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Deployment of Robotic Process Automation for order handling process in a case company

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ABSTRACT:

Digitisation has been and still is one of the challenges for organizations as technologies quickly develop. This research examined the applicability of robotic process automation (RPA) for the automation of the order handling process. RPA supports digital transformation by being one of the best technologies to allow companies to address challenges in operational work across all industries and functions. The case company wanted to discover what robotic process automation means and how it could automate its order handling process. The challenges of the case company's order handling process are that it is manual work, which makes the process bound to persons, and there are many instructions for employees to remember.

The research method used is information system design, a comprehensive approach to understanding and improving processes. The empirical part of the study uses semi-structured interviews as a data-collection method. Eight employees with different expertise were initially considered. However, to ensure a focused and in-depth analysis, six individuals were selected for the study. The interviews provided a deep understanding of the current process and allowed for a thorough analysis of the identified challenges. Also, the case company's instructions and manuals were used as a data source. Using the gathered information, it was determined which of the challenges could benefit the use of robotic process automation.

The goal was to suggest which tasks should be automated to create a more efficient order handling process. Automating the order handling process using RPA is expected to streamline the processes and help address the identified challenges by reducing manual work. Reducing manual work saves employees time and helps with workload balancing. Also, less manual work helps with the challenge of too many things to remember as the software robots conduct the tasks. Automating manual actions could reduce the potential human errors as software bots are reliable when coded correctly.

The next step after the study is implementing the suggested automation with the help of robotic process automation experts. This study was limited to robotic process automation, which is defined as application programs. Using artificial intelligence-based RPA in process automation is recommended as a subject for further research, taking into account the order handling process.

KEYWORDS: Business processes, automation, robotics, process assessment, digitisation

VAASAN YLIOPISTO
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TIIVISTELMÄ:

Digitalisaatio on ollut ja on edelleen yksi organisaatioiden haasteista teknologioiden nopean kehittymisen myötä. Tässä tutkimuksessa tarkasteltiin ohjelmistorobotiikan soveltuvuutta tilaustenkäsittelyprosessin automatisointiin. Ohjelmistorobotiikka tukee digitaalista muutosta olemalla yksi parhaista teknologioista, joiden avulla yritykset voivat vastata operatiivisen työn haasteisiin kaikilla toimialoilla ja toiminnoilla. Tapausyritys halusi selvittää, mitä ohjelmistorobotiikka tarkoittaa ja miten se voisi automatisoida tilaustenkäsittelyprosessinsa. Haasteena tapausyrityksen tilausten käsittelyprosessissa on se, että kyseessä on manuaalinen työ, joka tekee prosessista ihmisiin sidotun, ja työntekijöillä on monia ohjeita muistettavana.

Tutkimusmenetelmänä on tietojärjestelmäsuunnittelun tutkimusmetodi, joka on kokonaisvaltainen lähestymistapa prosessien ymmärtämiseen ja parantamiseen. Tutkimuksen empiirisessä osassa käytetään tiedonkeruumenetelmänä haastatteluja. Aluksi harkittiin kahdeksaa työntekijää, joilla oli eri asiantuntemus. Kohdistetun ja syvällisen analyysin varmistamiseksi tutkimukseen valittiin kuitenkin kuusi henkilöä. Haastattelut antoivat syvän ymmärryksen nykyisestä prosessista ja mahdollistivat perusteellisen analyysin tunnistetuista haasteista. Tietolähteenä käytettiin myös tapausyhtiön ohjeita ja muita asiakirjoja. Kerätyn tiedon perusteella selvitettiin, mitkä haasteista voisivat hyödyntää ohjelmistorobotiikan käyttöä.

Tavoitteena oli ehdottaa, mitkä tehtävät tulisi automatisoida tehokkaamman tilaustenkäsittelyprosessin luomiseksi. Tilaustenkäsittelyprosessin automatisointi ohjelmistorobotiikalla odotetaan virtaviivaistavan prosesseja ja auttavan vastaamaan tunnistettuihin haasteisiin vähentämällä manuaalista työtä. Manuaalisen työn vähentäminen säästää työntekijöiden aikaa ja auttaa työmäärän tasapainottamisessa. Manuaalisen työn vähentäminen helpottaa liian monien muistettavien asioiden haastetta ohjelmistorobottien suorittaessa tehtäviä. Manuaalisten toimien automatisointi voi vähentää mahdollisia inhimillisiä virheitä, koska ohjelmistobotit ovat luotettavia, kun ne on koodattu oikein.

Seuraava askel tutkimuksen jälkeen on ehdotetun automaation toteuttaminen ohjelmistorobotiikan asiantuntijoiden avulla. Tämä tutkimus rajoittui ohjelmistorobotiikkaan, jotka määritellään sovellusohjelmiksi. Tekoälypohjaisen ohjelmistorobotiikan käyttöä prosessiautomaatiossa suositellaan jatkotutkimuksen aiheeksi tilaustenkäsittelyprosessi huomioiden.

AVAINSANAT: Liiketoimintaprosessit, automaatio, robotiikka, prosessiarviointi, digitalisaatio

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Abbreviations

RPA	Robotic Process Automation
HR	Human Resources
ERP	Enterprise resource planning
AI	Artificial intelligence
IA	Intelligent automation
BPM	Business process management
OH	Order handling
OC	Order clearance
SF	Salesforce
OMS	Order management system
IS	Information system
IT	Information Technology
VC	Variant code
VSD	Variable speed drive
GUI	Graphical user interface

1 Introduction

1.1 Study background and identified study gaps

Digitization has been and still is one of the challenges for organizations as technologies quickly develop. Robotic process automation is seen as a promising process automation technology in the research field. It is used in the digital transformation of business processes (Gómez Gandía et al., 2024). RPA is a component of digital transformation as it allows organizations to automate processes, improve accuracy and release human resources to do more strategic tasks. According to Gómez Gandía et al., RPA supports digital transformation by being one of the best technologies to allow companies to work on challenges in operational work across all industries and functions. Using software robots allows employees to focus on more essential processes and reduce errors in data analysis. RPA provides analytical capacities for big data from which organizations can gain expertise on their business patterns or how their workflows function. Organizations can utilize this information to endorse digital strategies to make their processes more productive and efficient. Previous studies show that RPA is suitable for automating business processes if selection criteria are considered. In the study conducted by Aguirre and Rodriguez (2017), they used processes that were low on cognitive requirements, high volume, needed access to multiple different systems, limited in exception handling, and prone to human error.

This research primarily has a valid practical point of view in bringing out the latest knowledge of robotic process automation and the previous studies of the applicability evaluation of RPA as a basis for empirical research. The study aims to bring new information to experts in IT and order handling about RPA and the practice of evaluating its application in the automation of both business processes and order handling tasks. RPA as a topic is interesting from both a scientific and a practical point of view. From a scientific point of view, this study is needed as RPA has only been studied a little in the application context of order handling. Currently, the study on RPA in the order handling process is limited. There is one study on using RPA to automate order handling in an

organization by Santasärkkä (2022). In that case, the process was manual, mainly using emails and only partially using the ERP system. There are insufficient connections between different RPA tools and order handling to solve the problems in the case company's order handling, which are presented in the Chapter 1.3.

This study is conducted as an Information system design study for the case company. The case company wanted to discover what robotic process automation means and how they could automate their order handling process. The thesis aims to select and design a Robotic process automation tool or workflow to enhance the case company's current order handling and clearance process. The study examines robotic process automation as a concept, determines the handling process's current status and challenges and identifies suitable automation targets from the processes and tasks of the order handling process. These presented perspectives were the starting point for this research. The points of view are supported by the results presented by previous studies, where RPA is suitable for automating processes that are implemented according to rules so that the software robot performs defined tasks in the same way as human users have previously conducted them.

1.2 Case company

The case company is operating in the electrification, motion and automation business. It was established in 1988. The company is a large enterprise with a net income of 2.5 billion USD in 2022. This study focuses on the motion business area, specifically electrical motors. The case company is one of the market leaders in the motion business. It provides optimal solutions and an extensive selection of applications in all industry segments. The product portfolio is developed according to the needs of the focus market and case company's customers. The thesis focuses on one of the case company's factories located in Finland. It manufactures customized motors that provide its customers with a wide range of possibilities.

1.3 Research problem

This study focuses on the first part of the case company's supply chain process, order handling and clearance. The order handling process includes manually checking that orders match with quotations and are possible to produce before orders can be confirmed and released for the following tasks in the supply chain. Order handlers cooperate with order clearance engineers and mechanical engineers, as the order handling process includes order clearance. Employees use multiple applications and systems to perform the steps needed to check and confirm the orders. From the case company's confirmed order lines, 90% are processed manually. Therefore, the process is bound to the person. Manufacturing special motors creates challenges for order handling and clearance as motors are diverse and batch sizes are small.

When it comes to order handling, the challenges are that the process is bound to persons, and there are case-by-case instructions. As most orders are manually processed, employees have to focus on order confirmation and clearance. They do not have enough time to focus on more strategic tasks where their expertise is needed. Instructions can vary for different customers, projects or orders. Employees have to remember many special instructions therefore, automation is expected to enhance the process and develop a more efficient order handling process.

1.4 Study aims and identified research questions, scope and limitations

This research aims to examine the applicability of robotic process automation to the automation of the order handling process. The study's aim is to analyse how RPA can be used to automate and enhance the case company's order handling process. This thesis has three main research questions formulated based on the study's aim. Research questions aim to determine robotic process automation as a concept and identify suitable automation targets from the processes and tasks of the order handling process. The thesis aims to enhance the case company's current order handling and clearance process by answering the following questions:

1. What key elements need to be considered when implementing RPA?
2. What is the current state of the case company's order handling process?
3. How to improve an order handling process with RPA?

The literature review answers the first question. It defines robotic process automation as a concept and provides the correct criteria to consider when automating the order handling process using robotic process automation. The second question gives a more detailed caption of the current order handling process using process charts and challenge analysis. It is used to define which parts could be automated with RPA. The last question is answered in the empirical part of the thesis. It will define the suggestion for robotic process automation tool and workflow to enhance the order handling and clearance process.

The study's scope is the case company's order handling process. A detailed focus point is set based on the findings in the literature review and determining the case company's current order handling process. The order handling process also includes the order review process, which is not included in this study. This research is limited to dealing with business processes from the point of view of process automation. Robotic process automation is limited to software robots without any artificial intelligence (AI) components. This means application programs that automate business processes or tasks selected by specific criteria. The thesis does not include implementing or testing the selected RPA tool or workflow. Limitations were necessary to maintain the purpose and manageability of the research.

1.5 Research structure

This study's structure comprises six chapters: introduction, literature review, methodology, results, discussion and conclusions. The introduction outlines the study by presenting the importance of the thesis, the case company, the research topic, the research question, scope and limitations. Chapter 2 presents a systematic literature review. It

defines and provides background on robotic process automation and the utilization of RPA in the automation of business processes. It also presents using RPA to develop business processes.

The third chapter describes the implementation of this study in more detail. It provides an overview of the research methodology and data collection methods and details the research process. The aim is to present the academic approach and research techniques used to collect and analyse data. The results of the study will be introduced in chapter four. First, an analysis of the current state of order handling and clearance is presented. Next, the objectives of the solution are introduced. The analysis and objectives of the solution are based on the employee interviews. Then, the robotic process automation design and designing process is presented. The fifth chapter reflects on the research questions and gives managerial implications to the case company. The study ends with a conclusion of all the findings.

2 Literature review

This chapter defines robotic process automation (RPA), provides a background of RPA, and discusses its use in automating business processes. The literature review is used as a knowledge base for the empirical part of this research.

2.1 Robotic Process Automation

Robotic Process Automation (RPA) is a technological approach to automate business processes (Tripathi, 2018, p. 9-11). Tripathi states that RPA uses software robots designed to mimic humans working with digital systems. It allows automating basic tasks and software robots can operate beyond various systems and applications without broad integration. According to Tripathi, software robots can, for example, extract information and interpret data, process data or generate text answers. Robotic process automation tools are programmed to operate on different individual workstations. The software robots can execute tasks, such as clicking applications, pasting, copying, reading forms or typing texts. Robotic process automation is used to streamline workflows and increase operational efficiency by reducing unnecessary manual work and workflow times (Sobczak, 2021, p. 125-126). Figure 1 presents the process relations with robotic process automation.

Robotic Process Automation (RPA) is used in the digital transformation of business processes. According to Mafrolla et al. (2019, p. 2-7), RPA is a component of digital transformation because it allows organizations to automate processes, improve accuracy and release human resources to do strategic tasks. RPA is used to automate tasks that are high-volume, demanding and time-consuming (Siderska, 2020, p. 23-28). According to Siderska, these tasks can be order processing, HR processes, data transferring or invoicing.

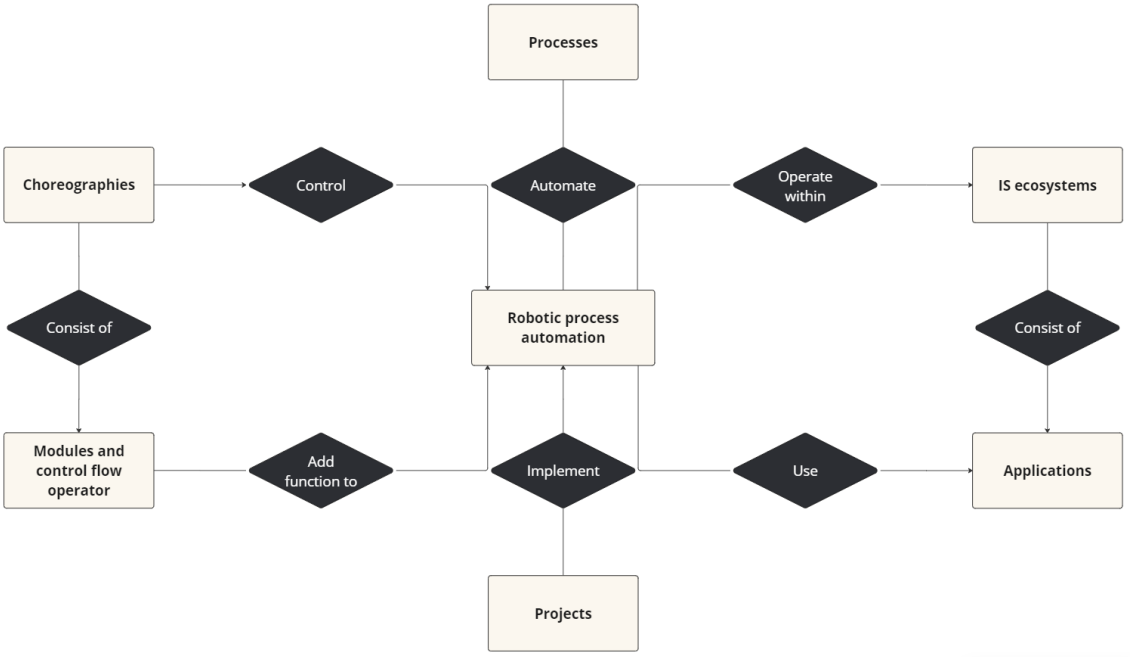

Figure 1. The nature of RPA (Hoffman et al., 2020, p. 100, adapted).

Siderska (2020, p. 23-28) states that robotic process automation supports digital transformation by being one of the best technologies to allow companies to work on challenges in operational work across all industries and functions. Using robots will reduce manual work which enables employees to focus on more essential processes and reduce errors in data analysis. According to Siderska, robotic process automation provides analytical capacities for big data from which organizations gain expertise on their business patterns or how their workflows function. Organizations can utilize this information to endorse digital strategies to make their processes efficient and accurate.

2.2 RPA technology and tools

Robotic process automation has three main components: Software bot, RPA studio and RPA orchestrator (Tripathi, 2018, p. 15-16). These create the platform for RPA. Connections between these are shown in the figure 2.

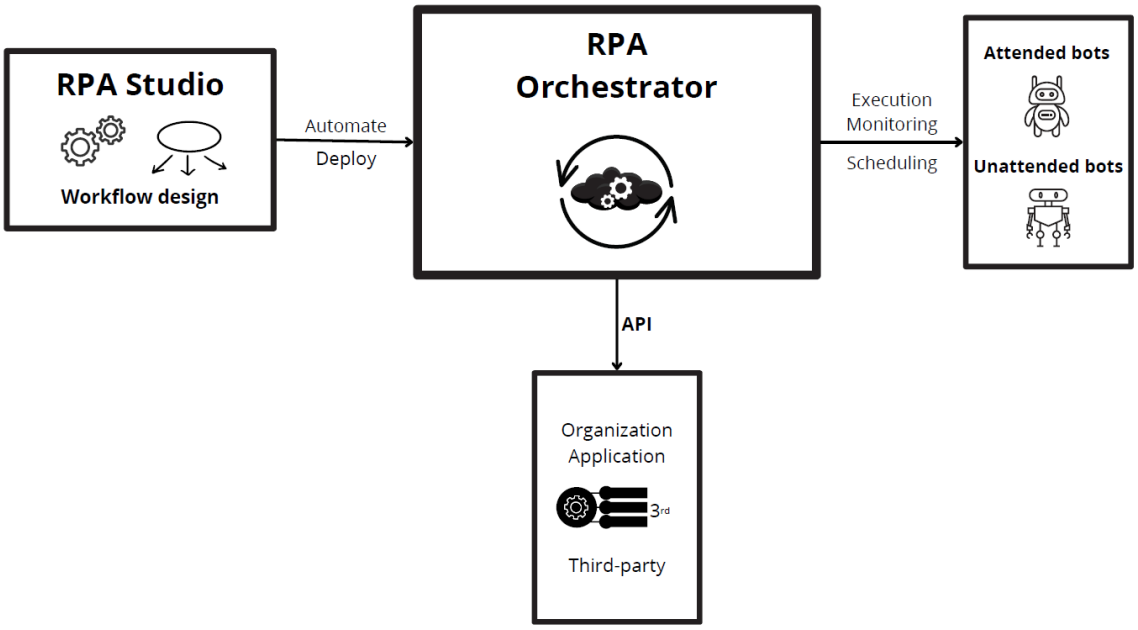

Figure 2. RPA components (Choi et al., 2021, p. 4, adapted).

Software robots can be attended or unattended (Choi et al., 2022, p. 2-5). Attended bots have a role in assisting humans. The robot processed a large mass of data and routine, repetitive tasks, such as transferring and combining data between different systems (Tripathi, 2018, p. 15-16). A human user performs unstructured parts of the process, such as converting information into a structured form for the robot (Choi et al., 2022, p. 2-5). The robot completes the work by processing the structured data, checking their correctness, retrieving information from other systems, creating a decision letter in the case and finally notifying the human user that the work has been completed.

The unattended software robot can automatically execute even complicated and complex business rules and processes (Choi et al., 2022, p. 2-5). The robot is also able to work in several systems at the same time, transferring information from one system to several systems at the same time. Thanks to these abilities, robots can also handle the tasks of the entire process. According to Choi et al., some parts of the process or tasks may require a conscious human way of handling information and intuitive or situational reasoning, which a robot cannot perform.

The RPA studio is the development environment where users create and configure automation workflows (Choi et al., 2022, p 2-5). It is a GUI tool that allows users to design and define the steps of a process to be automated. Users can create automation workflows by dragging and dropping activities onto a canvas, connecting them to determine the sequence of steps. Users can use these activities to perform various operations, such as data manipulation, application interaction and file handling.

The orchestrator acts as a control center for managing, scheduling, and monitoring the bots (Choi et al., 2022, p. 2-5). It facilitates communication between bots, assigns tasks, and ensures overall coordination within the RPA ecosystem. According to Choi et al., the control room provides robot management capabilities. It monitors and controls a robot's operation in a network. Orchestrators can start/stop robots, make schedules, maintain code, transfer robots to other tasks, and manage credentials.

There are different available RPA tools for organizations to choose from. Gartner (2021) presents visually available tools (see Figure 3). There are leaders from which Uipath, Automation Anywhere and Blue Prism were selected suitable for this study as they are popular and prevalent. To present other available tools, Pegasystems is introduced from the visionaries. Table 1 summarizes selected robotic process automation tools and their advantages and limitations.

Table 1. RPA tools.

Tool	**Advantages**	**Limitations**
Uipath	Seamless integration, customer friendly (Ribeiro et al., 2021).	Not designed for small businesses (Khan, 2020).
Automation Anywhere	Has IA capabilities, pre-built software bots, flexible (Ribeiro et al., 2021).	Complex UI, designed for finance, banking and IT, not designed for small businesses (Khan, 2020).

Tool	Advantages	Limitations
SS&C Blue Prism	Effective management, precise and scalable (Madakam et al., 2019).	Focuses on governance and compliance, only for back-office automation (Khan, 2020).
Pegasystems	Integrates RPA to BPM, ability to unify bots and employees, low-code development (van der Aalst et al., 2018).	New system with less experience (van der Aalst et al., 2018).

Figure 3. Magic Quadrant for RPA (Gartner, 2023).

2.3 Suitable processes automated with RPA

Robotic process automation is suitable for automating business processes (Moreira et al., 2023, p. 248-252). Despite this, not all processes are automatically best to automate with RPA or other automation technology. Moreira et al. state that the most frequently used and most significant evaluation criteria are the high volume of the process, compliance with the standard, the number of systems used simultaneously, and the stability of the process systems.

High-volume, standard and routine tasks are optimal for configuring the software robot (Costa et al., 2022, p. 7-9). Standard processes rarely change, which results in only minor needs for robotic process automation maintenance work. The standard process includes detailed descriptions of the procedures used in the process and the different application software. According to Costa et al., high-volume processes are suitable for RPA when considering the possibility of cost savings and improving the efficiency of the organization's operations.

According to Asatiani & Penttinen (2016, p. 67-74), when evaluating the suitability of a process, it should be considered whether the process requires the user's manual work or reasoning ability. Robotic process automation automates repetitive and simple tasks performed by human users that do not require reasoning ability. In assessing the amount of manual work, Anagnoste (2018, p. 57-61) states that the more people need to perform manual work, the more profitable it is to automate the process with robotic process automation.

The processes have to meet the following criteria: is the process highly based on business rules, and does the process digitally structure data (Costa et al., 2022, p. 7-9). If a process is based on business rules, it is easier to automate as the rules are documented or can be documented. Costa et al. state that the terms of business rules are needed to express the decision-making logic of processes. A software robot needs a precisely described rule for every action it performs. Robotic process automation can process digital,

structured information with clear rules without excessive amounts of exceptions in the process.

The process to be automated can have a connection to one or more information systems or application software (Santos et al., 2020, p. 405-415). The manual work of a human user increases the risk of errors when the user has to use several information systems while performing their work tasks. At the same time, work efficiency decreases. According to Santos et al., the software robot can handle several systems simultaneously. Also, it takes more time for a human user to transfer the data from one field to another in different applications than the robot.

A stable system environment means executing the process with the same information systems, which remain the same each time the process is executed (Asatiani & Penttinen, 2016, p. 67-74). Anagnoste (2018, p. 57-61) states that when evaluating the suitability of a process for robotic process automation, the question is how often changes occur in related systems, such as new software versions. This also has a direct impact on the maintenance costs of robotic process automation as updating software bots to comply with new version can be costly. These fluctuations usually cause changes to the user interface or database structure, therefore conducting modifications to the software robots.

Asatiani and Penttinen (2016, p. 67-74) emphasize the simultaneous use of several evaluation criteria as a base for assessing suitability in processes. Using various evaluation criteria can help the organization's strategic decision-making when deciding whether to adopt robotic process automation to automate processes and help create effective results. The more evaluation criteria process fulfil, the more likely the robotic process automation is successfully accomplished.

2.4 Benefits of RPA

There is a decent amount of research on the benefits of robotic process automation. Robotic process automation has multiple benefits for business processes, which are summarized in Table 2. This chapter explains these benefits in detail, focusing on business process automation.

Table 2. Benefits of RPA.

Benefit	**References**
Efficiency in business processes	Aguirre & Rodriguez (2017), Anagnoste (2018), Costa et al. (2022), Flechsig et al. (2022), Kokina & Blanchette (2019), Mafrolla et al. (2019), Marciniak & Stanisławski (2021), Siderska (2020), Sobczak (2021), Tripathi (2018)
Productivity	Aguirre & Rodriguez (2017), Costa et al. (2022), Flechsig et al. (2022), Jovanović et al. (2018), Kokina & Blanchette (2019), Mafrolla et al. (2019), Marciniak & Stanisławski (2021), Moreira et al. (2023), Santos et al. (2019), Siderska (2020), Tripathi (2018)
Accuracy in business processes	Aguirre & Rodriguez (2017), Costa et al. (2022), Flechsig et al. (2022), Kokina & Blanchette (2019), Jovanović et al. (2018), Mafrolla et al. (2019), Marciniak & Stanisławski (2021), Moreira et al. (2023), Santos et al. (2019), Siderska (2020), Sobczak (2021), Tripathi (2018)
Scalability	Flechsig et al. (2022), Kokina & Blanchette (2019), Mafrolla et al. (2019), Santos et al. (2019), Tripathi (2018)
Better data analytics	Kokina & Blanchette (2019), Marciniak & Stanisławski (2021), Moreira et al. (2023), Siderska (2020), Tripathi (2018)
Employee satisfaction	Costa et al. (2022), Flechsig et al. (2022), Mafrolla et al. (2019), Moreira et al. (2023), Tripathi (2018), Kokina & Blanchette (2019)

Benefit	References
Cost-effective	Aguirre & Rodriguez (2017), Anagnoste (2018), Asiatiani & Penttinen (2016), Costa et al. (2022), Czarnecki et al. (2021), Flechsig et al. (2022), Huang & Vasarhelyi (2019), Jovanović et al. (2018), Kokina & Blanchette (2019), Marciniak & Stanisławski (2021), Moreira et al. (2023), Santos et al. (2019), Siderska (2020), Sobczak (2021), Tripathi (2018)

Robotic process automation improves productivity and efficiency in business processes (Flechsig et al., 2022, p. 5-7). According to George et al. (2021, p. 122), RPA automation releases human resources by robots that implement unnecessary tasks. Employees' expertise is wasted on mindless tasks, such as copying or pasting data between information systems. George et al. highlight that robotic process automation improves productivity by releasing employees to focus on more critical processes or tasks. RPA enables swift data exchange internally and externally (Flechsig et al., 2022, p. 5-7). According to Flechsig et al. robotic process automation makes processing efficient and helps to create a flexible way to interact with customers. Kokina and Blanchette (2019, p. 7-9) state that productivity is improved because software robots can operate accurately 24/7 without human supervision and can perform large amounts of work in a shorter time than humans.

Robotic process automation creates consistent accuracy in business processes (Flechsig et al., 2022, p. 5-7). Software bots use predefined rules to create objective outputs when programmed correctly. Flechsig et al. highlight that business workflows are optimised by software bots processing data accurately and consistently. They argue it eliminates human errors in organizations' workflows and reduces double work. When using software robots, the need to redo the work is reduced as tasks are performed correctly the first time. According to Flechsig et al., this leads to better customer satisfaction as service is accurate and rapid.

RPA enhances scaling opportunities (Tripathi, 2018, p. 11-14). RPA helps workflows with changing or irregular workloads. Tripathi argues that software robots can perform any volume of tasks by operating 24/7. He states that if there are too many tasks for bots, the amount of bots can be increased. For example, organizations can obtain different amounts of orders at different times of the year. To manage this without RPA, the organization may have to reassign the workforce from other business processes. According to Tripathi, RPA can adapt to changing volumes by scaling up or down without additional workforce.

RPA helps with data analytics (Tripathi, 2018, p. 11-14). Tripathi explains that software robots can collect analytical data and business insights in processes by recording each task's metadata. For example, this can help predict volumes and task-performing abilities as data received is analysed. Tripathi states that robotic process automation can pinpoint process flaws and help locate where change is needed. These can reveal the requirements for assigning the workforce to different tasks or using more automation. More analysed data also helps with decision-making as it is usually data driven (Janssen et al., 2017, p. 338-345).

Robotic process automation enhances employee satisfaction (Flechsig et al., 2022, p. 5-7). As previously stated, RPA automation releases employees to focus on more essential processes by bots performing time-consuming and manual tasks. Flechsig et al. state that when using robotic process automation to automate manual tasks, employees can use their expertise on more strategic tasks and feel fulfilled with their work. Employees can focus on strategic tasks that create value for the organization. For example, Purchasing and Supply Management professionals are happy not to perform manual tasks and can focus on strategic tasks such as communicating with suppliers rather than regular operational work.

Robotic process automation is cost-effective due to all the benefits presented. RPA promotes operational cost savings by eliminating errors, expediting process cycle times,

enhancing productivity, enhancing decision-making, optimising the workforce and scaling business processes. Also, robotic process automation can reduce audit costs by streamlining audit processes (Huang & Vasarhelyi, 2019). Software robots collect, analyse and report data automatically. According to Huang and Vasarhelyi, bots can generate audit reports by gathering important information from various systems and applications in the organization.

2.5 Challenges and limitations of RPA

There is still significantly less research into the challenges associated with using robotic process automation, such as risks or possible disadvantages than previously described benefits. Table 3 summarizes the challenges. Challenges are explained in more detail in this chapter.

Table 3. Challenges of RPA.

Challenge	**References**
Unsuitable processes	Anagnoste (2018), Asiatiani & Penttinen (2016), Choi et al. (2022), Costa et al. (2022), Flechsig et al. (2022), Mafrolla et al. (2019), Marciniak & Stanisławski (2021), Moreira et al. (2023), Santos et al. (2019), Siderska (2020)
Errors	Flechsig et al. (2022), Marciniak & Stanisławski (2021), Moreira et al. (2023), Siderska (2020)
Unstructured/incorrect data	Costa et al. (2022), Flechsig et al. (2022), Marciniak & Stanisławski (2021), Moreira et al. (2023)
Employee suspicion	Anagnoste (2018), Asiatiani & Penttinen (2016), Costa et al. (2022), Flechsig et al. (2022), Moreira et al. (2023), Sobczak (2021)
Need for maintenance	Flechsig et al. (2022), Marciniak & Stanisławski (2021), Moreira et al. (2023)
Stakeholder management is not considered	Anagnoste (2018), Flechsig et al. (2022), Moreira et al. (2023), Sobczak (2021)

The challenge in robotic process automation is identifying processes to be automated (Asiatiani & Penttinen, 2016, p. 68-69). As stated previously, not all processes are suitable for automation with robotic process automation. According to Asiatiani and Penttinen, it is essential to identify the right processes to be automated to benefit from the repetition. Choosing the wrong processes can result in software robots being incapable of handling the process tasks because of missing or incorrect regulations (Flechsig et al., 2022, p. 7-9). This can cause unhandled tasks or humans having to step in to process missing tasks, decreasing savings. Software robots need clear instructions on all the tasks to operate correctly. According to Flechsig et al., if there is not a comprehensive understanding of the chosen business process, software bot modeling is due to cause errors.

For RPA to succeed, data have to be high-quality and consistent. (Costa et al., 2022, p. 7-9). Structured data has to be stored digitally, as software robots cannot process paper or unstructured documents. Risk can also materialize if the robot repeatedly processes tasks based on incorrect data. Data should continuously be updated using the latest instructions and manuals in the organization. According to Costa et al., when process descriptions are incorrect, it increases additional personnel costs for the organization and potential loss of income.

Employees may be suspicious of the changes in job descriptions made by RPA (Sobczak, 2021, p. 127). Software robots can be perceived as a threat to their employment. Using transparent communication can eliminate and reduce risks related to resistance to change and staff frustration (Moreira et al., 2023, p. 248-252). Stakeholder's roles should be reviewed in the automation process, according to Moreira et al. Considering RPA, stakeholders are the company's internal stakeholders, such as employees from different departments, and external stakeholders, such as customers and partners. For example, the IT department should be committed to using RPA in the early stages from the point of view of future maintenance needs. Anagnoste (2018, p. 57-61) states that

organizations should grant access to relevant information so that all parties understand the coming changes.

The benefits of robotic process automation cannot be assumed to be automatically achieved. Realizing the benefits is influenced by the organization's readiness for the method, the ability to accept it, and the delivery and implementation of RPA. According to Moreira et al. (2023, p. 248-252), robotic process automation needs maintenance after implementation. Regular execution checks should be performed to keep software bots running correctly and accurately. Checks also reduce the errors done by software robots running incorrectly.

2.6 RPA in business process development

The goal of businesses is to constantly develop and rebuild their processes to be cost-efficient and accurate. Robotic process automation and traditional automation are used to automate tasks (Jovanovic et al., 2018, p. 34-36). In the development of business processes, RPA will not replace heavy-structured IT systems. According to Jovanovic, RPA is a light-structured IT system that works as a complementary and helpful method in automating various business processes in different fields. It allows automating basic tasks and software robots can operate beyond various systems and applications without broad integration.

Both automation methods can be used in their suitable processes. According to Jovanovic et al. (2018, p. 34-36), these have different approaches, applications, and integration with other systems. Robotic process automation is used to automate existing processes that people have previously performed (Santos et al., 2019, p.405-415). The robot entirely or partly replaces people executing the process and logs in to other systems with usernames. Jovanovic et al. (2018, p. 34-36) claim that RPA is non-intrusive therefore, it can integrate seamlessly with various systems or applications without changes. They add that traditional automation uses APIs and programming to integrate

different systems, which usually requires more understanding, which can lead to the renewal of systems.

Jovanovic et al. (2018, p. 34.36) state that RPA uses software robots designed to mimic humans based on predefined rules, but traditional automation is a program following instructions, and it does not attempt to mimic human actions. They claim that RPA is usually more cost-effective than traditional automation because traditional automation needs more resources and training in the initial phase. Jovanovic et al. state that RPA and traditional automation have different applications. According to them, RPA usually automates specific tasks within the process, while traditional automation automates the whole process.

Business experts are usually responsible for the development of business processes with robotic process automation (Santos et al., 2020, p. 405-415). They define in the user interface, using drag-and-drop technology, how the software robot's workflow should work. This requires the IT department to ensure that it is possible to use robotic process automation by setting up environments and communication connections. Business representatives have the most information about business and related processes and tasks. This information is needed in connection with the definition of robotic process automation.

Traditional automation always requires the participation of software developers and the IT department because system integrations between several systems are often required. Santos et al. highlight that producing process automation with traditional automation takes longer than robotic process automation. According to Ylä-Kujala et al. (2023, p. 179-180), organizations should decide if their IT department can handle the robotic process automation or if they need an expert or a consultant to perform the automation process.

The key to using RPA in business process development is to design the development and implementation using a framework that specifies a classification system (Ylä-Kujala et al., 2023, p. 179-180). Process workflows and descriptions should be systematically mapped to understand the current tasks. Organizations should have an understanding of what they need when it comes to project phases, stages, and tasks. According to Ylä-Kujala et al., organizations can perform sensitivity checks before implementing robotic process automation to avoid failures in the project. Sensitivity analysis is used to challenge insufficient assumptions, which is a quick way to make the robotic process automation project more successful.

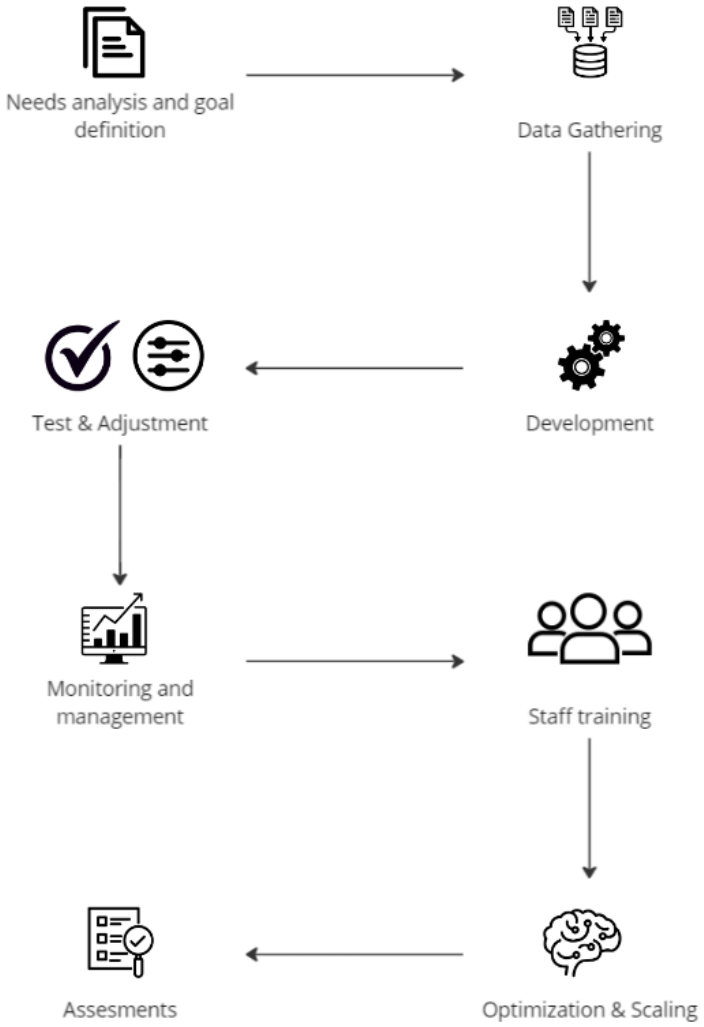

Figure 4. Essential steps to develop process with RPA (Nguyen et al., 2023, p. 4, adapted).

According to Nguyen et al. (2023, p. 4), there are required steps to implement robotic process automation in organizations (see Figure 4). When starting the implementation of RPA, organizations should conduct an analysis to determine which processes need automation to enhance the process. Organizations should consider what they want to achieve with robotic process automation and create a strategy to support it. The second step is to collect the information needed to deploy the analysis. Data can be gathered from information systems and other necessary sources.

Next, the RPA workflow should be designed using the strategy created previously. According to Nguyen et al. (2023, p. 4), Robotic process automation needs testing to see if the solution is effective or needs improvements. Testing should be conducted at intervals to ensure the system continues operating accurately. Employees should be instructed to use the tool to achieve the best results. Employees can report possible misfunctions when they have an understanding of the system. To get the best value for the investment in robotic process automation technologies, the organization should consider scaling the tool to other processes. RPA is highly scalable, as once it is implemented, it is easy to expand to other tasks or functions. At the end of the robotic process automation implementation process, organizations should assess the achieved RPA tool benefits. The results should be compared to the initial strategy, which parts were successful and which failed.

2.7 Summary

Robotic process automation uses bots to automate tasks across various systems and applications, increasing operational efficiency by reducing manual work. It's used in the digital transformation of business processes, allowing organizations to automate high-volume, demanding, and time-consuming tasks. RPA is suitable for automating business processes, especially those with high volume, compliance with the standard, the number of systems used simultaneously, and the stability of the process systems. High-volume, standard, and routine tasks are optimal for configuring the software robot. The

automated processes should be highly based on business rules and digitally structured data. The process to be automated can have a connection to one or more information systems or application software.

Robotic process automation improves productivity and efficiency by automating tasks and freeing up human resources to focus on more critical processes. It enables swift data exchange, improving processing efficiency. RPA creates consistent accuracy as software bots use predefined rules to process data accurately and consistently, reducing errors and double work. Robotic process automation enhances scaling opportunities as it can adapt to changing volumes by scaling up or down without additional workforce. RPA helps with data analytics as software robots can collect analytical data and business insights, helping to pinpoint process flaws and locate where change is needed. RPA enhances employee satisfaction by allowing employees to focus on more strategic tasks, increasing job satisfaction. RPA is cost-effective as it promotes operational cost savings by eliminating errors, expediting process cycle times, enhancing productivity, and reducing audit costs.

Not all processes are suitable for automation with robotic process automation. It's essential to identify the right processes to benefit from automation. For RPA to succeed, data must be high-quality and consistent. Software robots cannot process paper or unstructured documents. Employees may be suspicious of the changes in job descriptions made by RPA. Transparent communication can reduce resistance to change and staff frustration. The benefits of robotic process automation cannot be assumed to be automatically achieved. Realizing the benefits is influenced by the organization's readiness for the method, the ability to accept it, and the delivery and implementation of RPA. Regular checks should be performed to keep software bots running correctly and accurately.

Businesses aim to constantly develop and rebuild their processes to be cost-efficient. Robotic Process Automation and traditional automation are used to automate tasks,

each with different approaches and applications. RPA, a light-structured IT system, integrates seamlessly with various systems and is more cost-effective than traditional automation. Business experts usually develop business processes with robotic process automation, while traditional automation requires software developers and the IT department. The key to using RPA is to design the development and implementation using a framework that specifies a classification system and performing sensitivity checks before implementation.

In conclusion, RPA has the potential to significantly enhance business process automation, leading to improved productivity, efficiency, and accuracy. However, careful planning, execution, and continuous research and development are necessary to address challenges and limitations when using robotic process automation in an organization to realise its full potential.

3 Methodology

This chapter provides an overview of the research methodology and presents the research process. The aim is to present the academic approach and research techniques used to collect and analyse data. These ensure meeting the research objectives effectively.

The case company wanted to find out what robotic process automation means and how they could use it in the automation of their order handling process. The thesis target is to select and design an RPA tool and workflow to enhance the case company's current order handling process. According to Helo et al. (2019, p. 14-15), there is nomothetical and normative research. Nomothetical research explains the current situation and normative research is seeking future solutions. This research is normative as its main goal is to improve the order handling and clearance process in the future. Also, nomothetical methods need to be used to understand and analyse the current status and the challenges of the order handling and clearance process.

The thesis is an empirical study as the source information is qualitative data based on actual case company. The case company has assigned the research problem based on its challenges with its order handling and clearance process. A literature review was used as a base for the empirical research. Qualitative data is gathered by conducting employee interviews. The information from the interviews is base for the research. As the goal is to provide a technical solution, information system design was selected as the research method.

3.1 Information System Design

Information system design is used to create and enhance information systems (Helo et al., 2019, p. 27-28). Helo et al. highlight that a systematic approach is needed to analyse the current situation and create a technical solution to the problem. The goal is to create instructions for the programmers, but otherwise, Information system design has similar

characteristics to process development. According to Helo et al. (2019, p. 25-26), process development is used to analyse the current practices and challenges of the process and propose different ways to improve it. As the goal is to provide a technical solution, information system design was selected as the research method. According to Helo et al., user requirements interviews are one of the methods to collect the data to support the research.

Jones & Gregor (2004, p. 27-29) presents the framework for information system design presented in Figure 5. Observations of use with theory requirements are used to create information system principles and propose the developed information system. The cycle is used to improve the system features and explains how to use gathered information to advance the proposed information system design. All the blocks are needed to propose the solution.

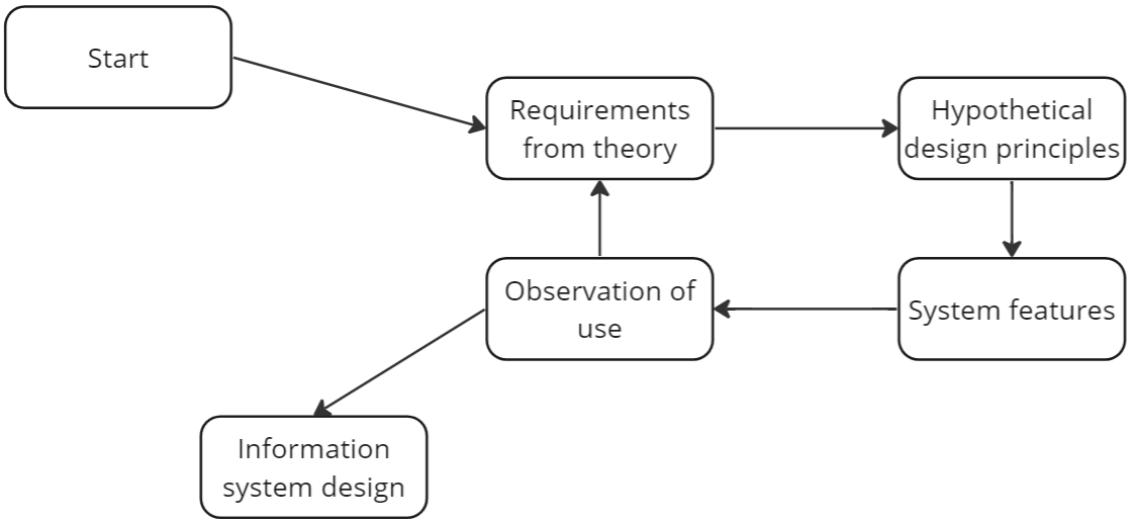

Figure 5. The framework for Information system design process (Jones & Gregor, 2004, p. 29, adapted).

Information system design can be done using methods from design science (Peffers et al., 2007, p. 27-29) Peffers et al. define the steps in IS design as defining the problem, defining objectives of the solution, designing and development, demonstration, evaluation and communication. These steps are used in this research as a base for the solution.

As implementation is not included in this study, the demonstration is not fully done. In Figure 6, all the steps and their relations are presented. The thesis focuses on Problem-Centered Initiation as the case company provided its problem, and the goal is to provide a solution to it. The research goal is to enhance the information system to solve the problem in the order handling process.

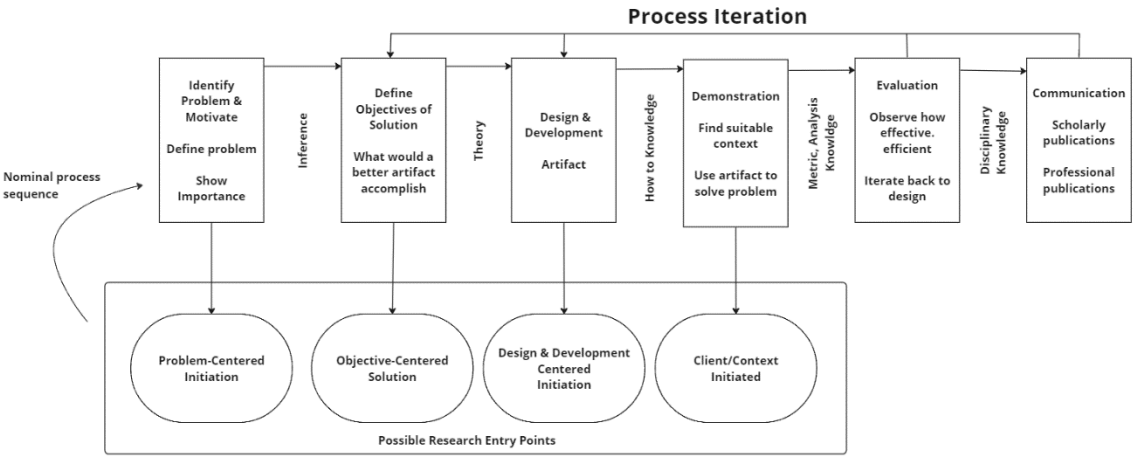

Figure 6. Information system design process (Peffers et al., 2007, p. 54, adapted).

Information system design can use seven guidelines presented in Figure 7. This research uses all the guidelines to conduct an effective research study in the field of information technology. The goal is to define and design the IS artifact (Hevner et al., 2004, p. 82-90). Artifact is used to solve the presented problem in the organization. IT artifact includes all the methods needed to develop and implement information systems. Hevner et al. remind that artifacts are not fully developed information systems, but rather innovations. These can define ideas, practices, technical capabilities, and products for effective and efficient analysis, design, implementation, and use of information systems. IT artifacts help organizations meet business needs.

Guideline	Description
Guideline 1: Design as an Artifact	Design-science research must produce a viable artifact in the form of a construct, a model, a method, or an instantiation.
Guideline 2: Problem Relevance	The objective of design-science research is to develop technology-based solutions to important and relevant business problems.
Guideline 3: Design Evaluation	The utility, quality, and efficacy of a design artifact must be rigorously demonstrated via well-executed evaluation methods.
Guideline 4: Research Contributions	Effective design-science research must provide clear and verifiable contributions in the areas of the design artifact, design foundations, and/or design methodologies.
Guideline 5: Research Rigor	Design-science research relies upon the application of rigorous methods in both the construction and evaluation of the design artifact.
Guideline 6: Design as a Search Process	The search for an effective artifact requires utilizing available means to reach desired ends while satisfying laws in the problem environment.
Guideline 7: Communication of Research	Design-science research must be presented effectively both to technology-oriented as well as management-oriented audiences.

Figure 7. Guidelines used in Information system design (Hevner et al., 2004, p. 83).

This study defines the problem in the case company and the goal is to provide a technical solution to the problem. Qualitative data is gathered from the employee interviews. The information from the interviews is used to analyse the current situation and challenges of the business process. Then, the technical solution is designed using the interview data. Lastly, the artifact is presented to the employees and management. Implementation is not part of this research.

3.2 Interviews

This study uses semi-structured interviews as a data-collection method. Interviews were selected as a data collection method as they are a qualitative research method and generally present individuals' understanding and experiences on specific topics. According to Myers & Newman (2007, p. 2-5), qualitative interviews are one of the most important data collection methods in qualitative research. In this study, interviews are a necessary

tool to collect user requirements and analyse the current status of the order handling process.

It was necessary to determine the needed sample size for the study. There are currently six employees in order handling and two employees in order clearance. Order clearance uses employees from the engineering department. They have cycles when different employees are doing OC, one employee from electrical engineering and one from mechanical engineering. In order handling, they all have different amounts of expertise therefore 6 persons were selected for the study. Selected employees have the most knowledge of their position and part of the business process. Selected employees are enough to analyse the current situation of the order handling process. Table 4 summarizes the information from the interviews conducted in the study.

Table 4. Summary of thesis interviews.

Interviewee	**Position**	**Knowledge area**	**Interview length**
I1	Order support manager	Order handling	29 min
I2	Customer support specialist and trade compliance officer	Order handling	20 min
I3	Customer Support Specialist and ERP Super User	Order handling	24 min
I4	Team leader of electrical Engineering	Order clearance	17 min
I5	Mechanical Engineer	Order clearance	34,5 min
I6	Electrical Engineer	Order clearance	26 min

In total of 6 interviews were conducted, of which 3 were completed in English and others in Finnish. Participants selected the most suitable language for the interview. All the interviews were recorded with permission from all the participants to help with the analysing process. The researcher made transcripts of each interview and completed the translation from Finnish to English from the recorded material.

The interviews were conducted remotely through the Teams application as it enabled to reach all necessary interviewees. As employees are using their computers to execute all tasks and can work remotely, it was reasonable to organize interviews completely remotely. Interviewees got the interview questions before the interview to ensure that they could be prepared. The interviews use a standardized interview guide covering the main topics and the question set is disclosed in Appendix 1. Preset open-ended questions set the frame for the interviews with the possibility to ask more detailed questions if needed. This allowed the interviews to have the same structure with the possibility of participants elaborating and specifying their answers.

At the start of the individual interview, the interviewees were told about the confidentiality of the study. The interviews will be transcribed and processed accordingly after in writing. The written material does not contain personal information or system information with the correct names. The interviewees were told that they could stop the interview in any situation. At the end of the research, the recordings of the interview and other material of the target organization will be destroyed and handed over to the case company as an appendix to the research report. The purpose of the study was explained to the participants. Finally, the progress of the interview and the themes discussed were also presented.

3.3 Study plan

This chapter presents the empirical study plan for this research. The study plan is based on the Information System Design process, presented in the Figure 6. A summary of the conducted study plan is presented in Figure 8. The research started with a planning phase. In this phase, the plan of the study was conducted with the cooperation of the case company. There were meetings with the management and employees of the order handling process to get an understanding of the research problem and the case company's requirements. The plan included research methodology, research questions, research problem and limitations.

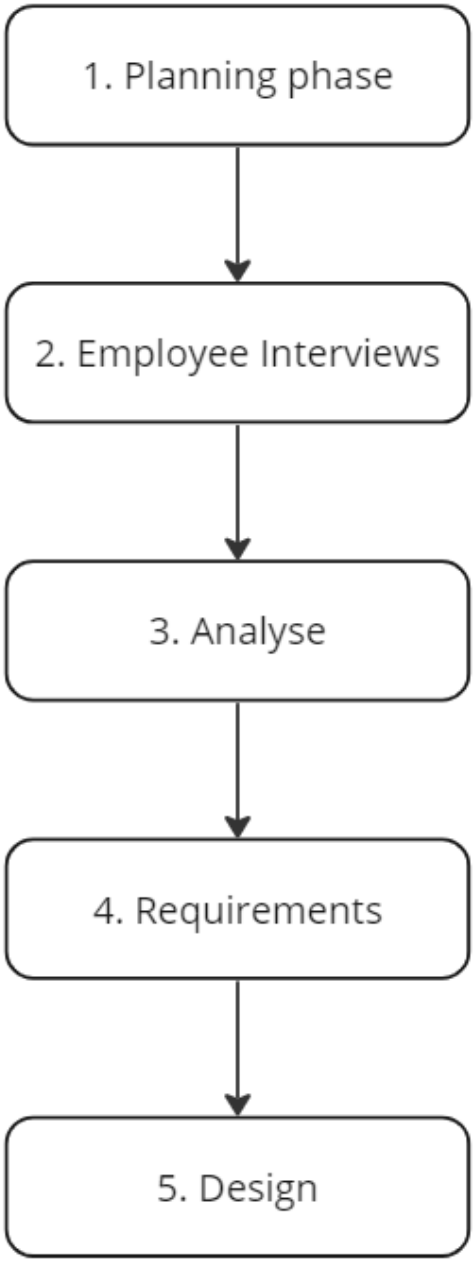

Figure 8. Presentation of the study plan (author).

Before starting the empirical study, a literature review was conducted as a base for the empirical research. As seen in figure 5., the literature review is used to gather all the needed requirements from the theory. This framework is used to find the critical requirements for robotic process automation. The literature review is also used to form the second phase, research interviews. Recent literature insights were used to create a

standardized interview guide covering the main topics and a set of questions. The main goal of the employee interviews was to gather enough data from the order handling process to analyse current practices and challenges. The research interview summary is presented in table 4.

The third phase was analysis, which used the interview data as a base. Also, the case company's instructions and manuals were used as a data source. In this phase, the goal is to identify the problem and show the importance of the research. This is done by providing insights into the current practices by drawing the process diagram and conducting a description of the process. The interviews were used to analyse the current challenges and decide which of the challenges could benefit from the use of robotic process automation.

The next phase in this study is objectives of the solution. The goal is to define the objectives of the solution and present what the artifact could improve in the process. This is done by selecting the process focus points. These are decided using the analysis information on challenges in the process. Process focus points are highlighted from the process diagram and presented how automating these parts could help the identified challenges in the process.

After analysis and objectives, the design phase is conducted. The goal is to use the analysis data to design and develop the artifact. This is done by creating instructions for the case company on which tasks could benefit automation and help with the identified challenges. Process focus points are presented in more detail than in the process diagram. Every individual task is presented using figures, and possible automation points are highlighted. The case company’s employees' expertise and manuals are used to present the tasks in detail. The solution is analysed, for example, if it is possible to produce, and if it is a viable answer to the identified challenges.

In the last phase, the solution is presented to the case company's order handling management and employees. Also, instructions on how to continue the automation process are provided. Solution implementation is not part of this research, and it is done only on a conceptual level.

4 Results

This chapter presents the study's results, which were collected as presented in Chapter 3. First, an analysis of the current state of order handling and clearance is presented, following the introduction of the objectives of solution. The analysis and solution objectives are based on the interviews. Then, using the collected information, the suggestion of optimal task automation with robotic process automation is presented. Finally, this chapter ends with a summary of the research results.

4.1 Data analysis

This chapter presents the analysis of the order handling process. The goal is to identify the problem and show the importance of the research. This is done by providing insights into the current practices by drawing a process diagram and describing the process. The interviews were used to analyse the current challenges and decide which could benefit from robotic process automation. Also, the case company's instructions and manuals were used as a data source.

The order handling process includes manually checking that orders match with quotations and are possible to produce before orders can be confirmed and released for the following tasks in the supply chain. The order handlers cooperate with electrical engineers and mechanical engineers, as the order handling process also includes order clearance. Order clearance is a pre-engineering phase where the electrical engineer checks manually that the order design can be produced according to customer wishes. Employees use multiple applications and systems to perform the steps needed to check and confirm the orders. From the case company's confirmed order lines, 90% are processed manually.

4.1.1 Process diagram and description

According to preliminary information from the case company, they did not have a process diagram for order handling that would have described the functions of the system's current state. A process diagram helps to understand the system entity, its functions and the connections between them (Crilly et al., 2006, p. 342-366). Process diagrams are an important tool in process analysis and improvement, as they help to identify process weaknesses, bottlenecks and opportunities for improvement. The process diagram is presented in Figure 9 and Appendix 2. Diagrams were drawn by the researcher. The order handling process diagram is based on the interview data, the case company's preliminary information and manuals.

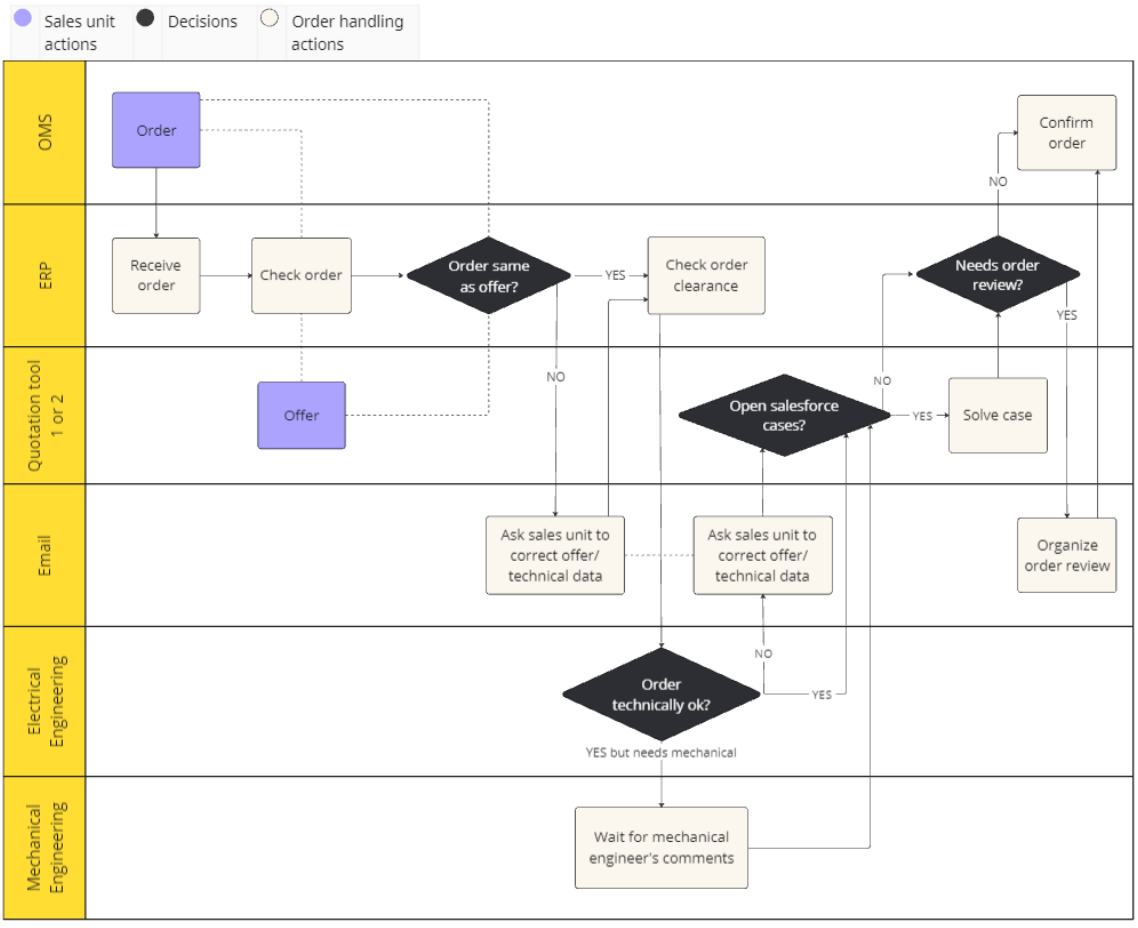

Figure 9. Order handling process diagram (author).

As shown in the process diagram (see Figure 9), the order handling process starts with the order from the sales unit. They use the Order Management System (OMS) to create orders and automatically transfer orders to the order handling work queue in the ERP system. Firstly, the order handler chooses an order from the queue and adds their sales group for the order. They manually cross-check the order so that the ERP data matches the OMS order because if the sales unit changes the data, no information comes through OMS to ERP after the OMS order has been done and saved the first time. Also, they check that all the needed information is provided by the sales unit. Order handlers have to update ERP data according to the OMS data.

If there is a quotation in either quotation tool 1 or 2, they check that it matches the order and change pricing in ERP if necessary. If the quotation does not match, they have to ask the sales unit to correct the mistake. The order handler has to check if the order clearance engineer has checked the order. In ERP, the OC status can be Y, YM or N. Y means the order is okay, and YM implies that the order is okay but needs information from the mechanical engineer. An electrical engineer will email a mechanical engineer if something is needed from there, such as long lead time parts. N means there is a notification that must be solved with the sales unit. Usually, if there are mistakes in electrical data and offer problems, the order handler sends the sales unit one email concerning both issues. After receiving information, they communicate it with engineering. Engineering decides if the information is enough to proceed with the order.

The order handler has to check from Salesforce to see if there are open cases, for example, an order change needed, customer cancellation or a quotation forgotten to mention on OMS. They solve the possible open SF cases. Lastly, the order handler checks if an internal order review process is needed. For example, an order review process is required if the order consists of large quantities or has special variant codes. Internal review is done in cooperation with other processes in the supply chain using email and SharePoint. When everything is clear, the order handler can confirm the order in OMS.

4.1.2 Challenges

According to all the interviews, there are challenges in the order handling and order clearance processes. The most critical factors for process productivity and efficiency are varying order quantity, process bound to persons, the need to remember many things, order clearance difficulties, differences in order data from different sales units and system issues. All challenges are connected and are negatively affecting employees' work. The challenges and relations between interviews and challenges are presented in table 5. Interviews were presented in the previous chapter in table 4. The challenges and problems they create for the case company's processes are explained in more detail in this chapter.

Table 5. Summary of challenges.

Challenge	**Acknowledged in interview**
Process bound to persons	I1, I2, I3
Poor predictability / irregular workload	I1, I3, I4
Too many things to remember	I2
Order clearance difficulties	I3, I4, I5, I6
Differences in order data from different sales units	I4, I5
System issues	I1, I2, I3, I4, I5, I6

The process is bound to persons. From preliminary data from the case company, management has identified the issue with the process being bound to persons. As seen on the process diagram (see Figure 9), the order handling process relies on manual work. There is automation, such as orders being automatically transferred into the ERP system from OMS and automation checking the variant codes if manual order clearance is needed, but mainly, tasks are manually processed. From the case company's confirmed order lines, 90% are processed manually. The orders are processed manually by the order handling team of six employees. The division expects orders to be confirmed within a week of receiving them. Employee resources are limited, and most of their working hours are focused on manual work. They do not have enough time to perform all the

needed work to provide strategic advantage to the case company. This challenge shows in the interview 3:

> *Human work resources has always been an issue for what I can remember in 5 years 95% of the time we have not been able to meet our target, more or less we have always more work than what is our target.*

The number of incoming orders can vary. They cannot accurately predict the quantity of coming order lines. They can have information in advance from sales if they have information for significant incoming projects. The information of coming orders cannot be predicted accurately. In some months, the order quantities can be very high, and some months are slower with incoming orders. Because of poor predictability, order handlers and order clearance engineers have changing workloads, making targets more challenging to reach. Employee resources are limited, and most of their working hours are focused on manual work. They do not have enough time to perform all the needed work. There is pressure and expectations from sales, sales units, customers and their factory. This challenge shows in the interview 1.:

> *In order handling, it is really difficult to predict the future order quantity. Sometimes we get information from sales or other sources that a bigger project is coming, but there is never exact information. One month there may be a lot of orders, and the next month it may be quieter. Keeping the workload steady is difficult and you can't predict it (workload).*

And also, in interview 4.:

> *Time management, it's challenge, especially in situations when engineering is late on work queue or workload is high for any other reason.*

Employees have too many things to remember. There is information and instructions on different customers, projects, orders, motor types and motor variants. The data is scattered in SharePoint in different manuals or, in some cases, employees' personal computers. It takes a lot of time to remember everything or find the needed information to perform the required order checks. There could be cases when all is clear, but they have

to perform all the checks because they do not remember previous cases. This challenge shows in interview 2.:

> *So many things need to remember as we do have many manuals and many aspects that we need to consider before confirming the orders.*

Order clearance is difficult. In order clearance, the electrical engineer checks that the case company can produce the motors according to the customers' wishes. Automation checks if the order has variant codes requiring manual checking, but it is hard to spot those that are always clear from the remaining orders. This makes order clearance engineers use unnecessary working time. They do not design the order in the order clearance phase but later; therefore, mistakes can be hard to spot in the OC phase. As they manufacture special motors that are diverse and batch sizes are small, checking the electrical correctness of the order is difficult without designing the whole motor. There can be different motor codes with a combination of different variant codes. This challenge shows in the interview 5:

> *Our products and product families are so complicated and there is variant codes and their combinations which can cause conflicts ... I might notice it (mistake) when I design it (the order), How can you know in the offer stage. Applications should be on point but those also have mistakes.*

Also, interview 6. highlights the same problem:

> *People can have tens or even hundreds of orders to check in a day so you cannot spot all (mistakes).*

There are also differences in order data from different sales units as they do not follow the same guidelines. If needed data is missing or incorrect, order handlers have to send a notification to the sales unit. About a third of the motor order lines have notifications sent to the sales units. Notification can be, for example, an order that does not have special shaft data. This challenge is shown in the interview 4.:

> *About third of our motor we'll have some kind of notifications sent to local sales units.*

Also, challenge is presented in Interview 3.:

> *Sales units, they are not following the same guidelines when they are booking their orders, and training are probably done quite different in different countries, which leads to very worrying quality of booked orders. And some are doing a very great job filling all the correct information before booking, but some of them seem to not learn how to do it correctly. And sorting out unclear orders takes a lot of time of our team.*

All interviewees explained the challenge of the systems having issues. There can be temporary system failures due to updates or systems being down. The case company continuously updates its systems, but those can have issues. For example, there can be changes in the release of new versions of the systems, which temporarily causes some functions to not work with the latest data. This can cause extra work or lost working hours for the order handlers as they have to reach the targets. This challenge is described in the interview 4.:

> *Probably biggest issues some applications not working, but that's not daily problem but when something fails, it usually causes a lot of extra work.*

In summary, all the challenges are connected and negatively affect employees' productivity. Excessive workload can result in stress, fatigue and decreased productivity (Houdmont et al., 2012, p. 221-255). Employees can underperform their tasks if they have too many things to remember. In the worst case, employees' stress and fatigue can cause burnout or other health issues, which can cause the company to lose working hours and increase operational costs.

Employees can make more mistakes when stressing about the workload or trying to remember all the needed information (Houdmont et al., 2012, p. 221-255). Also, manual processes always have the risk of human mistakes. For example, when employees paste information from OMS to ERP, mistakes can happen during the process. These could be

avoided when using software that automates processes, such as robotic process automation.

Mistakes can cause issues in the following processes in the supply chain. For example, the company might have to alter the motor components in the production phase, causing extra operational costs or late production. This can cause customer delays or a need to use faster transportation, which can cause inefficiencies and increase operational costs in the supply chain process. Not reaching the operational target can reduce customer satisfaction as they do not get the expected service level. It could cause a revenue loss if customers decide to use different manufacturers.

4.1.3 Challenge evaluation

All the challenges are relevant to the case company and negatively affect employees' productivity. Because of the research limitations, this study cannot address all the identified challenges. This research focuses on process problems that can be solved with a variety of robotic process automation solutions. For this study, relevant challenges are varying order quantities, processes bound to persons, the need to remember many things, and order clearance difficulties. Table 6 shows a presentation of the challenges' relevancy.

Table 6. Summary of challenge relevancy to this research.

Challenge	**Relevant to this research**
Process bound to persons	Yes
Poor predictability / irregular workload	Yes
Too many things to remember	Yes
Order clearance difficulties	Yes
Differences in order data from different sales units	No
System issues	No

Differences in order data from different sales units cannot be solved using robotic process automation. As training is probably done quite differently in different countries, this challenge should be addressed together with the sales units. One solution could be that the training materials would be unified, and training would be done similarly for all different sales units to have more accurate OMS orders and reduce the notifications needed to be sent.

Also, system issues cannot be solved only using process automation. There can be temporary system failures due to updates or systems being down. The case company continuously updates its systems, but those can have issues. This challenge is due to the IT department in charge of the systems and system updates. There is no easy fix for this, but employees could be prepared for system updates and try to do most of their work before those.

4.2 Objectives

This chapter presents the objectives for the artifact. The goal is to define the objectives of the solution and demonstrate what the artifact could improve in the process. This is done by selecting the process focus points. These are decided using the analysis information on challenges in the process. Process focus points are highlighted from the process diagram, and ways to automate these parts to help address the identified challenges in the process are presented.

4.2.1 Selected process focus points

After the analysis of the order handling process, the process focus points were selected (see Figures 10 and 11). Four relevant process tasks could benefit from automation and help with the identified challenges. Relevant challenges are presented in table 6. Process focus points are:

1. Checking the order. Order handlers manually cross-check the order that the ERP data matches with the OMS order because if the sales unit changes the data, no information comes through OMS to ERP after the OMS order has been done and saved the first time. Also, they check that all the needed information is provided by the sales unit. Order handlers have to update ERP data according to the OMS data. This is time-consuming manual work with many steps that the order handlers have to remember. This part of the process makes the process bound to persons and creates a lot of remembered points in the order processing. Cross-checks could be potentially automated using robotic process automation, which is expected to reduce manual work and save employees' working time. Automating these manual actions could reduce the potential human errors and create a more efficient process.

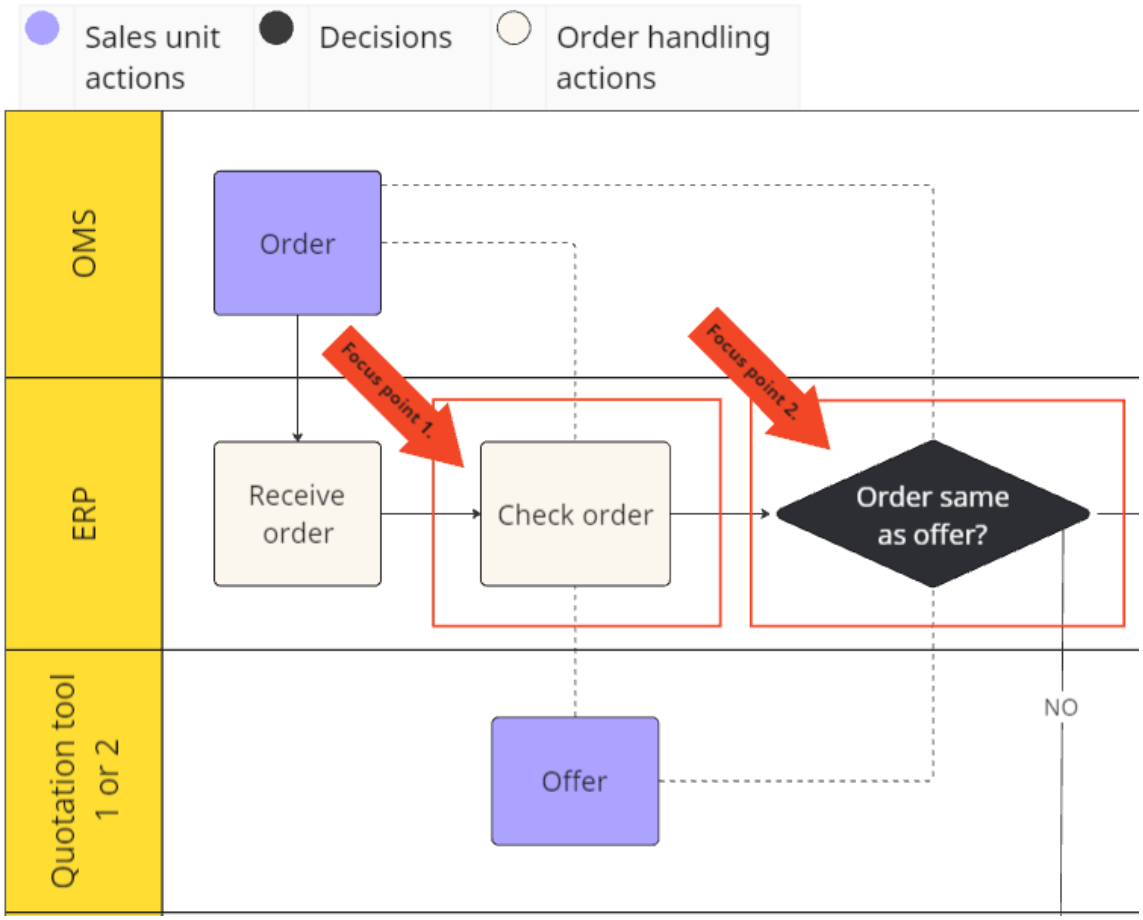

Figure 10. Process focus points 1. and 2. (author).

2. Order same as offer. The order handler checks if there are quotations either in quotation tool 1 or 2. If there is a quotation, they check that it matches the order and change pricing in ERP if necessary. If the quotation does not match, they have to ask the sales unit to correct the mistake. Quotation tool 1 quotations consist of different structured data with different sales units therefore those are not ideal to automate with RPA. On the other hand, Quotation tool 2 offers are usually the same structure and could be candidates to automate the cross-checks with the RPA. Also, quotation references could be automatically transferred to the ERP system and automatically present that there is an offer for the order in either quotation tool 1 or 2. Checking that the order matches the offer is manual work, which makes the process bound to persons. This automation could also reduce manual work and help with the challenge of too many things to remember. Reducing the manual work also helps with workload balancing.

3. Order clearance. In order clearance, the electrical engineer checks that the case company can produce the motors according to the customers' wishes. Automation checks if the order has any variant codes that require manual checking. They do not design the order in the order clearance phase but later therefore mistakes can be hard to spot in the OC phase. There can be different motor codes with a combination of different variant codes. Because the order clearance process is complex, it is not possible to automate the whole check. Some tasks could benefit from the robotic process automation and help with the order clearance difficulties. For example, the electrical engineer always has to check with electrical tool to see if a calculation reference can be found there. It could reduce the manual work in the order clearance if the check is automated with RPA.

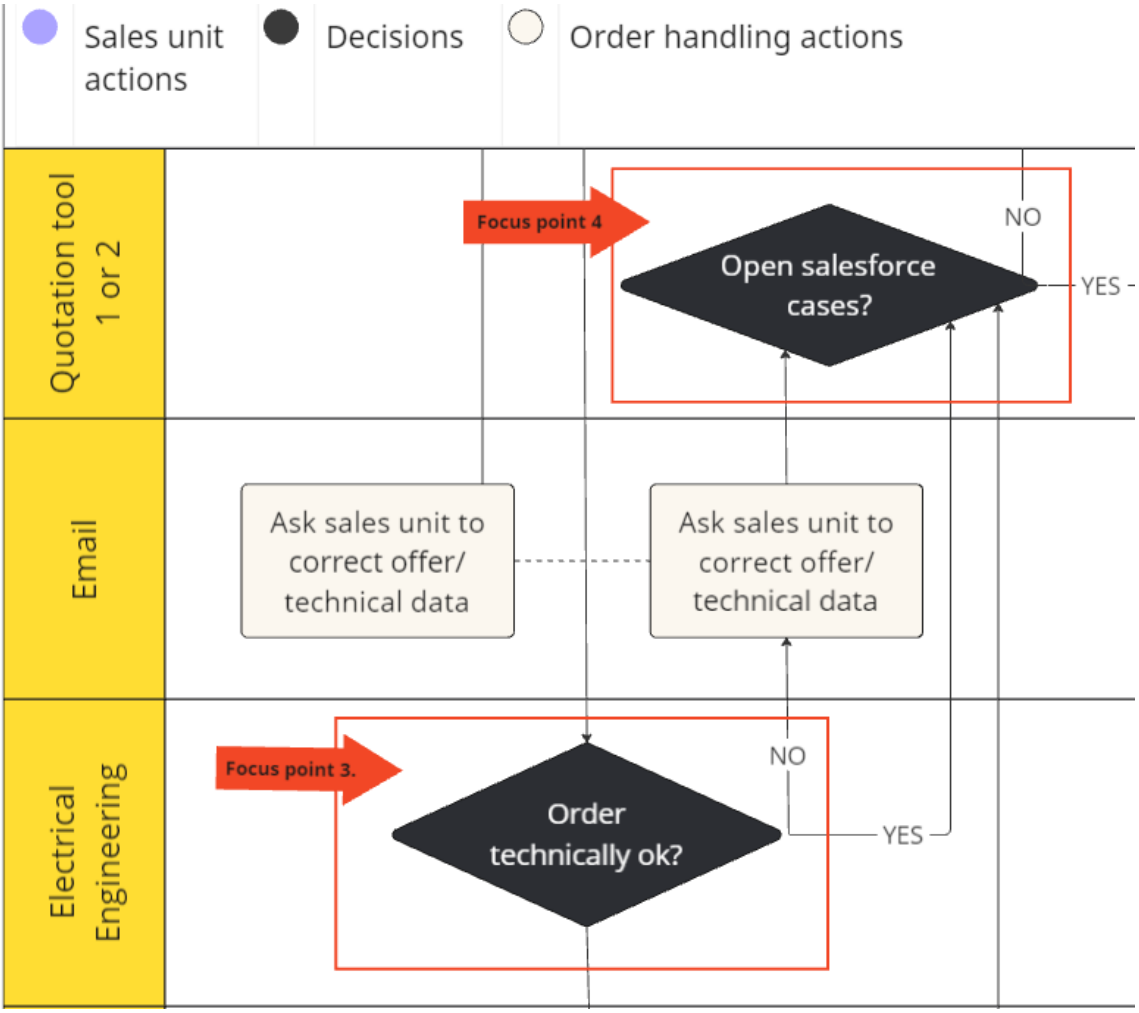

Figure 11. Process focus points 3. and 4. (author).

4. Are there open Salesforce cases? The order handler has to check from Salesforce to see if there are open cases, for example, order change needed, customer cancellation or quotation forgotten to mention on OMS. They have to solve the possible open Salesforce cases. It takes a lot of time to check every order, even if there are no open cases. Salesforce cases cannot be solved with automation as those are complicated, but it would save order handlers time if they did not have to check if there was a case or not. There could be a box in the ERP system that could tell the order handler if there are open cases. This saved working time could be used to do more strategic tasks.

4.2.2 Possible improvements in the process

Automating the presented process focus points is expected to help address all the relevant challenges to this research. The automation reduces manual work in the order handling and clearance process, which saves employees time and helps with workload balancing (Marciniak & Stanisławski, 2021, p. 9-10). Software robots can operate around the clock and deal with large order quantities. Also, less manual work helps with the challenge of too many things to remember as the software robots conduct the tasks. Automating manual actions could reduce the potential human errors as software bots are reliable when coded correctly. According to Marciniak & Stanisławski, saved working time could be used to do more strategic tasks, which creates a competitive advantage for the case company. A summary of the challenges that the process focuses on addressing is presented in Table 7.

Table 7. Challenges that process focus points address.

Challenge	**Process focus point could address**
Process bound to persons	1., 2., 3., 4.
Poor predictability	1., 2., 3., 4.
Too many things to remember	1., 2., 3., 4.
Order clearance difficulties	3.

4.3 Design

This chapter presents the solution design. The goal is to use the analysis data to design and develop the artifact. This is done by creating instructions for the case company on which tasks could benefit automation and help with the identified challenges. Process focus points are presented in more detail than in the process diagram. Every individual task is presented using figures, and possible automation points are highlighted. The case company's employees' expertise and manuals are used to demonstrate the tasks in detail.

The solution is analysed, for example, if it is possible to produce and if it is a viable answer to the identified challenges.

4.3.1 Order handling tasks

Process focus points 1., 2., and 4. are order handling tasks. Figure 12 summarizes the tasks in the process focus points, and this chapter describes them in detail. Tasks are not required to be done in any specific order, and order handlers can choose the best order for them.

In focus point 1., the order handler checks the data between OMS and ERP. They check that additional data B has the correct delivery/consignee address and customer PG. From the item level, they check that address, moving tag texts, configuration for variant codes, mounting position, color, routing and variant codes match the OMS data. From the front page, they check that quantity and incoterms are correct. They check that the header lever has the correct order type and text. From the header level, they also check that customer PG is not empty.

Focus point 2. is checking the quotation. The order handler checks if there is a quotation either in quotation tool 1 or 2. If there is a quotation, they have to check that the data matches the OMS data to check that the sales unit has ordered the motors with the exact details as offered. They check if the quotation has a price offer or price. If there is no price, they have to calculate the prices using the OMS data as a base for the Excel sheet. They check that the quotation reference is visible in additional data B in ERP.

In focus point 3., the order handler has to check from Salesforce if there are open cases, for example, order change needed, customer cancellation or quotation forgotten to mention on OMS. They have to solve the possible open Salesforce cases together with the sales unit. It takes a lot of time to check every order, even if there are no open cases. Salesforce cases cannot be solved with automation as those are complicated, but it would save order handlers time if they did not have to check if there was a case or not.

There could be a box in the ERP system that would tell the order handler if there are open cases.

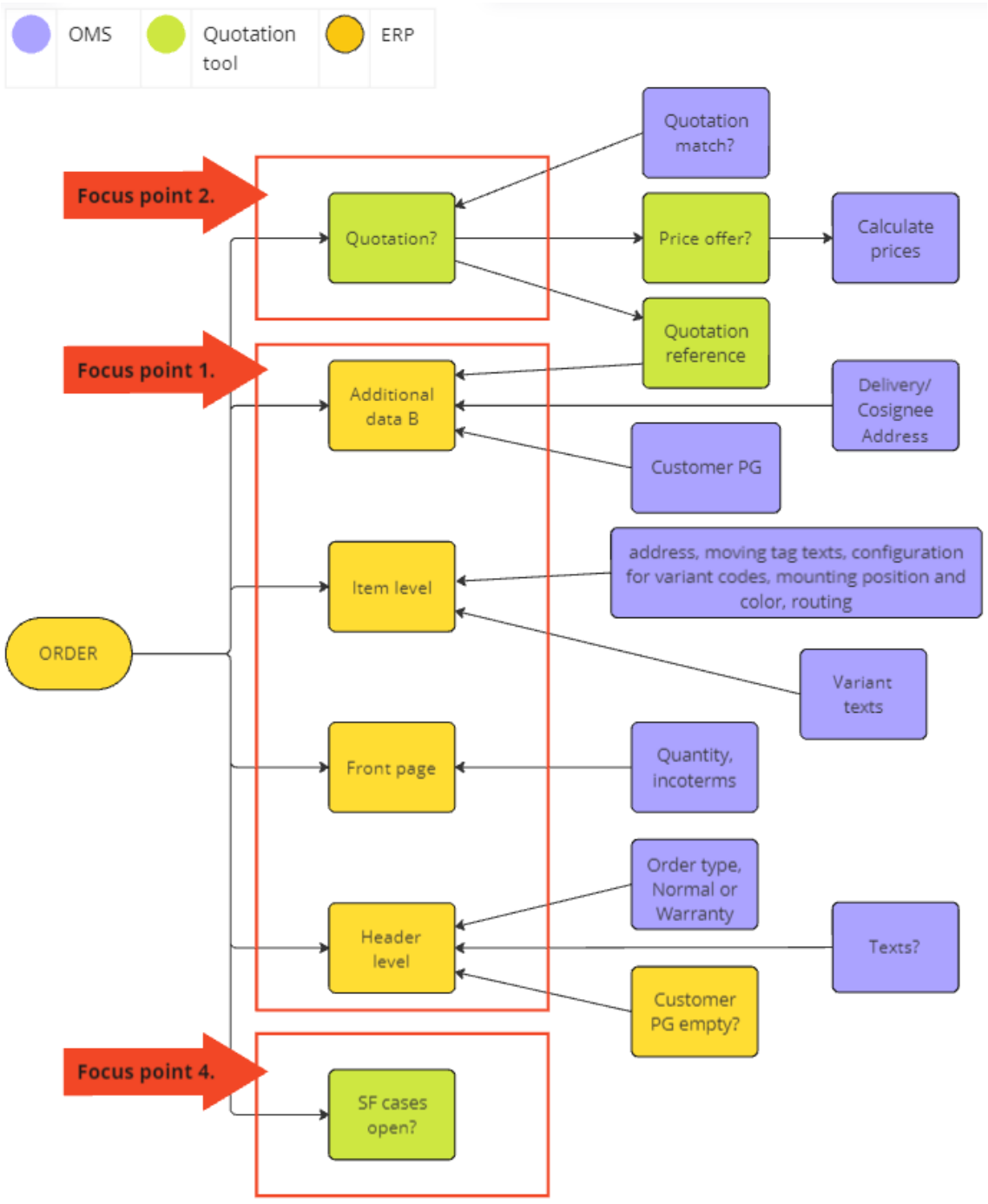

Figure 12. Order handling tasks (author).

4.3.2 Order clearance tasks

Process focus point 3. is order clearance task. The tasks in the process focus point are presented in Figures 13 and 14 and more in detail in this chapter. Tasks are not required to be done in any specific order, and electrical engineers can choose the best hierarchy.

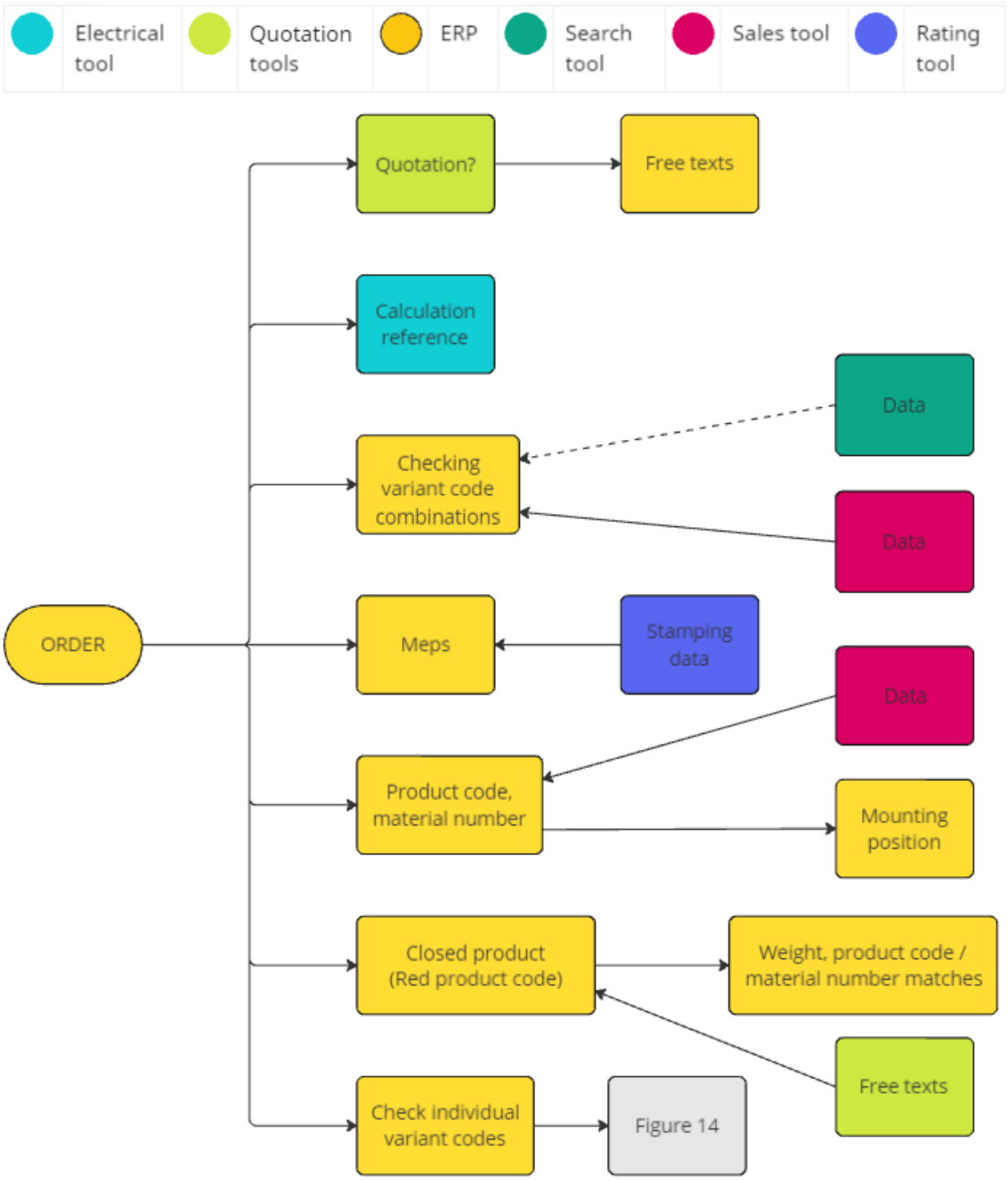

Figure 13. Order clearance tasks (author).

The electrical engineer checks the calculation reference on electrical tool. They check that all variant codes are compatible with each other. If the variant code is on the order, it should be suitable without checking, but there can be variant codes that can be ordered according to the sales tool even though they are not suitable for the ordered product. There can be variant codes that are not combinable. From search tool, they can check if there are previous orders with the same combinations or use the search tool to check for any conflicts with the variant codes. The electrical engineer opens a notification if there are any issues with the variant codes. In case there are MEPS variants, the electrical engineer checks those. MEPS variants aim to ensure different country-specific requirements, such as electrical requirements. They can use rating tool to check the stamping information. In addition, the certification team can be contacted in unclear situations.

The electrical engineer checks that the product code matches the material number. Using the product code information, they check that the mounting position is correct. Search tool data can be used to check the mounting position. There can be special cases when the product code is in red. It means that the product is closed. The order data must be checked, and the variants can be anything. Weight information can be wrong, meaning these require an extensive check in terms of OC. The offer texts should be checked to ensure that they match the order.

The electrical engineer checks individual variant codes. There are many different variants and combinations, but Table 8 presents the ones that always require checking. Variant codes 002 and 095 need to be checked to ensure that the stamping information is correct. The electrical engineer checks the offer's free text to see if the information is accurate. They use the rating tool application to check what stamping information is needed. Variant code 209 is checked to see if the special winding has the required information and if the stamping information is correct. They check that the calculation reference is found on offer or electrical tool.

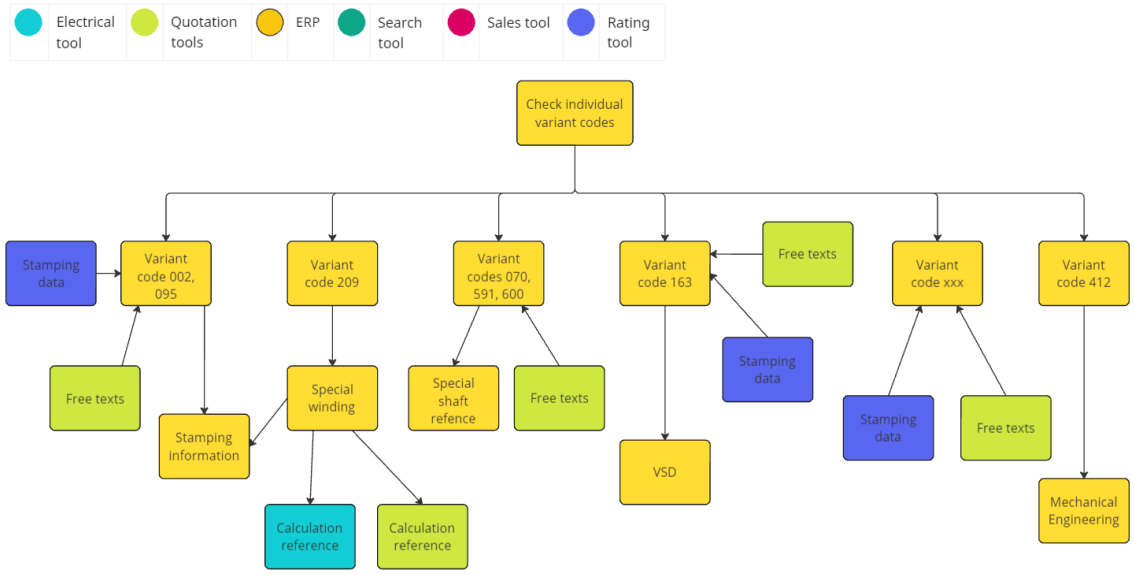

Figure 14. Checking individual variant codes (author).

Variant codes 070, 591 and 600 need checking from the free text that the special shaft reference is correct. Also, VC591 and VC600 need to be checked to see if the measurements and drawings are accurate. Variant code 163 has to be checked that VSD information contains the type of torque, speed range, required torque/power, supply voltage & frequency. Also, the loadability should be checked. Variant code xxx is used if there is a quotation spesific design. These are always case-by-case and need to be checked carefully. There should always be an offer with free texts. Variant code 412 is a long lead time part that mechanical engineering needs to check.

Table 8. Summary of variant codes that need to be checked.

Variant code	**Meaning**
VC002	Restamping voltage, frequency and output, continuous duty.
VC095	Restamping output (maintained voltage, frequency), intermittent duty.
VC209	Non-standard voltage or frequency, (special winding).
VC070	One or two special shaft extensions, standard shaft material.
VC591	Special shaft.
VC600	Special shaft.
VC163	VSD (Variable speed drive).

Variant code	Meaning
VC412	Special brake.
VCXXX	Quotation specific.

4.3.3 Suggestions for automation

There is another project in the case company that focuses on similar issues. It has a different point of view, but these fixes will also help the order handling process. It focuses on the technical aspects of the ordered motors. Table 9 summarizes the tasks presented previously, presents which issues will be addressed and explains the timetable. The case company should not focus on the problems that will be addressed in the years 2024 or 2025. If the fix is introduced after 2025 or not at all, there is a possibility of focusing on the challenge. If there is a planned solution for the year 2026 or later, it is relevant to help the order handling process in the meantime to fix the issue temporarily using robotic process automation.

Table 9. Summary of problems that will be fixed.

Process task	Problem will be fixed		
	2024	2025	2026/not planned
Quotation matches OMS / reference in ERP	X		
Quotation price		X	
Cross-check OMS and ERP			X
Open Salesforce cases?			X
Calculation reference	X		
Checking variant code combinations	X		
Meps	/		
Checking product code / mounting positions	X		
Closed product			X

Process task	Problem will be fixed		
	2024	**2025**	**2026/not planned**
Checking individual variant codes	X	X	

Table 9 shows that the technical tasks will be fixed in the years 2024 or 2025. This will help the order clearance process to be more efficient. There are some exceptions that will not be addressed and cannot be helped using automation. Meps variants will be addressed partially, but the certifications are still being discussed in some countries. To completely fix meps variants, the certification structure should be evident in the case company. Also, closed products are not on the list of fixes. These are exception cases that deviate from the normal process. According to Dijkman et al. (2019, p. 11-12), process deviations create longer throughput times than regular processes. The case company should consider including all different motor types in its product portfolio, so they do not need to use exceptions or produce motors without codes from the product portfolio.

On the other hand, commercial tasks still need to be addressed. Basic order handling tasks will not get any fixes. Only quotations will be fixed to be more standardized and automated. Salesforce cases will remain the same. The order handlers still have to perform the cross-check between OMS and ERP order data, which is time-consuming and manual work. It is inefficient to manually check every order to check if the data is correct. Tasks could be automated using robotic process automation as they are high volume, comply with the standard, and use multiple stabile systems (Kokina & Blanchette, 2019, p. 7-9).

The solution to the challenges, considering all presented information, is that the case company should focus on using robotic process automation with the help of RPA experts to automate the following process tasks:

1. Cross-checking the order OMS and ERP data.
2. Checking if there are open Salesforce cases.

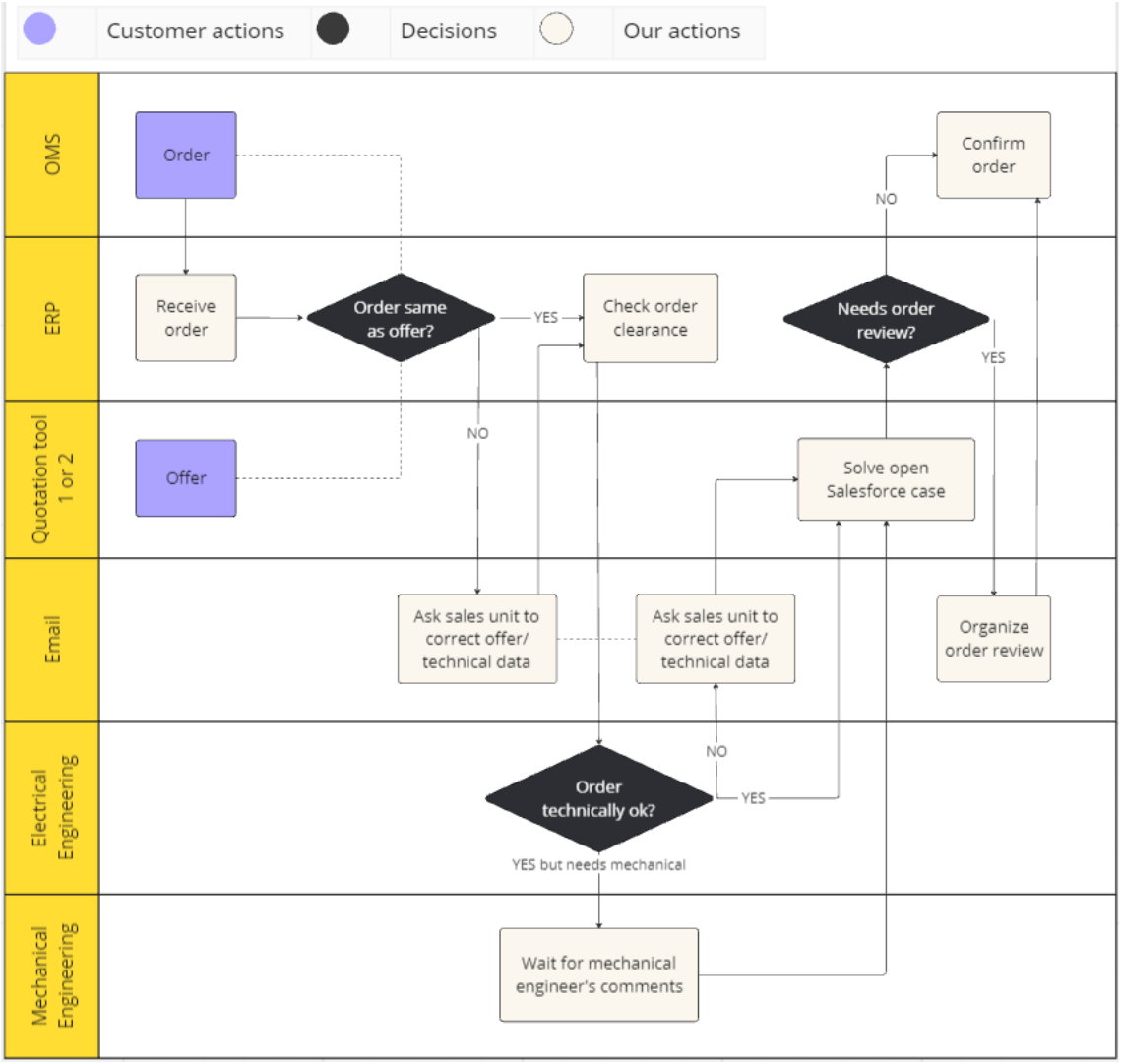

Figure 15. Process diagram after suggested automations (author).

The order handling process is expected to be more streamlined after the suggested automation (see Figure 15). Suggested automation helps address the identified challenges by reducing manual work in the order handling process. Reducing manual work saves employees time and helps with workload balancing (Marciniak & Stanisławski, 2021, p. 9-10). Also, less manual work helps with the challenge of too many things to remember as the software robots conduct the tasks. Automating manual actions could reduce the potential human errors as software bots are reliable when coded correctly.

4.4 Results summary

This chapter presented the results of the research. The goal was to get answers to the research questions presented in chapter 1.3. Firstly, an analysis of the order handling process was presented using process diagrams and descriptions. The employee interviews were used as empirical data to understand the current process. Also, the case company's instructions and manuals were used as a data source. The analysis revealed challenges in the process that negatively affected the order handling process's productivity and efficiency. Identified challenges are poor predictability that creates irregular workload, process bound to persons, the need to remember many things, order clearance difficulties, differences in order data from different sales units and system issues. As the research was limited to using robotic process automation to enhance the order handling process, this study did not address differences in order data from different sales units and system issues.

After the analysis, solution objectives were determined using the process analysis as a base. Four relevant process focus points were selected as the best candidates for automating tasks using robotic process automation. Cross-checking the order's OMS and ERP data was chosen as it is time-consuming, manual work that has many steps to remember. This makes the process bound to persons. Is the order the same as the offer was selected, as it makes the process bound to persons and creates a lot of remembered points in the order processing. Order clearance was chosen as a process focus point, as it is one of the challenges. Because the order clearance process is complex, automating the whole check is impossible. Some tasks could benefit from the robotic process automation and help with the order clearance difficulties. Checking if there are open Salesforce cases was selected as it is manual work, and it takes a lot of time to check every order, even if there are no open cases. Automating manual work can also help with irregular workloads as it balances them.

The last phase was the designing process. The goal was to suggest to the case company which tasks should be automated to create a more efficient order handling process. To

do this, process focus points were presented in more detail than in the process diagram, and every individual task was presented using figures. Possible automation tasks were highlighted in the figures. There was another project with a different perspective to address similar issues, so the timetable for these fixes was presented. The case company should not focus on the problems that will be addressed in the near future in the other project. The results show that the optimal solution to the challenges and enhancing the order handling process is using robotic process automation to automate the following process tasks:

1. Cross-checking the order OMS and ERP data.
2. Checking if there are open Salesforce cases.

5 Discussion

The limitation of the research is the absence of robotic process automation experts in the evaluation of the applicability of RPA. The points of view were based on the expertise of end users and knowledge gained in the literature review. Employee interviews gained essential understanding of the business process, but using robotic process automation experts could have been insightful in identifying possible tasks to automate. Their expertise could have been used to give a more detailed description of how to use the research results in implementing robotic process automation in the case company's business process.

Also, this study was limited to robotic process automation, which was defined as application programs. The research could have used artificial intelligence-based RPA with more advanced features, such as decision-making. This could have created other ways to automate the order handling process. Using AI-based RPA in business process automation is recommended as a subject for further research, taking into account the order handling process.

In conclusion, this research was done with the mindset that the case company could use it for other similar robotic process automation interpretations. RPA is scalable, as once it is implemented, it is easy to expand to other tasks or functions. This research focused on a specific business process, but the instructions on how to start in Chapter 3.3 can be used in the next RPA project. Overall, the research project was insightful and provided the case company with a lot of new knowledge about robotic process automation and its order handling process.

5.1 Managerial implications

There are also other improvement points in the order handling and clearance process that are not addressed in the results section. The sales units have manuals and instructions on products that the customers are ordering to guarantee that there is no

possibility of ordering motors with unsuitable variant code combinations. Despite this, the systems can have errors or possibilities to add unsuitable variant codes by mistake. The identified problem is that there are no instructions for engineers to report mistakes in the system. The proposition for the engineering department is to arrange a channel to report the possible errors in the system or portfolio so that all exceptions can be removed from the order clearance process.

The order handling and clearance process is also customer service as it manages the customer's orders to ensure that they are correct and possible to make. The goal is to make the ordering process as smooth as possible for the customer, but the service level is high in the current order handling process. In the order handling process, the customer is the sales unit. The order handlers fix the errors made by the sales units without reporting them, even though the mistakes are made on the customer's side. In an ideal situation, the systems should be done so that errors are not possible to make, but it is impossible to remove all human errors. The proposition is that the order handlers would always report the mistakes so that sales units could learn from their mistakes and help the order handlers work and improve their service level.

There are also differences in order data from different sales units as they do not follow the same guidelines. If needed data is missing or incorrect, order handlers have to send a notification to the sales unit, and about a third of the motor order lines have notifications sent to the sales units. As training is done differently in different countries, the proposition is that the challenge should be addressed together with the sales units. One solution could be that the training materials would be unified, and training would be done similarly for all different sales units to have more accurate OMS orders and reduce the notifications needed to be sent. This would also ensure that the customer's order is done correctly.

There is a challenge of the systems having issues. There can be temporary system failures due to updates or systems being down, as the case company continuously updates its

systems. The systems can have problems that cannot be solved by only using automation. There can be temporary system failures due to updates or systems being down. This challenge is due to the IT department in charge of the systems and system updates. There is no easy fix for this, but employees could be prepared for system updates and try to complete most of their work before those.

6 Conclusion

This research examined the applicability of robotic process automation for the automation of the order handling process. This chapter aims to generalise the results of this study and present the conclusions drawn from them. The research questions aimed to determine robotic process automation as a concept and identify suitable automation targets from the processes and tasks of the order handling process. Interpretation is done by looking at the results of the research framework and comparing it against the research. The literature review answered the first question:

1. What key elements need to be considered when implementing RPA?

The literature review mapped the use of robotic process automation in the automation of business processes. Robotic process automation was conceptualized in this study as a software used to automate business processes or their parts selected with specific selection criteria. From previous studies, frequently used evaluation criteria were identified that have been used to assess the suitability of a business process to be automated with RPA. The most commonly used evaluation criteria were the high volume of the process, compliance with the standard, the number of systems used simultaneously, and the stability of the process systems. When defining the evaluation criteria, it was recommended that several different criteria be used to form the most comprehensive automation evaluation possible. RPA was identified as suitable for automating several other business process tasks. Most tasks involved copying or transferring data between different systems and improving business processes.

The literature review identified several benefits and challenges related to automating business processes with robotic process automation. The most frequent benefits were the reduction of human errors in the process, the significant speeding up of process turnaround times and the possibility to transfer employees from routine manual tasks to tasks that generate more added value. Thanks to the benefits described above, the efficiency of the organizations' operations has increased, and the accuracy of the

information has improved. Challenges have been identified less than benefits. The most significant challenges were underestimating the management of stakeholders, choosing the wrong processes to automate, and employee suspicion. Stakeholder management is related to all the organization's stakeholders, where the most significant disadvantages were linked to employees' resistance to change and the commitment of IT departments in time for the implementation of robotic process automation. Failure to select automated processes directly affected the organizations' possibilities to realise the benefits expected from automation.

In conclusion, RPA has the potential to significantly enhance business process automation, leading to improved productivity, efficiency, and accuracy. However, careful planning, execution, and continuous research and development are necessary to address challenges and limitations when using robotic process automation in an organization to realise its full potential.

The second and third research questions are answered by using the results of the empirical part of this study. These research questions are:

2. What is the current state of the case company's order handling process?
3. How to improve an order handling process with RPA?

Firstly, an analysis of the order handling process was presented using process diagrams and descriptions. Using employee interviews to analyse the current process, challenges in the process were revealed. Also, relevant instructions and manuals were used as a data source. As the research was limited to using robotic process automation to enhance the order handling process, only relevant challenges were addressed. After the analysis, solution objectives were determined using the process analysis as a base. Relevant process focus points were selected as the best candidates for automating tasks using robotic process automation.

The last phase was the designing process. The goal was to suggest which tasks should be automated to create a more efficient order handling process. To do this, process focus points were presented in more detail than in the process diagram, and every individual task was presented using figures. Possible automation tasks were highlighted in the figures. The aim was to check other projects to determine which tasks are getting fixes in the near future and suggest automating the tasks without fixes. The next step after the study is implementing the suggested automation using the information system method.

In conclusion, automating the order handling process using RPA will streamline the processes and help address the identified challenges by reducing manual work. This research can be used in other organizations as a guide to implement RPA to automate their business processes. Even if the business processes and tasks differ from those in this study, the main empirical steps can be used in other business processes, such as procurement. The literature review is not specific to RPA in order handling automation but generalises it to business process automation. This limits the use of this study to business process automation.

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Appendices

Appendix 1. Interview questions

Basic information

1. Please, introduce yourself. Name, position and how long have you worked in current position?

Process in general

2. How would you define order handling / order clearance process?
3. Which steps are included in order handling / order clearance process?
4. Which applications/systems do you use in order handling / order clearance process?
5. What is your main task in your work?
6. How do you perform your main task?

Challenges in process

7. What is the main issue in your work?
8. What task takes most time in your work?
9. Do you have to correct mistakes/errors by You or others? If yes, how often does that happen?
10. Which are most occurring errors?
11. What mistakes are in the coming orders?

Robotic process automation

12. In which part of the order handling process you mostly perform manual, rule-based and repetitive tasks?

Appendix 2. Process diagram