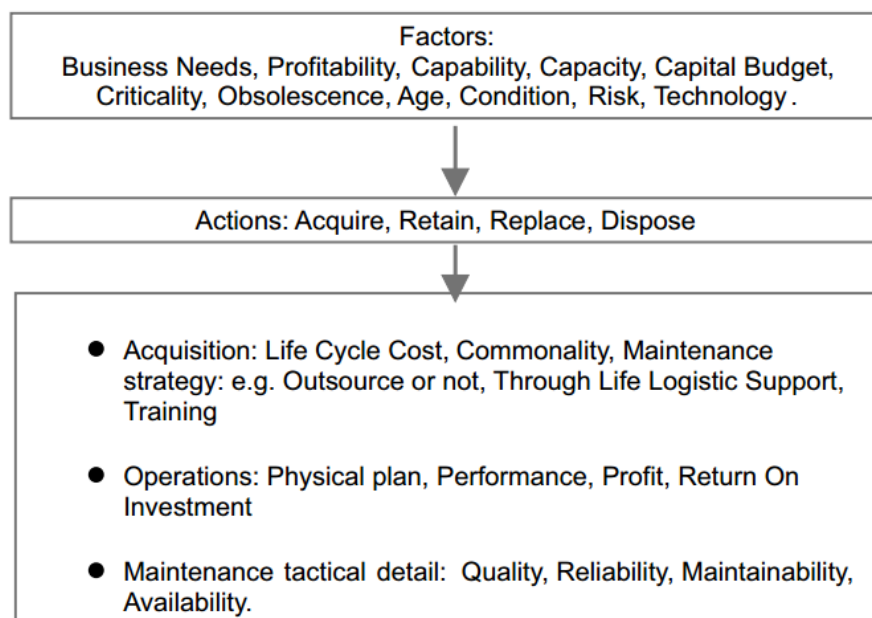


Figure 7. Asset strategy model (adapted from Hastings 2010)

3.3 Healthcare asset management market

There are several different asset management and asset tracking systems in use and available in the market. Furthermore there seems to be a positive trend considering the future. The global asset management market in healthcare had an estimated value of \$6.7 billion in 2015 and has a forecast of rising to \$29.6 billion by the year 2020 with a Compound Annual Growth Rate (CAGR) of 34.6% during the period. In asset tracking the RFID technology in hospitals is dominating the market and is expected to continue growing at a strong pace during the time period of 2015-2020. (MarketsandMarkets 2015)

Regionally North America leads the healthcare asset management market with a global market share of 44% in the year 2012 and has expected growth at a CAGR of 35% from 2015 to 2020 (MarketsandMarkets 2013; MarketsandMarkets 2015). North America has a majority share due to a large amount of RFID and RTLS technology providers in the US and the ease of access in the region. The European market follows North America in second place. Asia and the Rest of the World (ROW), like in many fields of industry, is expected to have the highest CAGR within 2015-2020 due to increased amount of investors and growing awareness in countries such as China and India. (MarketsandMarkets 2015)

Although there are several providers of asset management and asset tracking systems worldwide the market is dominated globally by a quartet sharing about 80% of the market share. The major players on the market include AeroScout, Inc. (U.S.), Ekahau, Inc. (U.S), GE Healthcare (U.K) and Awarepoint Corporation (U.S). The rest is shared by other multinational companies like IBM Corporation (U.S.) and Siemens Healthcare (Germany). AeroScout Inc. is expected to dominate the market in 2015 with close to a one-third market share. (MarketsandMarkets 2015)

Different asset management systems have been used in the Finnish healthcare from the 1980s, from the same decade when computers started to develop (Mäkelä 2006). However, only during recent years there has been an increased interest and acknowledgement of the benefits an asset management system can provide (Junttila 2008). The idea of this market research was to find out what the market related to these systems is in Finland. This will be presented more thoroughly in chapter five. Next the products of GE Healthcare regarding asset management and asset tracking will be introduced.

3.3.1 AssetPlus™ (GE Healthcare)

AssetPlus is a computerized maintenance management system (CMMS) product from GE Healthcare. It is especially intended to be used in the healthcare sector by a variety of different hospital teams: biomedical, technical service, medical technicians, financial services, information technology and caregivers. The strong focus of AssetPlus is on the biomedical module but IT and facility modules are also available. AssetPlus provides control of all assets through their lifecycles, helps optimize the use of personnel, delivers safe and high-quality treatment and enhances financial performance. (GE Global Asset Management)

AssetPlus is currently being used in 680 sites in 21 different countries with France having a majority of 360 sites. This means that over 15 million assets in total are being managed worldwide (Figure 8). At the moment AssetPlus is provided in 13 different languages.



Figure 8. Spread of AssetPlus (adapted from GE Global Asset Management)

Hospital personnel can make the most of the AssetPlus software to maximize their use of time by eliminating tasks previously done manually. The intuitive interfaces (Figure 9-11) enables the opportunity to work on comprehensive maintenance reporting and tracking to provide access to inventory data of every asset, preventive and corrective maintenance requests from different departments, stock levels of different devices, and parts and statistics of measurements and reports. (GE Global Asset Management)

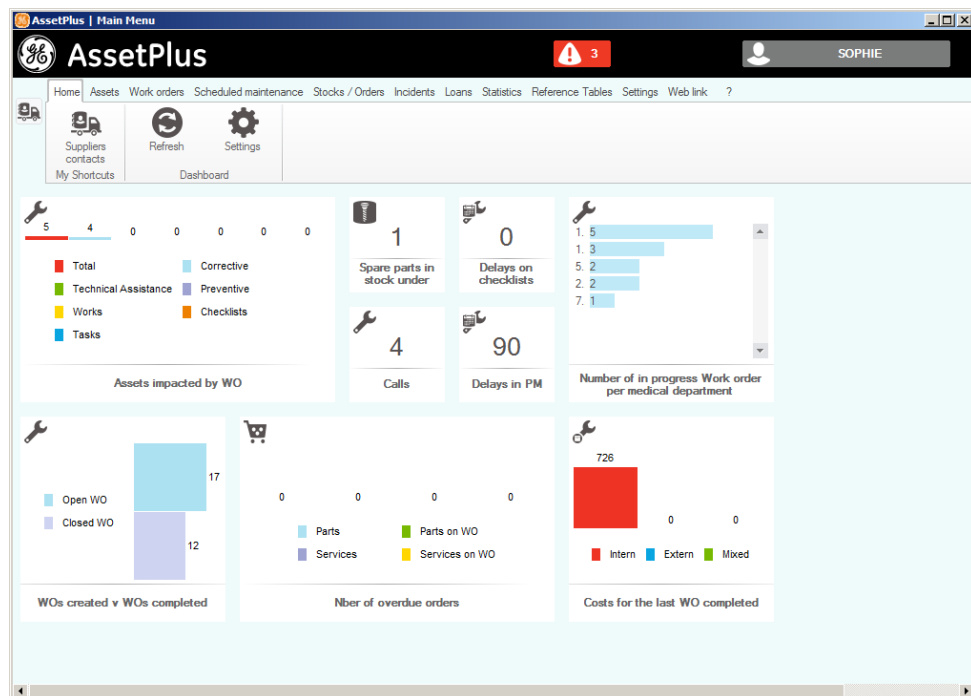


Figure 9. The Client server module interface of AssetPlus (GE Global Asset Management)

Asset inventory and database allows managing the inventory of equipment (medical, non-medical) by different technical teams either on the client server module (Figures 9 and 10) or the AssetPlus web module (Figure 11).

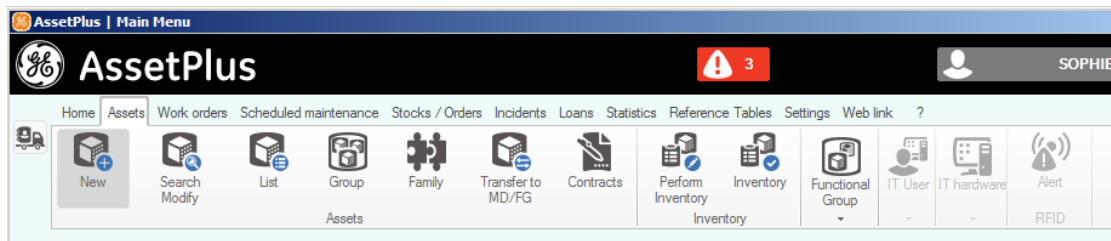


Figure 10. The tab menu of the client server module of AssetPlus (adapted from GE Global Asset Management)

The AssetPlus web module is a stripped-down version of the client server module. This means that not every function can be done on the web module as can be done on the client server module.

Figure 11. The Web module interface of AssetPlus (adapted from GE Global Asset Management)

AssetPlus also integrates the asset inventory descriptions with the standard ECRI nomenclature or equivalent and enables the flexibility for the user to edit device descriptions and create own nomenclatures (GE Global Asset Management).

Work order management is performed by different work order types; preventive, corrective, technical assistance and other subtypes. The strong feature of AssetPlus particular-

ly is the planning and monitoring of preventive maintenance (PM) work. The PM can be scheduled either as a singular device fixture or by groups of devices. Furthermore the device schedule can be set as fixed or as floating. The user is also provided with drop down menus to be able to track device and problems more precisely. (GE Global Asset Management)

The spare parts inventory can be managed through AssetPlus allowing parts to be linked to equipment and work performed. Information about parts can be linked to an asset, ECRI codes or even to a specific model or manufacturer. It is possible to track part stock levels and store locations of the stocked inventory. A direct link is provided to make parts requisitions as easy as possible. Supplier contracts can be managed by linking them to device inventory. (GE Global Asset Management)

Workforce planning saves time and optimizes the work of technicians. Data integrity and reduced data entry is due to locked fields and drop-down menus which are also customizable to suit the user. It is possible for instance to move scheduled tasks from one technician to another or move the task in time with a few clicks. Workload planning includes reporting all the scheduled absences, training, vacations etc. in the same place to grow the efficacy of the workforce. (GE Global Asset Management)

By monitoring current activities, generating reports on these activities, listing malfunctions to create a history for specific assets, and producing other information on assets provides better technical customer service. AssetPlus for example provides statistics on repairs performed (sector/technician), cost of actions (technical time/parts), action performance, preventive maintenance work, and equipment history. Barcode labeling is also possible on AssetPlus. A module is created within AssetPlus that allows the user to design, format and even print barcode labels to tag assets. (GE Global Asset Management)

The possibility to use AssetPlus on a mobile device enables the workforce to be reactive and raises the level of mobility. The chance of mobility results in decreased time to open and operate work-orders, limit the amount of travel needed by technicians and enable technicians to pick up work-orders “on the run”. Figure 12 represents an example of the process starting from a request and ending in a closed work-order with data available to anybody. (GE Global Asset Management)

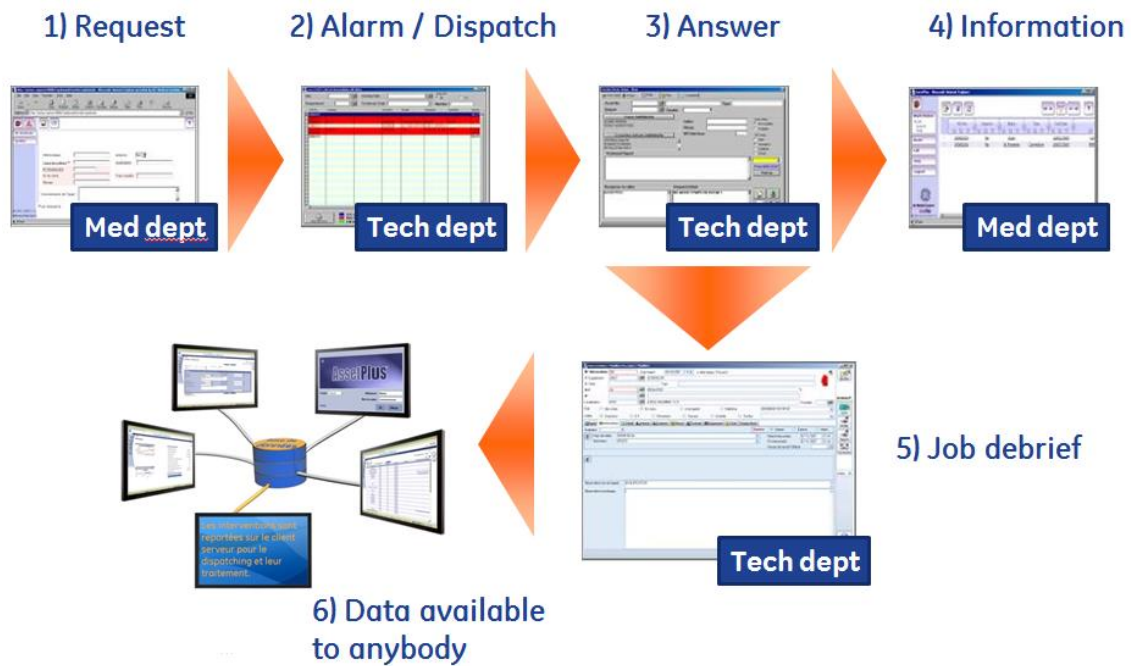


Figure 12. An illustration of a typical process in AssetPlus (adapted from GE Global Asset Management)

3.3.2 AgileTrac™ (GE Healthcare)

The AgileTrac Asset Manager system is another product from GE Healthcare that allows precise asset tracking and location due to RTLS –technology. AgileTrac feeds continuous information of each asset providing a real time situation to the users. This allows tracking and finding assets to run effortlessly saving time for personnel to focus on patients. The inventory level of critical assets is easier to follow as an automatic alarm system alerts when stocks are low. Rental expenses can be minimized when more equipment is in circulation and the utilization rate is maximized. Agiletrac for example calculates rental cost per day and keeps schedule of due dates for timely return. Customized loss prevention alerts keep all the necessary equipment in place. (AgileTrac™ 2015)

In conclusion the benefits an organization can gain by using the AgileTrac include:

- reduced operational costs with less equipment rental
- less missing or broken equipment
- improved utilization of all equipment
- faster equipment turnaround time: more streamlined patient care
- improved maintenance, cleaning and compliance
- complete data for real-time inventory management and capital planning (AgileTrac Asset Manager 2009)

3.4 Healthcare legislation

The Finnish law system also has effect on the use of asset management and asset tracking systems. The legislation on healthcare devices and equipment (*629/2010 Law on healthcare devices and equipment*) for example defines requirements of devices used in healthcare, responsibilities of manufacturers and users, and demands and surveillance of professional use. The law also obliges professional users to use a system, which possesses information of devices, their location, maintenance history and danger situations. A professional user is meant as a healthcare related organization that either uses or gives out medical devices to the patient whilst performing their profession. (Finlex 629/2010 2010)

In more detail legislation dictates that every healthcare unit must have a person in charge to monitor that every operation being done obeys the law. In addition, every operating unit and department has to have a person appointed in charge of devices. The person in charge of the devices is responsible that the personnel using the healthcare devices have necessary training, use the device as intended and according to instructions, maintenance of devices are done as scheduled, and inventory is being done periodically. (Finlex 629/2010 2010)

When healthcare units acquire new devices, the devices need to go through an acceptance inspection after which they need to be inserted into a device register. The device register is usually included in the asset management system. Usually the acceptance inspections are done by the receiving end for example the medical service department. The medical service department or corresponding department also updates the register. Alternatively the inspection can also be performed by the equipment supplier. During the inspection identification, usually a barcode sticker is attached to the device. With the identification devices can be individualized in the device register. (Finlex 629/2010 2010)

In Finland Valvira (National Supervisory Authority for Welfare and Health) supervises and guides healthcare organizations and medical professionals with the use of medical devices and accessories. Valvira monitors the public and the private sector and ensures that there is compliance with the requirements and safety amongst the use of medical devices. Valvira has the right to do inspections to ensure that actions are pertaining to law. Additionally organizations have the responsibility to report about dangerous situations to Valvira. (Valvira 2008) A schematic of how medical devices are managed in a healthcare organization is represented in Figure 13.

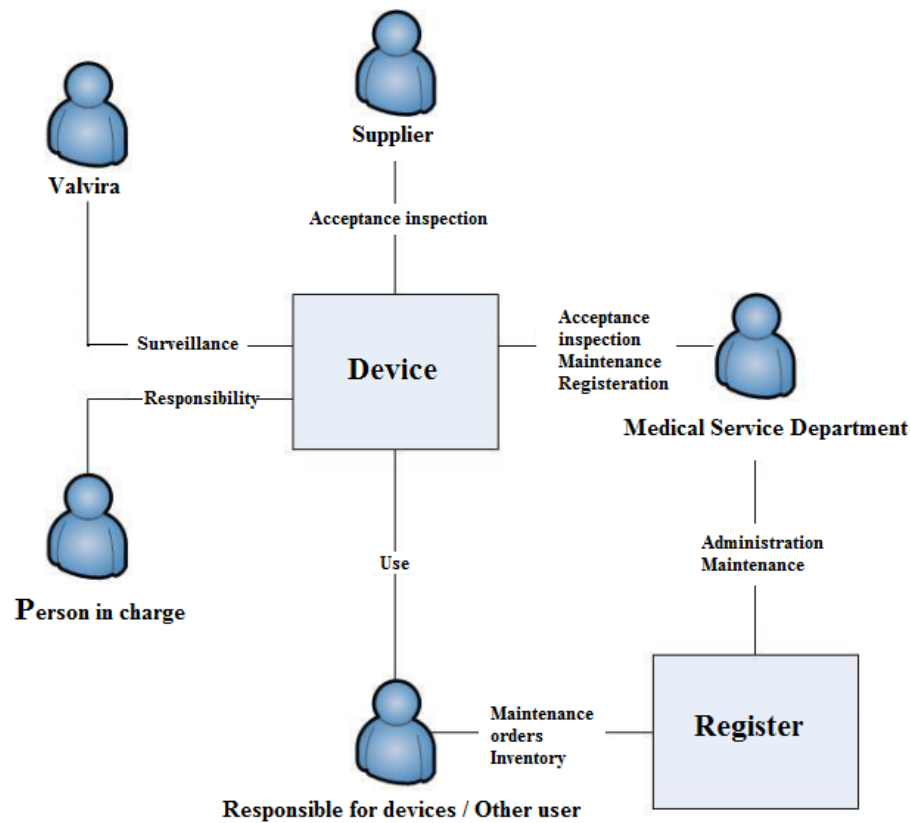


Figure 13. *Management of medical devices (adapted from Kesälähti 2014)*

The device itself and the device register/asset management system are the key players of the diagram. Other players include Valvira, the supplier, the person in charge, the person responsible for the devices/other user and the medical service department. Additionally the link between these players and functions are displayed. (Kesälähti 2014)

4. PERFORMING A MARKET RESEARCH

4.1 The market research process

When bringing a new product or service to the market the main question is whether there really is a market for it. In addition to finding out if there is a place in the market for the product or service there needs to be consideration whether it works as such or if it needs fine-tuning to better match supply with demand. Both of these questions can be answered by performing a market research. (Conducting Market Research 2015) The term market research can be understood in different ways; it can be the process of gaining insight into the market, a function in an organization, or the outcomes of research, for instance a database or report (Mooi & Sarstedt 2011). The focus on this work will be on the process of gaining insight into the market. In conducting a market research process two types of information will be gathered: primary and secondary data. Information that derives straight from the potential customers belongs to primary research, which can be gathered in several different ways. Secondary research involves bringing together statistics, reports and other data from sources outside the customer such as different organizations like government agencies. (Conducting Market Research 2015)

The market research process with its different stages is represented in Figure 14.

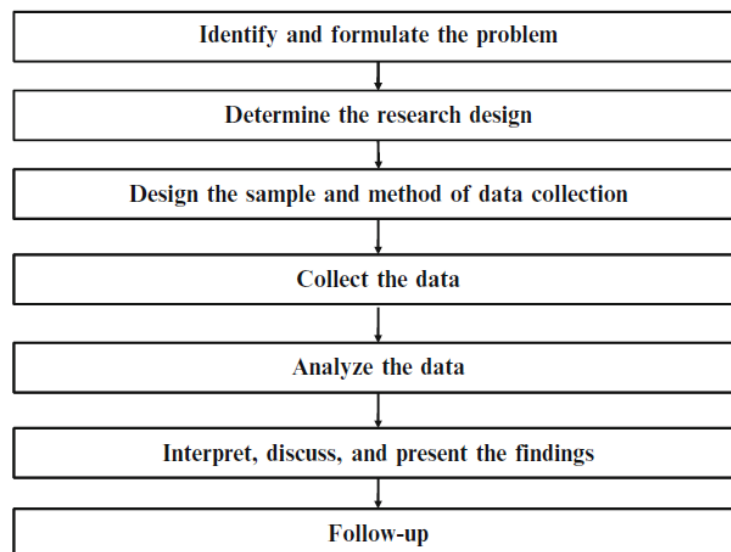


Figure 14. *The market research process (adapted from Mooi & Sarstedt 2011)*

In order to execute a successful market research good planning is necessary. Planning of a market research process starts with identifying the problem and ends up in presenting the outcomes and reflecting what to do with the results. (Mooi & Sarstedt 2011)

4.1.1 Problem identification and formulation

The market research process starts off with identifying and formulating the problem into an understandable form. Identifying the problem is essential but identifying the right problem is a challenge. To identify the correct problem marketing symptoms or opportunities must be identified before. A marketing symptom is a problem that an organization faces, for example increasing product complaints, declining market shares, or complications of a new product to attract customers. Sometimes there is no real problem at hand but rather a marketing opportunity. These opportunities could be exploring new emerging markets or possible benefits offered by new products or product channels. After the problem has been identified and formulated the research design can be determined. (Mooi & Sarstedt 2011)

4.1.2 Research design

The research design has a close link to the identification and formulation of a problem. When facing a research problem that has not been researched before exploratory questions are used since little is known about the issue being researched. Exploratory questions are best answered with exploratory research design. This initial research such as interviewing possible customers helps identify opportunities and pitfalls, which ease to determine and refine the research problem. It also helps to distinguish the difference between what is nice to know and what is important to know, in other words to set priorities and pass impractical ideas. Exploratory research can be performed in many ways including interviews, focus groups, projective tests, observational studies and ethnographies. (Mooi & Sarstedt 2011)

Once a clearer picture of the issue has been acquired exploratory research changes in to descriptive research in order to describe the research problem. It usually builds up on the information previously adopted in the exploratory research. Descriptive research is all about describing the subject at stake either by focusing on a single variable (e.g. market share) or multiple variables (e.g. market share related to demography) simultaneously. It can be used for several purposes including describing customers or competitors. For example, how large is the asset management business worldwide? What do competitors of GE Healthcare have to offer in asset tracking? What is the current situation of our customers regarding these products? Descriptive research is also commonly used to segment markets and measure performance. Segmentation is necessary when companies are not able to connect with all customers individually. Measuring perfor-

mance, for instance tracking sales of a certain product, is a regular procedure in organizations. (Mooi & Sarstedt 2011)

After a more complete picture of the issues related to the problem is identified it is possible to examine how key variables are linked. This is done by causal research. Causal research is less often used in market research compared to exploratory or descriptive research. Examples of causal research include performing either laboratory or field experiments. Figure 15 represents how the nature of research design changes as you move through the funnel from exploratory research design to causal research design. (Mooi & Sarstedt 2011)

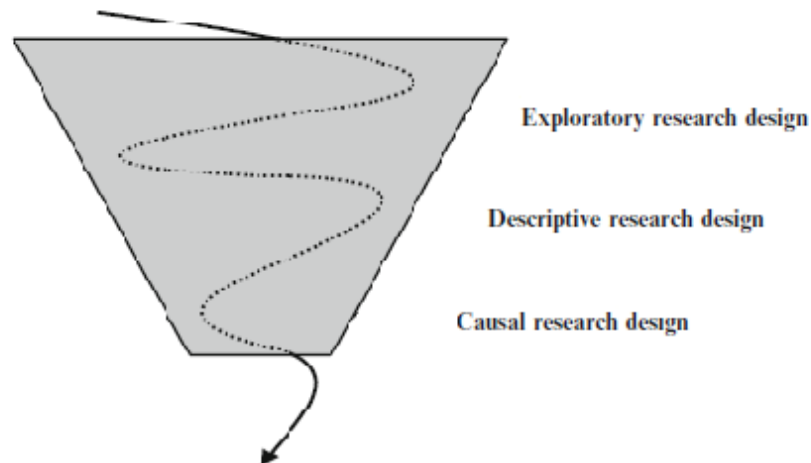


Figure 15. *The steps of determining the research design (adapted from Mooi & Sarstedt 2011)*

After the research design has been determined the next step is to design the sample and method of data collection. (Mooi & Sarstedt 2011)

4.1.3 Sample and data collection design

When the research design has been solved the design of the sample and method for collecting data must be decided. Deciding whether to perform a primary research or use existing data (secondary) is the key question. Collecting data is straightforward but it can involve difficulties when planning it. What questions should be asked in a survey? How to get enough out of interviewing situations? Who to target in the customer organization? From how many customers information is gathered? (Mooi & Sarstedt 2011) Different methods of how data can be collected are discussed more in chapter 4.4.2.

4.1.4 Data collection and analysis

After making the decision on how the information will be obtained it is time to collect the data. Collecting data means putting the design and method of data collection into operation. Not only is collecting data about gathering the information wanted but it also involves recording and organizing it. The way the data is collected should be related to how the data will be used and analyzed. Nevertheless, despite which method is used to collect data recording the data should be concurrent with collecting it or as soon as possible afterwards. After the data has been collected it must be analyzed. Data analysis is the interpretation of the data collected in order to find patterns, trends, similarities etc. and figuring out what these patterns possibly mean. (Mooi & Sarstedt 2011)

4.1.5 Interpretation, discussion and follow-up

The second last phase of the market research process is to interpret, discuss and present the findings. Based on the results of the research researchers should be able to answer questions and present future actions based on the data. One could think that this would be the last phase and in fact market researchers often stop after this stage. However, doing a follow-up on the findings is as important. Sometimes further research is necessary in order to implement the market research findings. This would be necessary for example when market conditions have changed during the market research process. Follow-ups on previous market researches may also be a way of entering new deals to conduct more research. (Mooi & Sarstedt 2011)

4.2 Market Sensing

Market sensing is a process for gaining knowledge of the markets so that individuals in the business can make decision making more informing and clear. The process includes learning about the current and prospective customers and competitors but also other factors related to the business such as regulatory issues and possible resellers. Business market managers and others in the business can work around and revise their market views, which are impressions of what the market is and how it works. Market sensing plays an important role for challenging previous assumptions about customers, competitors or even the resources and capabilities of the organization itself. Anderson et al. divide market sensing into four different facets: defining the market, monitoring competition, assessing customer value, and gaining customer feedback. In order for a firms business to flourish it should be superior to its competitors in each of these facets, especially in assessing customer value since it is the cornerstone of any business. (Anderson et al. 2009) In this thesis the focus of market sensing is on defining the market and monitoring competition. Assessing customer value and gaining customer feedback are important aspects but are not timely in this phase of the market research and thus are not presented in this work.

4.2.1 Defining the market

When business market managers want to define the market their objective is to pinpoint groups or firms, which are of greater interest to them. To do this they choose descriptors to delimit a market and thus gain a view of the market; what its prospects are and the course of actions it pursues. Market segmentation and determining market segments of interest are essential in defining the market. Market segmentation means the partitioning of markets into sectors of customers so that customers within a same group have similar requirements and characteristics and customers of different sectors have divergent requirements and characteristics. Depending on what descriptor is used to segment the market, views of the market can change dramatically. This enables firms to get better insight of the market and possibly gain competitive advantage over competitors. (Anderson et al. 2009)

Markets can be segmented in a variety of ways but mainly they are categorized into conventional and progressive bases. Despite which base is chosen to segment markets the following criteria is valid for judging the segmentation: measurable, profitable, accessible and actionable. Conventional ways of segmentation include industry, customer size, customer behavior and geography. Industry related segmentation is usually quite straightforward unless the classification of the product or service is exceptionally precise. When business market managers believe that customer size has a strong influence they rather segment it based on that. Customer size usually relates to secondary sources of size or amount like number of locations, number of employees or financial figures like total sales of the customer firm. Customer behavior describes the relationship between the supplier and the customer by four different segments: firms that are purchasing the supplier's offering for the first time, firms that have purchased the supplier's offering before and are still purchasing, firms that have not purchased the supplier's offering before, and firms that have purchased the supplier's offering but do not purchase anymore. Additionally customer firms can be segmented by their purchasing activity from light to heavy with medium in between. Lastly customer firms can be segmented based on their geography. The most common division geographically is between domestic markets versus international markets. If the supplier firm is targeting only domestic markets it is possible to further segment by local and regional basis. (Anderson et al. 2009)

Sometimes business market managers find that the conventional way of segmenting is not enough. To gain a deeper insight of the requirements of markets it is possible to use progressive bases of segmentation. Progressive bases of segmentation include application, customer capabilities, customer business priorities, usage situations and customer profitability. (Anderson et al. 2009)

4.2.2 Monitoring competition

Gaining knowledge about the current and prospective customer requirements and likings is the main concern when thinking of targeted market segments and customers. However in order to understand, create and deliver value to customers in the best possible way it is almost as important for business market managers to monitor competition. By monitoring competition firms can use this knowledge to adjust their own market strategy and decide on how to react to actions made by competitors in the market. (Anderson et al. 2009)

Business market managers determine which firms to monitor by investigating the market offerings that present and prospective customers consider as an alternative to the firm's own market offering. The firms that stand out are competitors. The same monitoring is done to firms that are not yet competitors but may become competitors in the future. These firms are not currently doing business in a specific market segment but have the potential to enter it in the near future. Usually in these cases the research and development unit of a firm monitors advances in technologies outside the industry, which have potential to allow new firms to enter the market. Another possible threat to keep in mind is if mergers and acquisitions happen in related industries that might result in new business units and thus into potential competitors. (Anderson et al. 2009)

Firms typically use a major share of their monitoring resources on current competitors although history suggests that a larger share of the resources should be shifted towards potential and new customers. As an example, GE challenged its business units to destroy their own current businesses with Internet business models through a "destroyyourownbusiness.com" initiative. This allowed managers to examine conclusions for their businesses, which helped them to see both potential competitive threats and opportunities. (Anderson et al. 2009)

The framework of competitor analysis in Figure 16 by Porter consists of four components: future goals, assumptions, current strategy and capabilities. Gathering information of these four components provides an extensive understanding of each customer. (Anderson et al. 2009)



Figure 16. *The framework for competitor analysis by Porter (adapted from Anderson et al. 2009)*

Every organization has to have future goals, at least if they want to remain competitive in the market. Keeping track of what competitors are up to and want to accomplish in the market provides an understanding on what they are willing to do to accomplish these objectives. Some competitors might be trying to increase sales while others could be focusing on cutting down costs of sales. Goals of a competitor exist both on corporate level but also on business unit level. Usually just by examining announcements within companies and reading the news will give somewhat of an insight of what is going on. Gaining a broader and more precise overview of the future goals of a competitor can be difficult and require pulling more knowledge together. (Anderson et al. 2009)

In order to predict what a competitor will do it is necessary to understand the assumptions a competitor makes about itself, other firms in the market and its market view. What is significant is the fact that competitors might not be aware of some of their assumptions. A “blind spot” is an area where a competitor does not see the significance of an event, understands it wrongly or acts too slow to gain advantage of it. A competing firm can exploit an opportunity like this. By identifying blind spots or other biases in a competitor firm an advantage edge on the market can be gained. (Anderson et al. 2009) An example of a “blind spot” can be seen in the radical decline of former movie rental giant Blockbuster. Wrong assumptions caused Blockbuster not to understand the significance of emerging technologies and changing customer preferences and thus acted too slow to gain advantage. Eventually Netflix took over the market and caused Blockbuster to file for bankruptcy. (Reynolds 2014)

Strategy analysis of a competitor is necessary to understand how the competitor acts in the marketplace but also how it reacts to actions by other firms. Strategy analysis of a competitor consists of three components related to the competitor; selected target markets, positioning of its market offerings and the marketing mix being implemented. Finding out what segments a competitor targets is not a difficult task. By looking into what channels it uses for advertising and studying the content of these ads should indi-

cate which market segments are being targeted. Investigating how a competitor positions its market offerings can be done by studying the content of its ads, statements it makes about the offerings, visiting their website or even having a visit at a trade show booth. The marketing mix consists of the “4 Ps”: Promotion, Product, Place and Price that have to be understood. Having an understanding of the competitors’ target markets and positioning, a firm has already solved the promotion part. If possible a firm should always purchase a competitor’s market offering to better analyze the product element of the marketing mix. Acquiring knowledge about the place factor is done by the sales force, which figures out what channels of distribution the competitor uses. The price factor is the trickiest one to figure out since there are problems determining the comparability of different market offerings. (Anderson et al. 2009)

Knowing the competitors’ core competencies and capabilities strategic-wise allow a firm to gauge its strengths and weaknesses against them. The firm should examine the competitors’ capabilities of for example marketing, management skills, financing as well as the competitors recent history to see how they react to changes in the market or actions by other firms. Valuable information for a firm to know about its competitors is the level of commitment regarding different market segments. How significant is a certain market segment compared to another market segment? How much effort are they putting in each market offering? The more valuable a product or market segment is to a firm the more energy and time they put for instance into marketing. Sometimes a competitor’s commitment may rely on emotions meaning that actions it takes might not be rational long-term. This can be the case when a firm’s early success has been launched by a certain offering or market segment and it is difficult to realize the time to look forward and move on. (Anderson et al. 2009)

A SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis is a simple and efficient tool to analyze a firm. The SWOT analysis is usually divided into a fourfold table. The table consists of aspects related to the present in the form of strengths and weaknesses and also aspects related to the future in the form of opportunities and threats. Strengths are factors a company is good at and will try to enforce while weaknesses are factors a company has to try to improve. Opportunities present factors that a company can use to lever its position and threats are factors a company wishes to get rid of. The SWOT analysis is suitable to be done in all types of organizations and companies and it can focus on company level or a certain part of the company’s business. (SRHY)

4.3 Market competition and gaining a competitive advantage

The main objective of companies is to maximize profit from their fields of business. To do so a company must defeat competition in the same field and gain a competitive advantage over them. An upper hand over competition can be gained for example by providing a product with lower cost or having a product which stands out and is difficult

to replicate by competition. The Five Forces model by Porter in Figure 17, which is presented next, provides a tool to assess this competitive edge.

The Five Forces analysis by Porter provides a framework, which combines the general theoretical competitiveness (incl. competitive edge) with the empirical measurable competitive factors of a firm. The framework notes that an analysis on competition must not be based only on examining the amount and behavior of competitors in a field but also on the structure and environment of the field. The model by Porter (Figure 17) consists of five forces: industry rivalry, threat of substitutes, threat of new entrants, the bargaining power of buyers, and the bargaining power of suppliers (Saastamoinen & Tammi 2013).

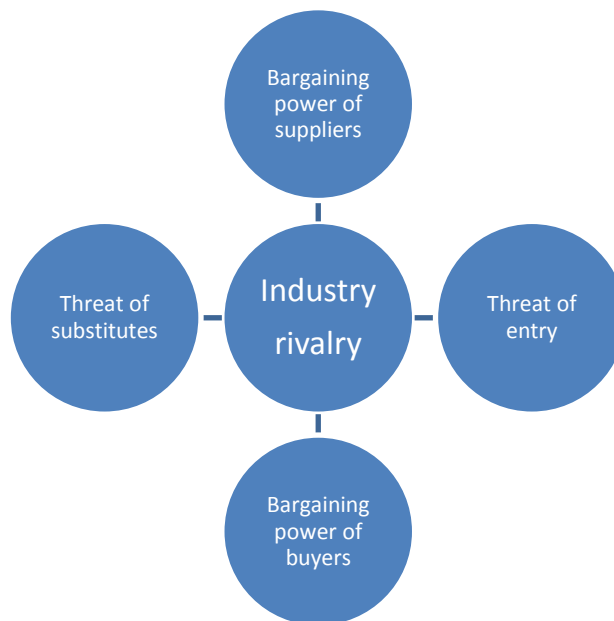


Figure 17. *The Five Forces model by Porter (adapted from Saastamoinen & Tammi 2013)*

Based on this model by Porter a company pursues to maximize profit but their objective is hindered by the toughness of the field of competition, the existence of substitutes, the bargaining power of customers, the threat of new entrants and the bargaining power of suppliers (Saastamoinen & Tammi 2013). An industry becomes less and less profitable the stronger these competitive forces become. Having low barriers for entry, strong suppliers and buyers but still many competitors and substitute products means an industry is seen unattractive due to high competitiveness and low profitability. On the other hand if barriers are high for entry, the bargaining power of suppliers and buyers are weak and there are few substitute products and service meaning low competition an industry becomes more attractive. (Jurevicius 2013)

The general question of the industry rivalry force is how organizations respond to the strategy and workings of other organizations (Saastamoinen & Tammi 2013). For many industries the industry rivalry is the main factor, which determines how competitive and lucrative an industry is. For this reason the industry rivalry force is situated in the middle of the Five Forces –model (Figure 17). In such an industry the competition for market share is aggressive which results in low profits. Rivalry in an industry is intense when there are many competitors and the competitors are about equal in size, barriers for exit are high, customer loyalty is low, products are indifferent and are easily substituted, and if the growth of the industry is slow. (Jurevicius 2013) In short an organization will be powerful if their product or service is unique compared to competition. If competitors are not able to provide what one competitor can this organization will have a competitive advantage. (Makos 2015)

The force “Threat of new entrants” assesses how penetrable a particular industry is for new entry. The key question is whether a company has a stable market position or if the entry of new competitors is probable. Whether an industry is profitable and the barriers are low rivalry has a habit of intensifying. Intensified rivalry results in more competition for the same market share, which results in the loss of profits in general. For an organization to avoid new entry into a market it is advisable to create as high barriers for entry. Probability of new entrants is high when existing companies do not possess patents or trademarks, lack brand reputation, when low capital investment is required to enter market, if there is no government regulation or if customer switching costs are low. Additionally low customer loyalty, if the scale of economy is easily reachable and if products of competitors are quite identical the threat of new entrants increases (Jurevicius 2013)

Bargaining power of suppliers enables suppliers to sell for higher price or lower quality to buyers. This has a direct link to the buyer firm’s profits because it has to pay more. Strong bargaining power of suppliers is present when suppliers are large in size and have plans of forward integration, there are few suppliers compared to buyers and few substitute products exist. In addition having exceptionally high cost of switching products and suppliers holding scarce resources are seen as factors of suppliers having strong bargaining power. (Jurevicius 2013)

On the other hand, in the bargaining power of buyers the buyers have the power for demanding lower price and higher quality. Lower price equals to lower revenues for producers and higher quality in a rise in production costs. Both cases result in lower profits for producers. Strong bargaining power of buyers occurs when there are many substitutes, if only few buyers exist, switching costs to other suppliers are low and when buyers are price sensitive. Also the threat of backward integration of buyers and buying in large quantities are seen as factors of strong bargaining power of buyers. (Jurevicius 2013)

The last force concentrates on the threat of substitutes. The main question is that do other companies in the market provide substitute products or services. The force becomes threatening when substitutes can be found for a more attractive price and higher quality. Additionally if the cost of switching one product or service to another is low the problem is even more severe. For example switching apple juice to orange juice does not cost anything but changing from using a public bus as transportation to using a car does. (Jurevicius 2013)

The original Five Forces model consists of five different forces as mentioned in this chapter. However suggestions have been made the model could include a sixth force; the complements force. Basically a complement product or service increases the demand of the primary product or service with which it is accompanied. As a result the profit potential of the firm and industry increase. For example, *iTunes* is a compliment for *iPod* generating added value for both products. Following the introduction of *iTunes*, both *iPod* and *iTunes* sales increased meaning increasing *Apple's* profit simultaneously. (Jurevicius 2013)

4.4 Go-to-market strategy

“A game plan for reaching and serving the right customers in the right markets, through the right channels, with the right products and the right proposition” (Friedman 2002). The definition by Friedman sums up what go-to-market strategy is in a nutshell. The go-to-market strategy gives the possibility of creating a successful and winning total customer experience meaning gaining the right customers, performing with high sales and growing market share and at the lowest possible cost. Total customer experience is the continuing relationship with the customer including all the interactions in which the customer gains experience. These experiences, whether good or bad, make up the total customer experience. The possibility of gaining a total customer experience is the reason for having a go-to-market strategy. (Friedman 2002)

4.4.1 Go-to-market strategy must start with the customer

When a company wants to be successful in bringing a product or service to the market it must know exactly what the customer wants. In other words the company must align with the customer. There are numerous examples of companies with failed initiatives either because the focus has been somewhere else or because they have disregard over the issue. In many cases the excitement of the research and development causes blindness into thinking that something exceptional has been created; when in reality the product or service could be exceptional on paper but would not be needed by anyone in practice. Sometimes the marketing and product development teams of a company decide what the customer prefers without ever doing fieldwork by asking the customer. In some cases numerous customer surveys might be conducted but without proper meaning

resulting in a hunch what the customer prefers but not knowing exactly what satisfies the customer. (Friedman 2002)

The bottom-line point and resultant of any go-to-market decision is the customers. The outcome of these decisions depends on how well you understand the customer. The more you know about the customers regarding factors such as behavior and preferences, concerns and pain points but also budget the less you need to do guessing and making assumptions. Constructing a fact-base about the customers will help guide decision-making and thus “go-to-market strategy must start with the customer”. (Friedman 2002)

When companies align poorly with customers they either have not done analysis at all or they have overworked the analysis resulting in useless research. Doing no analysis at all means that there is no understanding about customer needs and behavior. This is usually the case when a company is too lazy to perform a customer analysis, assumes that they know the customer already too well or think that they make financial savings by dropping out on analysis. On the other hand there are companies that do mind-blowing amounts of customer analysis using the latest survey tools available and with precise procedures but still result in having no clue what the customer needs and how they purchase. Performing surveys, test marketing and other methods of doing analysis are all useful but only if the right questions are asked and the right information is gained regarding the customers, market, product etc. (Friedman 2002)

4.4.2 How is the information obtained?

When performing a market research there are different techniques possible to use in order to obtain information. There is never just a single right method to use but some techniques are more suitable depending on factors such as the type of information wanted, size of customer base but also how close you want to be to the customer. Table 3 provides an overview of some of the most common ways to gather information from traditional written customer surveys to interviewing customers face-to-face. Using the Internet as a source for market research is also an alternative and has grown its popularity since the amount of information available there is constantly growing. Table 3 also introduces benefits and drawbacks related to each of the techniques presented. (Friedman 2002)

Table 3. *Different techniques to gather information (Chrzanowska 2002; Friedman 2002; Opdenakker 2006; Adams 2008; Hirsijärvi & Hurme 2011)*

Technology	Benefits	Drawbacks
Written customer survey	<ul style="list-style-type: none"> - simple - quantifiable information 	<ul style="list-style-type: none"> - complex questions - target customer = end customer - no face-to-face contact
Face-to-face interview	<ul style="list-style-type: none"> - business-to-business (B2B) - complex issues - reaction time minimal between participants - spontaneous 	<ul style="list-style-type: none"> - time and money consuming - customer base rather small - need to take down notes - full-time presence
Telephone interview	<ul style="list-style-type: none"> - more complexity than written customer survey - in-depth - confidential - inexpensive - not dependable of location 	<ul style="list-style-type: none"> - lack of social cues - no face-to-face contact
Email interview	<ul style="list-style-type: none"> - extended customer access - inexpensive - no need to take down notes - interviewee has time to answer 	<ul style="list-style-type: none"> - lack of social cues - non-spontaneous answers
Internet	<ul style="list-style-type: none"> - endless information - "out of the box" ideas 	<ul style="list-style-type: none"> - no face-to-face contact - all customers not using the Internet
Focus Group	<ul style="list-style-type: none"> - higher capacity than one-on-one interviews - possibility to see customer reactions 	<ul style="list-style-type: none"> - logistically difficult to organize - expensive - not appropriate for all situations

Usually the distinctive criterion when choosing the technique to be used is the significance of social cues. If the interviewee has a critical and irreplaceable role regarding the subject and the opinion of this certain individual is of high value, social cues are very important. Interviewing face-to-face or by telephone are highly preferred in these cases. Sometimes social cues do not give extra value to the interviewer and therefore all interviewing techniques are appropriate to be used. (Opdenakker 2006)

5. EMPIRICAL RESEARCH: HOSPITALS

5.1 Conducting the empirical study

The empirical part of this work was done by visiting and conducting interviews at the main hospitals in Finland including all the four university hospitals and 15 central hospitals. This means that each hospital represents a different hospital district combining a total of 19 hospital districts. Additionally the largest hospital district, The Hospital District of Helsinki and Uusimaa (HUS), had been investigated prior to starting this thesis. With the addition of HUS each of the 20 hospital districts of Finland are covered.

While visiting different hospitals members of the technical/service departments, mainly technical managers or hospital engineers, were interviewed. The objective of these interviews was to find out the current situation and future plans related to asset management and asset tracking. Interviewees were selected based on the fact that they would be familiar with the subject and thus give the best-detailed information available of asset management and asset tracking especially in the hospitals they work for.

Interviewing methods can be categorized into three classes: structured interviews, half-structured (theme) interviews and unstructured (open) interviews. A structured interview consists of specific predetermined questions that are asked in the same order. Typically a structured interview is fairly simple to execute once the questions have been decided. An unstructured interview or open interview is the opposite of a structured interview. This interview type consists of open questions and free conversation between the interviewer and interviewee. The course of the interview depends on the answers the interviewee provides. A theme interview is sort of a combination of a structured and an unstructured interview. Typical of a theme interview is that the theme of the interview is known but the structure and order of the questions are not completely determined beforehand. (Hirsijärvi et al. 2011)

The research conducted in this work was done by the “half-structured” theme interview method. The idea was that the topic of the discussion and some main questions were sent beforehand to each interviewee. This allowed the interviewees to get a bit familiar with the subject and prepare themselves for the discussions. All of the interviews were done face-to-face with the customers and in most customer visits having my supervisor accompanying me. Both of us had a role of representing the questions to the interviewees. By having my supervisor participating in the discussions it was possible to write down notes simultaneously.

5.2 Implementing the market research process

In this master thesis the market research process (Chapter 4.1, Figure 14) presented by Mooi & Saarstedt was used as a framework to guide and perform study on the subject of asset management and asset tracking. The whole market research process was planned more or less accordingly to this framework and thoughts, and plans of this are presented next.

5.2.1 Identifying and formulating the problem

As mentioned by Mooi & Saarstedt, the market research process starts off with identifying and formulating the problem. Before starting this thesis at GE Healthcare Finland the problem had already been noted. To be precise, a problem did not exist but rather an opportunity for the company to explore the market. The first fact and starting point was realizing that GE Healthcare had certain products in its product portfolio: AssetPlus for asset management and AgileTrac for asset tracking. The second fact was that although having over 700 site installations worldwide and in 13 different languages GE Healthcare did not have a single installation of these products in the Nordic countries, including Finland. (GE Global Asset Management) One of the reasons for not having any installations was the lack of not being able to use these products in any of the native Nordic languages. All of this was seen as a possibility for GE Healthcare Finland to explore the asset management and asset tracking market in the Finnish healthcare sector. Following these circumstances a decision to conduct a market research was made to explore the current market and determine whether there is demand for these kinds of products in Finland.

5.2.2 Determining the research design

When determining the research design it is recommended to start off with a broader overview and work towards focusing and narrowing the scope. When the research issue is new to the researcher it is necessary to start with the exploratory research design. In the case of GE Healthcare Finland the asset management and asset tracking market in Finland is not familiar and therefore the market research must start off with exploratory questions. Interviewing customers of GE Healthcare Finland, which include hospitals, health centers and other healthcare related organizations, is an effective way to get knowledge of the current circumstances related to the asset management and asset tracking. By having direct contact to the customers, the insight received from them can help distinguish the opportunities and pitfalls lying in the market. (Mooi & Sarstedt 2011)

Exploratory research provides only a rough overview so in order to gain more detailed information the next step in the research process is the descriptive research design. The information obtained from the exploratory research acts as a base for the descriptive

research. In this case the knowledge achieved from all the interviews of the customer hospitals provided details that gave direction and guidance to do further investigations. Knowing facts such as what products customers are currently using, which companies are providing them, how satisfied are customers and what the future plans of customers are provide input for the descriptive research. Descriptive research applies into these questions for example through customer or competitor analysis. Descriptive research is all about describing a single variable or multiple variables simultaneously. (Mooi & Sarstedt 2011)

The third and most complex variation of research design mentioned earlier in chapter 4 of this work is the causal research design. Causal research design is used less compared to the two other research designs, exploratory and descriptive. The causal research design involves for example lab or field experiments, which are not relevant in this work. Therefore this work focuses on the exploratory and descriptive research designs. (Mooi & Sarstedt 2011)

5.2.3 Designing the sample and method of data collection

The choice between whether to do primary research, secondary research or both is also relevant. The difference between primary and secondary research is that secondary research comprises of already existing data available whereas primary research data does not yet exist. This work will gather both primary and secondary data. Interviews will provide new data and thus be primary data whilst secondary data will be gathered mainly through literature and scientific articles. (Mooi & Sarstedt 2011)

When deciding to perform primary research by interviewing, an important issue to consider is the scale of the research. This means that a typical question to be answered to when performing such a research is what is a suitable amount of interviews. There is no unambiguous answer since it depends greatly on the amount of time and resources available. (Hirsijärvi et al. 2011) Deciding the amount and which customers to interview in this work was fairly easy. The idea was to target all the main hospitals (central and University) of each hospital district in Finland. By doing this a couple of factors were ensured. First, each hospital of the 20 chosen represents one specific hospital district in Finland. In addition, the hospitals selected function as the largest and most significant units of each hospital district. This means that the choices made in the main hospital of a district has strong influence on the other units of the same district. Secondly the 20 chosen hospitals scatter around the whole of Finland offering a sample that is also geographically interesting. The customers interviewed can be seen pin pointed on the map of Finland in Figure 18.



Figure 18. Location of the customers interviewed on the map of Finland (MapCustomizer 2014)

As discussed earlier the interviews in this thesis were done face-to-face with the customers. Each interviewing method has its benefits and disadvantages. Deciding on which method to use depends mostly on how the interviewer wants to proceed, what resources are available but also on the sample size and type. The most appropriate way to collect primary research data in this case was meeting the customers and discussing face-to-face. Why was face-to-face interviewing chosen over the other methods available? The biggest reason was the desire of having an interactive meeting with customers focusing on getting answers to specific questions but also giving the interviewees more freedom to express their thoughts. Furthermore listening to what the customer prefers and needs helps to align the product with those wishes in the best way possible. (Adams 2008) This type of interviewing technique is known as a “half-structured” or theme interview (Hirsijärvi & Hurme 2011).

Discussing face-to-face with customers makes the encounter more spontaneous by minimizing the time of reaction between the interviewer and interviewee. For example compared to interviewing by email the interviewee has the opportunity to delay answering to questions immediately and has more time to phrase sentences. This might affect the content and outcome of the interview. (Opdenakker 2006) The possibility of discussing complex issues is seen as an advantage in face-to-face discussions. If something is unclear on either side of the parties there is always an opportunity to question whether everything is understood and then rephrase if necessary. Quite often the answers provided by the interviewees are not always totally understood by the recipient or the answers might be off the point meaning that the interviewee is not answering to what is

intended. In addition, face-to-face interviewing aligns well with business-to-business cases. (Friedman 2002)

In principle the lack of time and money, the need to take notes, having a small customer base and the need to concentrate on questions and answers are seen as disadvantages of face-to-face interviews. (Friedman 2002) Fortunately in this study all these matters were taken into consideration and did not create a barrier. First, the lack of time was handled by thorough and efficient schedule planning. Even though customer meetings were held all over Finland and required traveling an organized schedule was managed to create to cover every customer planned. Combining geographically close customer locations to mutual trips helped. Second, money is always an issue when conducting face-to-face interviews especially in cases when customers are scattered and located far away. Interviewing by email would have saved money but would have lacked the social cues desired. Going to visit the customer on site was worth the money in this case.

When performing a face-to-face interview taking notes while discussing and asking questions can be troublesome if there is only a single interviewer. One alternative would be to record the interviews but since there were two interviewers participating in nearly all conversations, it was not necessary. Having two interviewers discussing and asking questions makes it possible to write down notes simultaneously. Additionally multiple interviewers provide backup to each other and offer different perspective. It is also easier to concentrate on asking questions and listening to answers when the interview is more informal. Lastly face-to-face interviewing is probably not the best alternative if the sample size is large. Luckily in this case targeting all the main hospitals in Finland gave a sample size of about 20, which is completely in an appropriate range to conduct face-to-face interviewing.

When the decision had been made to perform face-to-face interviews with the customers, it was time to start getting in touch with the correct contact persons of each customer organization. The procedure was to call every contact person, explain the reason of the call and set up a meeting over by the customers. Finally a schedule was set up so that there was a time and date for every customer wanted to meet. Before every interview session an email was sent out confirming the planned customer meeting and reminding the topic of discussion. A short questionnaire containing the main questions regarding the topic to be discussed was also provided. All the customer interviews were performed approximately in a time span of two months.

In addition to performing primary research and gaining new information by interviewing, secondary research was also conducted. Secondary research was done simultaneously with primary research but also afterwards. The new information gained straight from the customers gave direction and a base for doing deeper investigations. Secondary research was obtained from magazine articles, old interviews, research reports, and from websites of different companies.

In conclusion, the market research process framework from Mooi & Sarstedt moulds into the following for this master thesis seen in Figure 19. The problem was identified and formulated as a “Market research for Asset Management and Asset Tracking products in Finnish Healthcare”. The research design was determined as exploratory and descriptive research designs. The design for sample of data collection included both primary and secondary research. The method of data collection for primary research was face-to-face interviews and for secondary research literature review. Collecting the data in face-to-face interviews was done by writing down interview notes.

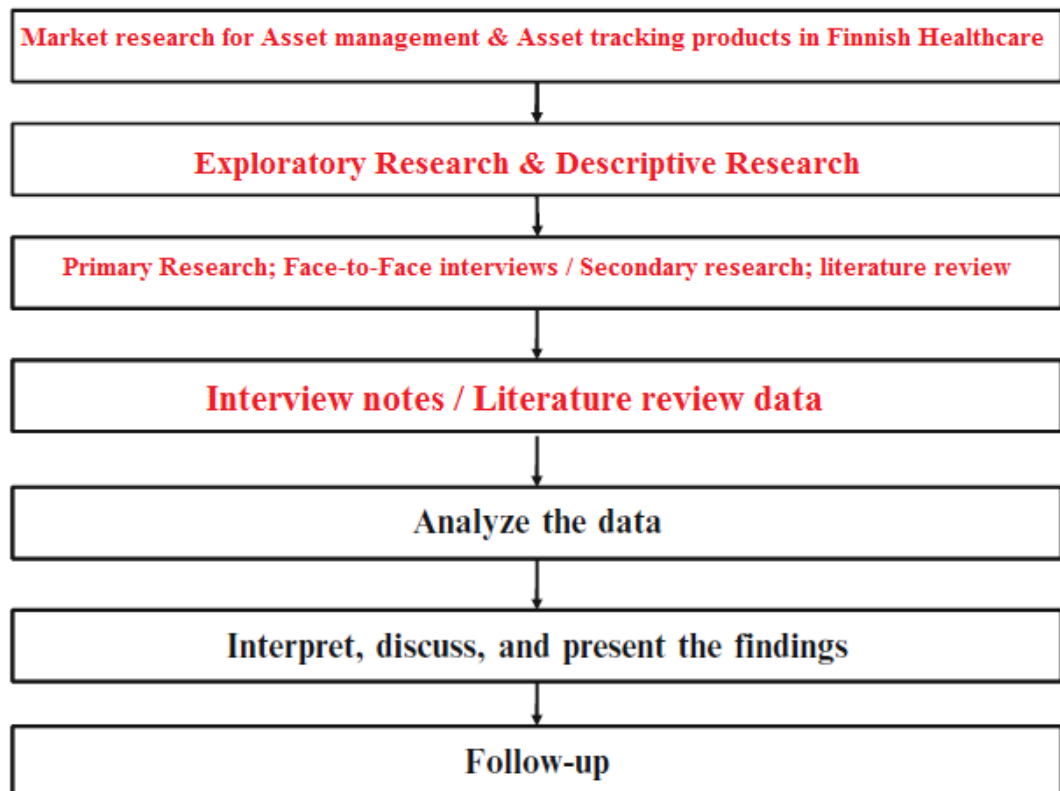


Figure 19. *An updated version of the Mooi & Sarstedt market research framework (adapted from Mooi & Sarstedt 2011)*

In the following chapters the end part of the Mooi & Sarstedt framework will be represented as a result of what was achieved in the previous phases. Analysis of the data acquired from the interviews, interpreting, discussing and presenting them and providing a solution for the follow up finish up the market research process.

5.3 Interviews and analysis of data

The objective of the interviews was to get an overview of the current state of asset management and asset tracking in the main hospitals of Finland of Table 4. Additionally the

objective was to figure out what the future plans and needs of each hospital are with products related to these fields. The questions used in the interview can be found in Appendix A.

Table 4. *The list of customers interviewed for the market research. The customers are listed (anonymously A-S) in order according to the dates interviewed.*

Number	District	Interviewees	Date
1	District A	Technical Director	21.4.2015
2	District B	Service Leader/Hospital Engineer	5.5.2015
3	District C	Service Leader	6.5.2015
4	District D	Hospital Engineer/Logistics Manager	6.5.2015
5	District E	Hospital Engineer	7.5.2015
6	District F	Service Manager	12.5.2015
7	District G	Hospital Engineer	19.5.2015
8	District H	Project Coordinator	19.5.2015
9	District I	Technical Director	21.5.2015
10	District J	Technical Director	25.5.2015
11	District K	Hospital Engineer/Service Technician	25.5.2015
12	District L	Hospital Engineer	26.5.2015
13	District M	Service Manager	26.5.2015
14	District N	Service Engineer/Group Leader	27.5.2015
15	District O	Technical Director/Hospital Engineer	3.6.2015
16	District P	Hospital Engineer/Hospital Engineer	4.6.2015
17	District Q	Service Manager	16.6.2015
18	District R	Service Supervisor	23.6.2015
19	District S	Group Manager/Knowledge Manager	24.6.2015

Total of 19 interviews

Naturally the first thing of interest wanted and needed to be known about our customers was what products they were currently using for asset management and asset tracking in their hospitals. Before conducting the interviews a rough estimate of what the markets were going to look like in terms of market leadership was known. Thus the results seen in Figure 20 of the current asset management market share was not surprising. Of the 20 hospitals investigated 12 hospitals currently have a product named Mequsoft from the company Sofor Oy. This means that Mequsoft has a dominant market leadership position on asset management products in the main hospitals of Finland. The European Commission states that having a market share of over 50% and holding it for several years qualifies for use of the dominant position title. (European Commission 2002) Solteq Solax, a product from the company Solteq, has two hospitals as customers out of the 20 hospitals and the six remaining hospitals are using products that occurred only once, representing the others section of the pie chart (Figure 20).

Current Asset Management Overview

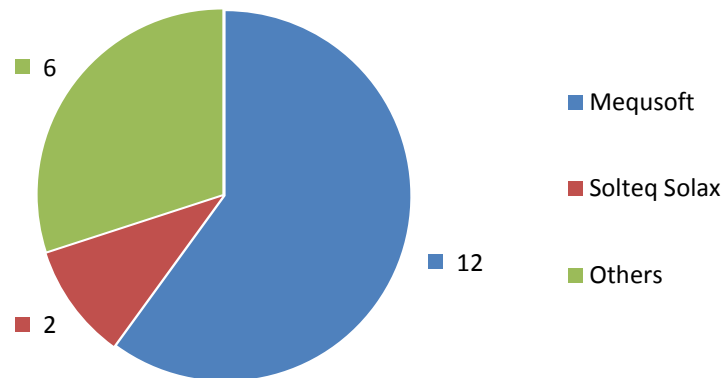


Figure 20. The current asset management product distribution (20 districts)

The results for the asset track part were surprising. Of the 20 hospitals we investigated only one hospital was using an asset tracking product, the Ekahau RTLS. Reasons and thoughts for the minor use of asset tracking products will be discussed later in this chapter after the asset management part has been covered. First, we will discuss about Mequsoft and the feedback received from customers using it. Second, the results of the customers using Solteq Solax and last customers with other products will be introduced.

5.3.1 Mequsoft

Mequsoft is a solution, which was originally developed in Hospital District N in the 1990s according to one of the interviews. Nowadays it is a commercial solution provided by the company Sofor Oy. The main function of Mequsoft is to act as a statutory medical device register. In addition, the database of Mequsoft contains basic information and service manuals of assets, maintenance history and costs of assets as well as workload and work expenditures. Mequsoft relies on a server/user solution meaning that the database is on a server and the main use of the register happens through a client-based program. Additionally a web-based user interface allows access to other users to search for device information and reports, order maintenance, do inventory and other functions. The newest version of the product is no longer named Mequsoft. From the beginning of 2014 a new product was released by the name of TAVA® Maintenance. Nevertheless, the product is referred to as Mequsoft in this thesis since customers interviewed using Mequsoft have not made the transition to TAVA® Maintenance yet.

During conducting the interviews, Mequsoft was being used in the 12 following hospital districts:

- The Hospital District N
- The Hospital District D
- The Hospital District G
- The Hospital District P
- The Hospital District E
- The Hospital District M
- The Hospital District N
- The Hospital District R
- The Hospital District O
- The Hospital District I
- The Hospital District F
- The Hospital District T*

** The Hospital District T was not part of the interviews*

Based on the interviews, one reason why Mequsoft has such a majority of hospitals as their customers is the fact that in the 1990s and early 2000s there were not many worthy alternatives to generate competition in the asset management markets in healthcare. Even some of the customers interviewed who did not have Mequsoft at the moment mentioned that Mequsoft had been an option but eventually they had chosen something else.

“The best and only alternative” - Hospital Engineer

“Basically the only alternative available in the markets during that time” - Service Supervisor

“Mequsoft was considered as an option” - Hospital Engineer

When customers were asked for how long they have had Mequsoft the customers had been using it the average for 10-15 years. A couple of the customers had been using Mequsoft from the beginning of the creation of it while others approximated 10-15 years. A few customers described the time of used just by saying *“very long”* or *“from the early days”*. Even the newest member of Mequsoft had been using it for over 3 years now by the time of the interview.

When customers were asked what the positives and benefits they got out of using Mequsoft the following comments came up:

“Fulfills every need” - Service Manager

“Device history decent” - Hospital Engineer

“As a device card has worked pretty well” - Service Manager

“Mequsoft works” - Hospital Engineer

“In general Mequsoft has everything what is needed” - Technical Director

“Compact package” - Hospital Engineer

“All the information in the same place” - Hospital Engineer

“Fulfills what the law orders” - Technical Director

“Roughly has done what is supposed to” - Service Supervisor

“Having electrical measurements” - Service Supervisor

“Device history works well” - Service Supervisor

After asking the positive sides of having Mequsoft the customers were asked to mention what were the negatives of it or what they were unsatisfied with and possibly would change. The following comments came up:

“Poor usability” - Service Manager

“Job control insufficient” - Hospital Engineer

“Seeing the maintenance reports would be handy” - Service Manager

“Lotus Notes, expensive and complicated” - Service Manager

“Registering cost info problematic” - Hospital Engineer

“Mequsoft is stiff” - Technical Director/Hospital Engineer

“Difficult to support” - Technical Director/Hospital Engineer

“Restricted to changes, all changes must be handled through the company” - Technical Director/Hospital Engineer

“Pricing of updates, prices gone up, everything is charged for” - Technical Director

“Too many useless functions” - Hospital Engineer

“Platform starting to be stiff” - Hospital Engineer

“Use on mobile devices not easy” - Hospital Engineer

“The search function is rather weak” - Hospital Engineer

“Lotus Notes is old school” - Technical Director

“Reporting is defective” - Technical Director

“Search function weak” - Technical Director

“Difficult to edit/change” - Hospital Engineer

“Search function and grouping devices poor” - Hospital Engineer

“Everybody has to have their personal computer” - Hospital Engineer

“Difficulties in fetching information” - Service Engineer/Group Leader

“Web version would be nice” - Service Supervisor

“No web version” - Service Manager

In conclusion, Mequsoft seems to split opinions. Some customers were quite satisfied using it while others thought that time had passed Mequsoft and changes were needed. What stood out of the interviewing results was the fact that even though each customer was using Mequsoft, there seemed to be differences on the capabilities each customer had with it. For example the customers who had been developing and using Mequsoft from the early days seemed to be pleased using it, while customers of later deployment were not. In fact one of the customers using Mequsoft mentioned that their product was tailored to their use and a similar version was nowhere to be found in other hospitals. A couple of customers also mentioned that the company Sofor Oy had been promising a newer version of Mequsoft for several years but with no fulfillment.

On the technical side of Mequsoft some comments came up more than once. Positive feedback was given especially to the practical device history and the fact that for some customers Mequsoft provided all the capabilities necessary to fulfill their needs. Users were not pleased with the usability of the software, commenting it to be stiff to use. One reason for this was that the platform is based on Lotus Notes. They found editing and making changes to Mequsoft difficult since it always required contacting Sofor Oy, which then took time and always ended up in additional charges. The main user of Mequsoft, usually being the medical service department, has to use the client-based program, which is installed on personal computers. Thus the main user has to always use the same personal computer to use Mequsoft. Some comments related to this stated that a web version for the client-based use would be beneficial. Also the search function in Mequsoft was said to be poor and weak.

In addition to interviewing what were the benefits and drawbacks of Mequsoft, there were some more precise facts we wanted to emphasize concerning whether Mequsoft enabled to perform certain functions. The questions asked about functionality were re-

lated to usability, work planning and scheduling, mobile device possibility, ability to configure the opening screen, possibility to add attachments, and whether their system had information on personnel qualifications. The results can be seen in Figure 21.

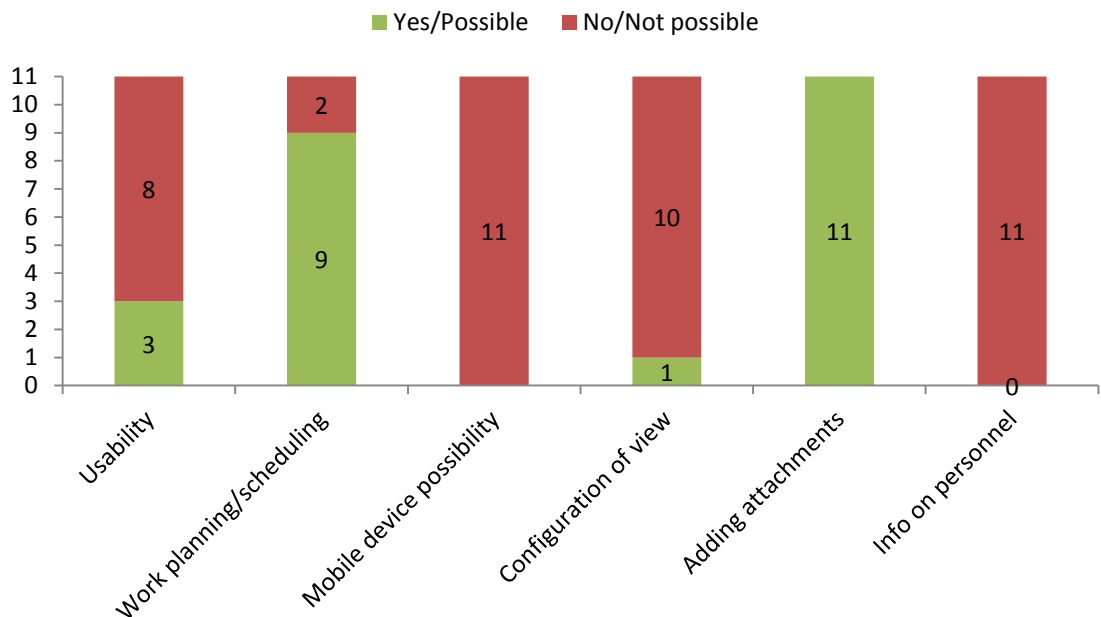


Figure 21. *Statistics on the use of Mequsoft (Interviews)*

The first question was about the usability of Mequsoft and how the users found using it on a daily basis. Only three out of eleven customers said that they did not have any usability problems and that they managed fine with it. The interesting fact is that two out of these three customers were founders/developers of Mequsoft from the early days. The rest, eight out of eleven customers, said either that the usability is poor, quite poor, stiff to use or not the best to use.

The second question was whether their system had the function to perform work planning and scheduling. Nine customers out of eleven replied yes but four customers out of these nine added that it was insufficient or that they still rather handled work planning and scheduling by email or telephone. The remaining two customers said that work scheduling and planning was not possible with their system.

The possibility to use the system on a mobile device was the third question asked. At the moment 11 out of 11 customers were not able to use it as an application on a mobile device. Three customers out of these 11 mentioned that it was somehow possible to use through the web on a mobile device but required some adjusting. Out of the 11 customers two customers said that it was available as an additional option, two customers mentioned that it would be handy and one customer noted that there was no need for such a possibility. Additionally a single customer said that they were receiving a possibility for using it on a mobile device but for a different system than Mequsoft.

The fourth specific question was whether there was a capability to configure what the user sees on the front page for example when opening Mequsoft. The result was clear: 10 out of 11 customers answered no and the single customer answering yes mentioned that the possibility to configure is poor.

The fifth question was about the possibility to add attachments such as maintenance reports or contracts to the system. Every customer out of the 11 said that it was possible. One customer said that it was not in use and another customer told that they kept such attachments only in paper form.

The last question was whether Mequsoft had information of the personnel. All 11 customers were mainly using a different system, excel-labeling, or paper versions for keeping track on for example qualifications and training of personnel.

5.3.2 Solax

Solteq Solax is a modern system providing an interface for the control of objects, dynamic work planning, scheduling and resourcing. It is provided by a Finnish company Solteq Oy, which focuses on software solutions for a variety of different fields of industry. (Solteq) Out of the 20 hospitals interviewed two hospital districts mentioned using Solteq Solax. Both of these hospital districts are in the progress of implementing the Solteq Solax system.

- The Hospital District J
- The Hospital District K

The Hospital District J started using Solteq Solax from the beginning of this year 2015. This product was sold to them as a package product with slight configurations. The Hospital district K joined later into acquiring Solteq Solax, making it a common project. Because the implementing progress is ongoing both still have mixed feelings about it. All of the functions are not yet available, for instance the reporting function is unfinished. Of the functions discussed with Mequsoft, Solteq Solax enables to do maintenance work planning and has an alarm system for preventive maintenance. Neither one has a possibility to use Solteq Solax on mobile devices, but it is possible as an additional option with an additional cost. The opening screen can be customized to some extent by the user and attachments can be added into the system (e.g. reports, manuals). Proper and reliable evaluation on the usability of Solax was not acquired since the implementation process was in progress.

The following positive comments were received of Solteq Solax;

“If data is gathered, it can be used to improve operations” - Hospital Engineer

“Has many functions available” - Technical Director

“Has potential” - Hospital Engineer

On the other hand the following negative comments were received;

“Incomplete” - Hospital Engineer

“Not user-friendly” - Hospital Engineer

“What should have been a 2 month job implementation has delayed and delayed” - Hospital Engineer

“Too unstable, does not withstand any errors” - Hospital Engineer

“Expensive compared to what is being paid” - Hospital Engineer

“Heavy to use and support” - Hospital Engineer

“Control of system not in own hands, too many cooks in the kitchen” - Hospital Engineer

“Controversial and incomplete” - Technical Director

In both customer cases the implementation of Solteq Solax is still in progress. Thus it is difficult to compare Solteq Solax to Mequsoft yet since only Mequsoft has been in use for several years in hospitals. At the moment Solteq Solax provides mixed feelings, both positive and negative.

5.3.3 Other products

The remaining hospital districts mentioned below are all using a different product as their asset management system.

- The Hospital District B
- The Hospital District C
- The Hospital District S
- The Hospital District A
- The Hospital District L
- The Hospital District H

The Hospital District B has been using a fairly new system from the turn of the year 2014-2015. The system is a Business Intelligence product, which relies on IBM Business Analytics software (IBM Cognos). The company providing the IBM Cognos is Tricons Oy, a Finnish company founded in 1986 and specializing in information management software. The product they received was specifically configured for their use in

a healthcare environment and thus was not a commercial product. The following positives were seen in IBM Cognos:

“The implementation process went easily and smoothly”

“Linkage to the finance department, internal billing possible”

“The whole lifecycle of assets (e.g. owner, location, maintenance, depreciation) visible”
(Service Leader/Hospital Engineer)

On the other hand the following negatives were mentioned

“Reporting unfinished”

“Can’t forecast spare-part needs”

“Printing possibility poor”

“Safety measurements not integrated” (Service Leader/Hospital Engineer)

The system was fairly new so not much user experience had been achieved making the estimation of usability difficult. The work scheduling function was still unfinished at the time of the interview. Use of the system on a mobile device was not possible because of strict security and protection. The user could not configure the opening screen and attachments could be added at least to some extent. Information on personnel was currently found in another system than IBM Cognos.

The Hospital District C has been using Ramboll FM for almost 2 years now. Ramboll FM is a real-estate data system, which is accompanied by an integrated medical device register. Ramboll is an international company focusing on planning and consulting (Ramboll). This district had thought about choosing Mequsoft but ended up with Ramboll FM. The following positives were seen in Ramboll FM:

“Covers the whole hospital district from health centers to hospices”

“Comprehensive device history including maintenance, warranties etc.” (Service Leader)

The following negatives were seen in Ramboll FM:

“Development still in progress of system”

“Planning of maintenance not yet available”

“Search function defective” (Service Leader)

So far they have been satisfied with the usability of the system. Work scheduling is managed so that personnel choose assignments when they appear in a first come first serve mentality. Using the system remotely on a mobile device is possible through the web but no application for it is available. The users cannot configure the opening screen of the system but they can add attachments. Information on personnel was found better outside Ramboll FM in a different system.

The Hospital District L has been using Ryhti Granlund from the year 2006-07. Ryhti Granlund is nowadays known as Granlund Manager and this district is receiving the new version of it. Granlund Manager is a software program promoting to be a maintenance management system (Granlund Manager). The company behind the software is Granlund Oy, a Finnish company focusing on real estate planning, consulting and software. Granlund Manager is said to be the spearhead of their software business. (Granlund). The following positives were seen of Granlund Manager:

“Adding new assets to the register easier”

“Running numbering of assets”

“Mass registration of assets possible” (Hospital Engineer)

The following negatives were seen of Granlund Manager:

“Lack in making work calls through the system”

“Information sometimes many clicks away” (Hospital Engineer)

User experience about usability of the new version is limited since it the implementation of it is in progress. Work scheduling is possible on Granlund Manager but it is not used that heavily, more on the real estate side. The possibility for the use on mobile devices is not available but it could be acquired as an additional option. However, the district does not see an immense need for it and thinks it is better to focus on improving the biomedical side more. The opening screen of the software varies a bit depending on the user but the user cannot configure it. Attachments can be added but information on personnel is found in other systems.

The Hospital District A has been using an asset management system EQU, which is a development of their own from the 1980s. Additionally the district is using two other systems to handle facility management and IT services. So far they have been satisfied in using the EQU system. Even some of the other customers that were interviewed complimented and had a positive view of EQU.

The following positives were mentioned about EQU:

“Traffic light system in scheduled maintenance”

“Teams handle specific fields; each team has a person in charge” (Technical Director)

The following negatives were seen of EQU:

“Only “super users” can handle the system completely”

“Possibility for mobile devices”

“Too few service routes available” (Technical Director)

Scheduling of work is possible in EQU but the usability of it could be better. Use of it on mobile devices is not possible at the moment but it is something that there is interest in later on. Users cannot configure the opening view of EQU themselves but handling of documentation is done with EQU. Information of personnel is found mainly in other systems.

The Hospital District S has recently acquired Microsoft Service Manager as their tool for asset management. Additionally a medical device register will accompany the asset management system. The Microsoft Service Manager is in the pilot phase with the asset management part further implemented than the medical device register part. The following positives were mentioned considering their new system:

“Completely tailored for their use, like Lego pieces that can be built as wanted”

“Should have every main function that is needed” (Group Manager/Knowledge Manager)

The following negative aspect of the upcoming Microsoft Service Manager was mentioned:

“Work scheduling does not allow calendaring by person” (Group Manager/Knowledge Manager)

The usability of the system is impossible to estimate since there are no user experiences yet. The tailored Microsoft Service Manager is capable of work scheduling with the minor limitation that was mentioned. Option for using the system on mobile devices exists and will be implemented. Configuring the opening screen is still a question mark but it is a function desired. On the other hand, a member of the district mentioned that it might cause problems and confusion. There should be a possibility to add attachments and information of personnel is on other systems. A member of the district mentioned that it would be an easy task to create an additional register for personnel information but the question would be what information is permissible to use.

The Hospital District H has been using a system called Toti from the early 1990s first as Unix-based and later on updated to a Windows version. Toti acts as a device register, which is stripped down into a simple and manageable management system. Some positive comments of Toti were:

“Simple and easy to use”

“Maintenance costs of software really inexpensive” (Project Coordinator)

On the other hand the following negative comments came up:

“Company behind Toti is a one man firm meaning support is minimal”

“Software on an old server resulting in signs of ageing” (Project Coordinator)

The usability of Toti is good since the software is a very stripped version of an asset management system. Work scheduling or planning cannot be done with the software. A possibility to use the software on a mobile device is not possible and neither is configuration of the opening screen. Configurations must always be processed through the company providing Toti. It is possible to add documents (reports, pictures etc.) and other attachments and information on personnel is found in other databases.

5.3.4 Asset tracking

In addition to finding out about asset management systems the market research also included asking customers about asset tracking. As mentioned earlier, out of the 19 hospital districts interviewed only 1 hospital district was using an asset tracking system. The central hospital in District H is using an asset tracking system called the Ekahau RTLS. About half of the hospital districts in Finland are also using Ekahau RTLS but in a smaller scale and for a different purpose. These hospitals are not using it to track assets but instead for the safety of personnel especially for first aid nurses. (Ekahau 2012) In this thesis the interest in asset tracking is in a larger scale, including tracking of devices and other assets.

Following are comments from the customer interviews when asked about the possibility of acquiring an asset tracking system:

“Asset tracking would be useful, especially with assets such as hospital beds that are continuously on the move” - Service Manager

“An asset tracking system would be good if the technology behind it works and the price is right” - Service Leader

“Utilization rate measurements would be interesting. Some departments are really interested” - Service Manager

“We haven’t thought about asset tracking at all” - Service Supervisor

“We don’t see the need of asset tracking on our devices” - Technical Director

“There have been talk about asset tracking but every department has their own devices”
- Service Manager

“We have interest in asset tracking but the price range is still too high. A lighter version of asset tracking would be enough” - Group Manager/Knowledge Manager

“No need for asset tracking, we perform a location checkup on devices once a year” - Hospital Engineer

“Interested but laborious to set up” - Hospital Engineer

“Asset tracking was thought of but it would require heavy investments” - Hospital Engineer

“It has been discussed but costs are too high. Utilization rate is more a problem than loss of assets” - Technical Director

“No need for intellect systems, usually the device is where it was reported. Nevertheless it would be handy with hospital beds, wheelchairs etc.” - Hospital Engineer

“We don’t have asset tracking and we have never had conversations about it” - Hospital Engineer

“Not really a big need for it but certain departments have expressed interest” - Service Engineer

“Discussions about asset tracking have occurred but we haven’t found a real need” - Technical Director

“Some interest but the price of such a system troubles us. For small assets and in preventive maintenance it would be useful” - Hospital Engineer

“We have interest in asset tracking but it must be profitable. Also is the RFID technology for instance at a high enough level?” - Technical Director

Based on the comments from different hospital districts a few matters stood out. First, the biggest concern for those interested in asset tracking was the cost of the system. Surely such an investment is not cheap especially if a whole new network must be set up into the facilities like in the case of RFID. The main question was that would such an investment early on save costs in the future? There were also some concerns on whether the current technologies are efficient enough yet.

Second, there were a couple of common benefits hospital districts would be hoping to achieve with such a system. Keeping track of smaller and movable assets such as hospital beds and wheelchairs is one reason. Tracking these units prevents from getting lost, which cuts down expenses of acquiring replacements for them. Another benefit in scope for customers was the knowledge of utilization rates of their assets. Especially tracking the more expensive assets and knowing how they are used creates interest.

Not every hospital district was interested about asset tracking; some even had not had any discussions related to it. Reasons for not having thought about asset tracking included the expense part of acquiring such a system but also the fact that not all hospital districts found the need for one. In fact it is no wonder; after all hospital districts do vary both in size and possess different amounts of assets. Thus the largest hospital district of larger caliber and geographically more spread out would probably find such a system more attractive and necessary than a hospital district of smaller size and more centralized.

5.3.5 Ekahau RTLS

The Hospital District H has been using Ekahau RTLS for approximately six years now. Ekahau RTLS is a product from the company Ekahau. Ekahau was originally founded in the year 2000 as a spin-off from the Helsinki University of Finland. Ekahau is now one of the leading vendors in the RTLS market and a pioneer in WiFi-related RTLS solutions. What separates Ekahau RTLS from other technologies used in asset tracking (ex. RFID, infrared) is the fact that it can be deployed on existing WiFi networks. This eliminates the need to build new infrastructure and shortens the implementation time. (Oracle Blogs 2008)

The following positives were mentioned of Ekahau RTLS:

“Very accurate tracking, 0-5m meaning room-level”

“Not only asset tracking but also location knowledge”

“ROI positive”

“Advantages > Disadvantages”

“Personnel and some patients are also tagged” (IT manager)

The following negative comments or matters which could be improved were also provided in the interview:

“Not used yet by the medical service department”

“More assets could be tagged” (IT manager)

A member of the district also mentioned that since they already had invested in an expensive WLAN before Ekahau RTLS was acquired and the WLAN network consisted of 400-500 base stations, Ekahau RTLS was a perfect fit to make the most of the existing WLAN. With such a large amount of base stations, the location tracking is not dependent if one of the stations were to go down temporarily.

5.3.6 Overview

The final and most important questions for which answers were needed were whether our customers were satisfied enough to continue using their current asset management systems or whether they were open for other alternatives. In addition, it was asked what kind of wishes and hopes they had for the future.

The customers interviewed can be classified into three groups according to their current situation and the interest level to GE Healthcare related to asset management systems. This can be seen in Figure 22. First, the “medium interest” group consists of customers that have been using a certain system for several years and are satisfied to continue using it in the future. The “low interest” group consists of customers who have changed their system in the near past into a newer version of their previous one or a completely new one. The “high interest” group consists of customers that are not completely satisfied, possibly need a change and are thus looking for new alternatives

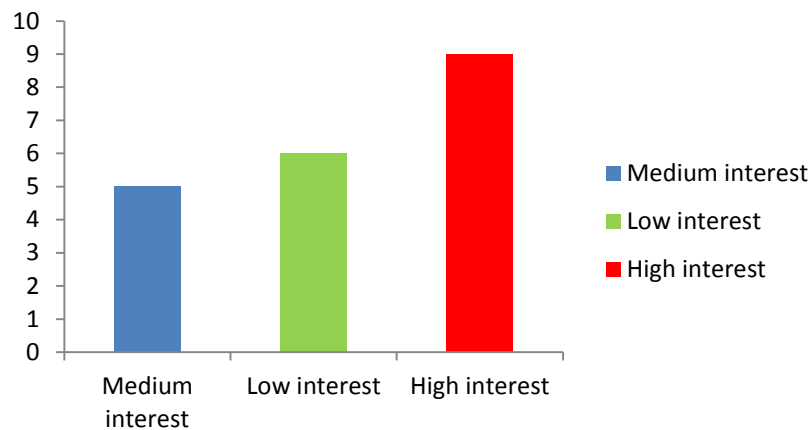


Figure 22. *Distribution of the situation customers are in regarding asset management*

When looking at Figure 22 the most promising group is the “high interest” group. These customers have the most potential to make changes to their asset management situation. Thus customers belonging to this group are also most of interest to GE Healthcare Finland. The “low interest” group involves customers that have recently acquired a new system or updated their current system. Having acquired or updated a new asset management system means that these customers possess least interest to GE Healthcare Finland, at least in the near future. Systems are not changed over and over again due to the need of heavy investments and other implementation, unless there is a real urge to do

so. As one of the customers interviewed remarked that such systems follow renewal cycles of 10-15 years. The “medium interest” group has customers that have been using a system for several years and are currently satisfied in using it. These customers are not top priority but have to be kept in mind.

5.4 Market sensing

Before having intentions of bringing a product to the market it is necessary to do research on how the current market stands. In other words market sensing involves gaining knowledge of the market in terms of both customers and competitors. In this chapter a customer analysis and competitor analysis are provided to better understand the market. The customer analysis presents different ways of segmenting potential customers. The competitor analysis focuses on analyzing the firms that represent the products that came out of the interviews. The framework from chapter 4.2.2 (Figure 16) and the SWOT –analysis were used as tools to investigate competitors.

5.4.1 Defining the market - customer analysis

Market segmentation and pinpointing market segments that are of interest to a company are the main points of defining the market in customer terms. Market segmentation can be done by many different descriptors and thus the views of different segments can change radically accordingly. (Anderson et al. 2009) In this section the suitable factors for market segmentation in this case are introduced. Segmentation is done with the conventional ways; industry, customer size, and geography. Customer behavior is excluded since each customer belongs to the same segment; firms that have not purchased the supplier’s offering before. (Anderson et al. 2009)

Segmentation by industry is unambiguous; all the customers in this market research are hospitals and thus belonging to the healthcare industry by delivering healthcare services. Customer size can be measured by different factors: usually in economical figures or in amounts of something. In this work we ended up investigating the hospital districts in terms of the amount of inhabitants they are responsible of, number of municipalities in a district, and geographical location. (Anderson et al. 2009)

When we compare the customers at ERVA level we can see how they rank when measured by inhabitants responsible for and amount of municipalities per ERVA district which is seen in Table 5. ERVA is a term used to describe the regional hospital groups of the Finnish healthcare system. There are five different ERVAs, each named after one of the five university hospitals in Finland. The idea behind this is that each regional hospital group has a hospital where the most demanding specialized medical treatment is centralized. The amount of inhabitants a district is responsible for reflects to the amount of patients needed to be treated which reflects to the amount of resources a district needs. However, there are differences in these districts depending on e.g. culturally,

geographically and even in the age structure of inhabitants. But in general the more resources a hospital or hospital district the more they can potentially benefit from an asset management tool.

HYKS is a dominant leader with almost double the amount of inhabitants responsible for then TAYS, which places second. TYKS, KYS and OYS are quite equal with each other. On the other hand, looking at the amount of municipalities an ERVA district has, HYKS has clearly a smaller amount than the rest (39 versus 60-68). (Kunnat 2015) The reason is explained by the fact that a majority of inhabitants in Finland are concentrated close to the capital to a relatively small area in size. However the other ERVAs, which are bigger in area size and have a greater amount of municipalities scattered around in a broader area are also interesting in terms of asset management and tracking. Since hospital districts inside ERVA districts collaborate with each other one would think it would be also beneficial to collaborate and take advantage of such products.

Table 5. *Statistics of the different ERVA areas (31.12.2014) (adapted from Kunnat 2015)*

ERVA	Inhabitants responsible for	%	Amount of municipalities	%
HYKS	1 904 062	35.0 %	39	13.0
TAYS	1 110 996	20.4%	67	22.2
TYKS	869 477	16.0%	60	20.0
KYS	816 405	15.0%	67	22.2
OYS	741 897	13.6%	68	22.6
Total	5 442 837	100%	301	100%

Looking closer at each ERVA district and dividing them into hospital districts it can be seen how each hospital district places into the same categories as in the previous table. (Appendix B) Every ERVA district has one major hospital district in the top five based on inhabitants responsible for as seen from the colored legends. The Helsinki and

Uusimaa district (HUS) of the HYKS ERVA is substantially larger than any other hospital district having almost 30 % of inhabitants covered. On the opposite, the hospital district Itä-Savo belonging to the KYS ERVA has only 0.8 % of all inhabitants covered. This means that HUS has almost 40 times the amount of inhabitants it covers compared to Itä-Savo. The hospital districts of the most northern ERVA area, the OYS ERVA populate the lower of the chart with an exception of the hospital district of Pohjois-Pohjanmaa. This is typical in the northern part of Finland, where population density is small and distances are large.

Looking at how customers are located geographically in Finland a logical division of areas can be noticed. As mentioned before, Finland is divided into five different regional hospital groups (ERVA), which are each responsible for a certain amount of hospital districts. This can be seen in Figure 23.

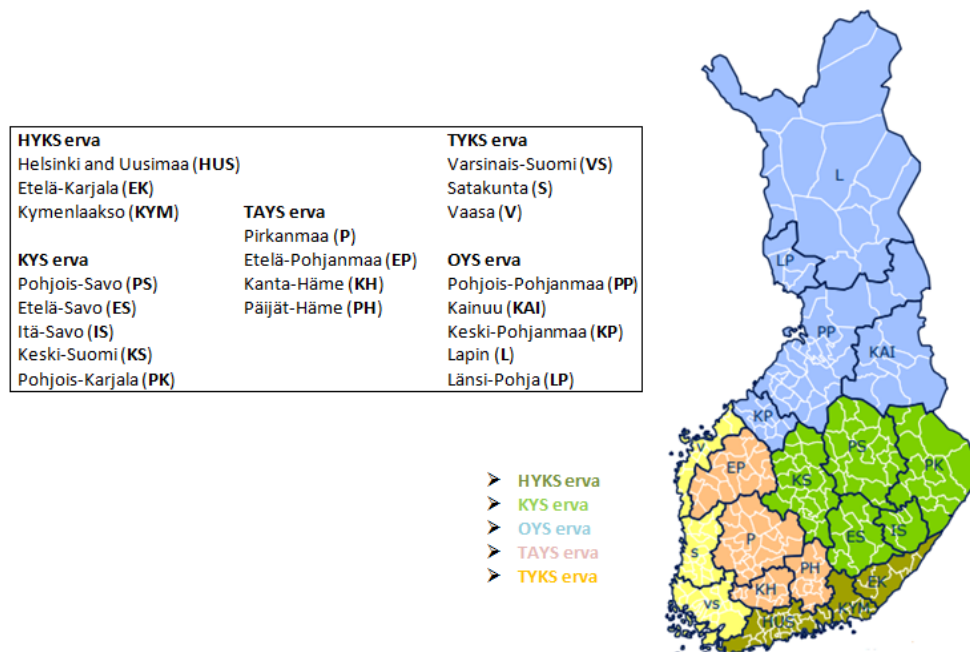


Figure 23. The ERVAs and hospital districts of Finland from 1.1.2015 (adapted from Kunnat 2015)

The HYKS ERVA represents the south of Finland whilst the OYS ERVA covers more of the north. KYS ERVA situates mainly on the eastern side and middle of Finland and TYKS ERVA on the western side. TAYS ERVA situates in the middle with a slight tilt to the west. Currently there have been discussions in Finland regarding making changes to the amount and division of ERVA districts. One proposal, which has been discussed, is to grow the amount of ERVA districts from the current five to 19 districts. (Toikkanen 2015) Changes are most likely to occur and this has resulted in vigorous building of new hospitals and renovation of old hospitals around Finland. Every hospital

wants to ensure and strengthen their position before any new decisions are made on the ERVA divisions. Currently there are ongoing hospital projects with a total worth of at least 3 billion euros. (Miettinen 2015) Without doubt the possible upcoming changes will have affect since heavy investments in facilities means also investments in new assets. This could mean that also products related to asset management and asset tracking would become timely.

5.4.2 Monitoring competition - competitor analysis

When targeting a new market it is also essential to define the market competitor wise. Chapter 4.2.2 discussed about monitoring competition. The framework by Porter (Figure 16), which includes future goals, assumptions, current strategy and capabilities provides a good overview of the competitors. This framework will be used to investigate the competitors that stood out as a result of the interviews and which compete in the same asset management or asset tracking market. A SWOT-analysis of each competitor will be also presented. The capabilities part of the framework by Porter will be covered as strengths in the SWOT –analysis to avoid repetition. The competitors that this chapter focuses on are Sofor Oy, Solteq Oyj and Granlund Oy in asset management and Ekahau Oy in asset tracking.

5.4.3 Sofor Oy

Sofor Oy is a Finnish company providing IT services from large to medium sized both domestic and international companies. The company's objective is to help customers improve their performance by creating a safe and interactive working environment. Sofor Oy provides services from life-cycle development of systems and application planning through integration to system administration and capacity services. The company is a privately owned company that has about 60 employees and revenue of 5.8 million euros last year (2014). It was founded in 1991 and is based in Kauhava, Finland. (Sofor)

Sofor Oy has been the dominant market leader in asset management for many years in the hospital sector with their product Mequsoft. At the moment they are in a transition phase with updating their Mequsoft product and also giving it a new name, TAVA Maintenance. They introduced TAVA Maintenance during 12.-13.2.2014 at their stand at a Hospital Engineering –event. At the same event they came out with news of having made a collaboration deal with a company called Finn-ID. The collaboration was done to enhance device identification and improve the usability of their solution. Furthermore Sofor Oy is integrating an asset tracking management solution to TAVA Maintenance. Thus the future goals of Sofor Oy are quite obvious. (Sofor 2014)

Assumptions competitors make about themselves can be tricky to figure out. In the case of Sofor Oy, having a dominant market leadership with Mequsoft can possibly lead

them to be lulled into having a powerful feeling about their position amongst other companies. Having such a market position can easily lead into having a false sense of security, in other words a “blind spot”. Having listened to customers currently using Mequsoft a possible blind spot might exist in the expectations of customers receiving the new version, TAVA Maintenance.

Strategy analysis consists of solving three components: selected target markets, positioning of its market offerings, and the marketing mix (Anderson et al., 2009). Sofor Oy targets organizations of all size and regardless of which industry they are in. However it seems that the main focus of TAVA Maintenance is in healthcare organizations since all references provided on their web page are healthcare related. Sofor Oy promotes itself by mentioning that it has carried out 1500 software projects and 600 application solutions to both international, large and medium sized companies and also public institutions. TAVA Maintenance is positioned as an easy to use solution for companies of all size and industry who want better control of their assets and maintenance. (Sofor) The marketing mix consists of 4 Ps: Promotion, Product, Place and Price. Promotion consists of target markets and positioning, which were discussed already. The product part was handled by brief demos during our customer visits where we were showed how Mequsoft appears to users and how it functions. The newer version TAVA Maintenance is still unfamiliar for us and also to some current customers using Mequsoft. To our knowledge Sofor Oy is targeting customers at least through congresses and by setting up customer meetings. Pricing is based on a fix price depending on the size of the customer and amount of assets and maintenance costs. Additionally customers of Mequsoft criticized that changes and additional features always cost.

The SWOT –analysis of Sofor Oy is seen in Figure 24. The strengths of Sofor Oy are rather clear: market leadership due to over 60% of customers with Mequsoft, experience of over 20 years, strong partnerships with companies such as IBM, Microsoft and Citrix and also the fact that asset management is a core business for them. Weaknesses include providing total satisfaction for each customer and the smaller size compared to competitors. These two weaknesses go hand in hand. Since Sofor Oy is smaller in size in terms of amount of personnel and revenue than its competitors and has a majority of customers it is difficult to provide the same level of service for each customer. This matter was also mentioned by some of the customers interviewed.



Figure 24. SWOT–analysis of Sofor Oy

The opportunities Sofor Oy has are maintaining their market dominance and bringing a chance for mobility with their new TAVA Maintenance version. Maintaining their market share lead is mainly dependent on how TAVA Maintenance is received by the customers. Threats of Sofor Oy include the already mentioned chance of a blind spot and the fact that their competitiveness in the asset management market has not been fully tested. For many years Mequsoft was the only adequate option for healthcare organizations that wanted more than just a regular device register. The market has changed since those early days and more competitors are competing for the same market.

5.4.4 Solteq Oyj

Solteq Oyj is a Finnish company found in 1982 and having over 30 years of experience in the fields of retail trade, logistics and service including software services. Their business is divided into two different segments of which one is asset management of services. The other segment is software services which makes 87% of their revenue meaning that only 13% belongs to asset management services. (Aho 2014) Solteq Oyj is a public company and has its main office in Tampere, Finland. The company has a total of 290 employees. (Solteq) The company’s revenue of 2014 was 40.9 million euros (Kauppalehti 2015).

The future goal of Solteq Oyj seems to be strong growth of their revenue according to Timo Heikkilä on the analysis of Solteq with input from CEO of Solteq (Heikkilä 2014). What backs this claim is the quite recent acquisition of Descom Group by Solteq

for 26 million euros. Consequently this acquisition unites the pioneer of digital trade and efficient supply chain management as one. It also drives the strategies of both parties: better profitability, growth and the opportunity to be the best digital trade operator in Northern Europe. (Descom 2015) With this acquisition the company will have about 550 employees and total revenue of 67 million euros (Harmanen 2015).

The assumption Solteq Oyj makes is that they are the leading provider of software solutions for retail trade, logistics and the service sector in Finland (Solteq). With the acquisition of Descom Group plans are to be the largest digital trade operator in Finland (Descom 2015). Solteq Oyj also won the “Workplace of the Future 2015” award, which reveals that from an employee’s point of view Solteq Oyj is an admirable place to work at (Solteq).

Solteq Oyj’s main target market is to provide software solutions for the retail trade sector. Their selection of products and customer portfolio covers almost the whole sector. In addition, the company is a big player in the domestic market of maintenance and service control systems. Speculations have been going on that with the help of Descom Group Solteq Oyj will chart possible acquisitions in Sweden in order to start expanding to Northern Europe. An analyst talks about a possibility of Solteq Oyj selling its asset management of services business to fund the expansion since this business has limited synergy to its core businesses. (Aho 2014) However on 14.10.2015 Solteq released news that as part of their new strategy the asset management business will continue as a subsidiary of Solteq Oyj with the name MainIoT Software Oy. The reason for the incorporation was the desire to assure the asset management business a more efficient and independent strategy creation and conditions for strong growth. (Solteq)

Solteq Oyj positions and promotes itself with over 30 years of experience in the business, having strong partnerships with different operators and plans to expand its business by internationalizing. The asset management related Solteq Solax product is positioned and promoted as a modern asset management system suitable for control of maintenance and other services. The promotion was covered as part of targeting certain markets and positioning. The product Solteq Solax itself has several references on the web page of Solteq Oyj but no mention of its use in healthcare organizations was found. The two customers in our interviews who used Solteq Solax had recently acquired them and were still adapting to the change. They were not able to demo the software like in the case of Mequsoft. Pricing includes a fixed price, maintenance costs and license fees according to one customer interviewed.

The SWOT –analysis for Solteq Oyj is represented in Figure 25. Strengths include recent acquisitions (Descom), internationalization to Northern Europe, a stable market position in fields of operation and a broad customer base and partnerships with big parties (e.g. IBM, SAP, Microsoft). Weaknesses include the dependence on one customer

branch business (software services) and the fact that their cost structure is not flexible. (Aho 2014; Solteq)

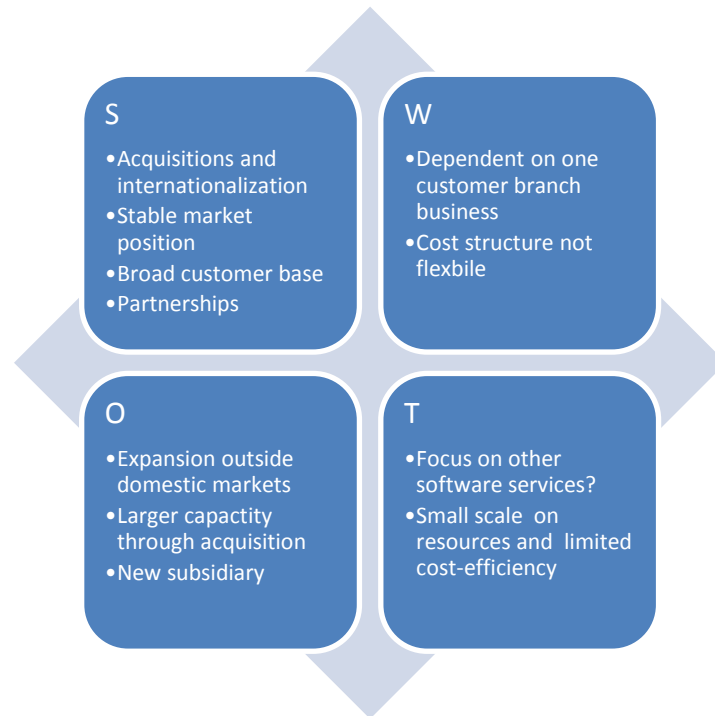


Figure 25. SWOT–analysis of Solteq Oyj

Opportunities Solteq Oyj has are the growing expansion outside domestic markets, a larger capacity to operate through the acquisition of Descom and the new subsidiary MainIoT Software Oy for enhancing the asset management service business. Threats that exist include whether the focus is still tilted too strongly towards other software services. Also the small scale on resources and limited cost-efficiency is an issue. (Aho 2014)

5.4.5 Granlund Oy

Granlund Oy is a Finnish stock company specialized in architectural engineering planning, real estate, energy and environment consulting as well as being an expert in software business. The spearhead of their software business is the maintenance control system Granlund Manager, which was used by a couple of the customers interviewed. Granlund Oy has over 50 years of experience in these fields since it was found in 1960. The corporation employs around 500 employees and their main office situates in Helsinki, Finland. The revenue of Granlund Oy at the end of last year 2014 was 45.4 million euros. (Granlund)

Granlund Oy has an ongoing innovation and development strategy 2012-2016. The objectives of the strategy are new energy solutions, improving the service experience of customers and raising co-operation to the next level with new collaboration models. In the year 2014 they made some growth (6.1%) in revenue and results (1%) compared to the previous year. Plans for 2015 were to keep the growth trend going on. In the long run the future plans of Granlund Oy are part of their strategy. In planning they want to continue focusing on architectural engineering and become the leader in that field. In consulting they want to enforce services related to maintenance consulting and energy efficiency. Unlike in planning, they want to broaden their service selection in consulting. In software business they want to develop this field more as an individual and focus on developing commercial software. Granlund Manager is the spearhead of their software business but in addition they want to develop new software for example for energy efficiency. (Granlund) The assumptions Granlund Oy makes are that they are the leading operator in every service field they work in. They have a variety of references of their projects from different sectors to prove the point.

Granlund Oy targets market on a broad scale: healthcare, industry, transport and logistics, cities, sports and culture venues, commercial trade etc. Granlund Manager is positioned as software, which is suitable for a large variety of customers from public to privately owned companies. Granlund Manager covers the whole maintenance and compared to customers the software expands it in many ways. The promotion of Granlund Manager is the same as target markets and positioning. No demo version of the Granlund Manager product was seen so the knowledge is based on the information provided by a few customers and the company's web page. Distribution channels are for example exhibitions and the press of this industry and private sales. (Granlund) Pricing of Granlund Manager is not known.

The following SWOT-analysis in Figure 26 was done for Granlund Oy. Strengths include experience of over 50 years in related fields such as software business, a large and broad reference base and a leading operator in the field. Weaknesses include that despite a large reference base the healthcare sector is a fairly new market in the asset management sector.

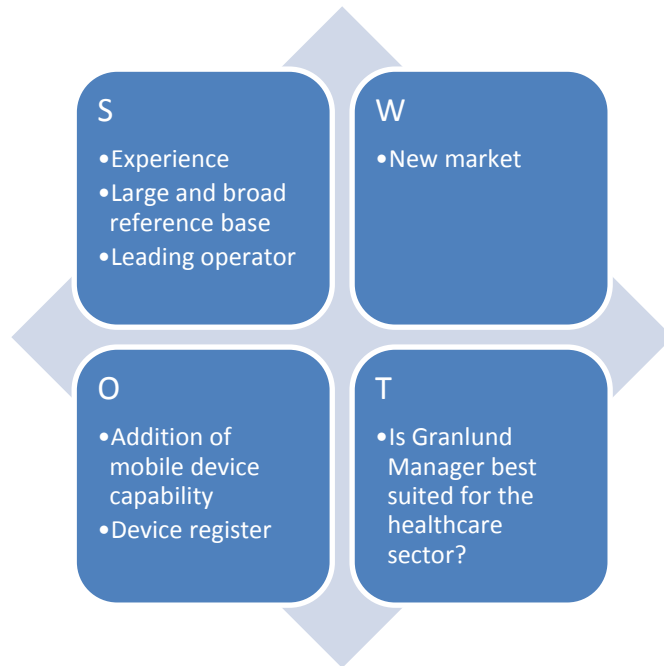


Figure 26. SWOT–analysis of Granlund Oy

Opportunities include whether Granlund Oy is able to continue enhancing the Granlund Manager more suited to the healthcare side. The addition of mobile device capability and a suitable device register are important. The threat is whether Granlund Manager is best suited for the healthcare sector or is it focused more on facility management.

5.4.6 Ekahau Oy

Ekahau is a privately owned company, which originates from Helsinki, Finland in the year 2000. Nowadays Ekahau is the leading provider of Wifi-based RTLS and other Wifi related planning solutions. The solutions by Ekahau are being used in several big international companies and in more than 300 hospitals worldwide. Especially in the United States, Ekahau has been successful. The headquarters of Ekahau are situated in Virginia, USA, whilst Ekahau Europe is based in Helsinki, Finland. (Ekahau) The revenue class of Ekahau is >\$10 million (China-Finland Golden Bridge 2014-2015).

Ekahau’s mission and hence future plan is “to be the preferred provider of innovative, Wi-Fi focused business technologies and premier service enabling organizations to succeed, intelligently”. Ekahau’s assumption is that they are the leading provider of Wi-Fi based RTLS solutions in the world. (Ekahau)

Selected target markets include organizations that are in need of an accurate asset tracking solution. Ekahau has special focus on the healthcare sector, schools and other education facilities. Ekahau positions its Ekahau RTLS solution as a standout compared to

other technologies and products since it can be used on existing Wi-Fi networks, thus eliminating infrastructure costs and time of deployment. The Ekahau RTLS product was demoed to us during one of our customer visits. Thus we gained an understanding on how it works and how it appears to the user. Distribution channels include their web page, congresses and sales individually. (Ekahau) The price range for tagging 50-100 assets and installation was 20000€ + 18% yearly maintenance costs (Pakkala 2012).

The SWOT –analysis for Ekahau is provided below in Figure 27. The strengths of Ekahau include having several patents behind their tracking technology, providing protection and creating a barrier for market entry, the focus on asset tracking with a strong and skilled workforce and a strong reference base worldwide. Weaknesses include that costs for asset tracking solutions are high and such a field requires strong investments in research and development.

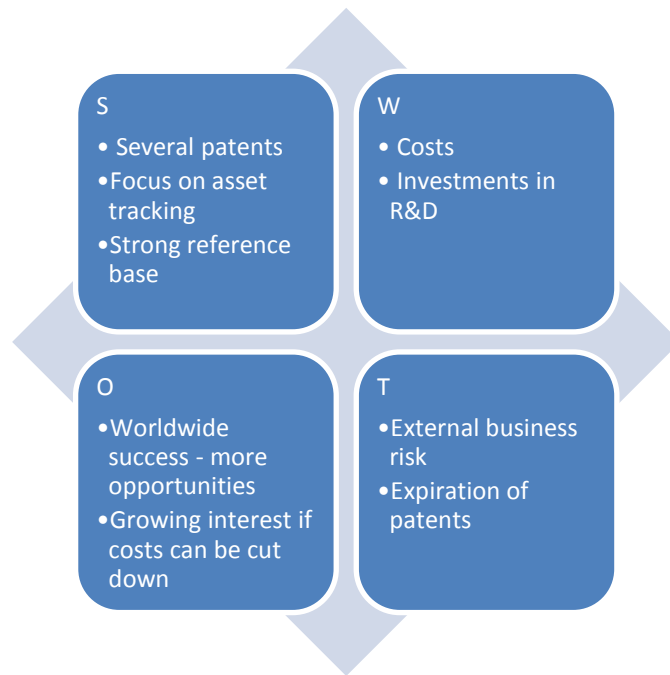


Figure 27. SWOT –analysis of Ekahau Oy

Opportunities include the possibility of having worldwide success since opportunities exist broadly and growing interest can be capitalized if costs can be cut down. Threats include the external business risk and expiration of patents, which open up the market for more competitors.

5.4.7 Five forces model

After evaluating competition competitor by competitor the Five forces model is a good tool to look at competition in a bigger picture by assessing all the five forces separately. In this section the asset management market will be assessed through the five different forces according to the findings and competitor analysis earlier in this work. Each force will be assessed by evaluating factors whether they enhance (+) or diminish (-) the force. The summarization of this is represented in Figure 28. (Jurevicius 2013)

As mentioned before the industry rivalry force is typically the main factor in many fields of industry. At the moment the asset management market in the Finnish healthcare has one dominant competitor (Sofor Oy), two smaller competitors (Solteq Oy, Granlund Oy) in terms of market share and other competitors as challengers including GE Healthcare Finland Oy. There is a moderate amount of competitors but the amount is growing (+), competitors are about equal size (+), customer loyalty is weakening (+) and products are indifferent and can be easily substituted (+). These factors intensify the competition. On the other hand barriers for exit are low (-) and industry growth is positive (-). These factors reduce competition instead of intensifying it. In conclusion the industry rivalry force is strong (++). (Jurevicius 2013)

Threat of new entrants is high since fairly low capital investment is required to enter a market (+), existing competitors can do little to retaliate (+), customer loyalty is low (+), products are mostly identical (+) and existing companies do not hold patents etc. (+). On the other hand the threat of new entrants is low since government regulations are fairly high in the healthcare sector (-), customer switching costs are fairly high (-) and economies of scale are not easily reachable (-). When these factors are taken into account the threat of new entrants force in total is strong (++). (Jurevicius 2013)

Bargaining power of suppliers is low since suppliers are mainly small in size compared to customers (-), companies do not have plans of forward integration (-), several rather than few substitute products exist (-), switching costs are not exceptionally high (-) and suppliers have substantial resources (-). Factors that indicate that bargaining power of suppliers is high include that there are a few suppliers compared to buyers (+). In total the bargaining power of suppliers is very low (----). (Jurevicius 2013)

Strong bargaining power of buyers occurs when there are several substitutes (+), switching costs to other providers are rather low (+), buyers are price sensitive (+). Weak bargaining power of buyers dominates when several buyers exist (-). Threat of backward integration and buying in large quantities are not relevant in this case. To sum it up the market buyers have a strong bargaining power (++). (Jurevicius 2013)

Threat of substitutes is strong when the cost of switching one product to another product is low (+) and if a competitor can provide a product for a more attractive price, higher

quality or both (+). The switching costs are rather low (-) so threat of substitutes is fairly strong (+). (Jurevicius 2013)

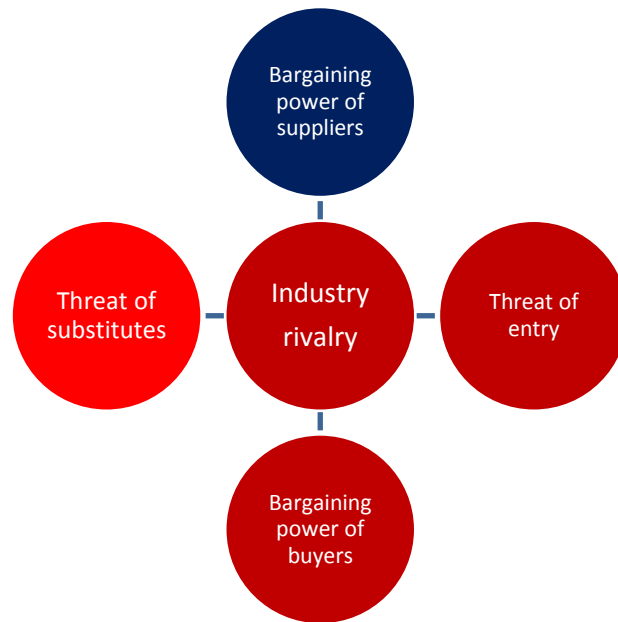


Figure 28. *The five forces model for the asset management market. Red indicates strength, blue indicates weakness.*

In conclusion, the competition is strong in the asset management market of the Finnish healthcare industry. Industry rivalry, the threat of entry, and bargaining power of buyers are strong and the threat of substitutes is fairly strong. The bargaining power of suppliers is very low but it does not shift the momentum of the forces in total (Figure 28).

5.5 Case examples

In this chapter a few case examples of hospitals, which chose to incorporate AssetPlus to their facilities are introduced.

5.5.1 Great Western Hospital (UK)

The Great Western Hospital of Swindon in the United Kingdom with 6000 medical assets and 650 beds had a desire to integrate three separate services into a single functional business unit with the help of asset management. They chose AssetPlus from GE Healthcare as the solution. An overview of the case of the Great Western Hospital and their Trust Department is represented in the below Figure 29.

The “Trust Equipment” department at the Great Western Hospital comprises three different areas: an equipment library, an equipment management area, and a biomedical workshop. The objective was to combine these three main areas to achieve harmonized procedures and methods through a digitally spread out asset management system shared amongst these different teams. (Great Western Hospital 2011)

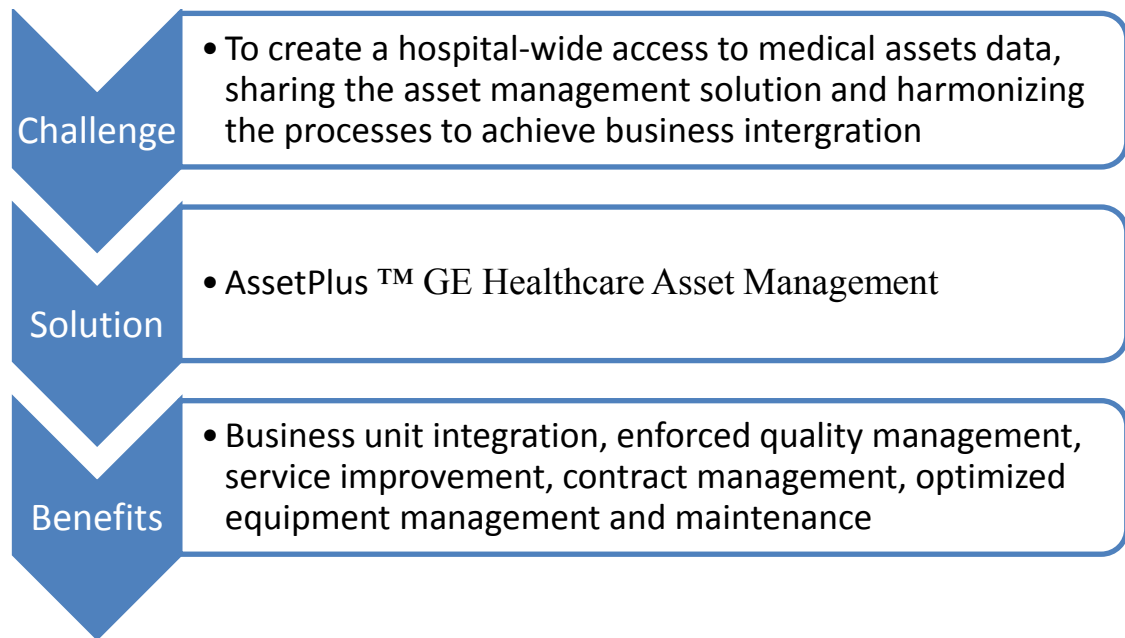


Figure 29. A summarization of the Great Western Hospital case (adapted from Great Western Hospital 2011)

The Asset and Quality Coordinator of the Trust Equipment department at the Great Western Hospital, Ronald Cardy followed the implementation of the inventory of all medical assets:

“We basically rewrote the rules on what we wanted an asset management system to do, and what we wanted to do with it. In terms of preventive maintenance, we manage approximately 6000 items through AssetPlus. The programmed alarms and alerts for the preventive maintenance allow us to spot exactly what needs to be done and when”. (Great Western Hospital 2011)

Quality and informed decisions are made with the help of customized reporting:

“We export data from AssetPlus to Excel and then generate the required reports within excel very easily. This has allowed us to create standard reports that the management team reviews and analyses every single month”, says Ronald Cardy. (Great Western Hospital 2011)

AssetPlus also offers flexibility through the possibility to customize the product, as Ronald Cardy and the other members of the Trust Department noticed:

“One of the things I particularly like is the way you can change the names of the fields and limit that change to just a profile. That is quite useful and does allow for customization without changing the integrity of the overall system”. (Great Western Hospital 2011)

Such flexibility comes necessary when facing a situation like the one the Great Western Hospital faced. Having had a certain purchasing system at the start of using AssetPlus, a set of supplier codes had to be imported into the system. Along the way they decided to change their old purchasing system to a different one, meaning a new set of supplier codes had to be implemented. With the help of AssetPlus the old supplier codes were easily retired and replaced with the new ones. Additionally AssetPlus allowed customizing the field names as well, which were also different with the new purchasing system. (Great Western Hospital 2011)

5.5.2 Sainte Anne Hospital (FR)

The Paris Sainte-Anne Hospital in France with 3500 medical assets and 2500 beds is a long user of AssetPlus. An overview of the case of the Paris Sainte-Anne Hospital and their Biomedical Department is represented in Figure 30.

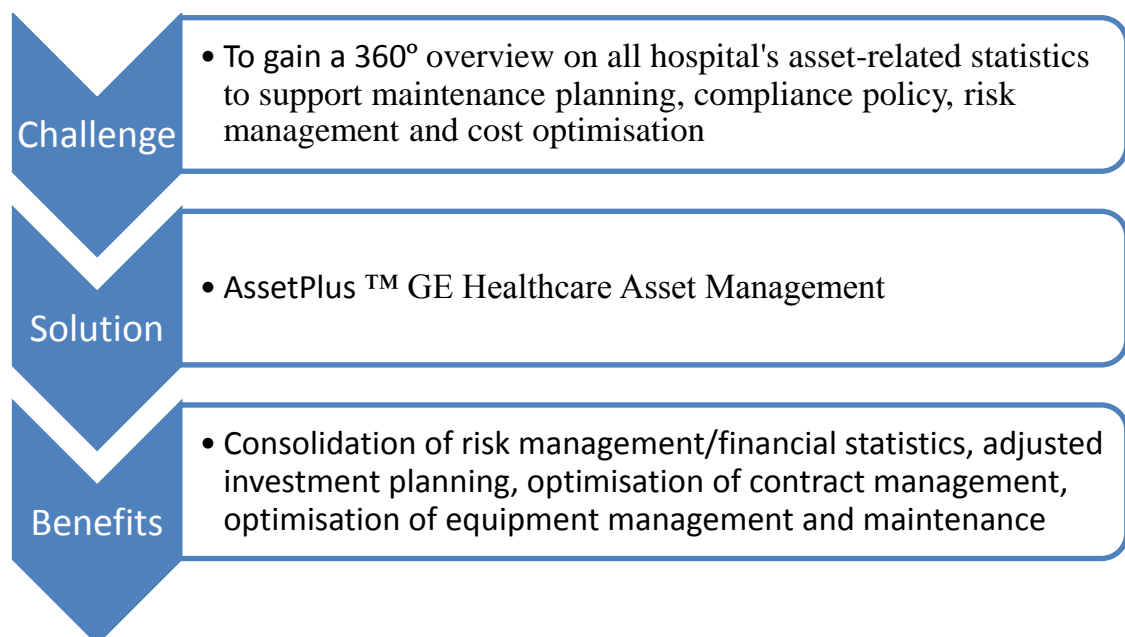


Figure 30. A summarization of the Sainte Anne Hospital case (adapted from Sainte-Anne Hospital 2011)

Since 1998, the year their Biomedical Department was created, every occurrence of each asset has been recorded in AssetPlus. Such data collection allows technicians and members of the department to get an overview of what is going on. Sebastien Pons, biomedical engineer in charge of the department explains the importance of analysis of the received information:

“Tracking is the basis of a genuine qualitative event-based approach. It highlights where improvement is needed, including in terms of organization. When you see that maintenance costs are growing, you can isolate the related costs for each department and clarify your budget reports.” (Sainte-Anne Hospital 2011)

Sainte-Anne Hospital is at the top in advanced neuroscience relating to cutting-edge and costly medical equipment. This kind of position requires strict purchase planning through rational decisions. As Sebastien Pons stresses, such state-of-the-art technology goes hand in hand with increased risk of error and growth in breakdowns. Through AssetPlus and the data it provides, it is possible to assess these risks and if necessary do adjustments on the maintenance management. Risk management is also as important with each and every single asset of an organization. Not only because hospitals are legally liable for the performance levels of their assets, it is also financially advantageous to maximize the use of equipment. Thus it is possible to track for example the number of hours an asset is used and make conclusions based on this to achieve better use of the asset. (Sainte-Anne Hospital 2011)

With the help of AssetPlus Sainte-Anne Hospital can keep track of pricing and costs since every intervention of an asset is recorded between acquisition and disposal. As Sebastien Pons stated; “When we get a new quote from a supplier, we can compare it to the previous orders and invoices and spot differences and key points for negotiation. Since all spending is recorded, quotes and invoices are systematically matched.” By doing this, Sainte-Anne can plan its purchases according to the data extracted from AssetPlus. “Analysing the AssetPlus™ data, we can define investment priorities, estimate costs, as well as fine-tune options such as training and operations.” (Sainte-Anne Hospital 2011)

6. CONCLUSIONS

The healthcare sector is a continuously growing business worldwide. Healthcare organizations are facing the fact that enhanced service must be provided in an uncertain world with limited resources. As mentioned in chapter 3.1, the service costs per device, inventory per bed and cost per bed are all on the rise. Optimization and management of resources is necessary to deal with these challenges. Fortunately tools such as asset management and asset tracking systems are available to exploit for organizations including the healthcare side. The aim of this thesis was to figure out and gain knowledge of the current market situation in the Finnish healthcare sector regarding products related to asset management and asset tracking. The reason for the interest in learning about the asset management and asset tracking market of the healthcare sector was the fact that GE Healthcare has products for both purposes but has lacked coverage in the Nordics including Finland. The potential market share for the asset management product AssetPlus™ and the asset tracking product AgileTrac™ are therefore seen as opportunities to explore.

The market research in this thesis was mainly done following the framework by Mooi & Sarstedt explained in chapter 4.1 (Figure 14). The focus was on primary research done by interviewing potential customers face-to-face with a half-structured theme interview. This method allowed not only open conversation but also answers to specific questions provided in Appendix A. Based on the interviews the asset management market is dominated by a competitor with a 60% market share. However, the more important statistic is the following; 9 out of 20 customers were not completely satisfied with their current situation and were open to look into other alternatives. Additionally many of the other customers also expressed interest in AssetPlus. In the case of asset tracking only a single customer had a product related to it. Opinions on asset tracking differed from having some interest to not having thought about the issue at all.

The study conducted suggests that there is a market penetration possibility for GE Healthcare into the Finnish healthcare asset management market. The asset tracking market does not seem appealing at the moment mainly due to a lack of interest by customers and doubts on the return on investment and technology behind tracking.

Based on the results of this market research GE Healthcare Finland Oy should invest in AssetPlus™ and target the asset management market of the Finnish healthcare sector. The first step would be to localize AssetPlus™ into Finnish since it is a prerequisite in order for customers to use it. After this the next step would be to contact customers of interest and set up meetings to demo the use of AssetPlus™ for asset management.

Since the time was not mature considering asset tracking it is advisable to do further research in the near future. Asset tracking will surely be of interest later on.

6.1 Critical evaluation

When conducting a scientific work a critical evaluation of the research is an essential part. The validity and reliability of the research have to be taken into account when evaluating the results. This means being aware of possible restrictions and errors of the conducted research and how these might affect the results and conclusion of the work.

Validity means the capability of the research method to measure exactly what is meant to be measured. More precisely validity observes how well the research method and the measures used represent the research subject being investigated. A total lack of validity makes a research completely useless and even an insufficient validity means that the research is off track. Reliability on the other hand means the capability of the research method and measures to acquire intended results and results that are not random. In other words reliability is achieved when a research is reproducible. (Anttila 1998)

Measuring only validity and reliability can be troublesome especially in the case of qualitative research. Instead it is more beneficial to measure the quality of the research through different criteria. The criteria, provided by Lincoln and Guba (1985), which include credibility, transferability, dependability and confirmability will be used to ensure the quality of this research work. (Lincoln & Guba 1985)

This thesis was about performing a market research on the subject of the current market of asset management and asset tracking in the Finnish healthcare sector. As mentioned earlier the framework by Mooi & Sarstedt acted as a strong backbone to execute this market research. Even though some interviews of the empirical part were conducted early on and before finalizing the decision to follow the framework by Mooi & Sarstedt it did not have a critical impact on the outcome. It could have eased the whole research process if the idea would have been crystal clear before the interviews.

The empirical part was mainly gathered by theme interviewing. The theme interview focused on the theme of asset management and asset tracking with a set of predetermined questions but otherwise open discussion on the subject. The selection of interviewees was based on trying to find the most competent contacts of each customer. In this case it meant contacts operating daily with such systems or having knowledge of them. The sample size (N=20) covered each Hospital District in Finland so it is safe to say that the credibility regarding the sample size is ensured. The amount of interviewees per customer session varied from single to multiple contacts. The credibility could have been maximized by having more than one interviewee in each session. This would have diminished the possibility of having an overly dominant subjective opinion on the subject by a single interviewee. During the interviews notes were written down to ensure

the possibility for further analysis afterwards. Recording the interviews was not seen necessary since most customer interview sessions were performed by two interviewers ensuring time to take down notes. Making an analysis on the data collected is always challenging since there is always a conflict with the subjective analysis made and maintaining a certain degree of objectivity. This issue will be discussed more in the last criteria of confirmability.

When examining transferability it is necessary to examine to what extent and in which situations the results of the study can be generalized. Since the sample size (N=20) was large and covered all the hospital districts of Finland it can be noted that it did not create a limiting factor on transferability and generalization. The criteria for generalization also include an appropriate gathering of data. This means that when choosing whom to interview it is recommended that the interviewees have similar experience, possess first-hand knowledge of the subject, are interested and have a positive attitude about the research. These facts were achieved in this thesis.

The research results on a qualitative research depend heavily on the interpretations made by the researcher. Therefore despite another researcher would perform the exact same qualitative research the outcome and results would most likely vary. The focus point is that the research is conducted so that the reader is able to follow the interpretations and be allowed to criticize them. (Anttila 1998)

In this master thesis the research process (Mooi & Sarstedt framework) and the methods used are thoroughly described, concepts are explained logically and additionally the methods used to gather the empirical data have been documented comprehensively. These allow repeatability of the research at least to some extent. However as mentioned above even though the research would be conducted following the same procedures again it is more than likely that the results would not be the same. To a certain extent this describes the nature of a qualitative research where the repeatability is ideal. (Anttila 1998)

The results on this research rely on the interpretations made by the researcher. Also in the competitor analysis in chapter 5.4.2 for example consists of how the researcher interprets data. In addition to collecting data by theme interviews the data input from within the company including internal documents were used. Participatory observation can be seen as a limiting factor since it most probably affects the objectivity of the research. This was acknowledged related to confirmability, which is important.

However the indisputable conclusion of this master thesis is that there is a real opportunity for *AssetPlus* to break through into the asset management market in the Finnish healthcare industry. In addition the results of this study can be exploited in the future for further research on the subject of asset management and asset tracking in Finnish healthcare.

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APPENDIX A: INTERVIEW QUESTIONS (FIN/EN)

- Mikä/mitkä on nykyiset käytössä oleva järjestelmät?
- **What are the system/systems currently being used?**

- Mitä niillä pystyy hallinnoimaan?
- **What can be done with them?**

- Kuinka kauan nykyinen systeemi ollut käytössä? Taustat järjestelmästä?
- **How long has the current system been used? Background of it?**

- Mitkä ovat hyvät puolet nykyisessä järjestelmässä?
- **What are the positive aspects of the current system?**

- Mitkä ovat huonot puolet nykyisessä järjestelmässä? Mikä voisi olla paremmin?
- **What are the negative aspects of the system? What could be better?**

- Onko helppokäyttöinen käyttäjilleen?
- **Is it easy to operate for users?**

- Työn ohjaus mahdollisuus? Huoltojen suunnittelu?
- **Possibility for work planning? Planning of maintenance?**

- Onko mobiilimahdollisuutta?
- **Ability to use system on mobile devices?**

- Voiko käyttäjä muokata aloitusvalikkoa?
- **Can the user customize the opening screen?**

- Voiko liitteitä lisätä järjestelmään?
- **Can attachments be added?**

- Henkilökunnan tiedot (koulutushistoria yms.)?
- **Does the system contain information of personnel (e.g. training history)?**

- Onko laitteiden paikannusjärjestelmää?
- **Is there a system for asset tracking?**

- Muuta?
- **Anything else?**

- Mitkä ovat tulevaisuuden näkymät?
- **What are the prospects for the future?**

- Onko edellytyksiä jatkaa nykyisellä järjestelmällä?
- **Are there conditions to continue with the current system?**

- Milloin olisi päivityksen tarvetta?
- **When would there be a need for an upgrade?**

- Mitä toiveita olisi tulevaisuuteen?
- **Any wishes for the future?**

- Muuta?
- **Anything else?**

APPENDIX B: STATISTICS OF HOSPITAL DISTRICTS (KUNNAT 2015)

Hospital district	Inhabitants responsible for	%	Amount of municipalities	%
HUS	1 599 390	29.4	24	8.0
Pirkanmaa	524 447	9.6	23	7.6
Varsinais-Suomi	475 842	8.7	28	9.4
Pohjois-Pohjanmaa	405 635	7.6	29	9.6
Keski-Suomi	251 178	4.6	21	7.0
Pohjois-Savo	248 407	4.6	19	6.3
Satakunta	223 983	4.1	19	6.3
Päijät-Häme	212 957	3.9	14	4.6
Etelä-Pohjanmaa	198 242	3.6	19	6.3
Kanta-Häme	175 350	3.2	11	3.7
Kymenlaakso	172 908	3.2	6	2.0

Pohjois-Karjala	168 896	3.1	14	4.6
Vaasa	169 652	3.1	13	4.3
Etelä-Karjala	131 764	2.4	9	3.0
Lapin	118 145	2.2	15	5.0
Etelä-Savo	103 873	1.9	9	3.0
Keski-Pohjanmaa	78 395	1.4	10	3.3
Kainuu	76 119	1.4	8	2.7
Länsi-Pohja	63 603	1.2	6	2.0
Itä-Savo	44 051	0.8	4	1.3
Total	5 442 837	100	301	100