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SCHOOL OF BUSINESS, ECONOMICS AND LAW

Master's degree project in Logistics and Transport Management

**Keeping track of inventory by introducing a
track and trace system**

A case study at Svenska Mässan Gothia Towers AB

Authors: Fredrik Gullberg and Cajsa Larsson
Supervisor: Sharon Cullinane
Graduate School

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By Fredrik Gullberg and Cajsa Larsson

© FREDRIK GULLBERG and CAJSA LARSSON
School of Business, Economics and Law, University of Gothenburg
Vasagatan 1, P.O. Box 610, SE 405 30 Gothenburg, Sweden
Institute of Industrial and Financial Management & Logistics

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Contact: me@fredrikgullberg.com; cajlars@gmail.com

Abstract

Title: Keeping track of inventory by introducing a track and trace system. A case study at Svenska Mässan Gothia Towers AB.

Thesis degree: Master's degree Project in Logistics and Transport Management.

Authors: Fredrik Gullberg and Cajsa Larsson.

Supervisor: Sharon Cullinane.

Purpose: The purpose of this thesis is to investigate whether the implementation of a track and trace system would result in increased warehouse control. This will be answered by conducting a case study at Svenska Mässan, an exhibition and congress centre with millions of visitors per year.

Research questions: (1) What impact would an implementation of a track and trace system have in regard to keeping track of inventory and decreasing loss at an exhibition and congress centre? (2) What are the main challenges when implementing a track and trace system?

Method: A single descriptive case study conducted at Svenska Mässan Gothia Towers AB, one of northern Europe's biggest players in the exhibition and congress industry, located in Gothenburg city centre. Empirical findings from observations and semi-structured interviews have been presented in a narrative style. This is followed by a thematic analysis where the theoretical framework and the empirical results are combined.

Main findings: An implementation of a track and trace system would allow Svenska Mässan to increase their inventory control and management through improved visibility. Svenska Mässan would decrease their current inventory losses, increase efficiency of operations, reduce resource costs in terms of labour, and reduce customer compensation performed by the After Sales department. A number of AIDC technologies are compared to the organisation's requirements and needs, and a combination of active and semi-passive or passive RFID tags are found to be the most suitable one. There is a number of challenges believed to occur during the implementation; (1) change resistance, (2) high variation of technological competencies amongst operative staff, and (3) involving external contingency staff in following new routines and guidelines. The authors propose a number of managerial and practical implications which Svenska Mässan can pursue in order to manage the identified possible challenges.

Key words: Track and trace, warehouse management systems, inventory management, RFID.

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Fredrik Gullberg

Cajsa Larsson

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Table of abbreviations

AIDC	Automatic Identification
CRM	Customer Relationship Management
DLP	Director of Logistics and Production
EMS	Event Management System
GPS	Global Positioning System
IoT	Internet of Things
MFD	Manager Furniture Department
PM	Production Manager
ROI	Return on investment
RFID	Radio Frequency Identification
RFID-DWMS	RFID-Digital Warehouse Management System
SM	Sales Manager
TOD	Technician of Operations Development
WMS	Warehouse Management System
WW	Warehouse Worker

1. Introduction

This chapter introduces the reader to the background of the topic of this thesis, starting with a discussion about the issues of inventory management as well as a description of Svenska Mässan and their operations in relation to this thesis' topic. Svenska Mässan's current inventory challenges are problematised followed by this thesis' purpose, research questions, delimitations and disposition.

1.1 Background

A costly and common issue to deal with in many industries is inaccuracies of inventory (Fan, Tao, Deng & Li, 2015). Inventory inaccuracies represent the difference between the inventory records and the number of items available physically. The difference could stem from either misplacement or from shrinkage, i.e. theft or damage of items. As an effect of this, inventory costs increase while the company might experience loss of sales, thus inventory control and inventory inaccuracies have a direct effect on profit (ibid). Efficient warehouse management and a strategic Warehouse Management System (WMS) would include control and optimisation of processes related to inventory (Faber, de Koster & Smidts, 2013). A WMS can result in more efficient resource management and higher visibility and traceability of items in storage (Richards & Grinsted, 2013). There are multiple track and trace technologies which can be integrated with a WMS, such as Radio Frequency Identification (RFID), in order to manage inventory inaccuracies (Fan et al., 2015).

Many companies today experience customer orders to be highly customised, thereby increasing the demand of real-time data and information about warehouse processes and inventory status (Lee, Lv, Ng, Ho & Choy, 2017). By integrating smart technology into warehouse and inventory operations, companies can increase efficiency and decrease inaccuracies. Industry 4.0 is a concept which propose highly developed logistical solutions adopting Internet of things (IoT)-based WMS. The integration of smart processes with the help of technological solutions such as RFID, will improve warehouse productivity and efficiency as well as creating a robust system with higher visibility (ibid).

The case study company in this thesis is Svenska Mässan Gothia Towers AB (henceforth referred to as "Svenska Mässan") (Svenska Mässan, 2019a). Svenska Mässan is one of northern Europe's biggest players in the exhibition and congress industry and is located in the city centre of Gothenburg. Over 2 million visitors met, ate and stayed at the exhibition and congress centre during 2018. The facilities consist of two hotels, multiple restaurants and more than 41.000 square meters for exhibitions and congresses. Each year more than 50 trade shows and exhibitions are held with 6.500 exhibitors in total (ibid).

Svenska Mässan (2019a) offers a service which include exhibitors being able to rent equipment to use in their exhibition stands. The equipment is normally booked per event and is reinstated in to stock either physically or by being moved between events, thereby not physically returning to the warehouse. Time schedules between events are often tight and many people are in movement. Svenska Mässan is currently experiencing that equipment often is misplaced or disappears, not to be found again, without a trace to a source. Manual inventory checks and thereby re-procurement of already purchased items are, as a result of that, performed continuously. The current inventory- and warehouse management is time consuming as continuous stock-taking is needed to ensure correct and adequate inventory volumes for future exhibitions and events. The lack of visibility and traceability of when and where items are lost are the main issues experienced today (ibid).

1.2 Problem discussion

Svenska Mässan is currently experiencing major losses of inventory, more precisely equipment which is rented out to exhibitors as well as used for in-house events. The annual cost of inventory replacement is 10 % of total inventory value, where approximately 2 % stands for items being misplaced or stolen. The remaining 8 % represents planned investments in renewing inventory as well as new investments. Some items are more exposed to these factors than others, for some items the percentage rises to estimated 10 %. These items are referred to as “sensitive items” and include items which are of bottleneck character. They are could be of high monetary value, such as an expensive designer chair, of high importance or theft-prone, for example a poster prop. Svenska Mässan estimates that though the direct cost of inventory losses is around 2 % of inventory value, the indirect costs of replacing them are about 10 times greater. The indirect costs include sourcing and procurement of new items, resources in the form of warehouse staff needing to continuously search for items as well as costs related to lowered service levels. Svenska Mässan takes full ownership of all direct and indirect costs, regardless if the items were misplaced or stolen. The organisation is very careful of maintaining good relationships with the exhibitors, which is one of the reasons behind Svenska Mässan taking ownership of costs related to misplaced and stolen items.

Svenska Mässan is experiencing lack of inventory visibility and thereby lack of inventory control. By not knowing where inventory is located Svenska Mässan is unable to work as efficiently as they wish, thereby decreasing their productivity as a result of time-losses, inventory losses and costs related to such issues. Their wish is to increase inventory visibility by the possible introduction and implementation of a track and trace technology. The implementation of a track and trace technology could decrease their losses of inventory as well as decrease resource usage, increase efficiency of operations and productivity. Svenska Mässan has expressed a main interest in RFID tags and barcodes, in terms of track and trace technologies.

1.3 Purpose

The purpose of this thesis is to investigate whether the implementation of a track and trace system would result in increased warehouse control. By conducting a case study at Svenska Mässan, an exhibition and congress centre with millions of visitors per year, the intent is to answer the following research questions:

1. *What impact would the implementation of a track and trace system have in regard to keeping track of inventory and decreasing loss at an exhibition and congress centre?*
2. *What are the main challenges when implementing a track and trace system?*

1.4 Delimitations

Information regarding inventory items which is discussed in this thesis are based on information received from Svenska Mässan, the authors did not themselves investigate which items are more likely to be misplaced or stolen. This thesis will not take into consideration the inventory of Svenska Mässan which are not used to service exhibitions and events. No inventory or stock related to the hotel- or restaurant function at Svenska Mässan will be covered or included in this thesis. As Svenska Mässan has expressed a main interest of RFID tags and barcodes in terms of suitable track and trace technologies, these types of technologies will be the core focus of this thesis. Other track and trace technologies will not be investigated, compared or matched towards the organisation's requirements.

Neither historical statistics nor quantitative material will be included in this thesis. Rather, a qualitative approach will be used throughout the collecting of empirical material as well as when analysing such. As a result of this, no specific costs in terms of purchasing and implementing track and trace technologies will be studied in detail. The scope of this thesis includes an investigation of what effect track and trace technologies would have in terms of decreasing loss and misplacement of inventory as well as the challenges related to the implementation. This thesis will thereby not include any costs calculations but rather study costs as a general variable which could be higher or lower, increase or decrease. Further, no specific software suppliers have been explored in this case study, including Svenska Mässan's current ERP system EBMS, due to the scope of this thesis.

1.5 Disposition of thesis

The outline of this thesis is presented in figure 1 below.

Introduction	Discusses the background.
Theoretical Framework	Elaborates on the literature related to the reasearch question.
Methodology	Discusses the choosen reasearch approach and execution.
Empirical Findings	Introduces the findings of the interviews and observations.
Analysis	Presents how the theoretical framework and empirical material relates.
Discussion	Authors' own reflections on empirical findings.
Conclusion	Finalises the thesis conclusion and future recommendations.

Figure 1: Outline of the thesis, developed by the authors.

2. Theoretical framework

This chapter presents relevant literature in terms of warehouse management, inventory management and track and trace technologies. This is done by describing the importance of each topic as well as possibilities and disadvantages following them. The topic of track and trace is contextualised by describing and discussing the concept of Industry 4.0 and Internet of Things. Finally, change management literature is discussed, as it describes the complexity of starting a change process and how to manage it.

2.1 Warehouse Management

The most essential aspect of efficient warehouse management is knowing exactly what is in the warehouse and where items are located (Connolly, 2008). Managing a warehouse can be challenging and difficult as it involves skills of cost management and facility investments as well as the ability of meeting customer service expectations (Rushton, Croucher & Baker, 2017). Warehouses constitute an important role, both externally and internally, between members of the supply chain as it is critical in regard to costs and services (Faber et al., 2013). Adequate and proper warehouse management plays a vital part in the company's success or failure. Warehouse management include the control and optimisation of all processes related to inventory and distribution (ibid). Processes within the warehouse is generally described as receiving-, storage-, picking- and shipping of items but this is not necessarily true. Warehouse processes can include many different, and multiple sub-components, and can come in many different shapes (Kłodawski, Jacyna, Lewczuk & Wasiak, 2017). Processes in a warehouse might consist of handling of inbound flow, assigning material and items to the correct locations, storage, packing, shipment as well as other value-adding services related to logistics (Faber et al., 2013). The warehouse management used is dependent on what sort of tasks that are performed and the type of industry that the warehouse operates in (Connolly, 2008; Kłodawski, et al., 2017).

Warehouse management is a combination of planning and control systems as well as decisions related to inbound and outbound flows and storage (Rushton et al., 2017). It is to a great part driven by the complexity of tasks and less to the dynamics of the market, i.e. warehouses with highly complex tasks has a higher demand for detailed planning and thereby a sharper control system. The complexity of the warehouse is dependent on the variety and number of processes as well as the number of different items and orders handled. The higher number and variation of items, orders and processes, the higher is the task complexity (ibid).

2.1.1 Warehouse Management Systems

One of the main tools used to operate within a warehouse is a warehouse management system, a WMS (Atieh et al., 2016). It is a system which allows for quicker data processing and coordination of activities and movements within the warehouse (ibid). A WMS can provide a number of potential benefits for the operator of it, some include more efficient and effective resource management, for example labour management, a higher visibility and traceability of

items in stock and accurate stock-takes (Richards & Grinsted, 2013). Thus, presenting positive effects such as improved responsiveness, reduction in picking errors and returns as well as improved customer service and minimised paperwork. A WMS is a tactical tool as it automates warehouse operations and thereby form a key component for strategic business improvement (ibid). The WMS should be designed so that it reduces costs through more effective and efficient operations and processes within the warehouse (Atieh et al., 2016). It is of high importance to select the right tool and software for the specific company and organisation in order to reach the full capacity of warehouse control (ibid).

The WMS requires obvious investments in the form of capital for purchasing of the system as well as costs related to the implementation and maintenance of it (Richards & Grinsted, 2013). Not so obvious is the investment of enthusiasm and commitment from the team working in the warehouse and the senior management. The drive and motivation from the team members and management is needed in order for the WMS to be implemented in the organisation, integrated in operations and regularly evaluated and optimised (ibid).

2.1.2 How to select a WMS

Richards and Grinsted (2013) propose a seven-step model used when selecting a WMS. The model should not be used before a process of justification has been performed. The justification process includes an identification of problem areas, estimation of costs, identification of savings and determination of costs of a WMS should already been accomplished. The seven-step model of selecting a WMS is described below as well as illustrated in figure 2:

1. Calculate return on investment (ROI)

1.1 Consider the WMS ability to improve stock accuracy, increase productivity and cost savings, improve traceability and improve customer service levels. The key focus when selecting a supplier should be on the functional must have rather than what would be nice to have. The potential of payback and the justification are greater the more transactions per day and locations there are in the warehouse.

1.2 Understand the WMS suppliers' cost methods. The cost methods usually consist of four main components; the software licence needed to run the system, service costs related to the implementation, customisation costs and maintenance and support costs.

1.3 Costs related to the hardware and infrastructure

2. Process decision

Study the level of configurability within the WMS. Newer and more modern WMS are generally highly configurable with the purpose of working in almost any type of setting. It is of high importance that the end-user of the WMS is able to understand the product.

3. Analyse the existing system

Understand and analyse the already existing system within the warehouse. By avoiding the interface of an already existing module of WMS in an ERP or business system, shortfalls of functionality might be outweighed.

4. Capability of in-house development

Investigate whether or not the WMS should be developed in-house or purchased as a package. If the specified overall requirements are highly specialised or requires specialised integration with existing in-house systems, it could be viable to develop the new WMS in-house instead of purchasing a package.

5. Information request

5.1 Prepare a request for information (RFI) document. The RFI should describe the business, business direction, warehouse situation and future plans for the warehouse. The operational specification of what the WMS should cover should also include quantitative information related to the warehouse, such as number of loading bays and number of people who would operate within the borders of the WMS.

5.2 Send the RFI to a number of WMS suppliers which are focused within the area of business which is relevant. This activity will reject a number of suppliers which does not have the adequate expertise.

5.3 Finalise a decision on to what extent the purchase should cover. The software and hardware could be purchased outright, or it could be rented.

6. Produce a short list

Select a few of the most relevant suppliers and produce a short list. Collect references, ask suppliers to perform a tailored demonstration of their product and investigate the company behind the product. Make sure to identify functionality gaps and collect costs related to such gaps.

7. Finalise the choice of WMS

Utilise a decision matrix and choose the most appropriate supplier (ibid).

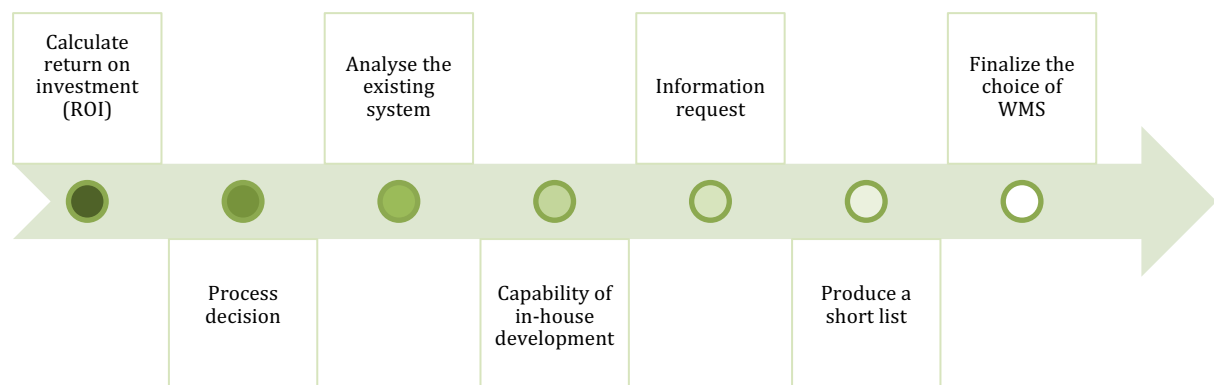


Figure 2: The seven-step process of selecting a new WMS (Richards & Grinsted, 2013), developed by the authors.

This seven-step model will constitute the base of the collection and presentation of empirical findings for this study. It will further assist the authors to structure the analysis. The model will be modified and tailored in order to fit the topic of this thesis, see appendix II.

2.1.3 The implementation of a new WMS

By introducing new technologies or technological change into an organisation, many different sets of challenges arise resulting in management and managers struggling (Leonard & Kraus, 1985). In order to efficiently introduce, implement and absorb technological changes, managers

need to use different strategies, one of them is adapting a dual role. The dual role consists of managers serving as both technical developers and implementers. It is the person responsible for the implementation which need to integrate perspectives and needs of both developers and future end-users. This can be done by marketing the technology in an adequate way, so that it rises attention and attraction from future operators, i.e. the purpose needs to be very clearly communicated to the future users of the technology. It is further important to create a framework for information, meaning that implementation managers must collect information from all group which is affected by the new technology. This include observing the current state of operations and discussing frustrating and rewarding processes within the relevant activity with operational and tactical staff. It should also include an examination of all interactive variables such as warehouse workers and sales staff. It is also important to legitimate change resistance. Change resistance does not disappear if no proactive actions are performed, it only grows and can thereby ruin the entire change project (ibid). More of managerial implications in order to manage change resistance is further described in later in chapter 2.5.

2.2 Inventory Management

Large numbers of different inventory items will complicate the control process of inventory, thereby inventory needs to be managed (Mohammaditabar, Ghodsypur & O'Brien, 2012). There are many ways of managing inventory and these often need to be performed simultaneously as well as being integrated with each other. One tool used to manage inventory is by categorising different items into groups, for example through the use of ABC classification, another one is through increasing the visibility of the flow of items (ibid). By increasing inventory management, a company could reach increased revenues, lower costs as well as higher customer satisfaction (Garcia, Ibeas & Vilanova, 2013).

The overall performance of a company significantly lies in the importance of the design of the company's inventory management system (de Vries, 2011). An inventory management system is an integrated system which not only integrate but also standardise and automate decision processes in regard to the management and control of inventories. It allows the organisation to make operational, tactical and strategic inventory related decisions by providing information required. Inventory management systems do not only consist of technical software systems or modules, but also tangible elements and tools such as procedures and routines. Previous research has agreed on four elements which are essential when designing and implementing inventory systems and in order to achieve high performance. These four include a physical dimension, planning and control, information as well as an organisational aspect. Technology is more widely used in order to facilitate the decision-making processes, this since significant investments in integrated information systems has shown to improve communication and coordination. By having accurate and up-to-date information regarding inventory, data is more likely to be true and thereby relevant as a catalyst and motivator for decisions (ibid).

Zhang, Goh and Meng (2011) discuss the topic of inventory visibility as a significant dimension of the visibility in a supply chain. Inventory visibility allows companies to access inventory information in order to make their supply chain effective. As it provides accurate and up-to-

date data regarding in-stock and in-transit inventory, it optimises the end-to-end process of the supply chain. Many supply chains today suffer from limited inventory visibility, causing unawareness of operations status and the flow of inventory. Inventory visibility is mainly performed through the implementation of track and trace technologies, such as barcodes or RFID. By decreasing inventory inaccuracies, the costs of the supply chain, such as costs related to not being able to satisfy customer needs, decreases (ibid).

2.3 Track and Trace technologies

Track and trace technologies offers a great number of benefits, explaining why it has been increasingly implemented in the recent years (Gossen, Abele & Rauscher, 2016). By enabling traceability solutions companies can fully utilise the opportunities given by the process optimisation (ibid). Automatic identification (AIDC) technologies are used to track and trace items, products and assets throughout a supply chain by capturing and transferring up-to-date data without human interaction (Ustundag & Cevikcan, 2018). The most common types of AIDC technology are barcodes, RFID, real-time locating systems and Global Positioning System (GPS) and they have different features and are used for various purposes (ibid). Below follows more detailed information regarding the two types of AIDC technologies which are most relevant for the context of this thesis.

2.3.1 Barcodes

Barcodes are bars which organisations can use to label unique items or products related to logistical activities, such as inventory items (Richards, 2018). The barcodes consist of vertical bars that form a series, each part of the bar representing letters, numbers and symbols. Barcodes are mainly used today as a tool to help identify products, locations in warehouses, containers as well as serial and batch numbers (ibid). There are many different standards for barcodes in logistics today, though there are no specific provision that all manufacturers follow (Ustundag & Cevikcan, 2018). As a result of this they all differ in some way, thereby making it somehow difficult to transfer products between different companies, although many industries follow the same standard. There are different types of barcodes, all with different data capturing capacities. More traditional types of barcodes consist of parallel lines and has a low data capacity, while the two-dimensional barcode has modules, such as quick response (QR) codes, and can store up to over 7000 characters (ibid).

A barcode, and the data it holds, are read by either a barcode reader with a laser beam or with a barcode reader software installed in mobile device (Ustundag & Cevikcan, 2018). What sort of barcode reader one chooses depends on the application area and they can be truck-mounted, hand held, stationary or wearable (Richards, 2018). Common for all types of barcode scanners is that all types contain scanners which can read, decipher and store data in real time (Ustundag & Cevikcan, 2018).

The hand-held scanners scan the barcode and transmits the data to a computer (Richards, 2018). The scanner has the ability to read a number of different barcode types, depending on manufacturer, model and cost (ibid). Data is read and stored in the device and later downloaded

to a computer via an USB connection. The hand-held barcode scanners allow for quicker and more accurate data collection in warehouse environments. As task and instructions are given on the screen of the device, productivity is increased as warehouse workers do not need to return to a hub for instructions after a completed task. A hand-held barcode scanner does come with drawbacks, such as difficulties to perform operations safely and correctly while still managing the scanner. The wearable barcode scanner is chosen by many companies due to its low requirements of change to the existing warehouse operations, under the circumstances that a barcode system is already implemented. It allows warehouse workers to use the scanner hands-free as it is often worn on the wrist or lower arm with the scanner placed on the warehouse worker's finger. The use of the wearable barcode scanners allows for quicker picking processes and the potential of reducing picking errors thus increasing accuracy and productivity (ibid).

Barcodes has decreased in popularity in advantage for other track and trace technologies, such as RFID systems, though it still remains to be the most commonly used AIDC technology (Ustundag & Cevikcan, 2018). Using barcode technology is an inexpensive way of being capable to trace objects, products and assets through a supply- or value chain with limited human interaction. Regardless of previously mentioned, barcode technology has its overall weaknesses, including high requirements of line-of-sight reading, low data security levels as well as the barcodes themselves being vulnerable to damages. In addition to this, barcodes lack the possibility of transmitting data, resulting in its read-only capability (ibid).

2.3.2 RFID

RFID is the identification of items by the use of radio waves (Rushton et al., 2017). It has become more frequently applied in supply chains in order to increase visibility and traceability of items or units, in addition to this RFID is often used as a way of increasing security in relation to high-value goods. A number of components are included in a RFID system; a tag, an antenna, a reader and a host station. The tag is fixed to the item or unit, contains a microchip and an antenna, and could be either active or passive. Passive RFID tags has no battery included and constitutes the majority of use in commercial supply chains, whereas the active RFID tags has a battery and tend to be used for units of high value or high importance. The tags are integrated with software and is able to capture and transmit data into a smart logistics system (ibid). Ustundag and Cevikcan (2018) describes the main differences between an active RFID tag and a passive RFID tag, these are summarised in figure 3 below.

Type of tag	Characteristics	Strengths	Weaknesses
<i>Passive tags</i>	No power source	Less expensive, lighter weights, smaller size tags, easy to print.	Short read range, limited storage space, unable to attach sensors, no power source, read only.
<i>Active tags</i>	Internal power source	Greater read range, larger storage capacity, read and write capability.	More expensive tags and readers, larger size tags.

Figure 3: Passive and active RFID tags (Ustundag & Cevikcan, 2018), developed by the authors.

In addition to the passive and active tags, Ustundag and Cevikcan (2018) describes the semi-passive RFID tags. The semi-passive RFID tag is battery assisted and has an integrated source of power which supply the chip with energy though is reliant on the reader's energy in order to send a signal. Semi-passive tags have a greater reading range than passive tags and are able to support sensors but are bigger in size than passive tags as well as more expensive (ibid). Tejesh and Neeraja (2018) describes, in addition to above, that semi-passive tags are more difficult to handle than the passive tags, as are the active RFID tags.

RFID have many different applications, making it suitable for tracking inventory within a closed facility such as a warehouse (Tejesh & Neeraja, 2018). As it can track and position unique objects it is possible to apply in many different sectors, such as differentiating between different products or items in a warehouse (ibid). When using RFID in order to better manage warehouse activities and increase inventory control, i.e. decreasing shrinkage of inventory, misplacement of items and transactions errors, it is referred to as RFID-DWMS (Wang, Chen & Xien, 2010). DWMS stands for a Digital Warehouse Management System and its aim is to improve operations in warehouses by integrating RFID, computers and wireless communication technologies. A RFID-DWMS would enable a typical, warehouse to attain benefits normally found in automatic warehouses, such as automatic storage and retrieval management, higher accuracy in shelf management and real-time inventory management. RFID-DWMS is also said to consist of a much lower investment than a complete remodelling of a warehouse into an automatic warehouse (ibid).

RFID allows items to communicate their information and data between themselves without human interaction (Wang et al., 2010). Impacts of RFID technology in regard to inventory control and especially deviations of inventory, is usually accounted based upon three sources. These three sources include shrinkage of inventory, misplacement of products and transaction errors, which all could be decreased or prevented by the implementation of RFID. The technology would allow for such issues to be detected in time and thereby reduced efficiently (ibid). One of the advantages of RFID is relation to barcodes, is that the information written on the tags are rewritable, meaning that the tags can be updated or changed (Rushton et al., 2017).

Additional advantages are that the tags can be read from a distance as well as being less vulnerable to damages (ibid). RFID also allows unique identification of each item carrying a tag, allowing for status monitoring, better stock visibility and traceability, increased accuracy of data, decreased shrinkage of inventory as well as automated inventory counts (Lim, Bahr & Leung, 2013).

Richards (2018) states that due to its cost, individual-item-level tracking for a majority of a company's products is far away. Barcodes are widely used because of its low costs and its capability to still provide accurate and cost-effective identifications of items. When implementing a RFID application in an organisation, a number of items are required; RFID readers, tags, middleware, systems upgrades and a radio frequency network within the warehouse. It is also important to remember the disadvantages that a RFID implementation could include. Some of these disadvantages include the issue of reading a tag when it is in close proximity to metals, areas of the warehouse where the signal is weak, overlapping of tags and intermittent data capture, i.e. some tags are not read. One of the greatest benefits of RFID compared to barcodes is that the tags are not as sensitive to damaging, thereby not said that the tags are indestructible (ibid). When exposed to liquids, static discharges and magnetic surges, the tags are sensitive and could get damaged (Lim et al., 2013).

2.4 Industry 4.0 and Internet of Things (IoT)

Ever since the beginning of industrialisation, technological leaps have led to an upheaval of manufacturing (PWC, 2018). Industry 3.0 refers to the widespread digitalisation which involved the automation of single machines and processes. The distinction between Industry 3.0 and Industry 4.0 is that Industry 4.0 involves an end-to-end digitisation and data integration of the value chain (ibid). Inventory accuracy, space utilisation, process management and picking optimisation are the major challenges in the era of Industry 4.0 for warehouse operations (Richards, 2018). In the changing environment there is a need to improve the flexibility, reduce the cycle time and an agile supply chain strategy becomes essential (Lee et al., 2017). Industry 4.0 is a concept within modern and smart logistics which show how the application of Internet of things (IoT) and technological solutions will reshape how physical objects are managed, sourced for and supplied (ibid).

IoT is the concept of seamlessly integrating one or more devices, equipped with sensing, identification, communication and networking capabilities, into an organisation's activities and operations, for example warehousing or inventory control (Lee et al., 2017). A popular and widely adopted IoT-based application in WMS is RFID, as it allows for track and trace as well as identification of specified objects (ibid). In addition to RFID tags, IoT also refers to devices such as infrared sensors, GPS, Geographic Information Systems (GIS) and laser scanners (Yanhui, 2013). The primary purpose of using IoT in warehouses is to connect all items within the warehouse with the network and thereby enable more efficient identification and management (ibid).

As inventory inaccuracies and process management are one of the major challenges in today's warehouse management, a more agile strategy is needed (Lee et al., 2017). Applying IoT into a current WMS requires the integration of technological and administrative innovations, creating the need of proper selection of technology support, timely information and agility (ibid). Using IoT tools will help an organisation to better manage and determine the storage of items or materials as well as how they travel within the facility and to ensure the status of the physical inventory (Yanhui, 2013). A WMS based on IoT provide a company with a higher chance of reducing inventory inaccuracies as information is already integrated with the system. Real-time inventory records allow for more effective warehouse monitoring than if the controlling would be done manually (ibid).

2.5 Change Management

The changes in digitalisation and technology today forces companies to adapt new systems, ways of operating and business models, and change has become the pattern of doing business rather than sparse events (Matos Marques Simoes & Esposito, 2014). Change management is a structured approach used to help and support individuals and organisations in making organisational changes. An organisational change could be changing behaviours of individuals or adopting new business processes or technologies (ibid). The goal of organisational change is often to improve internal or in-house process efficiency by increasing how resources are used (Lines, Sullivan, Smithwick & Mischung, 2015). The implementation of new practices or methods requires that individuals within the organisation must not only learn these new approaches and methods but also disengage or dismiss the traditional way of operating (ibid). One of the main issues in organisational change can be that the people involved resist it, resulting in many change projects do not reach completion (Adriaenssen & Johannessen, 2016).

Change resistance occurs when individuals see the risks of a change project out-balancing the possible benefits of it or when they perceived risk of losing what they already have achieved or already possesses (Adriaenssen & Johannessen, 2016). Actions which obstruct, oppose or slows down a change project are all included in the concept of change resistance, which is one of the major reasons to change projects failing (Lines et al., 2015). These actions might include members of the organisation spreading negative opinions and rumours, openly sabotaging the project, hiding useful information during the implementation of the project or by voluntarily or involuntarily remove themselves from the project or even the organisation (ibid).

One of the most relevant dimensions to the success of an organisational change or a change project is communication (Matos Marques Simoes & Esposito, 2014). The success of communication is considered to stem as a result from preparing organisational members for change, reducing their uncertainty and perceived risk as well as creating commitment, i.e. it manages the level of change resistance. By communicating the reasons for and the effects of a change project, proper communication becomes a tool and a social process where people are able to interact and exchange experiences and create meanings. It is important to recognise sensemaking and sense giving in order to develop organisational members' meanings about an organisation change (ibid).

Adriaenssen and Johannessen (2016) discusses multiple propositions which aims to provide a system for reducing organisational change resistance. One of these propositions regards how management need to frame and discover who the optimist within the organisation are and assign them responsibilities within the change project. If the change project has optimistic members the probability of success is greater than if this action is not performed. They also propose the importance of anchoring know-how and information available in employees' memories into the change project, thereby resulting in employees considering the change project in a positive light. Se full presentation of Adriaenssen and Johannessen's propositions and managerial implications can be seen in figure 4 below (ibid).

Proposition magnitudes	Practical implication	Management implication
<i>Decision-making under uncertainty</i>	People are afraid to lose what they already have and will fight changes in order to secure their current and existing positions.	Be aware of people's tendencies to rather choose to secure their existing positions than achieving possible benefits from a change project.
	People tend to not respond to possible gains of a change project unless the gains are presented as being more than 100 %.	Present the change project as an opportunity to double the strengths of operations today.
<i>Framing</i>	People are conservative and tend to lean toward the established, safe option over potential gains.	Involve optimists in change projects and let them be the agents of change.
	People's perception of a project beforehand will influence their thoughts about the project and move them in a direction of mindset.	Act cautiously when introducing changes, as too many rapid changes will increase resistance.
<i>Anchoring</i>	People will be more prone to engage in change projects if they believe that the project is reasonable.	Use the anchor effect in order to manage people's change resistance by presenting the project as reasonable.
<i>Availability</i>	People tend to believe that information retrieved from memory has higher credibility than information emerging from analysis.	Use information which can be easily compared with events that employees can identify with.
	People are not inclined to engage in projects where they do not experience the changes as emotionally attractive.	Increase the emotional reward of the change by using anchoring and framing.

Figure 4: Propositions to reduce change resistance (Adriaenssen & Johannessen, 2016), developed by the author).

2.6 Summary of theoretical framework

The theoretical framework of this thesis starts by a thorough description and explanation of what warehouse management is and how it plays a vital role in a company's success or failure. Later follows a chapter discussing how WMS are used to coordinate activities and operations within a warehouse. As WMS enables benefits such as more efficient and effective resource management through higher visibility and traceability of inventory. A framework proposed by Richards and Grinsted (2013) discuss how companies should act when selecting a new WMS. This framework has been used further in the thesis as it clearly describes the justification process as well as seven necessary steps to take before settling on a new system implementation. As the implementation and integration of a new technological system can be met with many challenges, a number of these and how to manage them are described.

Inventory management is a crucial part of the overall performance of a company. Thus, the theoretical framework continues with discussing four essential elements for high performance inventory management. The conclusion of the sections is that inventory visibility is key as it allows for effective management of operations. Achieving inventory visibility is proposed to be the result of the implementation of track and trace technologies, mainly discussed are barcodes and RFID tags. Closely related to AIDC technologies are Industry 4.0 and the concept of IoT. The concept of IoT allows for seamless integration of technological solutions in a warehouse, enabling more efficient management of inventory.

Lastly, the concept of change management is described. There are many different difficulties which could occur when an organisation carries out a change project, change resistance is one of them. How to use both practical and managerial implications in this process is discussed.

3. Methodology

This chapter describes, motivates and discusses the methodological choices that have been taken by the authors of this thesis. The purpose of this is to present a transparent explanation of how the research was conducted. It is structured by first presenting the research approach, secondly by presenting the research design, thirdly by presenting data collection, empirical writing and analysis. Finally, the authors discuss the research quality of this thesis.

3.1 Research approach

With the purpose of gaining a deeper knowledge and understanding of warehouse management, inventory control as well as track and trace implementation, the authors have chosen a qualitative research approach to this thesis. Justesen and Mik-Meyer (2011) discuss that qualitative research aim to create a deeper knowledge and understanding of a phenomenon rather than finding general validity. As a result of this, qualitative research does not present an absolute and definite truth (ibid), which is also the case for this thesis. Bryman and Bell (2015) describe that the qualitative approach allow the researcher to perform their research in an adaptive and flexible way as it allows for new and unpredicted information to emerge. As a result of the characteristics related to qualitative research the results are not easily transferable to other fields of research. The qualitative findings are not based on quantitative statistics and data but on a subjective interpretation of the context (ibid). This thesis aims to explore a nuanced picture of how Svenska Mässan could increase their inventory control through a potential implementation of a track and trace system, thereby making the qualitative research approach the most suitable method.

When conducting scientific research, one is guided through the research paradigm, a so-called philosophical framework (Collis & Hussey, 2017). The two main paradigms today are positivism and interpretivism where positivism originates from natural sciences and interpretivism is originated in a critical response to positivism. Research which is conducted through positivism assumes that the reality is singular and objective, and that the results can be generalised from the sample to the population. Interpretivism assumes that reality is subjective and in our minds. Interpretivism allows result to be generalised to similar settings to the one where the research is conducted (ibid). The paradigm of positivism is rejected in favour for the interpretivism paradigm, following this thesis qualitative character and abductive reasoning. Interpretivism allows the researcher to take an inductive approach, where the topic is studied within its context and theories are developed for understanding (Collis & Hussey, 2017).

Abductive reasoning has been used throughout the making of this thesis. According to Bryman and Bell (2015), abductive reasoning is similar to deductive and inductive reasoning in that way that it allows the researcher to make logical conclusions and form theories based on those conclusions. Abductive reasoning has become more used as it overcomes the limitations with deductive and inductive reasoning, for example the need of strict logic and falsification of hypothesis which is related to deductive reasoning. In contrary to inductive reasoning,

abductive reasoning allows the researcher to build theories on empirical data. The best explanation is chosen from a number of explanations, based on empirical material and data, and is presented as the result. The abductive way of reasoning might result in a limited ability to reason rationally and highlights the importance of cognitive reasoning (ibid). As abductive reasoning has been used throughout this thesis, the results of the case study cannot be seen as an absolute truth but only the best explanation of what the implementation of a track and trace technology at Svenska Mässan would result in.

3.2 Research design

This thesis has adopted a case study research design as it allows for more detailed descriptions, which not all other designs do. Bryman and Bell (2015) say that adopting a case study research design allows the researcher to explore the complexity of a situation or an event. As not many case studies on exhibition centres' inventory control has been performed earlier in scientific research, this case study allows the authors to investigate something rarely discussed. The research design also allows the authors to explore a wider spectrum of Svenska Mässan's change process. The design aims to outline activities, challenges and incentives of the implementation of a track and trace system in regard to increased warehouse control.

A case study is suitable to use when the researcher wishes to answer questions of how and why, according to Yin (2018). This case study would thereby allow the authors to go more in-depth in regard to Svenska Mässan's activities than another research design would. What could be discussed is how well this case will be generalisable to other contexts. The authors of this thesis would argue that based on Svenska Mässan's market share of the Swedish exhibition centre industry and the previous limited research on this topic, this case study would add value to research and allow general conclusions to be drawn.

3.3 Description of case study company

Svenska Mässan is the country's oldest exhibition and was inaugurated in 1918 with a trade fair and attracted 42.153 visitors. The purpose when the West Sweden Chamber of Commerce started the exhibition was to establish a meeting place between industry and trade to promote the business community that was previously lacking in Sweden. The foundation behind, and with total ownership of, Svenska Mässan is the Swedish Exhibition & Congress Centre Foundation (Sw. Svenska Mässan Stiftelse). The foundation is financially independent, which means that there is no external owners or investors. All financial decisions are based on own merits, and any surplus is reinvested in the business (Svenska Mässan, 2018).

3.3.1 Organisational structure

Svenska Mässan is owned by a foundation which means that they have no external owners or investors. The board is elected by the Supervisory Council which consists of representatives from the business community of West Sweden. Representatives include the City of Gothenburg, the West Sweden Chamber of Commerce, Gothenburg Traders' Association, universities in Gothenburg and the Swedish Trade Federation (Svenska Mässan, 2019b).

The stakeholders of Svenska Mässan (2019b) are many, not only the board and the foundation behind the company have interest in its outcomes and activities, but also employees at Svenska Mässan, bondholders, customers and suppliers. Svenska Mässan say that there are two different main benefits as a result from the ownership structure. The first one is the ability to reinvest all profits into the company and the second is the flexibility it provides. Svenska Mässan does not have to account for shareholders different interest but instead they are able to make their own decisions. This provides them with great flexibility in how decisions are made and how fast changes can be carried out (ibid). Being owned by a foundation limits Svenska Mässan's possibilities of raising equity capital. The monetary resources accessible to Svenska Mässan during the year are the direct result of last year's financial accounts.

3.3.2 Vision, mission and development factors

Svenska Mässan's overall objective is to have a profitable growth that provides the conditions for progress towards the vision and the fulfilment of the mission, see figure 5. In order to achieve their overall objective, they have chosen to focus on below six development factors that should permeate the operations (Svenska Mässan, 2019c).

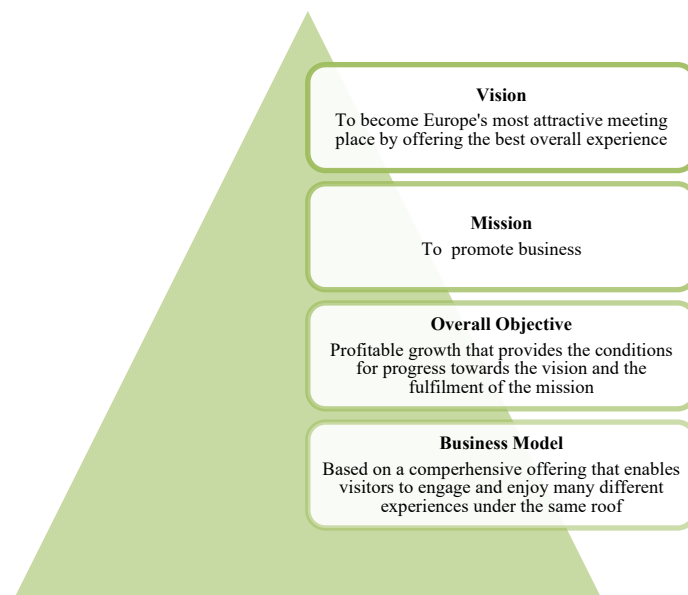


Figure 5: Svenska Mässan's vision, mission, overall objective and business model (Svenska Mässan, 2019c), developed by the authors.

1. Sales and business development: The ability to build relationships and trust has increased in importance. Digitisation has made it possible to reach customers in both the corporate and private segments in new ways. Through digitisation, it has become possible to reach more international customers in cost-effective manners and Svenska Mässan aims to continue developing their digital marketing. This further means that Svenska Mässan wishes to proactively position themselves on the international trade fair and meeting market. Svenska Mässan thereby needs to further offer new trade fairs and meeting experiences as well as prepare for the possibility of customers asking for new business models.

- 2. Digitisation:** Digitisation has led to increased consumer power, and social media provides a high reach and confidence in consumer reviews. As services and products are more compared today through increased consumer power, the customer experience has become increasingly synonymous with the digital services that companies can offer their customers. Information and data have become crucial for building new experiences and for making business more efficient. Svenska Mässan's goal is to explore new technology that can add value to customers and improve operations activities. Their aim is to be a fast follower in digitisation, but not to be an industry leader.
- 3. Plant development:** The exhibition industry is currently experiencing that the customer's planning horizons are decreasing. This results in increased demands for rapid changes and flexibility in facilities and processes. Events tend to run for fewer days because companies want to reduce travel-related costs and employees want a balance between work and leisure. In order to maximise value, there is an increased interest in implementing parallel events and shortening setup times. Svenska Mässan aims to increase capacity and wants to invest in an optimisation of existing facilities from a sustainable perspective. The facility will also need to make proactive adjustments to the facility due to external infrastructure changes.
- 4. Culture, competence and working methods:** Digitisation enables new ways of working that can lead to better experiences and efficiency. The rapid mobility abroad requires agile working methods and committed employees. Experiences that follow customer preferences requires new skills and competencies, while in an increasingly mobile labour market, it has become more difficult to attract new employees as well as retaining already existing ones. Svenska Mässan will continue to strengthen their organisational culture with a focus on customers, innovation, and inclusion. They want to enhance their attractiveness as employers by offering opportunities to develop within the company as well as overall great working conditions.
- 5. Overall experiences:** The hospitality and the meeting industry are becoming more and more part of the fast-growing experience industry. The customers describe the services based on what succeeds in affecting them and out of the unexpected. It becomes increasingly important to be unique during the physical meeting. Therefore, Svenska Mässan wants to strengthen its meeting and accommodation offers with a broader range of options and delivery of experiences becomes a core competence.
- 6. Sustainable development:** In a global context, Sweden and Gothenburg have a strong position in sustainability. To the extent that it is possible, the Svenska Mässan wants to be able to offer customers sustainable alternatives. Sustainability is an influential decision factor in every decision that is made and a tool for measuring profitability. Existing and new employees are also attracted by sustainable values and clear sustainability profile (ibid).

3.4 Data collection

Several sources have been used in order to retrieve data for this thesis. The first being a pilot study with the Director of Logistics and Production (DLP) and the Technician of Operations Development (TOD) at Svenska Mässan, which assisted with not only overall insights in the organisation's operations but also helpful guiding in regard to selecting interview respondents and observation occasions. Empirical material has been collected mainly through semi-structured interviews with people working within the studied organisation. Observations have been conducted in order to obtain more understanding regarding Svenska Mässan's operations and challenges. Six interviews have been performed, both with operational staff, tactical managers and strategic managers at Svenska Mässan, but also with managers at other exhibition and congress centres in Sweden and abroad. Secondary data in the form of previous research were used to build the theoretical foundation for this thesis.

3.4.1 Pilot study

In order to conduct adequate and proper interviews, thereby collecting relevant data and material (Holme, Solvang & Nilsson, 1997), it was of high importance that the authors of this thesis were well familiar with the organisation of Svenska Mässan. In addition to this it was important that the authors received help in regard to selecting suitable respondents for the interviews. A pilot study was conducted early on in the making of this thesis with the purpose of gaining insight in Svenska Mässan's operations and current warehouse control status. The authors met with the DLP as well as the TOD. The first mentioned was appointed as the authors' supervisor with the later mentioned being the link to the operative activities taking place. Both the DLP and the TOD assisted, with their expertise, the authors with obtaining overall insight in the operations of the organisation as well the selection of suitable respondents of interviews and observation occasions. For example, the TOD assisted in helping to select the right warehouse worker (WW) to interview. The selection of the WW respondent was based on his work role as responsible for the studied part of the warehouse at Svenska Mässan.

3.4.2 Observations

A number of observations was conducted at Svenska Mässan, both in the warehouse, in the exhibition halls and in the shape of a guiding in the current software used to manage inventory. The purpose of performing the observations was to get insight in the facility's and the organisation's possibilities and limitations, achieve an understanding of how warehouse control is performed today and to generally understand the organisation. Based on these observations, the authors were able to not only produce adequate interview questions, but the authors were also able to better explain empirical material.

Kylén (2004) says that an observation has the purpose of allowing someone to observe events, activities, behaviours, flows of action and frequencies. The observers are later able to combine what they have seen with previous experiences, allowing them to understand relationships or study certain patterns. An observer usually makes assumptions based on personal values though the observation itself does not include values, interpretations or conclusions (ibid). The

observations conducted for this thesis were all planned, and the authors were participating in the observation. All observation, with the exception of one, were unstructured, the semi-structured observation included the authors being guided through the existing WMS. The unstructured observation is, according to Kylén (2004) not characterised by a certain structure but is subjective in what material is observed. The principal benefit of an unstructured is that it provides an overall understanding of a context based on the observer's previous knowledge and experience, though the subjective commitment might influence the result (ibid). The authors tried to stay as objective as possible during the observations and not to make assumptions based on personal values, though still trying to be interested and asking questions to the other participants.

3.4.3 Interviews

The interviews performed for this thesis were all semi-structured and performed either in personal meetings or by phone, and the selection of respondents was mainly based on recommendations retrieved from the pilot study.

3.4.3.1 Semi-structured interviews

Six semi-structured interviews were performed throughout the production of this thesis. Bryman and Bell (2015) state that the use of interviews as a method of gathering empirical material in qualitative research, are one of the most common methods. The researcher can design their interviews based on different organisational types, either structured, unstructured or semi-structured (ibid). A semi-structured interview typically includes a number of topics with questions which are decided on beforehand, but also space which allows for the respondent themselves to lead the conversation into other interesting and relevant areas (Justesen & Mik-Meyer, 2011). Questions might not follow the exact outline but are flexible so that the interviewer can a range of related topics, though the questions should be asked in a similar wording for all interviews (Bryman & Bell, 2015). The process is flexible and should be performed in a way which allows the respondents to feel free to answer the questions in their own way (ibid). The interviews performed for this thesis followed the same structure though not all questions were relevant to ask to all respondents. For example, questions regarding internal strengths in terms of inventory management at Svenska Mässan were not relevant to ask external respondents. In that case the authors tried to ask a similar question more tailored towards that specific respondent's place of work.

During the six interviews the authors of this thesis tried to stay as objective as possible but not objective to that degree that they are perceived as non-responsive or non-inviting to discussion. Due to the characteristics of a semi-structured interview, it is important to note that the result is interpretable and that there is no absolute objective truth (Bryman & Bell, 2015). The advantages of using interviews to collect empirical material is that trust is can be created between the interviewer and the respondent, thereby enabling more valuable and useful information to be collected (Justeson & Mik-Meyer, 2011).

3.4.3.2 Selection of respondents

Choosing the right interview respondents will to a higher degree allow the interviewer to collect adequate material. The choice of performing a pilot study at Svenska Mässan was mainly based on Bryman and Bell's (2015) discussion that researchers' knowledge of the information they are studying will increase the chances of selecting the proper respondents. Some of the respondents for the interviews were also partaking in observations and in the pilot study, thus the time spent with them for those occasions will not be included as interview time. All interviews took place at Svenska Mässan in Gothenburg, with the exception of the interviews performed by phone. The selection of respondents is stated below in figure 6.

Date	Respondent	Time
25-03-2019 10:00	Svenska Mässan: Production Manager (PM), Lundell	60 minutes
27-03-2019 15:00	Svenska Mässan: Sales Manager (SM), Peter Berggren	60 minutes
25-03-2019 13:00	Svenska Mässan: Technician of Operations Development (TOD), Pontén	60 minutes + 25 minutes
26-03-2019 10:00	Svenska Mässan: Warehouse Worker (WW), Larsson	60 minutes
27-03-2019 13.00	Stockholmsmässan: Manager Furniture Department (MFD), Olsson	35 minutes (by phone)
11-03-2019 14:00	Messe Düsseldorf: Director Logistics & Site Services (DLSS), Hume	30 minutes (by phone)

Figure 6: List of interviews, developed by the authors.

3.4.3.3 The interview process

The interview process started with the authors trying not to tell the respondents too much information about the thesis objective beforehand, in order to not bias the respondent's ideas and thoughts. The overall purpose of the thesis was communicated in the email sent to the respondent's when sending out the interview proposals. All interview was scheduled within a week from initial contact, the purpose of this was to keep the objective fresh in mind of the respondents.

All interviews held with members of the staff at Svenska Mässan were held at Svenska Mässan. Most of the interviews were held in meeting rooms with the exception of one, which were held in a calm spot in the warehouse. This choice was made in line with Alvesson's (2003) reasoning that the respondent should feel comfortable with the location of the interview. The respondents were asked before the interview started if they agreed to be recorded during the interview which all agreed to. The purpose of recording the interviews was to enable full participation from both

authors during the interview as well as having the material saved for transcribing purposes. This was communicated before the recording started to all respondents. All respondents were asked if they wanted to be anonymous or if the authors could use their name and work title in the thesis, no respondent asked to be anonymous. All of the respondents from Svenska Mässan shared information which were directly related to their department and work role, making it possible to assume that they would not be anonymous within the organisation of Svenska Mässan. This fact might have restricted their responses not to reflect negatively or poorly on Svenska Mässan and its business.

The interviews, with the exception of one, were held in Swedish as this is the native language of both the respondents and the authors. Both authors were present during all interviews and was part-taking in asking questions and establishing a relationship with the respondent. The interviews were transcribed in Swedish to the authors best attempts to make the Swedish statements as similar as possible in English.

3.4.3.4 Interview framework

The framework conducted for the interviews for this thesis was conducted with the purpose of linking theoretical themes of warehouse management and track and trace technologies from academic literature with practice at Svenska Mässan. The main research question of this thesis is “What impact would the implementation of a track and trace system have in regard to keeping track of inventory and decreasing loss at an exhibition and congress centre?”. As a result of the research questions a great part of the interview framework have been based on the justification process and the process of selecting a WMS, described by Richards and Grinsted (2013). For example, the question of “Can you identify any areas where you could possibly save resources if inventory control is increases?” refers to the justification process. Questions regarding how open staff would be to adapt technological solutions are related to change management and possible challenges connected to a change project. An example of such question is “Do you think that staff would be open to more technological solution?”.

Because of the nature of semi-structured interviews, they were all performed somewhat different, though the same framework and body was used for all interviews. For example, some of the planned questions were already answered by an elaborated answer to a previous question. As all respondents, except one, had Swedish as their preferred language, these five interviews were conducted in Swedish. This decision was made based on two parameters; the authors wished to avoid language barriers as well as making sure that they established a comfortable interview situation for the respondents. The interview guide and the questions have been translated to English with the authors’ absolute best effort, see Appendix I for the presentation of the English interview guide.

3.4.4 Secondary data

The thesis holds a significant amount of secondary data, which has been a major part of the process of conducting the study and producing the thesis. The secondary data has allowed and helped the authors to gain overall understanding of the studied topic and its related concepts.

Data have been retrieved from scientific reports, academic articles and books as well as published reports within the relevant topic and concepts. The use of the University of Gothenburg's Library Search Engine and Google Scholar has allowed the authors to systematically collect online material. Secondary data regarding the case study company has been collected through the performed pilot study and published material from Svenska Mässan. The key words used in the process were "Track and trace", "warehouse management systems", "inventory management" and "RFID". Secondary data has been used in order to gather external information about Svenska Mässan as well as other similar actors in Sweden and Germany.

3.5 Empirical writing and data analysis

According to Collis and Hussey (2017), the interviews performed were transcribed and later reduced to less extensive material. The transcribed material was coded into frequently mentioned categories, which were based on the same framework as the interview guide. This allowed for the authors of this thesis to in a structured way, plan the presentation of the empirical findings. The focus for the authors has been to communicate the respondent's opinions, thoughts and experiences as similar to their own description as possible. As no respondents has requested anonymity, all quotes are presented with the respondent's name in order to be transparent towards the readers of this thesis.

There is a number of reasons why this thesis analysis can be criticised, the first one being the translation from Swedish to English which might have affected the authors' ability to capture nuances of the language (Xian, 2008). Secondly, the authors' ability to stay objective during coding and analysing of the material, i.e. the ability not to make own assumptions about the respondents' replies to questions (Alvesson, 2003).

3.6 Research quality

In order to make sure that research has a certain level of quality, the research itself must be evaluated. Collis and Hussey (2017) describes that research should be evaluated based on its reliability and validity. Reliability seeks to evaluate to what degree the study can be replicated whilst validity represents to what degree the study observes or measure what it was expected to (ibid). It is discussed by Bryman and Bell (2015) that especially qualitative research should rather be questioned based on its trustworthiness rather than reliability or validity. This because of its low measurability in comparison to quantitative research. The criteria which the research trustworthiness is based on are the dependability, credibility, transferability and conformability. (ibid). These criteria will be further used by the authors to evaluate the trustworthiness of this thesis.

The variable of *dependability* is equivalent to reliability, i.e. how accurate and precise the research would be if the study was performed again (Bryman & Bell, 2015). In this case, the result of the study would be rather difficult to replicate. As the authors of this thesis has worked closely together with some of the respondents, and during the time period of the project, results and findings has been shared. The authors thereby argue that these findings have presented the

organisation with an outside perspective based on scientific theories, which would affect a hypothetical replica of the study.

Credibility is the counterpart to what is often referred to as internal validity, which describes the extent of how the result of a study can rule out sources of systematic errors (Bryman & Bell, 2015). This study cannot, with absolute certainty rule out systematic errors as the majority of the data is drawn from either interviews, observations or information presented by Svenska Mässan employees. Based on the widespread of respondents from Svenska Mässan, the authors of this thesis would like to claim that the result has credibility, mainly as many organisational levels of Svenska Mässan has been covered in the sample. Further, time spent on interviewing as well as the full interview guide is transparently presented in this thesis, adding to the thesis overall credibility.

The *transferability* parallels to external validity which defines how well results of a study can be generalised (Bryman & Bell, 2015). Whether or not this thesis has a high level of transferability and thereby can be generalised is highly dependent on the type of organisation and area of business one would apply the result to. The result of this case study is based on Svenska Mässan's operations and activities, which could imply that the result is not able to generalise. On the other hand, if an organisation with similar inventory processes experienced the same issues as presented in this thesis, some findings could most likely be applied. As an example, the possibilities of decreasing inventory losses through the application of track and trace technologies.

The *confirmability* of a study measures how bias the participants in the study are towards the result of the research (Bryman & Bell, 2015). High confirmability is less desired within qualitative research than in quantitative research, which normally makes qualitative research studies more subjective (ibid). As this thesis maintains a qualitative approach, the level of confirmability could be seen as rather low. A majority of the respondents are employed at Svenska Mässan, and all observations aimed to study Svenska Mässan's operations. For this thesis, the low degree of confirmability does not affect the trustworthiness of the result as a result of the subjectivity of a qualitative case study.

4. Empirical findings

This chapter presents the empirical findings of this thesis. The first part of the chapter contains a description of Svenska Mässan's current inventory management. The second part consists of pinpointing current challenges and issues with their way of managing inventory today, by using the justification process explained in the theoretical framework. Lastly, variables affecting Svenska Mässan's possibilities and challenges related to higher inventory visibility and control is discussed, by using the seven-step framework of selecting a WMS also described in the theoretical framework.

4.1 Current inventory management

The following sub-chapters will separate Svenska Mässan's current inventory and warehouse management into two parts, how the collection of equipment after an exhibition is performed and what type of technological support system is currently used.

4.1.1 Collection of equipment

When an event or exhibition is finalised, the equipment which has been rented out to exhibitors has to be collected by warehouse workers (WW). The equipment is generally collected at the end of every exhibition when exhibitors have left the hall. WW are sent to the place of the exhibition and are asked to collect all equipment, using no lists but simply collecting all items visible. Some items which has been rented out, are of sensitive character. These items are either of high monetary value, high importance or theft-prone, making the collection of these items more complex. These items are thereby specified on a list, pulled from the WMS EBMS, with the purpose of securing the sensitive equipment as soon as possible. The list includes not only the type and number of items which should be collected but also the exact location of them. If time slots are very tight or depending on how well-staffed the workforce is, the list might not be provided, and items would be picked up as soon as the WW has time for it.

Svenska Mässan's logistics and production staffing strategy consists of combining permanent employees with external contingency workers. These contingency workers are often recurring and have experience working at Svenska Mässan. Though, during larger exhibitions and events additional contingency workers are used, resulting in an increased staff force where competencies and experience in the facilities might differ. During these time periods, there might be a certain learning threshold as some contingency workers are un-experienced as well as a need of standardised routines and knowledge being explicit rather than tacit. Normally, the allocation of staff resources is evenly balanced throughout the time after an event or exhibition, i.e. the manning of the warehouse is not based on peak-hours but rather evenly spread during the planned dismantling time.

Load carriers are used to store, and transport collected items. The collection of items is performed simultaneously as exhibitors are leaving the halls and securing their own materials. This usually result in limited accessibility and disrupts the transportation flow, forcing the WW

to choose alternative routes, to wait or to abandon the truck and collect item by foot. The list states where in the hall and in which stands items are located, though in reality items are not always found where they are supposed to be. This causes increased waiting times and resource use, as WW have to look for the items elsewhere. If the specific item is not found in the close area, the WW simply moves on with collecting other items, either from the PL or collecting items in general. Depending on the experience of the WW, they might know where items typically end up in relation to or after an exhibition and thus go there to collect items. This is usually performed based on the assumption that these were still related to the specific exhibition or event. When all items on the list are either collected, or almost all is collected and the rest is not to be found, the list is handed to the foreman. When the exhibition hall is empty on equipment, the activity is seen as finalised.

4.1.2 Technological assistance

Svenska Mässan uses Ungerboeck Software International, previously named EBMS (hereby referred to as EBMS), a platform consisting of a software which consolidates the CRM (Customer Relationship Management) processes. The software is specialised to serve actors within the event-, exhibition- and conference industry, and is described as an “End-to-end venue and Event Management Software (EMS)”. This is used in order to register and confirm customer requests, booking and scheduling of requests, event sales and financials. The software is used by both the After Sales- and the Logistics and Production department of Svenska Mässan. This thesis will mainly focus on the processes, activities and issues from a logistical point of view. Though the sales department module will be disregarded for this thesis, the customer satisfaction fulfilment levels will be discussed and taken into consideration.

One of the observed limitations within the system is the lack of real time visibility in regard to available items. In order to accurately see availability of items in relation to specific customer orders, the staff operating in the software must move between different editions. The software itself thereby, if not multiple editions of the software is used, that the inventory levels are not accurate. The result of this process is that the workflow is not perceived as seamless, and that the process is inefficient with the outcome of reduced inventory control.

4.2 Implementation incentives

Below follow empirical findings in terms of internal challenges and issues. The structure is based on the justification process described by Richards and Grinsted (2013). One external challenge when implementing a new system could be how it affects or interacts with the organisation’s customers. Thus, an examination of the relationship between Svenska Mässan and its customers was performed.

4.2.1 Internal challenges and issues

All interviewees from Svenska Mässan agree that the main problem area within the organisation's current inventory control is the general lack of control. Pontén¹ explain how control activities of the inventory mainly is performed next time the specific item type is used or during the annual inventory check. Pontén, Lundell² and Larsson³ all discuss the fact that staff continuously need to search for items after used in an exhibition or an in-house event.

“It happens before almost every exhibition that we find out that there are items that have not been taken down to the proper warehouse or stand where it should have been, forcing us to spend time looking for it.” (Larsson, 2019)

Items can be found in different storage rooms or behind curtains in common lobby areas, as a result of staff not collectively reporting what is brought back from an exhibition or an event. Lundell describe that the general line of work after an exhibition is to collect all items and simply emptying the area. Berggren⁴ agrees and explain that the exhibition is cleared out quickly, a result of tight time schedules, and that items are not checked off from a list. The effect of this is that for certain items, loss or shortage is not revealed until next inventory check. As Svenska Mässan holds an inventory balance for each exhibition, they are fully aware on what has been brought to a specific location. The lack of control presents itself as they do not carry a feature which control that all items has been brought back to the warehouse. An additional effect of this is that items which gets damaged during an exhibition or event are not always reported before they are discarded, thereby adding to the incorrect inventory balance. Lundell further discuss the issue of not knowing if an item is still located within the premises, although with an unclear location, or if it has been stolen.

“The issue is that items disappear. It does not have to be physical and forever, but we do not know where it is. Sometimes we find it hidden somewhere in the house or in an incorrect storage room. Or the item could be lost. These are the two main issues today.” (Lundell, 2019)

There have been recent actions taken in order to manage the loss of inventory after exhibitions and events. One of them is the re-implementation of a list containing so called sensitive items, i.e. items that are more prone to loss and misplacement or are of high value. The list is supposed to be used after every single exhibition and event, but the routine is not fully implemented. All interviewees state that it should be used every time but is only applied when staff feels like the time schedules allow for it. Larsson explain that warehouse staff are less prone to operate according to the list as they perceive it as too time consuming. Larsson also discuss that there are no assigned responsibilities of who should operate the list or delegate the activity, resulting in it not being integrated as a day-to-day activity or routine.

¹ Pontén, P. (2019, March 25). Personal interview with TOD at Svenska Mässan.

² Lundell, K. (2019, March 25). Personal interview with PM at Svenska Mässan.

³ Larsson, F. (2019, March 26). Personal interview with WW FBI at Svenska Mässan.

⁴ Berggren, P. (2019, March 27). Personal interview with SM at Svenska Mässan.

“The foreman just needs the exhibition halls to be emptied in order to start preparing for new events. How much time we have to use the list fluctuates depending on how hectic the year is, last year I cannot remember we used it once. If we were to prioritise the list, I would say most people would place it very low.” (Larsson, 2019)

Lundell further explain that they have the ambition of implementing a routine of one foreman to run a weekly check of the premises where they from experience know that items tend to end up. The project of implementing the process has already started and said that it was perceived as fully implemented, when in reality it was not. Lundell say that the staff needs continuous reminders of performing the activity and suspects that there is a lack of interest as no staff member has ownership of the activity.

All interviewees agree upon the resulting costs of the lack of inventory control as being mainly resource-based. Searching for inventory all across Svenska Mässan’s premises is very time consuming, time which could be spent performing for example quality work on inventory, says Larsson. Pontén further discuss time spent having to search in EBMS for other inventory items which could be used to substitute for a specific item which is missing.

“[...] yes, time as well as playing detectives trying to look for substitute items. That requires staff to thoroughly control that the substitute item itself is not booked for another purpose. What kind of customer aftermath that results in, I am not sure of.” (Pontén, 2019)

It is not only production and logistics staff being forced to deal with time loss due to the low inventory control. Berggren discuss the issue of not being able to supply customers with the correct items’ orders. As inventory balances are presented on the website where customers place bookings, it is of high importance that the balance presented is correct. Berggren say that as for now and from a sales perspective, the inventory balances are not reliable. When a specific item booked is not available, though an order confirmation has been sent to the customer, sales need to manage possible disputes and crediting. Lundell and Pontén explain the issue of staff feeling stressed and under pressure when having to constantly search for items which should be in inventory.

“Being worried... from a work environment point of view, it would be much better to be in control. No one feels well when not feeling in control.” (Lundell, 2019)

“Of course, if affects them, they are the ones who have to work faster, and stress trying to manage the situation and finding items.” (Pontén, 2019)

All Svenska Mässan interviewees agree upon the main areas were the organisation could save resources if inventory control increased. The first one is staff hours, i.e. warehouse staff having to consume time on searching for lost items and, the After Sales department having to dispute with customers and manage possible complaints and crediting. Increased inventory control would additionally also result in less mental stress amongst staff and management as the

uncertainty of being able to fulfil customer requirements would decrease. Lastly, the quality of operations would increase as staff has more time to operate efficiently and effectively.

“Our chosen staffing strategy is to outsource it and mainly using external contingency staffing from contractors. This means that we have an ever-changing workforce with different people each time operating our items. It is very difficult for that kind of employee to perceive ownership and thereby pride in what they do, in comparison to how we feel as internal staff. We would have liked if all people who worked here were as engaged in maintaining high quality in operations as we do.” (Berggren, 2019)

Berggren discuss the fact that Svenska Mässan have chosen to mainly use external contingency staffing, resulting in a staff force with varying experience and knowledge of processes, routines and operations. There is a general concern amongst the Svenska Mässan interviewees that it would be difficult to get all contingency staffing on board with new ways of operating. Larsson explains that this could be the effect of the contingency staffing not perceiving the same ownership and thereby also responsibilities and drive to improve current operations and routines. This is further discussed by the Svenska Mässan interviewees to possibly complicate an implementation process, as the contingency staffing perhaps would not perceive the same interest as the internal staff force.

4.2.2 Relations with exhibitors

The general perception amongst the interviewees is that exhibitors to a varying degree manages to follow instructions provided. The interviewees do not believe that the main reason is because they want to break the rules. Instead the cause is that they get too much information and information overload arise. Berggren believes that Svenska Mässan has problems with reaching out to its exhibitors because they are communicating too much. Svenska Mässan give the customers all the information about the specific fair, but also sell in the complete offer that is in the facility with restaurants, hotel rooms and conference offer. While Pontén believes that one cannot be an expert on everything to be an exhibitor at the Svenska Mässan. One common problem is that exhibitors overload the electricity at the plant. Although they have received the information about the restrictions, they do not know how to do to follow the instructions.

What sort of penalties the exhibitors are given depends on the type of issue. As the main issue is how well they follow rules given, the staff at Svenska Mässan control that for example weight restrictions are followed. Larsson discuss that the operative staff are not sure of whether or not damages on rented items are debited forward to the exhibitor or if Svenska Mässan themselves carry such costs. All interviewees point out the issue of uncertainty related to where damages occur in the process of delivering an item, exhibitors using an item and staff collecting the item. This causes issues regarding who should pay for a damage where Svenska Mässan not for certain knows who is responsible for it. Debiting for single item damages are rarely done, as a result of this. All interviewees are in agreement that this is an effect of Svenska Mässan being very cautious of their relationship with their exhibitors.

All interviewees at Svenska Mässan was presented with a proposition that exhibitors would have to leave the exhibition hall for the closest hour after the closing of the exhibition or event. The proposition was based on Hume's⁵ description of how the process of collecting sensitive items work at the congress and exhibition centre in Düsseldorf (Messe Düsseldorf). This type of operation allows Messe Düsseldorf to have at most 1 % in loss of inventory (misplacement and theft) as only warehouse staff is allowed in the exhibition hall during this hour. The Svenska Mässan interviewees were all positive to this proposition, with the exception of Berggren. Berggren strongly advise not to use this sort of operation, as seen below in quotation.

“Every little thing that potentially could complicate anything for our exhibitors cold cause them to choose another option than us. We must be committed to our customers, thus making the process of exhibit at Svenska Mässan should be easy for them. [...] This sort of action would cause an outcry from out exhibitors!” (Berggren, 2019)

4.3 Towards higher visibility and control

The following sub-chapter describes this case study's empirical finding in terms of how Svenska Mässan would benefit of increased inventory control, feature and functions needed in order to have successful implementation as well as their in-house capabilities of improving current inventory management. Lastly, technological requirements and organisational infirmities are discussed.

4.3.1 Possible effects of increased inventory control

All Svenska Mässan interviewees said that efficiency of operations would rise with increased inventory control. Larsson and Lundell mean that warehouse staff needs to spend many hours just searching for items in the buildings, and Larsson says this occurs before almost every event. Pontén and Berggren mean that better inventory control would not only result in warehouse workers saving time, but it would also save lot of time for the After Sales department. The After Sales department not spends many hours trying to manage alternative solutions for customers, for example by renting furniture from external suppliers or by offering the customers substitute items instead.

“It would have been less complicated as we would not sell products that we do not have at our hands. Or that we spend a lot of time and money trying to solve the issue, that only results in the profit decreasing.” (Pontén, 2019)

Improved inventory control would increase the customer service levels as Svenska Mässan would be able to deliver the exact items that the customer ordered. Pontén say that when deficiencies occur, it is not several months before the exhibitions, but rather right before it is time for exhibitors to move in. The result of that is that the staff and managers need to rapidly come up with a solution as they are short of time. According to Berggren, Svenska Mässan has moved the quality responsibilities to the customers by making them responsible to report any

⁵ Hume, I. (2019, March 11). Phone interview with DLSS at Messe Düsseldorf.

shortages or deficiencies of quality to Service Centre. When it comes to furniture, it might be an issue of the item is not properly cleaned, certain items are missing or that the item is damaged. Berggren would like the warehouse staff to be able to spend more time on making sure that the items delivered meet customers' requests as well as their expectations.

When asked to estimate the efficiency of the current system, Pontén estimates it to 30-35 %, and when proposed with the possibility of a new system with traceability of items the estimation rises to 85-90 %, though depending on system design. When further asked about the efficiency of how well Svenska Mässan manages issues related to their lack of inventory visibility, the belief is that it is rather luck than skill which has allowed them to manage inventory issues in the pasts. An example of this is that rarely all items of one product category is rented out simultaneously as well as Svenska Mässan's variety of substitute items available. Larsson estimates that the warehouse staff force could decrease by half a person during hectic events though operations would still be of higher efficiency if a more adequate traceability system were in place.

4.3.2 Features and functions needed for successful implementation

All interviewees state the importance of an easy-to-use system in order to achieve a successful implementation. Lundell and Pontén both stress that it must not be perceived by users as "too technical" or "complicated". One of the main reasons for this is said to be the external staff from contractors. As the experience that the contingency workers have from Svenska Mässan and its operations, it is important that the system they are asked to operate within must be easy to learn and use. Pontén further discuss that if a new system is to be implemented it has to be completely digital, it is important that the new system does not require additional manual imposition but that it functions seamlessly. Lundell agrees and say that if above criteria are not fulfilled, there is a risk of staff being very resistant to abandon the previous manual methods in advantage of the digital one. Lundell continuous by discussing the importance of being able to prove that the system changes and implementation is justified by thorough research.

"We must be able to demonstrate that we have done the research. This is how it is done today, and this is what we could get. We need to prove validity in order to motivate this decision." (Lundell, 2019)

The interviewees were asked if they would rather develop the existing system EBMS by adding modules to it or to use an additional system. The interviewees from Svenska Mässan differed in their answers, though all stated that the optimum would be if all could be managed within one inventory system or that the systems at least interacted with each other. Olsson⁶ agrees that it is not always necessary to maintain all functions within one system, provided that the existing system and the new system interact with each other. One Svenska Mässan interviewee said that if only the warehouse staff were affected by the new system, they would manage to operate within two separate ones. All interviewees agree that one major key to the implementation of a

⁶ Olsson, N. (2019, March 27). Phone interview with MDS at Stockholmsmässan.

new system is that users does not have to input the same information in two separate systems. If EBMS cannot be tailored to match new requirements of track and trace attributes, the additional system has to be able to interact and communicate with EBMS.

4.3.3 In-house capabilities of improving the existing management

The interviewees with experience from EBMS were asked if they can identify any inventory control related shortfalls in the system, whereas all answered that there is a lack of visibility. The inventory levels in EBMS are based on staff printing out excel worksheets and manually counting all items in the warehouse, thereby having accurate and up-to-date inventory levels in EBMS is practically impossible. Two of the interviewees expressed that EBMS is rather an ERP (Enterprise Resource Planning) software than a warehouse- or inventory management and control system. The interviewees at Svenska Mässan discuss the issue of new control processes not managing to become a routine, such as Lundell's initiative to have one foreman doing weekly rounds to check for lost and hidden inventory. The list of sensitive items is an additional example of a routine which is not really a routine, as it is only used if staff perceive that they have time work according to it. Both Pontén and Lundell discuss the lack of interest of following routines implemented to add structure to the warehouse operations. Larsson explains that many of the staff is lacking the perception of ownership and believes that if management were more prone to grant ownership of certain routines to specific staff members, increased inventory control would be the result.

4.3.4 Technological requirements

All interviewees, Lundell, Pontén, Larsson, Berggren, Hume and Olsson, agree that a new technological system creating higher inventory visibility and thereby control, need to be easy to use. It needs to be able to communicate and connect with the already existing system and there cannot be any need to input the same data twice in different systems. It is of high importance, agrees the interviewees, that clear routines and instructions are communicated to all people operating within the system, including contingency workers. All Svenska Mässan interviewees also agree upon the need for a longer distance track and trace reading function, especially for the so-called sensitive items. A longer distance track and trace reading function would decrease the time that operative staff spend on searching for lost items within the facility, as well as increasing the visibility of inventory. Almost all interviewees agree that some sort of barriers with an alarm, preferably silent to security staff or in colour, could be used within the exhibition halls, in order to decrease the risk of items leaving the facility.

Lundell explains a concern of the technology requiring an additional tool, such as a scanner or similar. The concern is that a scanner would be seen as something extra to manage and that staff operating it would perceive the process as difficult and time consuming. Lundell also expressed concerns that the scanner itself would be forgotten or even lost amongst the many items and the large facilities of Svenska Mässan. Other interviewees do not express the same concern though they all agree that an excellent solution could be where staff is able to download an app on their own smartphone or tablet, or one provided by Svenska Mässan, and use the app as a scanner and work tool.

One of the most important features of a new system, according to all interviewees, is that the system has high connectivity and is able to easily communicate with EBMS. This feature is thought to ease the transition of the process for staff members which are more reluctant to change as well as low technologically skilled. The other most important feature is that it is able to provide accurate and real-time inventory levels in order to reach high inventory visibility and thereby increasing the control of inventory. This feature is, according to the interviewees, to mainly allow staff members to save time they used to spend on looking for misplaced or stolen items. It is in addition to this, also thought to decrease the time After Sales spend on crediting customers and substitute items which are missing. A possible side effect of this is also the possibility of increasing customer satisfaction levels as items which they have ordered, always is provided to them in a satisfactory condition. The feature would also allow for more seamless operating of items and allow for more visibility and control perceived by staff members, thereby decreasing possible mental stress and anxiety, which would result in a better work environment.

4.3.5 Organisational infirmities

There are three main organisational infirmities within Svenska Mässan identified through the interviews and observations. These are expressed to be (1) possible change resistance amongst operative staff, (2) varying technological experience and knowledge amongst operative staff including certain resistance towards implementing and using new technology, and (3) getting the external contingency staff on board with stricter routines and new work tools.

The absolute core infirmity is expressed to be the implementation process itself, meaning to get all staff members on board with the change project and to manage it fully within day to day operations. There is a concern amongst almost all internal interviewees at Svenska Mässan that operative warehouse staff will not be open to stricter routines or standards in regard to securing items after an exhibition.

“The issue that I see is that someone does not understand the purpose and chooses not to tell. Which results in them not doing it or forgetting it.” (Pontén, 2019)

As described above, it is key that management communicates a clear purpose and engages the warehouse staff, both internal staff and contingency staff. All interviewees agree that staff must be motivated and convinced that the change project will be beneficial for them as well as the organisation, and that their work load will not get more intense or complex to manage. A general perception amongst the interviewees is that even though all operative staff are more or less aware of the current issues related to Svenska Mässan’s inventory control and management, not all will be as easy to engage in a possible change project. This is thought to be a possible effect of resistance towards implementing and using more highly technological solutions in operations.

“It cannot be too complicated. If it is something which is very time consuming or complex, we will have difficulties implementing it. I need to be clear on communicating the purpose of why we are making this change, in that case I think it would work.” (Lundell, 2019)

Technical competency differs throughout the staff force, and Larsson express the need of not making it too complicated. Larsson is concerned that if there are too many steps and processes in managing the inventory with the technological tool, certain staff members will get very resistant. Larsson further believes that if staff were to get proper training and education in how to use the tool, the implementation process would be more seamless as well as the end result having a better outcome. One suggested way of easier managing technological resistance is discussed to be workshops or training which is tailored after the individual's previous experience of technology.

In regard to getting the external contingency staff conform to stricter routines and new work tools, the main concern is that they lack the feeling of ownership. As their work time and experience at Svenska Mässan varies and is non-consistent, the perception is that they might not be as engaged as the original and internal workforce. One major challenge is perceived to be the engaging of contingency workers in operating new tools in new processes, as well as being able to clearly communicate stricter routines. Many operations are performed based on experience and tacit knowledge, the issue seems to be how to turn tacit knowledge, so called “know-how”, into explicit knowledge and thereby routines and frameworks.

5. Analysis

This chapter will compare the empirical findings with the theoretical framework. The first part of the analysis is structured based on the seven-step framework which has been used throughout this thesis. The second part describes the possible challenges following an implementation of a track and trace technology into Svenska Mässan's organisation. Lastly, these challenges could be managed through the use of Adriaenssen and Johannessen's (2016) seven propositions on how to manage change resistance.

5.1 Finding the right fit of technology

The following sub-chapter is mainly based on the seven-step model presented by Richards and Grinsted (2013), further described in the theoretical framework, chapter 2.1.2. It has been partly modified during the process in order to fit this thesis's purpose as well as the case study company's requirements. Modification has also been done in order to meet this thesis delimitations.

5.1.1 Motivators for implementing a track and trace system

Connolly (2008) describes how a WMS provide multiple benefits, such as more efficient and effective resource management through higher visibility and traceability of inventory items. This would result in improved customer service, reduction of errors as well as improved responsiveness (Richards & Grinsted, 2013). All interviewees at Svenska Mässan strongly believes that increasing of an organisation's inventory control mainly lies within increasing stock accuracy. Improving the traceability of items would not only increase productivity for warehouse operations but also for the After Sales department. Larsson, Lundell, Berggren and Pontén all state that much resources in terms of labour are spent on correcting the inventory errors resulting from the lack of inventory control. Larsson estimates that the warehouse staff force could be decreased by half a person though quality and efficiency would still increase, with the help of a more adequate traceability system. This reasoning is in line with Gossen et al. (2016) which argues that traceability solutions allows companies to fully utilise the opportunities presented by such solution. Yanhui (2013) agrees and discuss that the application IoT technologies will help to better manage physical inventory in order to reduce inaccuracies and thereby increase productivity.

Faber et al. (2013) debate that when achieving control of inventory operations, such as discussed above, major cost decreases are in reach. Costs in terms of labour resources and inability to meet customer request will most likely decrease by increasing the visibility of inventory (Zhang et al., 2011). De Vries (2011) discuss that the overall performance, including cost related performance, lies in a company's inventory management system. All interviewees from Svenska Mässan agrees that the core resulting costs of the deficient inventory system today presents costs which are mainly related to labour. The interviewees all agree upon the fact that if inventory control were higher, costs would decrease. This is not only applicable for

the Logistics and Production department but also, as earlier stated, for the After Sales department as they are continuously required to manage dissatisfied customers.

All interviewees agree upon the fact that increased inventory control through the implementation of a track and trace technology would improve customer service levels, thereby agreeing with authors such as Richards and Grinsted (2013), Atieh et al. (2016) and Garcia et al. (2013). Zhang et al. (2011) say that by having high inventory visibility, for example through the application of track and trace technologies, the company is able to more cost-efficiently satisfy customer needs. Pontén and Berggren specifically discuss how Svenska Mässan's customer service levels would increase if they were able to properly control that all services they sell to customers are guaranteed to be fulfilled.

5.1.2 Technology configurability level

Richards and Grinsted (2013) state that it is important that the end-user of a new system is able to understand it and that it has high configurability in terms of being able to work in almost any type of setting. In addition to this, Richards (2018) say that one of the success factors of an implementation to reach completion is an agenda for training of all staff. All Svenska Mässan interviewees express concerns regarding system complexity. It is of high importance that a new technological implementation is easy to understand and tailored to the organisation's requirements and needs. Svenska Mässan is concerned that if the applied technology has high complexity in terms of user-friendliness, it will not be able to reach full capacity. This is in agreement with Yanhui (2013) which says that if a system is based on IoT, more effective monitoring can be done than if the controlling were to be performed manually. All interviewees express that it is key that the new system is configurable with the current ERP system EBMS, and some of the interviewees express interest in a development of EBMS rather than a new implementation.

5.1.3 Analyse of the existing system

A WMS should, according to Richards and Grinsted (2013), be able to provide efficient and effective resource management, such as presenting visibility and traceability of items in inventory. Atieh et al. (2016) say that selecting the right tool and software is key in order to reach the full capacity of warehouse control. As for today, Svenska Mässan uses the system EBMS, an ERP system rather than a WMS or inventory control system. All interviewees from Svenska Mässan, as well as Olsson from Stockholmsmässan, agrees that the main shortfall of EBMS is the lack of visibility. The inventory levels in EBMS are based on excel spreadsheet and manual inventory controls performed annually, resulting in inaccurate numbers. Mohammaditabar et al. (2012), Rushton et al. (2017) and de Vries (2011) describe how standardised and automated systems are better suited when large numbers of different inventory items circuit, as such inventory control processes has higher complexity. Technology would facilitate for more seamless integration of processes and operations by improving communication and coordination, a result of accurate and up-to-date inventory data (de Vries, 2011).

Observations as well as the Svenska Mässan interviews present that certain control routines in terms of inventory management are only performed depending on workload. As an example, the list of sensitive items which is supposed to be used after each event and exhibition. Pontén and Lundell express that there is a general resistance towards change amongst all staff, both in-house permanent staff and external contingency staff. If a new technological system were to be implemented, Leonard and Kraus (1985) say that it is of high importance that change resistance is managed and proactive actions are performed. If not, it is highly likely that the implementation and the entire change project is ruined (ibid).

5.1.4 In-house development opportunities

Richards and Grinsted (2013) describe how one needs to investigate how specialised the requirements on a new system is or if it requires specialised integration with existing in-house systems. The interviewees from Svenska Mässan clearly express that they wish that the new track and trace system is able to communicate on its own with EBMS, though EBMS is not a WMS or an inventory control system. According to Richards and Grinsted (2013) could highly specialised requirements for integration with already existing systems, be a motivator to develop the new system in-house instead of purchasing a package. Tejesh and Neeraja (2018) describes how for example the AIDC technology have many different applications, and Ustundag and Cevikcan (2018) explain the three different types of RFID, which allows for tailoring according to a specific organisation's needs. Whether or not, Svenska Mässan has possibilities of, or interest in, developing an in-house system of their own, is undetermined after this performed case study.

5.1.5 Operational specification of requirements

All Svenska Mässan interviewees agree on a number of requirements that the new track and trace system need to have. The four main requirements include; (1) the system need increase inventory visibility through traceability features, (2) certain items should be able to have a longer distance track and trace reading function, (3) the system need to be user-friendly, and (4) it cannot add complexity to the customer renting process.

Lee et al. (2017) explain how the application of a technical solution derived from the IoT concept could increase inventory control through seamless integration of inventory and warehouse activities. RFID tags, with the possibility of longer distance track and trace reading function, allows for efficient identification and coordination of inventory, making it a suitable fit for organisations in need of increased inventory visibility and control (ibid). Fan et al. (2015) agree and say that by introducing AIDC solutions, an organisation can reduce or even completely eliminate inventory inaccuracies as it increases inventory control. Some AIDC technologies, such as RFID does not even require the use of a scanner, making it easy to integrate in operations (Wang et al., 2010; Ustundag & Cevikcan, 2018). As technological competencies vary across Svenska Mässan's staff force, it is of high importance that the tool applied into operations are easy to use. In addition to this, Svenska Mässan use contingency staff from an external contractor, which further emphasises the need of user-friendliness. It is an absolute necessity that the new system can be seamlessly integrated into today's activities

and processes. Larsson even says that if there are too many steps and processes in using the system, certain staff members will probably show major resistance towards it.

All interviewees stress the fact that the new application must be able to communicate and somewhat coordinate with EBMS. As one of the observed limitations in EBMS today is lack of real time information, a result of data being manually collected and used for input. By the system being able to communicate with EBMS it makes a tactical tool through its automation of warehouse operations (Richards and Grinsted, 2013). This would make the system a key variable when making strategic business decisions (ibid) as well as contributing in decreasing issues resulting lack of communication between the warehouse unit and the After Sales department. Some of the interviewees express a wish that the new system for track and trace would rather be a module of EBMS than a separate system. The possibilities within EBMS to tailor and develop such function is to this state unclear, as it is not public information.

All interviewees discuss the possibility of adding a longer distance track and trace reading function to some items, especially the more sensitive ones. The reason for this is that a longer distance track and trace reading function would decrease the time used for searching for inventory items within the facilities, as well as adding to the overall inventory visibility. Not all interviewees discuss portals or barriers as a way of monitoring if items are still located where they were originally places, but most of them do. This would be a cost-efficient and easy way of controlling that items do not leave their designated placement. Zhang et al. (2011) and Lim et al. (2013) describe that the main tool used to create or increase inventory visibility is by using track and trace technologies, RFID or barcodes. As not all items are perceived to need a longer distance track and trace reading function, the authors propose below figure (figure 7) to be used as a decision matrix.

		Consequences – What is the maximum reasonable consequence			
		Insignificant	Minor	Moderate	Major
Likelihood rating	Likely	Low	Medium	High	High
	Possible	Low	Medium	Medium	High
	Unlikely	Low	Low	Medium	Medium
	Rare	Low	Low	Low	Medium

Figure 7: Risk-consequence ratio matrix, developed by the authors.

Items that fall within the low risk-consequence spectra are estimated to not need any sort of tagging except a clear mark of belonging to Svenska Mässan. The purpose of the marking is to prevent unconscious theft, as exhibitors then are well-aware of the belonging of the item and easily can avoid to mistaken it for theirs. The second spectra, with a medium risk-consequence ratio, is proposed to be tagged with a track and trace function, though with a shorter reading

range. Based on where portals or barriers could be placed, a suitable tag could be either the passive RFID tag or the semi-passive RFID tag (Ustundag & Cevikcan, 2018). Lastly, items within the third spectra with an estimated high risk-consequence, should be tagged with an AIDC technology with a longer reading range, such as an active RFID tag. By using the risk-consequence matrix, a more cost-efficient and structured strategy of selecting the proper tool of traceability would be enabled. This is in agreement with Richards (2018) who say that it is not realistic to mainly use active RFID tags for identification of all items within an organisation’s warehouse, due to its relatively high costs.

It is important, expressed by all interviewees at Svenska Mässan, that any type of implementation of a new system cannot cause any additional disturbance for exhibitors. Exhibitors at Svenska Mässan are today presented with a lot of information as it is, and Berggren stress the fact that nothing can be applied which would make the process of exhibiting at Svenska Mässan more complicated or complex. The studied literature does not present any details in regard to how customers would be affected by the implementation of a track and trace technology, other than increased service levels.

5.1.6 Identification of suitable technologies

As described above, Svenska Mässan’s requirements are the following; (1) Increase visibility, (2) include a track and trace function, (3) be user-friendly, and (4) not complicate the customer renting process from the customer’s point of view. Figure 8 below consists of a table where Svenska Mässan’s requirements is matched against different types of AIDC technologies.

	Barcodes	RFID passive/semi-passive tags	RFID active tags
<i>Increase visibility</i>	x	x	x
<i>Longer distance track and trace reading function</i>			x
<i>User-friendly</i>		x	x
<i>Low complexity in terms of customer relations</i>	x	x	x

Figure 8: Matching requirements and demands, developed by the authors.

All AIDC technologies will increase visibility and thereby also inventory control for Svenska Mässan. Barcodes are an inexpensive way of tracing object and both passive, semi-passive and active RFID tags use radio waves to identify items and thereby increase traceability and visibility of items (Ustundag & Cevikcan, 2018). As for the requirement of being able to add a function for certain items to easily detect where in the facilities they are located, this requires a longer distance track and trace reading function. The only suitable technology for this

requirement is active RFID tags. Active RFID tags has its own internal power source as well as a greater reading range, which for example is suitable for items of high value (Ustundag & Cevikcan, 2018). In this case, this could be suitable to apply to items which are in the high-risk spectra in figure 7.

In terms of user-friendliness, the requirements include little to no human interaction, the possibility of connecting it to the already existing system in an easy way and a minimisation of additional physical tools such as a scanner. Amongst the different AIDC technologies and the two chosen focus technologies for this thesis, either active, semi-passive or passive RFID tags seems to be the most adequate and suitable one. Barcodes are only readable with a scanner, making the usage of a portal or barrier impossible (Ustundag & Cevikcan, 2018). RFID on the other hand, can be integrated with software and capture and transmit data without human interaction (ibid). None of the studied technologies would affect the customer process of exhibiting or partaking in an event at Svenska Mässan. If any, the overall result of increased inventory control and increased visibility and traceability would result in higher customer satisfaction and thereby increase Svenska Mässan's customer service levels (Mohammaditabar et al., 2012; Garcia et al., 2013; de Vries, 2011; Zhang et al., 2011).

5.1.7 Concluding recommendation

Based on the case study and the literature review performed, Svenska Mässan would be able to increase their inventory control through the application of an AIDC technology. The four main requirements are compared to alternatives of AIDC technologies in figure 8, showing that active RFID tags are the only technical solution fulfilling all requirements. An implementation of active RFID tags on inventory items would result in increased visibility, a long distance read range in terms of traceability, it is user-friendly as it does not require human interaction, as well as not adding complexity to the customer process.

The second-best option is semi-passive or passive RFID tags. The only area where passive tags are unable to fulfil a demand is within the long distance read range position, though the semi-passive tags are said to have a longer read range than the passive ones. As Svenska Mässan do not wish to apply the long distance read range feature on all items but only the so-called sensitive items, a possible solution could be to use a mix of active and semi-passive or passive RFID tags. By using the risk-consequence ratio matrix in figure 7, Svenska Mässan can identify which items requires higher technological solutions, i.e. active RFID tags, and which items' requirements are fulfilled with semi-passive or passive RFID tags. As the active RFID tags are more expensive than the passive ones (Ustundag & Cevikcan, 2018), the concluding recommendation is to use a combination of the two RFID types. As barcodes do not fulfil more than half of Svenska Mässan's requirements, see figure 8, the alternative is dismissed from further discussion.

5.2 Challenges within the implementation process

There are three main challenges identified during this case study, these are (1) change resistance amongst operative staff, (2) high variation in technological competencies amongst staff, and (3) getting external contingency staff to comply to new and more extensive routines. These challenges will be further analysed and contextualised in the following sub-chapters, but how to most adequately manage them will be presented in chapter 5.3.

5.2.1 Resistance towards change

All interviewees at Svenska Mässan express concerns in terms of, mainly, operative staff showing change resistance if a new and more digitised system were implemented. Inventory control has traditionally been performed through manual labour and excel spreadsheets, a possible cause of the current high levels of inventory inaccuracies. Matos Marques Simoes and Esposito (2014) state that one of the most important variables for a successful change project is to communicate with all staff. In order to create staff commitment, staff's perceived risk and uncertainty must be reduced, thus communication is key (ibid). The interviewees from Svenska Mässan acknowledge that in order to reach optimal success from the implementation of a track and trace technology, staff must be convinced that that the project is beneficial for them. The interviewees believe that the most appropriate way of doing this is to motivate the project by emphasising the benefits as well as clearly explaining the purpose of the project. It is also important to make sure that staff understands that their work load will not get more intense or complex, but that the implemented change will be a tool making their daily operations easier to manage.

To conclude, both the theory and the interviewees at Svenska Mässan agrees upon the fact that in order to have a successful implementation of an organisational change project, it is important to manage change. Leonard and Kraus (1985) explain how it is important to legitimate change resistance. If change resistance is left undiscussed, it will only grow and could therefore ruin the entire project (ibid). The study performed at Svenska Mässan clearly shows that they are well-aware of potential change resistance occurring, which according to Leonard and Kraus (1985), show that they are already acknowledging it.

5.2.2 Technological competencies within the organisation

Leonard and Kraus (1985) and Adriaenssen and Johannessen (2016) discuss how it is common that many different challenges arise when a technological change is implemented in an organisation. It is important to create frameworks which are based on data and information collected from the groups which are affected by the new technology (ibid). All interviewees from Svenska Mässan are in full understanding of the issues which can emerge from the differing technological competencies. One of the interviewees, Larsson, explicitly say that it is important that the new tool is not too complex, and that processes are easy to comply to. Lundell agrees and say that it is management's responsibility to clearly communicate the purpose of how the technology will help all staff with managing their work tasks more efficiently. It is further discussed by the interviewees that the training process for the end-users of the

technology much be tailored after each individual's previous experience and knowledge. Leonard and Kraus (1985) agrees and explain that in order to manage frustrations related to adapting to, and learning the new technology, it is important to clearly communicate with the future users of the technology.

5.2.3 External contingency staff

Svenska Mässan has expressed concerns that it could be difficult to engage the external contingency staff in the change project. The organisation is concerned that the lack of ownership believed to exist within the external staff force would result in them not being as engaged as the internal workforce. Lines et al. (2015) discuss that when a new practice is implemented, the difficulties does not only lie in learning new approaches but also to dismiss the traditional way of operating. As the contingency staff working at Svenska Mässan has varying experience within the organisation, this could be an adequate challenge to consider. Once again, Leonard and Kraus (1985) emphasises the importance of clear communication to all future end-users of a new technological tool and Richards (2018) describe how it is key to develop a training agenda for all staff as well as planning for time for training. For the case of Svenska Mässan, the interviewees agree that new routines are important, and that know-how knowledge need to be turned into explicit knowledge in order to allow for easier compliance from external contingency staff.

5.3 Organisational actions for managing challenges

Leonard and Kraus (1985) say that one possible strategy one could use in order to efficiently introduce and implement technological changes in an organisation, is to adapt a so-called dual role. Main activities within the dual role consists of integrating perspectives and needs of all involved, clearly communicating the purpose of the implementation and creating frameworks for futures users (ibid). Pontén and Lundell are very clear on the importance of presenting future users with a comprehensible purpose of why the change process is performed. They both believe that if they are unsuccessful in this matter, the implementation will not work, and operative staff will not engage in the project. Overall, one of the main activities to perform in order to achieve a successful implementation is to communicate the purpose behind it as well as creating staff commitment (Leonard & Kraus, 1985; Matos Marques Simoes & Esposito, 2014; Richards & Grinsted, 2013).

The varying technological competencies amongst operative staff members is, as mentioned earlier, a possible challenge in terms of the success of the implementation. If staff is not able to, or unwilling to, learn how to operate the track and trace system, the implementation of it will naturally be without success. Richards (2018) discuss the importance of not only developing an agenda for training for all staff, but also to set aside time for introducing the new system to end-users. As routines and procedures is as important as the software modules in a new system, it is adequate to develop framework which allows for easy compliance to such (de Vries, 2011), especially in an organisation with varying technological competencies. Interviewees from Svenska Mässan themselves state the importance of proper training through for example workshops, an activity they believe would increase the operative staffs'

engagement in the project. This sort of activity, developing adequate frameworks and routines, will also help with engaging external contingency staffing. As they have varying experience with Svenska Mässan's operations, clear guidelines will help them to more easily comply to new standards and thereby be integrated in new system procedures. By also including the recurrent external staffing in workshops related to the development of the system, their engagement and interest will probably increase (Leonard & Kraus, 1985).

Actions on how to manage possible change resistance, one of Svenska Mässan's main expressed challenges, is presented below in figure 9. The table and its content are based on Adriaenssen and Johannessen's (2016) seven propositions on how to reduce change resistance, as presented in figure 4 in chapter 2.5. Figure 9 consists of implications based on each organisational level; strategic, tactical and operational. These implications are the result of theoretical findings as well as empirical findings, with the purpose of being tailored towards Svenska Mässan.

Proposition magnitudes	Practical implication	Management implication	Strategic level	Tactical level	Operational Level
<i>Decision-making under uncertainty</i>	People are afraid to lose what they already have and will fight changes in order to secure their current and existing positions.	Be aware of people's tendencies to rather choose to secure their existing positions than achieving possible benefits from a change project.	Include operative and tactical staff in the process of setting requirements and demands. Present ideas and possible features and functions and ask for feedback from future end-users in order to show possible benefits.	Perform workshops and part-take in meetings with the operative representative. Thoughts and ideas should be documented and used for setting requirements and further procedures within the project.	Select one (or more) staff member which is well-anchored and known within the staff force. This person(s) will act as an overall representative and plead the cause of the staff force.
	People tend to not respond to possible gains of a change project unless the gains are presented as being more than 100 %.	Present the change project as an opportunity to double the strengths of operations today.	Present long-term goals of increasing KPIs in terms of, for example, potential cost savings through more efficient operations.	Present short-term goals of potential ways of saving time and decreasing uncertainty, through the implementation of the new technology.	Try to identify areas for improvement and examine current operations in order to find opportunities for development in routines and processes today.

<i>Framing</i>	<p>People are conservative and tend to lean toward the established, safe option over potential gains.</p>	<p>Involve optimists in change projects and let them be the agents of change.</p>	<p>Delegate the responsibility of finding an operative staff optimist to the manager closest to the end-users. Invite the optimist to part-take in the planning process in order to increase engagement and optimism.</p>	<p>Identify an optimist and ask to be part of the planning process. Use the optimist as a tool enabling easier communication in terms of potential issues, give feedback on possible issues presented by the operational representative.</p>	<p>The optimist should emphasise the positive aspects with the change among the rest of the staff. The optimist should make sure that staff knows that potential issues or fears will be communicated upwards in the organisation.</p>
	<p>People's perception of a project beforehand will influence their thoughts about the project and move them in a direction of mindset.</p>	<p>Act cautiously when introducing changes, as too many rapid changes will increase resistance.</p>	<p>Agree upon a suitable project process time period, preferably when operative staff are not extremely busy. Specify milestones and reasonable deadlines, and act quickly upon any time-related setbacks.</p>	<p>Based on milestones and deadlines, develop an agenda for training and education of operative staff. Include the previously mentioned optimist in planning for suitable ways of educating and training operative staff.</p>	<p>Try to see deadlines and milestone as goals, and make sure to report if a deadline needs to be postponed.</p>
<i>Anchoring</i>	<p>People will be more prone to engage in change projects if they believe that the project is reasonable.</p>	<p>Use the anchor effect in order to manage people's change resistance by presenting the project as reasonable.</p>	<p>Communicate information in terms of what is understandable and relevant for the end-user. Disregard features and functions which are not applicable to the operative staff's work tasks.</p>	<p>Try to identify previous successful change projects and remind operative staff of that process and the results of it. Present reasonable areas of improvement, where staff is aware of the issue that needs to be managed.</p>	<p>Examine previous projects, try to identify processes which has been changed and how the results were positive.</p>

<i>Availability</i>	People tend to believe that information retrieved from memory has higher credibility than information emerging from analysis.	Use information which can be easily compared with events that employees can identify with.	Allow time for self-evaluation, discussions and workshops.	Perform a workshop discussing what usually happens in critical situations and how this makes operative staff feel, relate the benefits of the change project to the findings of the workshop.	Examine and remind yourself what current issues you are experiencing in your role and try to identify how you felt in the moment.
	People are not inclined to engage in projects where they do not experience the changes as emotionally attractive.	Increase the emotional reward of the change by using anchoring and framing.	Try to also include tangible and emotional effects, such as less mental stress and uncertainty, of the implementation when presented to staff members.	Appoint certain responsibilities and areas of the project to operative staff members in order to increase the perception of ownership and thereby the emotional reward.	Identify areas of self-improvement and try to relate to how the change project could assist. By having specific responsibilities, it is in the staff member's own interest to clearly report possible setbacks and issues, in order to improve the implementation process.

Figure 9: Actions to reduce change resistance, developed by the authors.

6. Discussion

Within this chapter the authors discuss the main findings in the analysis. Challenges following an implementation of a track and trace technology is discussed as well as actions which could be taken to manage change resistance and technological resistance.

The result of this study shows that Svenska Mässan is in need of a more adequate system supporting inventory visibility and control through the application of a traceability feature. The current ERP system EBMS has no applied features allowing traceability of items which has resulted in a high level of labour resources being spent on searching for items across the facilities. Other departments than the Logistics and Production department are also affected by this shortcoming, After Sales has to continuously deal with undesirable costs in terms of compensating customer service level deficiencies. Costs in terms of purchasing a track and trace system or costs related to the implementation process, has purposely been completely eliminated from this study. Within the scope of this thesis falls research questions such as what effect a track and trace system would have in terms of decreasing loss and misplacement of inventory, and what challenges such implementation would bring. Thus, even though the authors decided to eliminate cost calculations, the research questions are answered. The possible effects of keeping track of inventory by introducing a track and trace system are presented, and costs are merely discussed in terms of higher or lower, and decreasing and increasing.

It is unclear after the performed case study if the shortcomings of EBMS is a result of traceability features and functions being unavailable to apply or if the financing of such application is the issue. An additional question which emerged during this project, mainly after the interview with Olsson, is if completely accurate inventory levels towards customers is desirable. Should all inventory items in stock be available to place an order on, or should Svenska Mässan carry a safety stock in regard to the sensitive items? Applying a traceability feature on inventory items would increase Svenska Mässan's internal inventory control and management, but the authors of this thesis asks themselves if it is truly necessary for all customers to always know what and how many items are in stock.

The study shows that routines and operations guidelines are not always followed, said to be a result of time constraints, though the authors of this thesis do not believe that this is the single factor. The insufficient following of routines could also be a result of perceived lack of ownership of processes amongst operative staff, irritation following inadequate work tools as well as defective understanding of the purpose of why they are asked to perform certain routines. This finding emphasises and validates the need of a seamlessly integrated and easy-to-use IoT technology in order to decrease losses and increasing the efficiency of operations.

As the result shows that RFID is the most suitable track and trace technology of the studied technologies, a number of challenges are likely to follow the implementation. Leonard and Kraus (1985) discuss change resistance as one of the major challenges following an

organisational change. Svenska Mässan has identified the same, in addition to high variation of technological competency amongst operative staff and achieving new routine-compliance from external contingency staff. The authors of this thesis supported by theoretical findings, believes that by performing workshop, allowing time for adequate training of end-users and clearly communicating the purpose of the change the challenges identified can be managed. These findings further validate the choice of seamless RFID tags which do not require manual use of scanners.

Actions which need to be taken in order to manage change resistance are proposed in figure 9, an extension of implications proposed by Adriaenssen and Johannessen (2016). In line with additional literature findings and empirical findings, the authors have composed implications for Svenska Mässan to perform on each organisational level in order to manage change resistance. The authors of this thesis propose a number of managerial and practical implication which would allow for a more including change project approach. One example is within the proposition magnitude “decision-making under uncertainty”, where people tend to not respond to possible gains of a change if they do not perceive the gains to be more than 100 %. Here, the authors propose that strategic management present tactical management with cost-related KPIs which would be increased as a result of the possibilities of performing operations more efficiently through the application of RFID. Tactical management would then present short-term goals of potential decreases of time usage and uncertainty. Operational management should try to identify areas for improvement as well as examine current operations in order to find processes which would benefit from the RFID implementation.

Before this case study started, the authors were presented with Svenska Mässan’s vision and six development factors, presented in chapter 3.3, which should permeate operations at Svenska Mässan (Svenska Mässan, 2019c). How the application of a track and trace technology such as RFID would contribute to meeting each development factors are presented below in figure 10.

Development factors	Track and trace’s contribution to Svenska Mässan’s business development
<i>Sales and business development</i>	Not determined.
<i>Digitisation</i>	By improving operations activities and increasing the efficiency of operations through new technology, the result would be higher inventory control and increased customer service value.
<i>Plant development</i>	Traceability of inventory allows for higher process flexibility, thereby adding resistance towards fluctuating demands and rapid changes in customer planning horizons.

Culture, competence & working methods

Higher inventory visibility and control will enable agile working methods which would result in higher efficiency. By performing innovative improvement actions, Svenska Mässan is able to strengthen their position as an attractive employer.

Overall experiences

By applying track and trace technologies the overall customer experience will most likely increase. This would be the result of higher inventory control and visibility allow more accurate execution of services.

Sustainable development

Managing inventory losses will decrease waste and increase efficient resource usage, contributing to performing operations in a more sustainable way.

Figure 10: Development factors and the application of track and trace technology, developed by the authors.

The figure above explains that the application of a track and trace technology such as RFID would allow Svenska Mässan to increase their efficiency and productivity through increased inventory control. The loss and misplacement of inventory will decrease as higher inventory visibility will follow the implementation of RFID. By being able to operate with more agile working methods, Svenska Mässan will be more capable to satisfy customer demands and expectations. Last but not least, by keeping track of inventory Svenska Mässan is able to decrease waste and streamline their resource usage, thereby allowing the organisation to act more sustainable.

7. Conclusion

The last chapter concludes the final answers to the two presented research questions of this thesis. Future research includes interesting topics related to this thesis which could be further explored in order to fill the academic research gap.

The implementation of a track and trace technology at Svenska Mässan would enable higher inventory visibility, resulting in decreased inventory losses in terms of misplacement of items as well as theft. The implementation would also result in decreased uncertainty in terms of what is available in the warehouse. Outcomes of this would not only include decreased resource usage and costs for the department of Logistics and Production but also for the After Sales department. Amongst the studied AIDC technologies, RFID tags is identified as the most suitable, more precisely a combination of active and semi-passive or passive tags. By applying a risk-consequence ratio matrix on all items, Svenska Mässan is able to identify which items should be tagged with a long distance read range active RFID tag and for which items a semi-passive or passive tag is sufficient. When closing an exhibition and collecting all items, the warehouse workers should operate by using a list of sensitive items, though the empirical findings of this study show that this is not always the case. The application of active RFID tags would allow operative staff to instantly know exactly where an item is located, thereby decreasing the time spent on searching for it. In order to decide upon which specific tag should be selected and for which items, further investigation of the RFID technology need to be performed by Svenska Mässan. The items tagged with semi-passive or passive RFID tags will be located within the facility using barriers or portals, placed strategically where items could leave an assigned area. This would allow the organisation to know in which area items are located, though in a more cost-efficient way, as semi-passive and passive RFID tags are less expensive.

The main challenges identified at Svenska Mässan, are mostly in agreement with the main challenges described in literature. These identified challenges at Svenska Mässan consists of (1) change resistance, (2) high variation of technological competencies amongst operative staff, and (3) involving external contingency staff in following new routines and guidelines. At least the first two challenges are broadly discussed within change management literature. Varying technological competencies are identified to best be managed mainly through adequate training and workshops. The workshops and the training should be given to all future end-users, including external contingency staff, thereby presenting managerial implications of how to engage non-permanent staffing. Change resistance is proposed to be managed through an extension of seven propositions related to change resistance management. These propositions include managerial and practical implications on all organisational levels. An example of how to manage the proposition of “framing” is by involving an operative optimist. The optimist will engage operative staff, presenting clear purposes of why certain changes are performed as well as understandable goals. This action could help to manage conservative staff which are resistance towards change and tend to lean towards the safe and known option, instead of potential gains.

7.1 Future research

In order to completely determine if the findings of this thesis are generalisable, further research on other exhibition and congress centres should be performed. Control and management of inventory in the exhibition and congress centre industry, where items do not leave the facility and always circle back into stock after usage, is to the authors knowledge little discussed in scientific research before. It would be interesting to further study whether or not customer service accuracy would increase or decrease if an organisation like Svenska Mässan would carry a safety stock in regard to inventory levels visible for customers.

An interesting finding from the interviews was how the German exhibition centre in Düsseldorf manage their sensitive inventory. Here, all items are collected within the nearest hour after an exhibition, made possible through forcing all exhibitors to leave the exhibition hall. When this was presented to the interviewees at Svenska Mässan, two different reactions were given. The Logistics and Production department found the method interesting and fully feasible, and the After Sales department found it appalling. The Logistics and Production department saw the method as a way of securing items in an efficient way, while After Sales thought that this would potentially complicate the process for exhibitors making them select another option than Svenska Mässan. This finding show that there are two different views on how Svenska Mässan should manage their customer relations. One example of future research could thereby be to further investigate how the German exhibition centre manages to perform this without harming customer relations.

In terms of this thesis main conclusions, more research is needed in regard to which are the most optimal combination of RFID tags. This thesis is limited in technical aspects of the different types of RFID tags, especially in regard to the semi-passive and semi-active types. Supporting research in terms of technological constraints within the facility of Svenska Mässan is further needed as a part of a pilot study before implementation for an implementation like this. Additional research is also needed in terms of how to manage external contingency staff in a large organisational change project, as this thesis mainly cover managerial and practical actions used to manage change resistance from an internal point of view.

8. References

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8.1 List of interviews

Berggren, P. (2019, March 27). Interview with Sales Manager at Svenska Mässan [Personal interview with Gullberg, F. & Larsson, C.]. Svenska Mässan Gothia Towers, Gothenburg.

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Olsson, N. (2019, March 27). Phone interview with Manager Furniture Department at Stockholmsmässan [Phone interview with Gullberg, F. & Larsson, C.].

Pontén, P. (2019, March 25). Interview with Technician of Operations Development at Svenska Mässan [Personal interview with Gullberg, F. & Larsson, C.]. Svenska Mässan Gothia Towers, Gothenburg.

Appendix I: Modifications made to the seven-step model

The following table structures and presents the modifications made to Richards and Grinsted's (2013) seven-step model of how to select a WMS.

2.1.2 How to select a WMS	5.1 Finding the right fit of technology	Modifications
1. Calculate return on investment	5.1.1 Motivators for implementing a track and trace system	<i>Exclusion of cost calculations and cost methods, steps 2 and 3.</i>
2. Process decision	5.1.2 Technology configurability level	<i>Investigation of requirements on features of the track and trace technology.</i>
3. Analyse the existing system	5.1.3 Analyse of the existing system	<i>No modification made.</i>
4. Capability of in-house development	5.1.4 In-house development opportunities	<i>No modification made.</i>
5. Information request	5.1.5 Operational specification of requirement	<i>Exclusion of supplier selection and purchase cover-decision, steps 2 and 3.</i>
6. Produce a short list	5.1.6 Identification of suitable technologies	<i>Matching requirements and demands with studied technologies.</i>
7. Finalise the choice of WMS	5.1.7 Concluding recommendation	<i>Presentation of final recommendations instead of supplier decision matrix.</i>

Appendix II: Interview guide

Before the interview starts the authors give short a presentation of the purpose of the thesis, a description of the context of inventory management and the interview, followed by the below questions:

- Do you have any questions before the interview starts?
- Do you mind if we record this interview for the purpose of transcribing?
- Would you allow us to use your name and work title in the thesis?

The interviewee's role at Svenska Mässan

- Can you tell us how you started working at Svenska Mässan?
- Can you tell us about your daily work at Svenska Mässan?

Justification Process

- What would you say are the main problem areas in regard to your current inventory control?
 - Based on your role? Based on your department?
- Are there any indirect costs related to the lack of inventory control?
 - Based on your role? Based on your department?
- Can you identify any areas where you could possibly save resources if inventory control is increases?
 - Based on your role? Based on your department?
- Has there been any recent changes to how you control inventories?
 - Were they positive?
 - Did they stick? If no, why not?

Relations with exhibitors

- Do you feel that exhibitors follow instructions given? What happens if they don't?
- Would any type of implemented change in regard to inventory control damage the relationship with the exhibitor?

Warehouse Management System

ROI (1)

- In what way would SM benefit from more accurate inventory levels?
 - Would this affect SM productivity? In what way?
 - The efficiency of operations?
 - Would this affect SM customer service levels? In what way?
 - Can you identify any direct costs which would decrease if SM had higher inventory control?
 - In comparison to a possible investment?
- In what way would increase traceability of items and higher visibility of stock, effect inventory control?

Process decision (2)

- What would be needed in order to make a new system easy to use in the organisation?
 - Any specific features or functions?
 - Would you rather choose to develop EBMS and adding modules to it or to use an additional system?
 - Do you believe that a new implementation would meet resistance amongst staff?

Existing system (3)

- EBMS
 - Can you identify any shortfalls in EBMS?
 - Are there any functions in EBMS that you wish that the system had?
- Operations
 - What would you say are SM strengths today in regard to inventory control?
 - Are there any system features (for example PL) that you use today which could be improved?

In-house development (4)

- Do you think that adding for example a module to EBMS (or a separate smaller function) would increase inventory control at large?
 - What sort of module or function could that be?

Possible future

- What would be the main challenges with changing how you manage inventory today?
- In what way would such improvement be visible in your department? In your role?
- Do you believe that a technological solution would increase inventory control?
 - If not, what could be done instead?
 - If yes, what type of solution?
- Do you think staff would be open to a stricter routine or standard in regard to how to secure items after an exhibition?
- Do you think that staff would be open to more technological solutions?
 - Are there any challenges in regard to this? If so, which?