Will robots take over? Assessing the potential of RPA in logistics processes

Case: Finnair Cargo. Cool Terminal

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Abstract

Over last years, digitalisation and automation of processes by integrating robotic process have been an important issue in companies' processes. The technological inventions have also impacted on the logistics industry, which helped to facilitate the process of service and product delivery. Leading aviation companies, like Finnair are evolving the extend of digitalisation to follow up the current industrial trends.

Nevertheless, automation of processes is not enough when considering logistics industry: providing excellent working conditions for employees would be an issue of vital importance. To do so, author suggests monotonous and reoccurring work done by humans to be replaced with RPA – Robotic Process Automation. The research was carried out as a case study for Finnair Cargo Cool Terminal.

The objective of the thesis was to find out the core processes to be replaced by RPA by analysing the data, which was collected using qualitative method of data collection by conducting interviews with Finnair employees.

As a result, five processes that can be robotized has been set. Among those, on the basis of KPIs identified by the author, the most efficient one has been selected.

It was concluded, that the process of WB automatic copying was considered as the most time consuming process which could be replaced with an RPA. It has been recommended that implementation of RPA in Finnair Cargo Cool Terminal would require further quantitative data collection to increase chances of successful integration.

Digitalisation, Automatization, Automation, Robotic Process Automation, Finnair, cargo

Miscellaneous (Confidential information)
Appendices 2-4 are confidential, and they have been removed from the public thesis. Grounds for secrecy: Information on any business or professional secret of a private business, the State, a municipality, some other public corporation or a corporation, institution or foundation (Act on the Openness of Government Activities, section 24, paragraphs 17 and 20). Period of secrecy ends: 8.12.2030

Contents

Figures

Tables

List of abbreviations

AWB – Air Waybill

Cargo-IMP – Cargo Interchange Message Procedures

CCC – Cool (Cargo) Control Center

CPS – Cyber-Physical System

CRM – Customer Relationship Management

DBE – Digital Business Ecosystem

ERP – Enterprice Resource Planning

FMECA – Failure Mode Effects and Criticality Analysis

HEL – Helsinki Airport

IAG – International Airlines Group

IATA – International Air Transport Association

IoT – Internet of Things

IT – Information Technology

KPI – Key Performance Indicators

MES – Manufacturing Execution System

MRO – Maintenance, Repair and Overhaul

OT – Operation Technology

RPA – Robotic Process Automation

SCM – Supply Chain Management

SOP – Standard Operating Procedure

TMS – Transport Management Software

ULD – Unit Load Device

WMS – Warehouse Management System

1 Introduction

The idea of robots as an important element in the business world may conjure a science-fiction view of the future (Hartman 2017). Over the last few years, automation has gained huge popularity in various industries (Joshi 2019). The fact is that many businesses from a wide range of industries rely on robots to perform basic tasks that are either too dangerous, laborious or time-consuming for humans to perform (Hartman 2017). The development and implementation of robotics will eliminate a significant portion manual jobs currently occupied by workers (The Role of AI and Robotics in the Fourth Industrial Revolution 2019). With so much technological potential at their fingertips, how do companies decide on the best automation strategy? (Tilley 2017).

1.1 Finnair Cargo Project

In March 2019, Finnair Cargo started a proposal plan for DBE Core Transport Co-innovation, where DBE Core is a platform that helps to integrate supply chain processes and necessary data (Digital Business Ecosystem 2019).The outcome of this project will demonstrate a structured and consistent scenario for the further actions. The DBE Core Cargo Transportation cooperation is aimed to automate processes that are still being done manually in Finnair Cargo. Thereby, execute the work more productively, error-free and, accordingly, lower possible risks.

Finnair Cargo is collecting required data, studying technology and analysing data standards and regulatory issues by conducting workshops and interviews with their partners. Since this is a cooperational work, Finnair Cargo will also provide their essential input to the real project. One of the company's offerings is a result of their pilots made in Finnair Cargo, in particular, implementation of robotic process automation (RPA hereafter). Consequently, use of RPA in Finnair Cargo will be a small part of a big solution to the processes' digitalization that is going to be solved in collaboration with DBE Core in near future.

In order to take into account RPA as an influential element of the automation issue, there is a necessity to find more processes in Finnair, namely, in Cool Terminal that could be replaced with RPA. This research is precisely focused on the identification of RPA's potential implementation in logistics processes considering the fact that only the mundane action is to be replaced. Finnair Cargo, Cool Terminal needs a proper research of such possibilities because the replacement of human resources in the simple logistics processes will lead to optimization of tasks, most importantly, provide greater value and return for the costs incurred. However, the result of not finding any possibilities for RPA in Finnair Cargo processes might also take place. In this case, this information can be used to ensure elimination of useless expenditures. The ability to bring new development in robotics field for Finnair Cargo makes this research relevant since the outcomes can be implemented to real automatization matter.

1.2 Problem definition and thesis objective

Finnair has stood in the way of process automation since 2015. The company invested money in its Digital Finnair project, which developed and implemented digital services for customers, such as the Finnair mobile app and the Nordic Sky entertainment system. In 2017, Finnair put together a team of 70 people, which continues to engage in the development of digital products and services. The company now has a SkyPay solution for flight attendants and new maintenance application. Finnair also trains its employees to adapt to the new digital system, thereby maximizing the efficiency of all processes taking place in the company. (Strategy Transformation 2019.)

The world and the aviation industry are not standing still. Therefore, Finnair’s customers and their stakeholders need modern tools to work more effectively. People are increasingly consuming digital services, solving a huge number of tasks via the Internet. In order to help Finnair and their clients to collaborate, the company has a plan to become the Best Intelligent Travel Ecosystem. (Strategy Transformation 2019.)

However, convenient applications are not everything. Creating excellent conditions for employees is equally important. When performing monotonous tasks, creativity is lost, and this is the main feature of the difference between humans and robots.

Nevertheless, part of the digitization is the introduction of RPA. Robots will undertake the problem of performing routine actions, which for the most part only take time away.

Yet automating processes for the sake of automation is also not worth it. It is necessary to get the maximum benefit from this implementation. For this to happen, the company shall analyze properly all the processes. This thesis just asks the main question: What processes (tasks) completed by humans in Finnair's Cool Terminal can be replaced with the RPA? This question can still be divided into two sub questions:

- What are the reoccurring processes in Finnair's Cool Terminal?
- How exactly can they be outlined as simple enough for RPA?

It is also important to know how RPA as a whole will affect logistics in the Cool Terminal. The result of the entire study will be a proven insight of any possible processes in Finnair's Cool Terminal that can be replaced with RPA, and which of them are not feasible at all. Besides, the thesis will uncover what benefits RPA can contribute in Finnair Cargo processes.

1.3 Constraints

This research covers rather broad topic related to robots in the aviation industry. Its result may be too wide and ineffective research, if not initially emphasize the limitations. Further described constrains are chosen in order to make the thesis clear and accurate.

Finnair is the largest air carrier in Finland. The main activity is executed in the parent company of the group, Finnair Pls, while many other services such as technical, travel, financial one and etc. are located in subsidiaries. (Company Management 2019.) Finnair wholly owns them. The scale of the company is immense, it is developing on an ongoing basis. Therefore, this also applies to process automation throughout the company. However, this study only affects part of Finnair Cargo, namely the processes at Cool Terminal in the control center (CCC). This latest modern terminal in Helsinki was already equipped with the latest technologies at the construction stage. (Cool Nordic Cargo Hub 2018.) Although the terminal is only on the path to full automatization.

Concerning the automation of processes, there are many different technologies from semi-automatic work flow orchestration to artificial intelligence (Spacey 2016). This study focuses only on robotics. However, since there are many types of this technology either, only RPA is considered for research.

It is important to note that RPA technology replaces particularly monotonous and simple tasks. Therefore, this research is aimed at discovering precisely those processes in Cool Terminal. The possibility, feasibility and necessity are the analytical basis of this thesis. Yet, everything else will be decided by the company itself.

2 Theoretical Framework

Chapters 2 and 3 are revealing the core theoretical aspects that the author has considered for conducting the empirical part of the research. The chapter covers topic of Industrial revolutions and their impact on technological progress. As a consequence, author describes understandings of innovations application in *logistics 4.0*. One of the core aspects illustrated in the theoretical research is the *RPA,* which creates the basis of empirical study.

2.1 Industrial Revolutions

In 1829 the word "technology" has been mentioned in a book by Jacob Bigelow. Over time, this word has had multiple meanings, and nowadays it is an invention that has a powerful role in our lives. (Klein 2008.)

Technology in broad terms has two forms: enhanced and replacement. Enhanced technology is something that improves an existing invention, making it better, faster, or producing more of it. On the contrary, replacement technology is the one that literally takes place of another, using entirely different principles, and makes the first technology out-of-date. Often this process causes all kinds of economic chaos since technology lies at the core of the conflict. The effects of it are often unpredictable. (ibid.)

The First Industrial Revolution utilized water and steam capacity to automate production. The Second utilized electric power to make large scale manufacturing. The Third utilized gadgets and data innovation to mechanize production. (Schwab 2015.) All of these discoveries are fundamental because they marked the beginning of a new inventions (Klein 2008). Now a Fourth Industrial Revolution is expanding on the Third, the digital revolution that has been happening since the middle of the last century. It is portrayed by a combination of advances that is weakening the lines between the physical, computerized, and natural universes. (Schwab 2015.) Figure 1 demonstrates all four Industrial Revolutions.

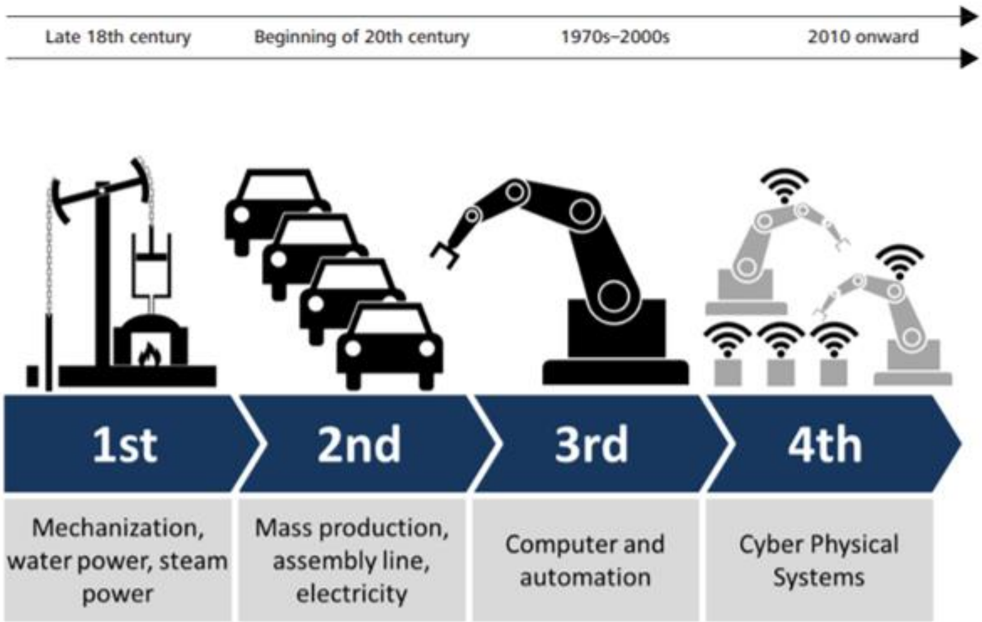

Figure 1. The Industrial Revolutions (Summary of characteristics of the industrial revolutions 2019).

2.2 The Fourth Industrial Revolution

The fourth industrial revolution is also called the Industry 4.0. This term was first defined in Hannover Messe trade fair in 2011. (Sniderman, Mahto & Cotteleer, 4.)

Whatever the name of it, Industry 4.0 represents the combination of cyber-physical systems, the Internet of Things, and the Internet of Systems. These innovations can possibly keep interfacing billions of individuals to the web, drastically improve the efficiency of business and organizations and help regenerate the natural environment through better asset management, potentially even undoing all the damage previous industrial revolutions have caused (Marr 2016).

However, historically, industrial revolutions have consistently started with more prominent imbalance and inequality followed by times of political and institutional change. Does this mean that our present political, business and social structures may not be prepared or fit for engrossing all the progressions a fourth industrial revolution brings? (ibid).

Speaking about the changes, integration of both information technology (IT) and operations technology (OT) brings a combined cyber-physical production environment and refers to the fourth industrial revolution. In greater detail, using digital information from many different sources and locations to drive the physical act of manufacturing. (Sniderman et al., 2; Industry 4.0: The fourth industrial revolution – guide to Industrie 4.0.) The new capacities of Industry 4.0 lead to the *smart anything* phenomena which frequently get most consideration: from shrewd grid, smart energy and smart logistics to savvy offices, including smart buildings and savvy plants, and shrewd services to brilliant assembling, smart production lines and smart cities (Industry 4.0: the fourth industrial revolution – guide to Industry 4.0,).

2.3 Digital Industrial Technologies

According to the Boston Consulting Group, the fourth industrial revolution specifies the application of nine digital industrial technologies which are shown in the Table 1 below. Nowadays, some companies have already invested in a few of these technologies. (Embracing Industry 4.0 and Rediscovering Growth.)

Table 1. Industry 4.0. application of technologies (Embracing Industry 4.0 and Rediscovering Growth.)

Technology	Application
Advanced Robotics	• Autonomous, cooperating industrial robots • Numerous integrated sensors and standardized interfaces
Additive Manufacturing	• 3D printing, particularly for spare parts and prototypes • Decentralized 3D facilities to reduce transport distances and inventory
Augmented Reality	• Augmented reality for maintenance, logistics, and all kinds of SOP (Standard Operating Procedure) • Display of supporting information (e.g. through glasses)
Simulation	• Simulation of value networks • Optimization based on real-time data from intelligent systems
Horizontal/Vertical Integration	• Cross-company data integration based on data transfer standards • Precondition for a fully automated value chain (from supplier to customer, from management to shop floor)
Industrial Internet	• Network of machines and products • Multidirectional communication between networked objects
Cloud	• Management of huge data volumes in open systems • Real-time communication for production systems
Cybersecurity	• Operation of networks and open systems • High level of networking between intelligent machines, products and systems
Big Data and Analytics	• Full evaluation of available data (e.g. from ERP, SCM, MES, CRM, and machine data) • Real-time decision making support and optimization

Fundamentally, the advancements causing the fourth industrial revolution engage existing information and new data that would now be able to be connected with the Internet of Things (IoT). This is in order to gain efficiencies on various levels, change existing assembling processes, make end-to-end data streams across the value chain and acknowledge new services and business models. (ibid.)

Regardless the technologies above, cyber-physical systems (CPS) and the Internet of Things (IoT) are really key umbrella terms with many technologies, and they definitely will lead the fourth industrial revolution (Industry 4.0: the fourth industrial revolution – guide to Industry 4.0).

The Internet of Things consists of objects with embedded or attached technologies that enable them to sense data, collect and send them for a specific purpose. Depending on the object and goal, this could be a captured data regarding movement, location, presence of gasses, temperature, 'health' conditions of devices, the list is endless. This data as such is just the beginning, the real value starts when there is an analyzing. IoT devices can also receive data and instructions, again depending on the 'use case'. All this applies to cyber-physical systems as well, which are essentially connected objects. (ibid.)

CPS are seen as a next evolution in manufacturing, mechanics and engineering. Cyber-physical systems are the basic building blocks of Industry 4.0 and the enablers of additional capabilities in manufacturing (and beyond) such as track and trace and remote control. Cyber-physical systems are also equipped with sensors, actuators and all the other elements which are part of the Internet of Things. Cyber-physical systems, just like the Internet of Things need connectivity. The exact connectivity technologies which are needed depend on the context. (ibid.) In the future, CPSs will be available in all industry sectors and, within the Industry 4.0 worldview. CPSs will open new production methodologies developing into the norm of tomorrow for industry. Production environments will be self-configuring, self-adjusting, and self-optimizing, leading to noteworthy agility, flexibility, and cost effectiveness. (Sabella 2018.)

A broad, multidisciplinary technology revolution is changing the world. Information technology is already revolutionizing our lives and will continue to do it. Fundamental changes in what and how we manufacture will produce unprecedented customization and fundamentally new products and capabilities (Anton & Silberglitt & Schneider 2001, 17).

These revolutionary effects are not proceeding without issue. Various ethical, economic, legal, environmental, safety, and other social concerns and decisions must be addressed as the world's population aware of the potential effects these trends may have on their cultures and their lives. Citizens and decision-makers need to inform themselves about technology, assembling and analyzing these complex interactions in order to truly understand the debates surrounding technology. Such steps will prevent naive decisions, maximize technology's benefit given personal values, and identify inflection points at which decisions can have the desired effect without being negated by an unanalyzed issue. Yet, the technology revolution will not be uniform in its effect and will play out differently on the global stage depending on acceptance, investment, and a variety of other decisions. (ibid. 18.) However, the step-by-step deployment path towards the full Industry 4.0 paradigm, is unique and well defined. The figure 2 demonstrates it below.

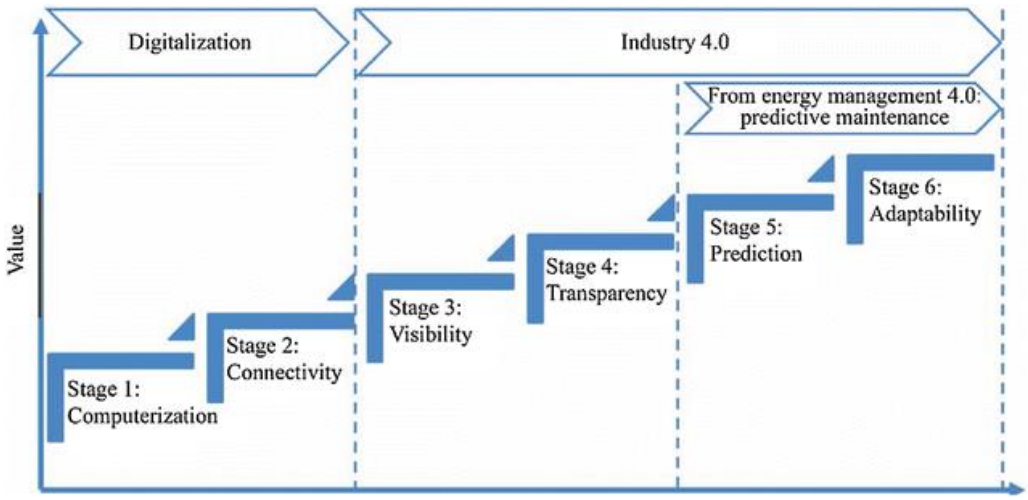

Figure 2. Industry 4.0 maturity index (Sabella 2018).

The first two steps are computerization and connectivity. A total integration of calculation, networking, and physical processes has not yet been accomplished at this stage. In a third step, with the utilization of sensors and digital models, the visibility of technology records and processes is achieved in real time. With digital models, industries see what occurs, yet in addition distinguish and comprehend, arriving at fourth step of transparency. Here it is important to clarify data by comprehensive data analyses, at all factory levels. The forecasting ability and predictability is the next step. It is about creating various situations, assessing the likelihood of event and being prepared for the potential results and consequences. Then, the digital models are progressively updated. Nonetheless, the Industry 4.0 will be completely executed with the last step which is adaptability. It is about automatic and immediate alteration measures and, when required, without human intervention. (Sabella 2018.)

There will be no turning back, and globalization will slowly change the environment in which each society lives. The world expects significant transformation as these advances play out on the global stage (Anton et al. 2001, 18).

2.4 Logistics 4.0

In the logistics, digitization has likewise become a key factor for progress (Mro 2018). Since at every step in the production and transit process presents challenges that can make or break a supply chain. Transportation delays, lack of cargo monitoring, theft, operator errors, outdated IT failures: all these factors and more can jeopardize profits and intensify cost pressure, no matter the business (Logistics 4.0: How IoT Is Transforming The Supply Chain 2018). Then Logistics 4.0 comes to the rescue which represents data and intelligence and works similarly as Industry 4.0. It oversees and finishes complex logistics procedures with IT innovations to continuously improve productivity and adaptability to reduce costs (Mro 2018).

The term “Logistics 4.0” to refer to the combination of using logistics with the innovations and applications added by CPS. “Smart Logistic” is a logistics system, which can enhance the flexibility, the adjustment to the market changes and will make the company be closer to the customer needs. This will make possible to improve the level of customer service, the optimization of the production and make lower the prices of storage and production. An efficient and strong Logistics 4.0 relies and uses the following technological applications: Resource Planning, Warehouse Management Systems (WMS), Transportation Management Systems (TMS), Intelligent Transportation Systems and Information Security. (Barretoa & Amarala & Pereira 2017, 1248.)

With a single system, the logistics managers will be able to ‘walk’ through the whole chain of the logistic process. Starting from the publication of the offer of available means of transport or load to automatic creation of a transport order. Going further, such systems will automatically send the driver precise instructions about the place of loading and unloading, dates of operation and the load after assigning a subcontractor or specific means of transport. Adjusting the modern systems exactly to the needs of a company will still be extremely important. Only the companies which will be flexible enough to adjust themselves to logistics companies will be able to cope in this competitive market. Carriers will be automatically connected with companies providing debt collection and factoring services. Thanks to the integration with telematics networks and Truck&Tracing, the forwarding companies will have access to visualizations of all the trucks of their subcontractors on one map integrated with the operating system. Production and trade companies which want to handle logistics by themselves will be able to select carriers automatically in real time. It will be possible because of the algorithms specifically dedicated to a company, branch or even a particular type of a product or shipping. (Palluch 2017.)

Logistics 4.0 is not only very safe since it works on the principle of network of connections and contacts, it is also intuitive to use, suggests counter-parties and further actions in operating systems (ibid).

3 Robotics Technology: Robotic Process Automation

As companies proceed from customary supply chains to more reliable advanced networks, it is critical to hold onto computerization abilities and next-generation technologies to drive from the traditional processes to the digital era. Robotic Process Automation or RPA is one innovation generally grasped by industry. In contrast to AI, RPA is more available to organizations as an essential initial step of computerized transformation. The key is to reveal critically important interfaces inside an organization's processes and prudently apply the technology. (The Path Forward: Operationalizing RPA to Automate the Digital Supply Network.)

Robotics Process Automation is a technology with which a user can design a coded “robot”. The robot imitates operations that a human employee performs or would execute in the same environment, meaning the interface of the organization’s system. The robots are educated to behave as their human colleagues. Assuming that every employee acquires its own workstation, the robot has a virtual one. (Almendro & de Bree, 2018-2019, 52.) Thus, a software is installed to the endpoint hardware, and a virtual desktop is accessible to a user (robot) enabling it to interact with a screen electronically (Rouse.). As noted by Leslie Willcocks (2016), professor of technology in London School of Economics, RPA, for the most part, replaces simple physical processes. To be more precise, the processes or the tasks where there is no need in human's understanding, observation and knowledge. (Xavier & Willcocks 2016.) Figure 3 demonstrates, what kind of work RPA compensates. They are rule-based tasks from mundane opening and extracting the structured data to following *if/then* decisions (What is RPA? In-Depth Definition & Guide [2019 update] 2019). To some extent, RPA is a digital workforce created to help empowering more important activities performed by knowledge workers (Leibowit & Kakhandiki 2018).

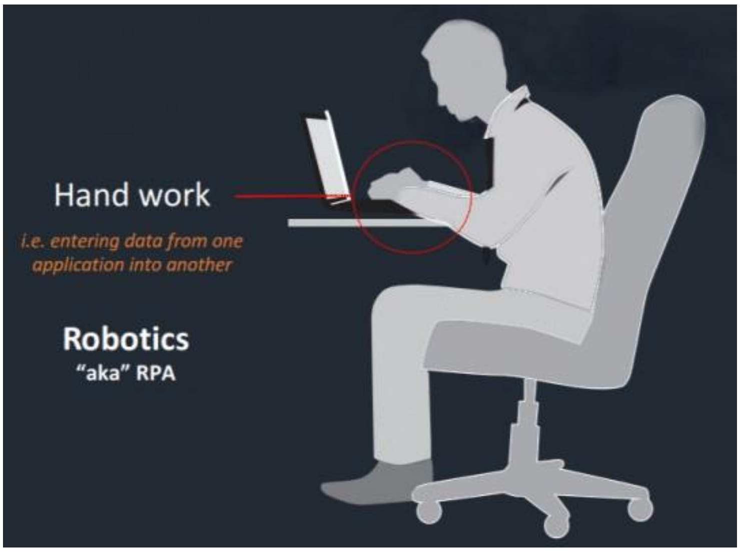

Figure 3. RPA replaces hand work (Leibowit & Kakhandiki 2018).

Currently, there are 2 types of RPA modes: attended and unattended. They both have a significant influence on the optimization’s deployment (Leibowitz & Kakhandiki 2018). Attended RPA works as a software assistant, and sometimes is called a Robotic Desktop Automation (RDA). Robot performs fixed actions at the workstation as a substitute for human employee. However, if there is a necessity of a decision that requires human's intelligence or experience, software robot gives control back to the worker in front of the workstation. (Col 2017.) Attended RPA is usually beneficial for the processes that cannot be automated entirely and typically is used in front-office tasks, i. e. the activities that are directly connected to customers services (Leibowitz & Kakhandiki 2018; Kokemuller.) Regarding the unattended RPA, the robot works by itself. It is autonomous software robot that can use applications independently to retrieve needed information, apply control rules to the data, accomplish processing to generate new material, and then insert that produced knowledge into other applications through their user interfaces (UIs) or application program interfaces (APIs). However, in case of exception situations or some errors, there is always a human supervisor that watches carefully for the execution of the robot's activities. (Col 2017.) Unattended RPA has a highly specialized use cases while RDA is aimed for more flexible tasks and utilized widely in the industry (Robotics Process Automation (RPA) and Automation in Finance.). Obviously, both attended and unattended RPAs are not interchangeable and can co-exist together creating a complete RPA solution at its finest. (Leibowitz & Kakhandiki 2018). The Figure 4 below illustrates the collaboration of human employee and software robot, together with usage statistics.

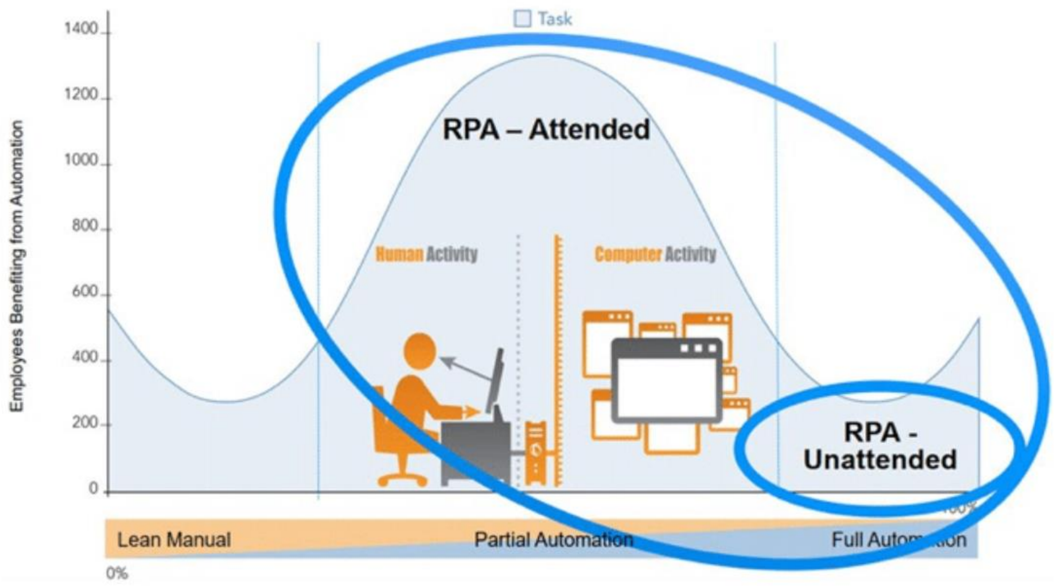

Figure 4. Attended and Unattended RPA usage (Robotics Process Automation an Automation in Finance.).

3.1 Robotic Process Automation Advantages

One of the significant benefits of RPA in the organization is low demand in changing its IT infrastructure. Meaning that RPA eliminates the possibility of the company to reorganize the existing systems and saves it from the designing a totally new system customized specifically for the RPA. Software robot easily adapts to employee's interface and mimic the actions that human performed before, yet virtually. (Almendro & de Bree 2018-2019, 52.)

Repetitive tasks are often highly energy extensive. They raise boredom and decrease concentration which can result errors (Hawkins 2018). Clearly, RPA allows a human employee to remove mundane tasks from the working clerical routine. Hence, a person can focus on more challenging and creative inputs, balancing a productivity workload and increasing the value of business as a whole. (Hawkins 2018; Almendro & de Bree 2018-2019, 52.)

In comparison to different intelligent system, RPA do not require significant expenses. Surely, it demands specific resources and some attention. For example, cost of development depends on the organization’s need in the off-the-shelf RPA solution. In case when the company uses outdated or unique software, their initial cost for development the new scripting would be higher. However, likely efficiency exceeds the expenses in long term anyway. Regarding the cost of change, it should not be expensive at all since RPA easily adapts to the landscape. Except for the fact that the organization has to change every process to implement the automation. There is also a cost of management. Initially, managing RPA is not costly for business. However, in long term perspective, RPA support team better develop farther into RPA Center of Excellence (CoE). With the automation progress in the organization, CoE plays an important role in appropriate managing of RPA. They should evaluate the necessity every RPA solution, whenever possible combine RPA scripts to avoid disorganization and unnecessary expenditures. In any case, it appears that RPA is one of the most profitable ways to automate. (Roy 2018.) Usually organizations achieve

ROI (return on investment) quite quickly, within one year (Almendro & de Bree 2018-2019, 52).

The deployment of RPA into the organization's processes adds a digital workforce which operates 24 hours per day, 7 days a week and 365 days a year. (ibid. 2018-2019, 52). Summing up the facts that are mentioned above, RPA implementation allows to execute routine tasks faster, yet more accurately. Increase agility and pay its cost back rather quickly. (Barkin 2016.) RPA helps to improve work quality both for the external processes and for employees who are always side by side with a software robot.

3.2 Robotic Process Automation Pitfalls

Besides the benefits of using a software robot, there are also challenges which should be taken into account in the early stages. The most important part in RPA implementation is applying automatization to the appropriate cases. (Almendro & de Bree 2018-2019, 53.) New technology requires a specific approach in selecting the most suitable task. Firstly, the use cases for the automatization that the organizations choose to automate shall be correctly evaluated for the further replacement with RPA. The tasks need to be high volume, rule-based, monotonous and does not have a lot of exceptions. (Albajari 2019.) Incorrectly identified use cases will only produce a low ROI and would not improve the process efficiency as expected by the companies (Meda 2019).

The organizations often take all the measures required before the deployment of RPA. However, they fail to take care of the consequences, which might come after the automation is implemented into the business (ibid). RPA essentially adds a new responsibility to process owners. While they will be managing a digital workforce that is rather small but produces higher quality results, they will need to allocate time and resources to manage and maintain the software robot (20 RPA Pitfalls & the Checklist for Avoiding Them [2019 update] 2019).

Without the lack of awareness by the employees about the impact of new technology to the organization, RPA can possibly create a negative impression among the workers. It might inspire a fear of losing jobs and unclear responsibilities after software robots are introduced. (Meda 2019.) Any changes that come from the implementation of new technology can be stressful. To ensure successful adaptation, organization's leaders have to communicate regularly with employees throughout the implementation process. They have to make sure that expected goals and responsibilities are clear and well known by everyone in the team. This will support trustworthiness to the changes. (Albajari 2019.)

3.3 Robotics Technology: Successful Cases in Airline Industry

Today, more than 90% of operations in the aviation industry are done using a computer. Most likely in the near future, greater number of industries will make maximum use of machine technology to benefit their processes. RPA is a fairly universal tool for automating tasks wherein the company does not lose its agility. Apparently, such robots that imitate a human and do repeated routine actions instead of a person will become the leading method for automating business processes over the next five years. Despite all its ease of implementation, one should not forget about the role of process management or lean management. Automating processes that are not needed at all is not quite commercially justifiable to the business. (Jaskulski 2016.) However, since this study is aimed at assessing the potential of RPA in Finnair Cargo, it is also important to consider successful cases in the airline sectors. See how various companies use RPA and achieve incredible results.

3.3.1 Case: Vueling

Vueling is a low-cost Spanish airline that operates mainly in European Union. The central registered hub is located in Barcelona, although there are also permanent bases in Italy, France and Canary Islands. (Auditor 2018.) Vueling is a part of International Consolidated Airlines Group (IAG), one of the world’s biggest airline alliances that has combined air carries in Spain, Ireland and the UK. IAG has brought together the branches in order to influence an aviation marketplace yet it takes into account individuality of each subsidiary (IAG Overview 2019). Vueling nowadays is the largest airline in Spain considering its amount of destinations, namely 148 cities, and size of the fleet, 115 aircrafts (Auditor 2018; Almendro & de Bree 2018-2019, 51).

There are many different repetitive and routine tasks within the Vueling Airlines that can potentially be replaced with RPA. Due to the monotony of such processes, there is always a risk of errors caused by the human factor. Moreover, such tasks take too much time and do not motivate the workers at all – quite the contrary.

One of these routine tasks is to print work packages for the MRO (Maintenance, Repair and Overhaul) every day. Figure 5 shows the process which is executed manually. The difficulty lies in the fact that such work packages need to be processed and printed out about 120 pieces per day. Usually, it takes 2-3 hours of working time for three or four employees to perform everything correctly. Sometimes, in order to be in time, tasks could be passed on to engineers. This aggravates the situation even more, since work packages must be handled and printed, but the resources involved are not enough. Employees simply waste valuable time that also affects the business in general. (Almendro & de Bree 2018-2019, 52.)

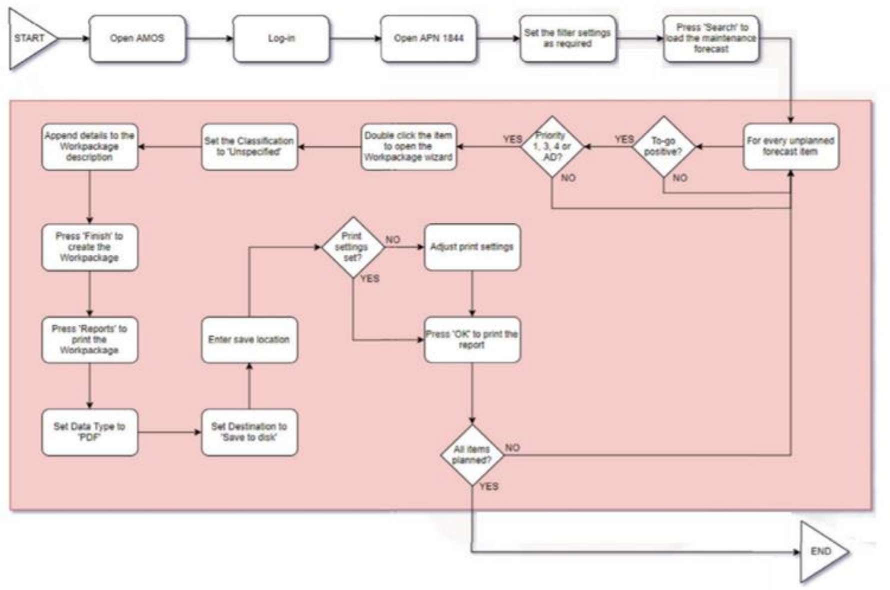

Figure 5. Manual business process at Vueling (About EXSYN.).

To solve the issue that Vueling faced, the airline decided that it has been necessary to have recourse to EXSYN. EXSYN Aviation Solutions is a company that specializes in aviation engineering and aircraft data. They provide the ability to adapt to digital changes by supporting the airline and the MRO. (About EXSYN.) EXSYN developed a software robot for Vueling that has automated the whole process of the work package from planning to printing. RPA took routine processes over in order to enable high accuracy and reduce human errors. (Almendro & de Bree 2018-2019, 52.)

To understand the process that is shown in Figure 5, the EXSYN performed a five-step analysis with goals and expected results. First of all, they had gathered information in order to create a landscape of the process. (Almendro & de Bree 2018-2019, 54.) It defines the relationships between company's business units (Working with the Business Process Management (BPM) Life Cycle 2015). The next two steps were to analyze and visualize all the information gathered. Meaning to consider the risks, rules, various system changes, input, output and etc. Then, it was necessary to evaluate the processes that one could understand its suitability for the RPA. EXSYN has developed two assessment systems or a scoring models: technical and value. The former is responsible for the complexity, structure and predictability of the process. This is important because the robot needs a clear and simple framework to perform the tasks. The latter evaluation system covers factors for the most probable return on investment (ROI) with further potential automation. In fact, the last step is the training (coding) of the robot itself, if all the previous steps predict a good result. (Almendro & de Bree 2018-2019, 54.)

A new automated process for printing the work packages with an involvement of the RPA is shown in Figure 6. Obviously, it is much simpler and clearer than the previous one.

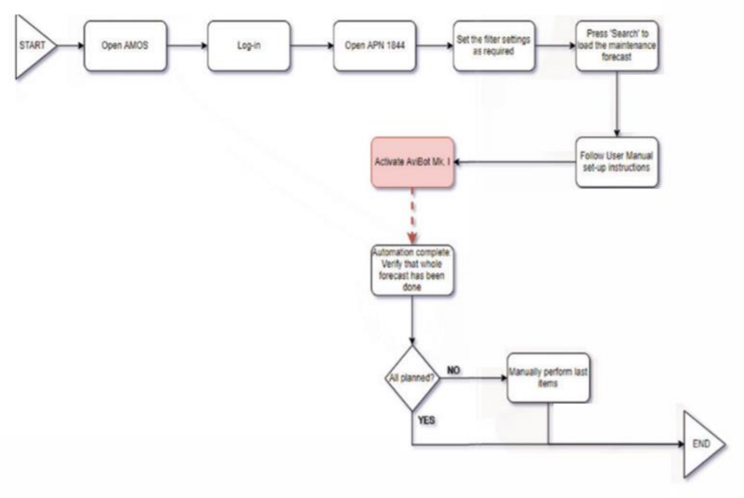

Figure 6. Business process with implemented RPA at Vueling (About EXSYN.).

The process with using the robot was first performed in test mode and in a test environment, away from the real conditions. The need for this is that the robot does everything in the same way as Vueling's workers did, but with the corresponding improvements. The test, as planned, showed the success of the implementation of the RPA. After 6 weeks since AvBot Mk. 1 has joined Vueling's team, it has saved 4,500€ of an aviation engineer man-hours. Also, only one person is needed to track the whole process. Errors related to the human factor have not yet occurred. The most important advantage of the RPA is that it freed people from their monotonous work and realized their involvement in more complex, in creative way, tasks.

Employees can do more interesting activities, which in turn also benefits the company. After all, with the help of automating routine processes, Vueling employees has got the motivation to create something more innovative. Moreover, RPA joined the organization very smoothly, without any significant changes in the processes of the company itself. That makes RPA a unique 24/7 workforce. (Almendro & de Bree 2018-2019, 56.)

3.3.2 Case: Finnair Cargo

Finnair Cargo also has a successful case of implementing robotics into one of its daily processes. It is not surprising that this achievement, which is described below, allows the company to think about automating more processes. This is a huge competitive advantage, since Finnair Cargo has already devoted its time to the realization of mimicking technology, and they are not at the beginning of the way to determine how close this RPA approach is for them. Now looking ahead, the chance that the company will suffer losses from new similar projects is rather low.

As one of the regular processes performed by Finnair Cargo on an ongoing basis, it is entering of the SPH code. Special Handling Codes are needed in order to ensure the accuracy of cargo handling. The importance of the correct code is crucial for all the shipments, especially for the ones that require certain temperature conditions. Every sensitive good must be assigned with the PIL code, which in turn must also contain another code complying with appropriate temperature requirement. They are CRT (Controlled Room Temperature), ERT (Extended Room Temperature), COL (Cool Storage) and FRO (Freezer Storage). (Special Handling Codes for Pharma Shipment Bookings 2018.) However, there are around 100 codes in total for all kinds of cargo. Usually these acronyms are entered manually, in most cases they are entered by several people using several different platforms. The probability of inaccuracy to enter such codes into the system is very high, while the search and correction of errors is rather labor-intensive process. Non-accurate input of SPH codes likewise leads to inconsistencies in the air waybill, which in turn also results in delays and loss of cargo. Such errors occur fairly often and, in a consequence are expensive. Proper handling is very important throughout the entire transportation. Sensitive products, such as pharmaceutical or agricultural goods, should be placed in the right place at the optimal temperature in order to prevent spoilage. (Finnair Cargo Corrects Special Handling Code Errors 50% Faster in Trial of New Robotics Technology 2018.)

According to Petteri Hellen, Head of Finnair Cargo's Operating System Development, while entering mismatched codes on the cargo booking document and the air waybill, the ERP system recognizes it and no longer operates, since it prevents the cargo from being processed further Finnair Cargo Corrects Special Handling Code Errors 50% Faster in Trial of New Robotics Technology 2018). Air Waybill, for its part, is the contract of carriage between the freight forwarder and the airline, according to which two signatories perform the details that both parties negotiated. (e-AWB, 2019).

The scale of this problem is considerable. Head of Digital Transformation in Finnair Cargo, Kari Saarikoski, says, they assessed the high possibility of using RPA in shipping documents that currently is considered as the human routine Finnair Cargo Corrects Special Handling Code Errors 50% Faster in Trial of New Robotics Technology 2018).

In March 2018, Finnair Cargo began a partnership with Digital Workforce, the company that specializes in intelligent process automation services. The collaboration led to a pilot project, where the idea was to implement a robotic automatic platform capable of identifying and independently solve problems of the SPH code. Ashish Desai, Manager of Information Technology Development for Cargo Applications, claims that the software robot works faster and more precisely than people, and it can also be used within 24 hours.

The consequence of this pilot project has yielded positive results at the final stage Finnair Cargo Corrects Special Handling Code Errors 50% Faster in Trial of New Robotics Technology 2018). It confirms that the Proof of Concept (PoC) was as successful and efficient as possible. To clarify, PoC is data collected proving the feasibility of the fact that the technology works (Investor Words2019). As an outcome, PoC demonstrated that it takes for the robot half the time than a human to complete all tasks related to SPH code. Moreover, those errors in the SPH code discrepancies, which were often due to the human factor, are almost completely excluded. Finnair Cargo Corrects Special Handling Code Errors 50% Faster in Trial of New Robotics Technology 2018.)

In September 2018, the project was successfully completed, and now the RPA is being implemented on the basis of continuous use. The project showed efficiency and proved its benefit in the Cool Terminal; thus, Finnair is now implementing such pilot projects in the field of finance and etc. In the terminal, they choose not to afford to be complacent and plan to optimize other processes with RPA, which first of all should be identified for replacement. Finnair Cargo Corrects Special Handling Code Errors 50% Faster in Trial of New Robotics Technology 2018.)

4 Case Study: Finnair Oyj

Finnair is a network airline that provides domestic and international carriage of passengers and cargo. The largest airline in Finland specializes in traffic between Asia and Europe, although have fast connections to two cities in South Africa, two countries in the Middle East and plenty destinations to North and South Americas, technically, 8 countries and 48 cities. (Finnair Destinations and Routs 2019.) Finnair offers finest interconnections to the world from and through its internal market because of the ideal geographic location. Figure 7 shows the position of Helsinki Airport, where Finnair's both hub and its headquarters, is situated in Vantaa. The key advantage is that Finland is the fastest destination from Asian metropolian areas to many European countries and northern hemisphere as a whole. (Finnair as an investment 2019.)

Figure 7. Location of Helsinki Airport (The history of Finnair 2017).

Finnair operates since 1923, and for its 96-years history, the company has grown from a small airline called Aero with one seaplane to a respected representative of the international airline industry with the fleet size over 80 aircrafts. (The history of Finnair 2017; Vauramo 2018.) Moreover, regularly awarded as one of the safest airlines in the world. According to JACDEC Airline Safety Ranking 2019, in view of 30 parameters of Risk-Index, extensive safety analysis shows that to date Finnair has a Risk-Index in the number of 93,91% which is the highest result among other airlines (JACDEC Airline Safety Ranking 2019). Having such indicators, one proves Finnair's competitive position in the market as the most attractive for stakeholders. In fact, the number of shares at the end of June 2018 was 128 136 115, the largest percentage of shares in the amount of 55,8% has the Prime Minister's office. (Investor relations. Shareholders 2018.) Finnair's revenue in 2018 was 2834,6M €, including the amount from airline's subsidiaries (Investor relations. Financial information. Key figures 2018).

Primarily, Finnair operates in the Group's parent company, Finnair Plc (Public limited company), while different services such as technical, financial ones and etc. are run in 100% self-owned subsidiaries (Investor relations. Company Management 2019). Finnair cargo business, as one of the ancillary services, constitutes 2 subsidiaries: Finnair Cargo Terminal Operations Oy and Finnair Cargo Oy, which provide freight transportation. They share assistance of great importance and have a strategic capacity to development.

4.1 Finnair Cargo

Finnair Cargo is one of the best cargo carriers in northern Europe. It is being improved every year as Finnair has invested a lot in the advancement of its hub in Helsinki. The biggest changes occurred in technology area. In order to improve the availability and transparency of the freight handling, Finnair Cargo launched a technology called Cargo Eye. The Internet of Things system monitors delivery, shows every migration of both cargo and aircraft, also displays the temperature during the entire carriage. Such detailed accuracy is extremely important, because the hub in Helsinki is able to receive, store and ship even sensitive goods such as pharmaceuticals and perishables. Now Finnair Cargo carries 8.6% more cargo than in 2016. Revenue grew by 13.5% and has shown the biggest year increase in Finnair history. Thus, Finnair is the most qualified among other carriers between Asia and

Europe since the most import cargo from Asian countries follows the strict standards and goes safely to another European harbors via Helsinki Cool Terminal. (Finnair Cargo 2018.)

4.2 Finnair Cargo Cool Terminal

Cool Terminal is the newest and most modern terminal in Europe and in the whole world through which majority of all the Asian cargo movements take place. Opened in 2018, 80 million euros were invested in it. The terminal is equipped with the latest technologies such as intelligent warehouse and robots. This concept helps reducing paperwork and errors, also creates efficient digital space. (Cool Nordic Cargo Hub 2018.) The conditions are built depending on the fact that the amount of cargo will be increased in next years, literally 45% is a predicted raise by 2020 (Amazing Facts About Europe's Most Modern Air Cargo Terminal, Finnair's Cool Hub In Helsinki 2018).

Cool Terminal has a huge area of 31000 m^2: 25,000 m^2 for general cargo, and 6,000 m^2 for temperature controlled filed. The allocated areas for perishables and pharmaceuticals are in different places and maintain different temperature. The packing area for easily spoiled goods as seafood is kept between 6° and 8°C, while the storage area is at 2°C. The temperature in a medicine part of the terminal is 20°C, while there is also a room for frozen goods that are kept in below 2-8°C. (Amazing Facts About Europe's Most Modern Air Cargo Terminal, Finnair's Cool Hub In Helsinki 2018.)

To ensure the proper storage of medical products, Finnair was the first airline in the world that received pharma acceptance by IATA. CEIV Pharma (Center of Excellence for Independent Validators in Pharmaceutical Logistics) is a certification that establishes norms for storage and transportation of medicine, including regulations for equipment and staff, that airline must to implement. (CEIV Pharma 2019.) Finnair Cargo uses the latest alarms and sensors to secure the quality of valuable products. They monitor pharmaceuticals not only during the stay in the COOL terminal, but also all along their shipment. (The Pharma Acceptance Process That Means Life-saving Medicines Travel Safely 2019.) Manufacturers and clients can be assured that their medical supplies do not undergo negative changes during the journey, given that CEIV sets out an adequate expertise.

The terminal itself is located next to the stand of wide-body aircrafts, which is also the part of beneficially designed conditions for handling cargo (Cool Nordic Cargo Hub 2018) The delicate goods are moved to the aircraft only 30 minutes until the departure, while the general cargo is transported within an hour (Amazing Facts About Europe's Most Modern Air Cargo Terminal, Finnair's Cool Hub In Helsinki 2018). The Cargo Eye system monitors the data thoroughly. Hence, the COOL terminal is optimal not only for the transportation of regular freight, but also ideally developed for extremely gentle and valuable goods.

Finnair Plc is deeply concerned about the quality of services it provides. Company manifests itself in the market as a competitive and influential organization/airline. And for its own growth and development, Finnair constantly implements modern and smart equipment into its processes. Cool terminal is already considered as extremely modern air cargo hub, although more automation of tasks and rapidly of processes are yet to come. Finnair is going to use such technologies as artificial intelligence and robots, and it is important to find the processes that are ready for replacement.

4.3 Logistics Workflow in Finnair Cargo Cool Terminal

Globally, Finnair Cargo divides its work processes into 4 categories: Steering, Global freight, Global mail and Support processes. The Appendix 2 illustrates them and, moreover, complements in detail each of the process. One can notice that it is also a timeline for the end-to-end process map, and putting emphasis on these defined responsibilities, the actual logistics workflow happens in Global freight area.

In fact, since this research only focuses on Freight in AY Network and slightly touches upon the customer service and invoicing part in the Cargo Control Center of the Cool Terminal (CCC). Since RPA works only in the screen environment, it is a potential area for implementing new technologies. Petteri Hellen confirms the fact that processes in CCC are the most important for this research to considerate. Indeed, Cargo Control Center is a space utilized for the control of cargo handling operations and all the logistics processes. The procedures of loading and unloading, heating control and monitoring of the cargo conditions and cargo-handling equipment is done and observed from there (Cargo control room.). Appendix 3 demonstrates all the sub-processes in this area.

There are 3 main sub-processes that take place and are being operated in CCC. The first, receiving the shipment into carrier terminal. The second, flight departure from the origin country and arriving into Helsinki Airport (HEL), also unloading and dispatching shipment to warehouse. The third, flight truck departure from the origin country, arriving in HEL and checking-in shipment into warehouse. Appendix 4 procedurally consider these sub-processes.

During the first main process, the cargo data as Air Waybill (AWB) and Cargo Interchange Message Procedures (Cargo-IMP) documentations is checked if the booking on the web portal matches the actual freight and then is processed to be ready for receiving shipment into terminal in HEL. When the shipment accepted as ready for carriage, and the acceptance is also received from Customs, the employee completes an export check-in, ensures the correctness of all the required documents and consolidates the information. Then, the shipment is ready to proceed to departure flight from HEL.

The second main process describes how data and documents are processed before and after flight has arrived at HEL and how Unit Load Devices (ULDs) are unloaded and delivered into HEL terminal. In a same way, as described in first sub-process, the employees have to ensure the data correctness and proceed with the check-in of the shipment.

Consecutively, the third sub-process begins, where flight truck departs from origin and arrives in HEL for following check-in. The freight is prepared for flight transportation after what shipped and loaded to the flight. Meanwhile, the first sub-process proceeds with the stage of preparing for transportation of the flight truck freight. All of the sub-processes lead result into information distribution, after what the shipment is arrived and handed over to the forwarder.

5 Methodology

5.1 Research Strategy

As the thesis considers a separate case company where the research is conducted, it can be identified as a *case study strategy* based academic work. By case study strategy researchers understand a specific case or phenomenon, under which the actions are taken. This also means that the results of the research can be reliable for the mentioned case/phenomenon only. (Saunders, Lewis & Thornill 2009, 146-147.)

5.2 Research Approach

With regards to research methods for a specific subject, it is critical to identify the right approach among various examination strategies. There are two main angles to examine the research: qualitative and quantitative analyses.

Qualitative methods are commonly used to get and reveal considerations and opinions, and as follows, they give a premise to decision-making (Shusterman.). The qualitative approach accumulates information that is freestyle and non-mathematical, for example, open-type questions, observations and interviews (Qualitative vs. Quantitative.). In McLeod's view (2017), qualitative research is exploratory and tries to clarify how and why a specific phenomenon works. Such phenomena can be seen decently enough just in the event that they are found in the context. Hence, a qualitative researcher participates in natural environment and seize an opportunity of an insider's view of the field. (ibid.) Quantitative research, on the contrary, accumulates information that can be introduced in a mathematical structure with a possibility to redesign it into diagrams and tables for simpler investigation. Such data can be acquired through, for example, experiments and closed questions. (Qualitative vs. Quantitative.)

Due to the nature of the research, a qualitative methodology was picked to address the research questions. However, the parts of qualitative data collected by the author is *quantitised*, meaning that the qualitative data is represented in numerical value (Saunders & Lewis & Thornill 2009, 151-153). The benefit of such a pragmatic approach is that it permits to utilize the technique which appear to be the most appropriate to the research issue. Pragmatic specialists perceive that each strategy has its constraints and that the contrasting methods can complement one another (The four main approaches 2009).

In case of qualitative research in this thesis, it involves a deep understanding of RPA implementation and explanation of the processes, while the numerical form allows this research method to be objective. Objectivity is fundamental here; analysts try not to influence the outcomes by their own presence, behavior or attitude. The conclusions are likewise analyzed for any possible bias. (The four main approaches 2009.) As indicated by McLeod (2017), statistics gained through quantitative research help turn the data into useful information for decision making. This strategy is used for measuring and predicting, which leads to a final course of action (Shusterman.).

5.3 Research Steps

The main focus of this thesis work is definitely a practical research which was implemented in Finnair Cargo Cool Terminal. A decision-making flowchart was chosen to show all the taken research steps. It is demonstrated on the Figure 11 below.

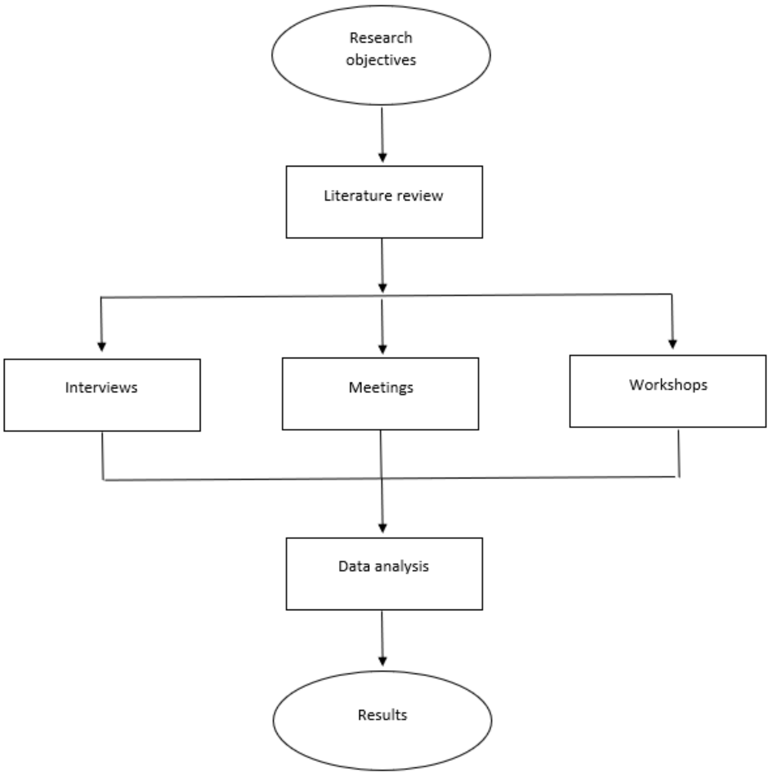

Figure 8. Research process

Literature review

Deep understanding of RPA:

- What RPA can and cannot do
- Reasons for RPA implementation
- RPA influence
- Case studies

Data Collection

Interview #1

Stakeholder: Ashish Desai, Manager of Information Technology Development for Cargo Applications

Most useful information gathered:

- Planning of RPA implementation in Finnair Cargo

- Strategy used to implement successful RPA case in Cool Terminal

Interview #2

Stakeholder: Petteri Hellen, Head of Finnair Cargo's Operating System Development

Most useful information gathered:

- Crucial points in making the RPA case successful
- Benefits in implementing RPA in Finnair Cargo in general

Meeting in Cool Terminal

Stakeholder: Petteri Hellen and employees from Customer service

- Familiarization with global cargo processes in Cool Terminal
- Explanation of provided internal documents of cargo processes
- Discussion of cargo processes
- Collection of information about routine manual tasks in customer service

Meeting in CCC

Stakeholders: Petteri Hellen and employess of CCC

- Familiarization with Cool Control Center
- Discussion about implementation of RPA
- Monitoring the practical use of cargo processes

Workshop in CCC #1

Stakeholders: Employees of CCC

- Collection of information about routine manual tasks in ”Planning” and ”Import” areas in CCC
- Discussion about RPA implementation

Workshop in CCC #2

Stakeholders: Employees of CCC

- Collection of information about routine manual tasks in ”Export”, ”Tracing” and ”Customs” areas in CCC
- Discussion of KPIs in every area in CCC
- Check the information for relevance

Data analysis

- Clarification of KPIs
- Creation of KPI FMECA table

5.4 Data Collection

In case of the qualitative method, the data was gathered with the help of interviewing Finnair's Cargo employees and by familiarizing with the information available on the company’s website, internal documents and external articles. Mainly, the data retrieved included information about the working principles of new technologies and the cargo processes in CCC.

Meetings in the Cool Terminal led to a discussion of the topics that needed to be covered in the research in order to the author could become familiar with the company’s internal logistics operations. During the individual interviews, the author discussed the issues with expert employees of different fields. Before the interview, a specific list of open-type questions was prepared (Appendix 1), and the answers provided by the employees were carefully documented. The information acquired from those meetings assumed a vital part in proceeding with the research at the initial stage. Since the employees did not always have extensive answers on the matter, the author was obliged to allude to already-existing materials (such as cases studies) in order to uncover further ways of research.

The qualitative interviews which were conducted during the workshops resulted into valuable aspects that supported the process of numerical data analysis. There was no need for the author to calculate anything, only to find the numerical data such as average times spent on the tasks and analyze it. Workshops that were organized with the competent employees supported the author's understanding of the processes in CCC and its implementation into the research.

Continuous cooperation with Finnair Cargo employees in Cool Terminal appeared to be the most important source for the data collection. Attending the meetings regarding the company's various working processes that were essential to be understood in order to achieve the objectives helped the author form an insight into Finnair's business. Moreover, the quantitative data discussions assisted in application of that knowledge. It is also important to point out that as long as Finnair's internal documents were the tools for accessing the company's private data, such as global processes revalidation, confidentiality issues should be taken into account.

5.5 Data Analysis

The qualitative data collected was quantitised by using a quantitative data analysis as described before and was presented as a Key Performance Indicators (KPI) FMECA – Failure Mode and Effect Analysis, which will be illustrated in Results chapter of the thesis (Failure Mode and Effect Analysis FMEA and Failure Modes, Effects and Criticality Analysis FMECA.).

After a deep analysis of the RPA working principles, as well as workshops in the CCC, the criteria/KPIs by which the author assesses the possibility of implementing a software robot into the routine tasks were identified and confirmed by Finnair Cargo employees:

- Average time spent on the task daily in minutes
- Complexity of the task made by the employee
- Number of possible exceptions
- Importance of the outcome
- Possibility of human error
- Severity of consequences after the mistake

In order to choose the most profitable process for replacing it with a software robot in the CCC, it is necessary that the RPA, during the assessment, make the greatest contribution to the automation of the process. As a result, the more hours spent on a certain process, the better it will be if the RPA can replace and correct it. At the same time, the complexity of the task should be as low as possible since only this case is in the competence of the RPA. There should be as few possible exceptions as possible as it is easier for highly efficient RPA operation. The importance of the task result as a whole in the CCC ought to be high for the implementation of RPA in order to make it a really considerable contribution when the replacement is completed. If there is a possibility for frequent human errors while executing the task, implementation of RPA will be able to make the work more productive. In turn, if the consequences after an error are severe, then the implementation of the RPA can affect the overall performance significantly.

The guidelines proposed by the author for evaluating RPA in detail are shown in Table 2.

Table 2: KPI for evaluating the processes

KPI	**Form of evaluation**	**Way of evaluation**
Average time spent on the task daily	Rating	Average time spent on the task daily assuming the normal workload, good quality of working conditions and sufficient employee's experience: 1p – 1-30 minutes 2p – ~1 hour 3p – ~2 hours 4p – ~3 hours 5p – ~4-5 hours 6p – >5 hours

Complexity of the task made by the employee	Rating	Overall complexity of a process performed by an operator based on the amount of operational activities and specialist's professional perception: 1p – Complex: unsatisfactory 2p – Rather complex: marginal 3p – Medium: satisfactory 4p – Rather simple: very good 5p – Simple: exceptional
Number of possible exceptions	Rating	Based on the amount of irregularities or special cases: 1p – Unsatisfactory (>7) 2p – Marginal (5-6) 3p – Satisfactory (4-5) 4p – Very good (2-3) 5p – Exceptional (0-1)
Importance of the outcome	Rating	Based on how much the task affects the bigger processes (performances): 1p – Not important 2p – Slightly important 3p – Moderately important 4p – Important 5p – Extremely important
Probability of human error	Rating	Based on the possibility of human error at the workplace in view of the normal workload, good quality of working

		conditions and sufficient employee's experience: 1 – Very Low 2 – Low 3 – Medium 4 – High 5 – Very High
Severity of consequences after the mistake	Numerical	A likelihood (bottom-to-top: rare, unlikely, possible, likely, almost certain) against consequence severity (left-to-right: insignificant, negligible, moderate, extensive, significant) matrix. (Talbot 2017). 2-3 – Very Low Risk 4-5 – Low Risk 6 – Medium Risk 7-8 – High Risk 9-10 – Very High Risk

6 Research results

Chapter 6 introduces the results received after conducting the research method used by the author.

6.1 Repetitive manual tasks

The main data that the author needed to be familiar with was all the data on employees' monotonous and repetitive tasks. Cool terminal workers showed the author on which simple tasks they spend the most of their working time during the day. And also, the employees offered their options on what specifically makes their work ineffective if they perform a certain action. The author took into account those tasks in which it was easy for the employees to make mistakes and, thus, spend even more time searching for the error or/and correcting it.

The following answers have been received and documented below:

Customer Service

- When shipment has arrived, an employee has to mark this information in green in the excel file which is called "same-day COOL-acceptance".
- In SkyChain ERP system, in the "ISR summary", in "Bank (prov.)", there is no "select all" button. Sometimes workers have to press "select" a lot of times.
- In the "Custom Release Document" (the permission from customs that they can deliver a shipment), there are numbers that has to be copied to SkyChain manually (i.e. clearance number). Important: the employees cannot just copy the numbers, they have to rewrite it.
- Finnair Web Portal does not refresh the page automatically; the employees have to press "search" button all the time by themselves.

Planning

- The employees have to check in SkyChain, in Flight Release, if there is a cargo and put this information in excel file: C/NIL meaning Cargo/No Cargo. (Usually for NB – Narrow Body Aircrafts).
- SkyChain often notifies incorrectly about the fact that there is almost not enough space for more goods.
- The problem is with the ULD inventory. There is no tracking system for AY pallets. The workers do not know where they are at the moment and how many of them are left in the warehouse. Usually there are not enough of them.
- The workers have to recheck information in order to detect a missing or incorrect information such as photos or dimensions.
- NB are copied automatically, while WB are not.
- Check ULDs that are ready. (Checking the flight and controlling vacated ULDs)

- An UWS (ULD weight signal) message, the workers copy from SkyChain to an emails for cargo cars.

Import

- If shipment's final destination is Helsinki (HEL), the workers have to "nominate broker" manually 90% of time. Exceptions: small companies or companies that are not in the system. Then the information goes to customer service and then to the customer himself/herself.
- If it is a consolidation shipment and a final destination is Helsinki, the worker has to press "deconsolidate" button manually.

Export

- The workers have to rewrite the Bulk ULD code and Gross Weight manually from SkyChain to Altea. The systems are not compatible.

It should also be mentioned that in CCC in Tracing and Customs areas, it was immediately clear that employees work on tasks that are too complicated and unique. As a result, these areas are not suitable for RPA implementation since RPA will definitely not be able to cope with the processes there.

Considering the information about RPA that is collected and written in the theoretical part, not only Tracing and Customs areas are within the bounds of possibility for software robot. On the basis of that data, some manual processes that terminal workers considered necessary to be documented, should be removed from the list of tasks mentioned above.

Thereby, two sections in the Planning area are taking to be eliminated from the list. In particular, incorrect notifications in SkyChain about space for the goods and information about tracking system for the AY pallets. The former point requires human aid and considered as unique, while the latter is too complicated and needs smarter software. In order get a clear image on manual tasks that match RPA feasibility, the Figure 12 was created, and it is demonstrated below.

Customer service	"Same-day COOL-acceptance" mark the shipment
	"Select all" button
	"Custom released document" copying of number
	"Search" button
Planning	C/NIL
	UWS message copying
	Rechecking the missing or incorrect information (photos, dimensions)
	WB are not automatically copied
	Vacated ULDs
Import	Nominate broker in HEL
	"Deconsolidate" in HEL
Export	SkyChain to Altea copying of the numbers

Figure 9: Manual tasks from the workshop that match RPA feasibility

CCC employees were interviewed several times during the workshops about their performance on the tasks. By covering all the KPIs, quantitative information in numerical form was obtained and validated, and then entered into the FMECA table (Figure 13).

The FMECA table was created according to the Table 2, which describes KPIs for the evaluation and Figure 12 that illustrates all the manual tasks executed by CCC workers. The former is positioned on the top on the Figure 13 while the latter is on the left. In order to get the result, the total sum was counted in every line. In consequence, the more points a certain manual task gets, the more likely implementation of RPA will make a significant contribution to Finnair Cargo Cool Terminal.

		Average time spent on the task daily	Complexity of the task made by the employee	Number of possible exceptions	Importance of the outcome	Probability of human error	Severity of consequences after the mistake	Total	
Customer service	"Same-day COOL-acceptance" mark the shipment	2	5	5	1	1	2	16	
	"Select all" button	3	4	5	2	2	4	20	
	"Custom released document" copying of number	5	3	5	2	5	6	26	IV
	"Search" button	6	5	5	4	1	4	25	
Planning	C/NIL	4	2	4	5	4	9	28	III
	UWS message copying	3	4	4	4	3	7	25	
	Rechecking the missing or incorrect information (photos, dimensions)	2	4	5	5	1	6	23	
	WB are not automatically copied	2	3	5	5	5	9	29	I
	Vacated ULDs	4	3	5	1	2	2	17	
Import	Nominate broker in HEL	3	5	4	3	1	5	21	
	"Deconsolidate" in HEL	3	5	4	5	1	9	27	III
Export	SkyChain to Altea copying of the numbers	5	3	5	3	5	7	28	II

Figure 10: KPI FMECA

As a result, there are 5 manual tasks in CCC in Finnair Cargo Cool Terminal that gained the most points. Therefore, there are 5 processes that can potentially be replaced and then automated by RPA. The "WB are not automatically copied" task is the one that obtained the highest score out of all the manual processes in this research. The possibility that the company will gain an advantage if it implements RPA in their processes is the most likely.

6.2 Answers to the Research Questions

The research questions that had to be answered throughout the research were stated to be the following:

- What processes (tasks) completed by human-beings in Finnair's Cool Terminal can be replaced with the RPA?
- What are the monotonous processes in Finnair's Cool Terminal?
- How exactly can they be outlined as simple enough for RPA?

In order to come to the definite conclusion, all the answers to the questions need to be presented clearly.

<u>What processes (tasks) completed by human-beings in Finnair's Cool Terminal can be replaced with the RPA?</u>

In order for this research to be complete, an answer to the main question of this thesis is that potentially there are 3 tasks executed by the CCC employees in Finnair's Cool Terminal that can be replaced with the RPA. Information on Wide Body aircrafts ought to be copied from the database to an online excel file manually. Also, the workers have to rewrite the Bulk ULD code and Gross Weight manually from SkyChain to Altea. Last but not least, the employees have to check in SkyChain, in Flight Release, if there is a cargo and put this information in excel file: C/NIL meaning Cargo/No Cargo. (Usually for NB – Narrow Body Aircrafts). What they have in common on the FMECA table is that they all have rather influential risk if a person makes a mistake in these processes. Transferring information is an extremely easy task for the RPA. If Finnair decides to implement software robot in these processes, then, besides the fact that they will protect themselves from unnecessary risks, the workers will also benefit from the fact that the time that is spent daily on these tasks would be significantly reduced.

What are the reoccurring processes in Finnair's Cool Terminal? How exactly can they be outlined as simple enough for RPA?

The gathering of information during a qualitative study was accomplished by analyzing articles about RPA presented on the online academic databases, including the works of authoritative in this field, Professor of Technology Work and Globalization Leslie P. Willcocks, who has been intensively studying this topic for many years. Also, with the help of Finnair's Cargo corporate information, the author has been familiarized with the internal processes of the company. Thus, simple processes were defined not only by the fact that there are reoccurring and repetitive processes declared by the CCC employees, but also based on what exactly RPA can work with.

Explaining to the terminal workers during the workshops why a potential implementation of RPA is needed and how it can help them, employees immediately understood what processes on the computer take their time, what they are uncomfortable with, or where they often make mistakes. There were outlined 14 processes, which is not considered as a significant amount. However, most of the times, the workers execute a diverse and unique job which requires human decision-making. It is important to mention for future studies that during the workshops, there was revealed the fact that almost everyone declares that they are annoyed that the databases with which they work every day are not compatible. And basically, that was the problem, because the CCC employees waste their time transferring or copying information from one place to another. All monotonous tasks that have been declared by employees, are documented above.

7 Discussion

The current research was believed to bring value to the case company. The outcomes of the thesis have been stated clearly and proved correct, thus, meant to positively influence the company’s working flow and efficiency. Finnair Cargo is capable of achieving at least three important changes after the implementation – a colossal decline in any possible human error while plotting the data in, increase the satisfaction of employees and speed accelerate the cargo handling processes.

Despite the fact that it was based on CCC in Cool terminal, the analysis of the results showed that the similar actions could be applied to other departments of Finnair and Finnair Cargo. The criteria for evaluating the monotonous processes for potential implementing of RPA could be helpful for Finnair in decision-making regarding the similar processes.

8 Suggestion for Future Studies

In addition, the further research is suggested with the incline on quantitative data and analysis.

This thesis work’s goal was to analyze existing processes and determine weak point, however, immediate implementation requires a deeper analysis from the financial perspective. Cost efficiency as well as expanded list of the other performance KPIs is required to be studied.

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Appendices

Appendix 1. Interview Questions

1. Could you please first shortly introduce yourself? Tell me about your job in Finnair Cargo. What do you do? Do you have a team?

2. Before you implemented RPA in Cool Terminal, why did you think that RPA would be useful at all?

3. When did you start planning implementation of RPA?

4. How long did it take from the idea to the planning and from the planning to the pilot?

5. How many cases did you have in mind that might be also replaced with RPA? What are these cases?

6. How did you choose that Special Handling Code assignment is the one that should be replaced with RPA first?

7. What strategy did you use to make it successful? (Step by step)

8. What, in your opinion, was crucial in making this case successful?

9. Do you think that this strategy/information might fit all the possible future cases in Cool Terminal?

10. What kind of roles did supplier and the team of Finnair have?

11. What challenges did you have during the PoC (proof of concept)?

12. What are the benefits of implementing RPA to the Cool Terminal? To Finnair Cargo?

13. Do you want to add anything?

14. What do you think can help me in my research?

Appendix 2. Finnair Cargo Process Map

Appendix 3. Finnair Cargo Global Freight Logistics Sub-processes

Appendix 4. Freight In Cool Terminal