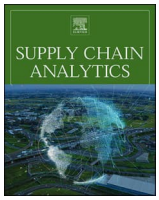
Supply Chain Analytics 9 (2025) 100102

Contents lists available at ScienceDirect

Supply Chain Analytics

journal homepage: www.sciencedirect.com/journal/supply-chain-analytics



A robotic process automation model for order-handling optimization in supply chain management

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ARTICLE INFO

Keywords:
Artificial intelligence
Robotic process automation
Process management
Supply chain automation
Digitalization

ABSTRACT

This study proposes a robotic process automation (RPA) model to streamline and optimize order-handling procedures in supply chain management. The current manual approach to order handling poses challenges, including limited accessibility and significant cognitive demands on employees. An information systems design methodology is applied to analyze and improve the process, with data gathered through semi-structured interviews to address these issues. The findings highlight that reducing manual labor alleviates workload imbalances and saves time in supply chain automation. Moreover, automating repetitive tasks through well-designed software bots minimizes the risk of human error. While this research focuses on applying RPA in order handling, future studies should explore the potential of artificial intelligence-driven RPA to enhance process automation further.

1. Introduction

As technologies advance swiftly, one of the problems facing organisations has been and continues to be digitisation. In the realm of research, robotic process automation (RPA) is regarded as a potential process automation technique. According to Gómez Gandía et al. [1], it is employed in the digital transformation of corporate operations. Because it enables businesses to automate procedures, increase accuracy, and free up human resources for more strategically important work, robotic process automation (RPA) is a part of digital transformation. Stevens [2] investigated the role of RPA on supply chain performance with a specific focus on its application on measuring supply chain performance with respect to cycle time, inventory turnover, on-time delivery and sustainability. RPA gives enterprises the ability to analyse large amounts of data and derive insights about their workflows and business patterns. Businesses can use this data to support digital strategies that will increase the productivity and efficiency of their operations. Prior research indicates that RPA can automate business activities provided selection criteria are considered. Tanaka [3] studied how RPA can be implemented to improve demand forecasting accuracy, expedite procedures, and promote well-informed supply chain planning decision-making. Farinha et al. [4] conducted a survey of how RPA helps decision-makers to determine which business activities are appropriate for automation based on specific criteria.

Pelkonen [5] investigated the suitability of RPA for automating the order handling procedure. He mentioned RPA is one of the greatest technologies to facilitate digital transformation that enables businesses to handle operational work difficulties in all sectors and roles. Kajrolkar et al. [6] explained in their study how robots using RPA software can automate data entry, fix mistakes, and make some of the decisions needed to order processing and to create associated customer invoices. They also investigated how automation can reduce the requirement for manual order management and limit failures in such procedures like human data entry and data validation. In addition to order processing, RPA is using several branches in supply chain and logistics management such as warehouse management [7], smart transportation [8], purchasing [9], logistics [10], optimization [11].

The primary practical perspective of this research is to present the most recent developments in robotic process automation and to draw on earlier studies on the applicability evaluation of RPA as a foundation for empirical investigation. The purpose of the study is to update the knowledge of order handling and IT specialists on RPA and the process of assessing its use in the automation of tasks related to both business processes and order processing. From a scientific and practical perspective, RPA is an important topic. This study is necessary from a scientific perspective because there hasn't been much research done on

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https://doi.org/10.1016/j.sca.2025.100102
Received 13 August 2024; Received in revised form 6 January 2025; Accepted 12 January 2025
Available online 17 January 2025

RPA in the context of order handling applications. There has not been much research done on RPA in the order handling process yet. Santasärkkä (2022) conducted research on the automation of order handling in an organisation using RPA. In that instance, the enterprise resource planning (ERP) system was only used in part and emails constituted most of the manual process.

To address the issues with a case company's order handling procedure, there are not enough linkages between various RPA tools and order handling. The goal of the case firm was to automate its order handling process and learn more about robotic process automation. The purpose of this study is to improve the order processing and clearance process used by the case company by choosing and designing a robotic process automation tool or workflow. This study looks at the idea of robotic process automation, assesses the handling process's current state and obstacles, and chooses appropriate automation targets from the tasks and processes involved in the order handling process. The beginning point of this research investigation was the perspectives that were offered. The arguments are bolstered by the findings of earlier research, which show that RPA may be used to automate rule-based procedures, allowing a software robot to carry out certain activities in an identical manner to how humans would have done them in the past. Based on the study aims, this study has identified three research questions (RQs) to investigate the applicability of robotic process automation to the automation of the order processing process.

RQ 1: What are the most important things to think about while putting RPA into practice?

RQ 2: How is the order handling procedure now being handled by the case company?

RQ 3: How may RPA be used to enhance the case company's order handling procedure?

The first research question is addressed through an extensive literature review. It explains RPA as a concept and the appropriate standards to consider when automating the order processing procedure. With the aid of process charts and challenge analysis, the second research question provides a more thorough description of the case company's present order handling procedure. It is employed to specify which processes of the case company can be automated using the RPA. The empirical portion of the study provides a response to the last research question. It is outlined necessary recommendations for a robotic process automation tool and workflow to improve the order processing and clearance procedure of the case company.

The study is divided into six sections, which are as follows in brief: Section 1 provides an overview of the study's background, significance, and research questions, while Section 2 provides a description of the case company under study. Section 3 presents a narrative literature review, defines and provides background on RPA, the use of RPA in the automation of business processes, and the use of RPA to develop business processes, whereas, Section 4 provides a more detailed description of the study's implementation, including an overview of the research methodology and specifics on data collection techniques. In Section 5, the study's findings are presented along with an analysis of the state of order handling and clearance as of right now. The managerial implications of this study are discussed in Section 6. Section 7 concludes the study with a summary of all the findings, study limitations, and recommendations for further research.

2. Description of the studied case company

The case company is in the automation, motion, and electrification industries. It was founded in 1988. The business is a sizable one, with a projected net income of US$ 2.5 billion in 2022. The motion business sector, and more specifically electric motors, is the subject of this study. The case company is one of the industry leaders in the motion sector. It offers the best answers along with a wide range of applications across all industry sectors. The needs of the case company's consumers and the focus market are taken into consideration when developing the product portfolio. The study centres on a factory of the example company situated in Finland. It creates specialised motors that offer a plethora of options to its clients.

The case company's order processing, clearance, and supply chain management are the main topics of this study. Orders must first be manually verified to match quotations and be able to be produced before they can be verified and released for the subsequent supply chain chores. Because of order clearing is a step in the order handling process, order handlers collaborate with mechanical and order clearance engineers. Employees in the case company carry out the procedures required to verify and review the orders using a variety of apps and systems. Ninety percent of the order lines confirmed by the case company are handled manually. As a result, the person is tied up to the process. Because unique motors are made in small batches and with a variety of motor types, order management and clearance might be difficult.

The difficulties in managing the orders in the case company include that each case must be handled individually, and that the procedure is limited to individuals. Employees must concentrate on the order confirmation and clearance because most of the orders are completed manually. They do not have enough time to devote to more strategic projects that require their knowledge. Instructions to the employees may change which are depending on the type of client, the project, or the order. Automation in the case company is highly anticipated to improve the procedural steps and create a more effective order handling process because employees are required to memorise numerous specific instructions.

3. Literature review

3.1. Robotic process automation

One technical method for automating corporate activities is robotic process automation, or RPA. According to Siderska [12], RPA makes use of software robots that are made to resemble people interacting with digital systems. Basic chores can be automated with it, and software robots can function across a range of platforms and apps without requiring extensive integration. Software robots can provide text responses, process data, extract information, and interpret data. Robotic process automation solutions can be configured to run on various workstations independently. The software robots can perform actions including typing text, pasting, copying, clicking programs, and reading forms. By cutting down on pointless manual labour and workflow durations, robotic process automation improves operational efficiency and streamlines workflows [13].

Business processes are being digitally transformed through the usage of RPA. RPA is a part of digital transformation, according to Siderska [12]), since it enables businesses to automate procedures, increase accuracy, and free up human resources for strategic work. High-volume, difficult, and time-consuming operations can be automated by RPA. He claims that these duties may include processing orders, handling HR procedures, transmitting data, or creating invoices.

According to Nalgozhina and Uskenbayeva [7]), RPA is considered one of the greatest technologies used to address operational difficulties in most of the business sectors, which support intrinsic digital transformation. Robotics adoption will decrease manual labour, freeing up staff members to concentrate on more crucial tasks and lowering data analysis errors. Nalgozhina and Uskenbayeva [7] claim that robotic process automation gives businesses the ability to analyse large amounts of data and derive insights about their workflows and business patterns. Businesses can use this data to support digital plans that will improve the accuracy and efficiency of their operations.

3.2. RPA technology and tools

Software bot, RPA studio, and RPA orchestrator are the three primary parts of RPA. Bots that pay attention can aid people. The robot

performed repetitive, normal operations including merging and transferring data between several systems, processing enormous amounts of data [7]. Unstructured portions of the process are carried out by a human user, such as organising data so that the robot can use it (Choi et al., 2022). The robot finishes the task by analysing the structured data, verifying its accuracy, obtaining data from other systems, draughting a judgement letter for the case, and ultimately informing the human user that the work has been completed.

Extremely complex and intricate business regulations and procedures can be automatically carried out by the unattended software robot [11]. Additionally capable of working in many systems simultaneously, the robot may transport data across multiple systems simultaneously. These capabilities enable robots to do the tasks involved in the entire process. According to Joel et al. [11], a robot cannot carry out some jobs or processes that call for cognitive human information managing and contextual or instinctive judgement. Nalgozhina and Uskenbayeva [7] also stated that the RPA studio is a creation platform where clients design and set up automation operations. It is a graphical user interface (GUI) application that lets users create and specify the phases of an automatic procedure. By dragging and dropping tasks onto a canvas and linking them to establish the order of stages, users can construct automated workflows. These tasks allow users to carry out a variety of tasks, including file managing, program exchange, and data processing.

For planning, overseeing, and keeping an eye on the bots, the orchestrator serves as a command centre [5]. It distributes tasks, promotes interaction amongst bots, and guarantees overall organisation throughout the RPA ecosystem. Pelkonen [5] claims that the control room can oversee robots. It keeps an eye on and manages a networked robot's activities. Orchestrators can plan, maintain code, start and shut down robots, move robots to different jobs, and handle privileges.

Organisations have a variety of RPA tools at their disposal. Because they are well-known and widely used, Uipath, Automation Anywhere, and Blue Prism were chosen as leaders for this investigation. The visionaries introduce Pegasystems to showcase further available technologies. A summary of the benefits and drawbacks of a few chosen robotic process automation systems is provided in Table 1.

Table 1
Available RPA tools and their pros and cons.

RPA Tools	Pros	Cons
Uipath	• Customer-friendly • Seamlessly integrated	• Not intended for small enterprises
Automation Anywhere	• Possesses pre-built software bots • Flexibility, and intelligence automation capabilities	• Complex user interfaces (UI) are not made for small enterprises • It is made for banking, finance, and information technology
SS&C Blue Prism	• Accurate, scalable, and efficient management	• Only considers back-office automation • Concentrating on governance and compliance
IBM Robotic Process Automation	• Seamless integration with IBM's broader software portfolio and ecosystem. • Advanced automation capabilities powered by AI and cognitive technologies.	• Steep learning curve compared to some alternatives, • Licensing and pricing models can be complex
Pega Systems	• Combines low-code development, bot and employee unification • RPA with business process management (BPM)	• Less experienced new system
Microsoft Power Automate	• User-friendly interface for citizen developers and non-technical users. • Seamless integration with the Microsoft ecosystem, including Microsoft 365 and Azure.	• Limited customization options for complex automation scenarios. • Limited advanced features compared to some enterprise-grade RPA solutions.
Appian RPA	• Makes automation accessible to users with varying technical skills. • Smooth integration capabilities streamline the automation process.	• May lack some advanced features found in other RPA solutions. • Users may encounter limitations when customizing automation workflows.

3.3. Suitable processes automated with RPA

Business operations can be automated with robotic process automation [14]. Even said, not every process is ideally suited for automation using RPA or other automation tools. According to Moreira et al., the most utilised and important evaluation criteria are the process's substantial quantity, regulatory compliance, concurrent usage of several systems, and process systems' robustness. For software robot configuration, large quantities, standard, and regular tasks work well [15]. Because standard procedures are rarely altered, there is a minimal need for robotic process automation maintenance. The standard method contains thorough explanations of the various application software and strategies utilised in the process. Costa et al. claim that when considering the potential for cost savings and enhancing the effectiveness of the company's operations, large-scale procedures are appropriate for RPA.

Asatiani and Penttinen state that when assessing a procedure's appropriateness, one should consider whether the process necessitates the user's manual labour or thinking skills. Straight forward, repetitive processes carried out by human users that don't require thinking skills are automated by robotic process automation. According to Joel et al. [11], the more manual labour that must be done, more lucrative it is to use robotic process automation to automate the workflow. The conditions that follow must be met by the processes: they must be heavily reliant on company regulations and digitally organise data. Because business rules are established or may be documented, automating a process based on them is simpler. According to Khan et al. [8], the decision-making logic of processes must be expressed in terms of organisational rules. Each action a software robot takes requires a well-defined rule. Digital, organised knowledge with well-defined rules and limited exceptions can be processed via robotic process automation.

Several information systems or software programs may be connected to the process that has to be automated [16]. Whenever a human user must use many information systems to complete their job duties, the likelihood of errors rises due to their physical labour. At the same time, productivity declines. Farinha et al. [4] claim that the software robot can manage multiple systems at once. Additionally, transferring data between fields in various applications takes longer for a human user than for a robot. Using identical information systems for the procedure every time it is carried out is known as an established ecosystem.

While assessing a process's potential for robotic process automation, Khan et al. [8] asks how frequently linked systems, like software variants, undergo modifications. Because it can be expensive to update software bots to the latest variation, this also directly affects the ongoing costs of robotic process automation. These variations typically result in alterations to the database structure or user interface, which necessitates modifying the software robots. The concurrent use of many evaluation criteria as a foundation for determining process applicability is emphasised by Farinha et al. [4]. When determining whether to implement robotic process automation to automate procedures and contribute to the creation of successful outcomes, the organization's strategic decision-making can be aided using a variety of evaluation criteria. The likelihood that robotic process automation will be effective increases with the number of evaluation criteria that the process meets.

3.4. Benefits of RPA

The advantages of robotic process automation have been the subject

of a fair amount of research. Data analytics is aided by RPA. According to Flechsig et al. [9], computerised robots may record the metadata of each task to collect analytical data and analyse trends in operations. As data is evaluated, for instance, this can assist in forecasting quantities and task-performing capabilities. Robotic process automation, according to Huang and Vasarhelyi [17], identifying process defects and assist in identifying areas that require modification. These may indicate the need for greater automation or the division of labour among various activities. Since decision-making is typically data-driven, more analysed data also aids in this process [18].

Employee satisfaction is increased by robotic process automation [9]. As said earlier, RPA automation frees up staff members to concentrate on more critical duties by having bots' complete laborious manual chores. According to Farinha et al. [4] employees can use their skills on more strategic activities and feel satisfied with their employment when manual chores are automated via robotic process automation. Workers can concentrate on strategic projects that add value to the company. Professionals in purchasing and supply management, for instance, are content to avoid manual labour and may concentrate on strategic duties like liaising with suppliers instead of routine operational duties.

Given all the advantages, robotic process automation is economical. By removing errors, speeding up process cycle times, improving productivity, improving decision-making, workforce optimisation, and business process scaling, RPA helps reduce operational costs. Additionally, by simplifying audit procedures, robotic process automation can lower audit expenses [17]. Data is automatically gathered, analysed, and reported by software robots. They claimed that by compiling crucial data from numerous systems and apps within the company, bots can provide audit reports. Table 2 provides an overview of the various advantages that robotic process automation offers for business processes. These advantages are thoroughly explained in this section, with an emphasis on business process automation.

3.5. Challenges and limitations of RPA

Finding processes that can be automated is a hurdle in robotic process automation. As has been said, not every process can be automated via robotic process automation. Flechsig et al. [9] assert that to reap the benefits of repetition, it is critical to choose which procedures should be automated. Software robots may be unable to do process duties due to lack or inaccurate regulations if the improper procedures are chosen. Savings may be reduced because of unfinished work or the need for humans to fill in for incomplete jobs. For software robots to function properly, all tasks must have explicit instructions. According to Flechsig et al. [9], software bot modelling is prone to mistakes if the selected company's process is not thoroughly understood.

Excellent quality and uniform data are essential for RPA to be successful [4]. Because software robots cannot process paper or unstructured documents, organised information must be stored digitally. Additionally, if the robot consistently performs tasks using inaccurate data, risk may arise. The corporation's most recent manuals and guidelines should be used to update data on a regular basis. Inaccurate process descriptions result in higher staff expenditures for the company as well as possible revenue loss, claim Khan et al. [8]. Workers might be wary of RPA's modifications to job descriptions [13]. They may see software robots as a danger to their jobs. Risks associated with staff dissatisfaction and resistance to change can be eliminated and reduced by using transparent communication [14].

The dangers and potential drawbacks of implementing robotic process automation are still largely understudied compared to the positives that have already been discussed. The difficulties are outlined in Table 3. This section goes into further information about the challenges.

Table 2
Benefits of RPA.

Benefit	References
Efficiency in business processes	Costa et al. [15], Flechsig et al. [9], Nalgozhina and Uskenbayeva [7]
Productivity	Flechsig et al. [9], Moreira et al. [14], Tanaka [3]
Accuracy in business processes	Flechsig et al. [9], Khan et al. [8], Moreira et al. [14]
Scalability	Flechsig et al. [9], Nalgozhina and Uskenbayeva [7]
Better data analytics	Marciniak and Stanisławski [19], Moreira et al. [14], Stevens [2]
Employee satisfaction	Khan et al. [8], Flechsig et al. [9], Moreira et al. [14], Stevens [2].
Cost-effective	Flechsig et al. [9], Moreira et al. [14], Tanaka [3]

3.6. RPA in business process development

Businesses want to continuously improve and rebuild their procedures so that they are accurate and economical. Tasks can be automated using both traditional and robotic process automation [4]. RPA will not take the role of heavily organised IT systems in the development of business processes. Jovanovic et al. (2018) claims that RPA is a light-structured IT solution that is useful and complementary for automating a range of business operations across diverse industries. Basic chores can be automated with it, and software robots can function across a range of platforms and apps without requiring extensive integration.

In the appropriate procedures, both automation techniques can be applied. Santos et al. [16] state that these have many uses, methods, and integrations with other systems. Processes that people have already completed can be automated with robotic process automation. The robot uses usernames to log into other systems and either completely or partially substitutes humans performing the task. According to Jovanovic et al. (2018), RPA may smoothly connect with a variety of systems or applications without requiring any adjustments because it is non-intrusive. They also note that traditional automation integrates many systems via programming and application programming interfaces (APIs), which typically calls for a deeper level of comprehension and may result in system renewal.

According to Santos et al. [16], traditional automation is a program that follows instructions and does not aim to replicate human activities. In contrast, RPA utilises software robots meant to resemble humans based on predetermined criteria. According to their claims, RPA is typically more affordable than traditional automation because the latter requires more initial training and resources. RPA and conventional automation have diverse applications, according to Jovanovic et al. (2018) They claim that traditional automation automates the entire

Table 3
Challenges of RPA.

Challenge	References
Implementation of RPA requires lots of time and effort	Met et al. [20], Pramod [21]
Deployment of RPA is expensive	Pramod [21]
Unsuitable processes	Flechsig et al. [9], Moreira et al. [14]
Need to find the blend of various technologies	Mendling et al. [22]
Humanoid connection required by customer, safety and confidentiality concerns	Kumar and Balaramachandran [23]
Computerised decision-making may reduce openness and boost some control characteristics.	Ranerup and Henriksen [24], Pramod [21]
Productivity declines when models are premature or insufficiently trained	Romao et al. [25], Farinha et al. [4]
Transitioning from manual to technological implementation will encounter opposition	Radke et al. [26], Pramod [21]
Automation faces difficulties when data is disorganised	Vishnu et al. [27], Moreira et al. [14]
Employee suspicion	Sobczak [13], Moreira et al. [14]
Need for maintenance	Flechsig et al. [9],
Stakeholder management is not considered	Santos et al. [16], Farinha et al. [4]

process, whereas RPA typically automates jobs within the process.

The creation of business processes with robotic process automation is typically the responsibility of business specialists [16]. Using drag-and-drop technology, they specify the workflow of the software robot in the user interface. To implement robotic process automation, the IT department must make sure that environments and communication links are set up. The most knowledgeable people about business and related activities and processes are business representatives. In relation to the definition of robotic process automation, this information is required.

3.7. Summary

RPA reduces human labour by using bots to automate operations across several systems and applications, hence improving operational efficiency. It is utilised in the digital transformation of business processes, enabling enterprises to automate labour-intensive, time-consuming, high-volume jobs. Automation of business processes is a good fit for RPA, particularly when it comes to high volume, standard compliance, the number of systems being used at once, and process system reliability. Routine, regular, and high-volume activities are most suited for setting up the software robot. A strong foundation of digitally formatted data and business rules should underpin the automated procedures. The process that must be automated may be connected to one or more application programs or information systems.

Because robotic process automation automates jobs and frees up human resources to concentrate on more crucial operations, it increases productivity and efficiency. It makes quick data exchange possible, increasing processing effectiveness. Software bots use pre-established rules to process data reliably and consistently minimise errors and duplication of effort are how RPA produces consistent accuracy. Because robotic process automation may scale up or down without adding more workers, it improves scalability potential in response to changing volumes. Software robots may gather analytical data and business insights, which helps identify process problems and identify areas that require modification. This is how RPA aids in data analytics. By enabling workers to concentrate on more strategic responsibilities, RPA improves job satisfaction and raises employee satisfaction. RPA is economical because it reduces audit expenses, speeds up process cycle times, gets rid of errors, and increases productivity. All these factors contribute to operational cost reductions.

Robotic process automation is not appropriate for every process. Determining which procedures stand to gain from automation is crucial. High-quality and consistent data are essential for RPA to be successful. Paper and unstructured documents cannot be processed by software robots. The modifications to job descriptions brought about by RPA may raise suspicions among employees. Employee annoyance and reluctance to change can be decreased by open communication. It is not a given that robotic process automation would automatically yield benefits. The organization's readiness for the approach, its capacity to embrace it, and the delivery and application of RPA all affect realising the benefits. Software bots should be regularly checked to ensure they are operating accurately and correctly.

Companies strive to continuously improve and restructure their procedures to save costs. Tasks can be automated using both robotic process automation and classical automation, each having its own methods and uses. RPA is a light-structured IT system that is more affordable than traditional automation and connects easily with a variety of platforms. While traditional automation necessitates software developers and the IT department, business professionals typically use robotic process automation to design business processes. Using a framework that outlines a categorisation system and conducting sensitivity tests prior to implementation are crucial components of RPA development and implementation.

Robotic process automation is typically used by business professionals to design business processes, whereas traditional automation calls for software engineers and the IT department. A framework that outlines a classification system must be used in the design, development, and implementation of RPA, and sensitivity checks must be carried out prior to implementation. To sum up, RPA can greatly improve business process automation, which will increase accuracy, productivity, and efficiency. However, to fully exploit the potential of robotic process automation in an organisation, problems and constraints must be addressed via careful planning, execution, and ongoing research and development.

4. Study methodology

To automate their order handling procedure, the case company sought to understand what robotic process automation was and how it may be applied. The goal of the study is to improve the case company's present order handling procedure by choosing and designing an RPA technology and workflow. Helo et al. (2019) state that both normative and nomothetical studies exist. While normative research looks for answers for the future, nomothetical research describes the current situation. Since the primary objective of this research is to enhance the order processing and clearance procedure going forward, it is normative. The present state and difficulties of the order processing and clearance procedure must also be understood and analysed using nomothetical approaches.

Based on a qualitative investigation of a case company, the study is empirical in nature. Based on its difficulties with order handling and clearance, the case company assigned the research problem. The empirical research was built upon a review of the literature. Employee interviews are used to collect qualitative data. The research's foundation is the data gathered from the interviews. The research technique of information system design was chosen since the objective is to offer a technical solution.

4.1. Information system design

This study approach uses information system design to build and improve information systems (Helo et al., 2019). Helo et al. points out that to assess the current situation and provide a technical solution to the issue, a methodical approach is required. The creation of instructions for programmers is the main objective, but process development and information system design share additional traits. The research technique of information system design was chosen since the objective is to offer a technical solution. Information system principles are formed, and the generated information system is proposed using observations of use in conjunction with theoretical needs. Since the case company presented its problem and the objective is to offer a solution, the study focusses on problem-centred initiation.

The objective of this study is to define the issue facing the case company and offer a technical solution. Employee interviews are used to collect qualitative data. The existing state and difficulties of the business process are analysed using the data from the interviews. The interview data is then used to build the technological solution. Finally, the management and staff are shown the artefact. This research does not include implementation.

4.2. Data collection

The employee interviews provide qualitative data. The data gathered from the interviews is utilised to assess the situation and the difficulties facing the business process. Semi-structured interviews are the method of data gathering used in this study. Myers and Newman [28] state that one of the most crucial techniques for gathering data for qualitative research is the use of qualitative interviews. Determining the study's required sample size was essential. Two workers are now in order clearance and six workers are in order handling. The engineering section employs people for order clearing. There are cycles where two

employees—one from mechanical engineering and one from electrical engineering—perform order clearance (OC). Since each of them had varying degrees of experience with order handling, six people were chosen for the study. It is sufficient to analyse the state of the order handling process with a small number of staff. The data gathered from the study's interviews is presented in Table 4.

With each participant's consent, all interviews were videotaped to facilitate analysis. Using the Teams application, remote interviews were performed to reach all required interviewees. It made sense to conduct interviews entirely online because staff members can work remotely and perform all chores on their computers. For them to be ready, interviewees were provided with the interview questions ahead of time. The primary themes of the interviews are covered by a standardised interview guide, and Appendix 1 contains the question set. The interviews are framed by pre-planned open-ended questions, with the option to ask more in-depth enquiries as needed. This made it possible for the interviews to follow the same format while giving participants the opportunity to elaborate and be more specific in their responses.

Participants in the interview were informed of the study's privacy at the beginning of the one-on-one interview. Following transcription, the interviews were handled in writing. Personal data and technical data with the proper names are absent from the written text. Interview subjects were informed that they could end the interview at any time. The selected organization's interview tapes and other materials were deleted at the conclusion of the study and given to the case company as an annex to the findings of the study. The participants were informed of the study's purpose. Lastly, the interview's development and the topics covered were also explored.

5. Study results

5.1. Data analysis

The objective of data analysis is to pinpoint the issue and demonstrate the significance of the study. This is accomplished by defining the process and creating a process diagram, which offers insights into the present practices. To assess the current issues and determine which could profit from robotic process automation, the interviews were conducted. Additionally, the case company's manuals and instructions served as a source of information.

Before orders are verified and released for the subsequent supply chain tasks, the order handling process involves manually confirming that the orders match the quotations and can be produced. Since order clearance is a part of the order processing process, the order handlers collaborate with mechanical and electrical engineers. The electrical engineer manually verifies that the order design can be manufactured in accordance with the customer's specifications during the order clearing pre-engineering phase. Workers carry out the procedures required to verify and review the orders using a variety of programs and platforms. Ninety percent of the confirmed order lines from the case company are handled by hand.

Table 4
Summary of study 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

5.1.1. Process diagram and description

Preliminary data from the case company indicated that it lacked an order handling process diagram that would have illustrated how the system operated as it did at the time. Understanding the system entity, its operations, and the relationships between them is aided by a process diagram. Because they make it easier to spot process flaws, bottlenecks, and improvement possibilities, process diagrams are a valuable tool in process analysis and improvement. Fig. 1 and Appendix 2 depict the process diagram. The interview data, the case company's preliminary information, and instructions form the basis of the order processing process diagram.

The order from the sales unit initiates the order processing procedure, as depicted in the process diagram (refer to Fig. 1). Orders are created using the Order Management System (OMS), and they are automatically moved to the ERP system's order handling task queue. The order handler first selects an order from the queue and associates the order with their sales group. After the OMS order has been completed and saved once, they manually cross-check the order to make sure the ERP data matches the OMS order. This is done because if the sales unit modifies the data, no information flows from OMS to ERP. Additionally, they make sure the sales unit has supplied all the necessary information. Order handlers are required to update ERP data based on OMS data.

When a quotation appears in either quotation tool 1 or 2, it verifies that the order matches the quotation and, if needed, modifies the pricing in ERP. It must request that the sales unit fix any errors if the quotation does not match. If the order has been checked by the order clearance engineer, the order handler needs to confirm this. The order clearance (OC) status in ERP might be N, YM, or Y. Y indicates that everything is fine with the order, whereas YM suggests that the mechanical engineer must provide some details. If something from there is required, like parts with a long lead time, an electrical engineer will email a mechanical engineer. N denotes that there is a notification with the sales unit that must be resolved. It talks to engineers once it has received information. If engineering determines that there is sufficient information, the order will be fulfilled.

If there are any open cases—such as a necessary order modification, a client cancellation, or a quotation that was overlooked to include on the order management system—the order handler needs to verify with Salesforce. The order handler then determines whether an internal order review procedure is required. Email and SharePoint are used for internal assessment in conjunction with other supply chain procedures. The order handler can verify the order in OMS once everything is clear.

5.1.2. Challenges in order handling process

Every interviewee stated that the case company's order management and order clearing procedures are difficult. The most important elements affecting process productivity and efficiency include fluctuating order quantities, process-bound individuals, the need to retain a lot of information, challenges with order clearing, variations in order data from various sales units, and system problems. Every issue is related to the others and has a detrimental effect on workers' productivity. Table 5 presents the challenges and the relationships between the tasks and the interviews.

The order handling procedure is manual, as can be seen on the process diagram (see Fig. 1). Tasks are mostly processed manually, while there is some automation, such as orders that are automatically transmitted from the OMS into the ERP system and automation that checks the variation codes if manual order clearance is required. Ninety percent of the order lines confirmed by the case company are handled manually. The six-person order handling staff processes the orders by hand. After receiving orders, the division anticipates receiving confirmations in less than a week. Due to a lack of resources, employees spend most of their working hours performing manual labour. The third interviewee

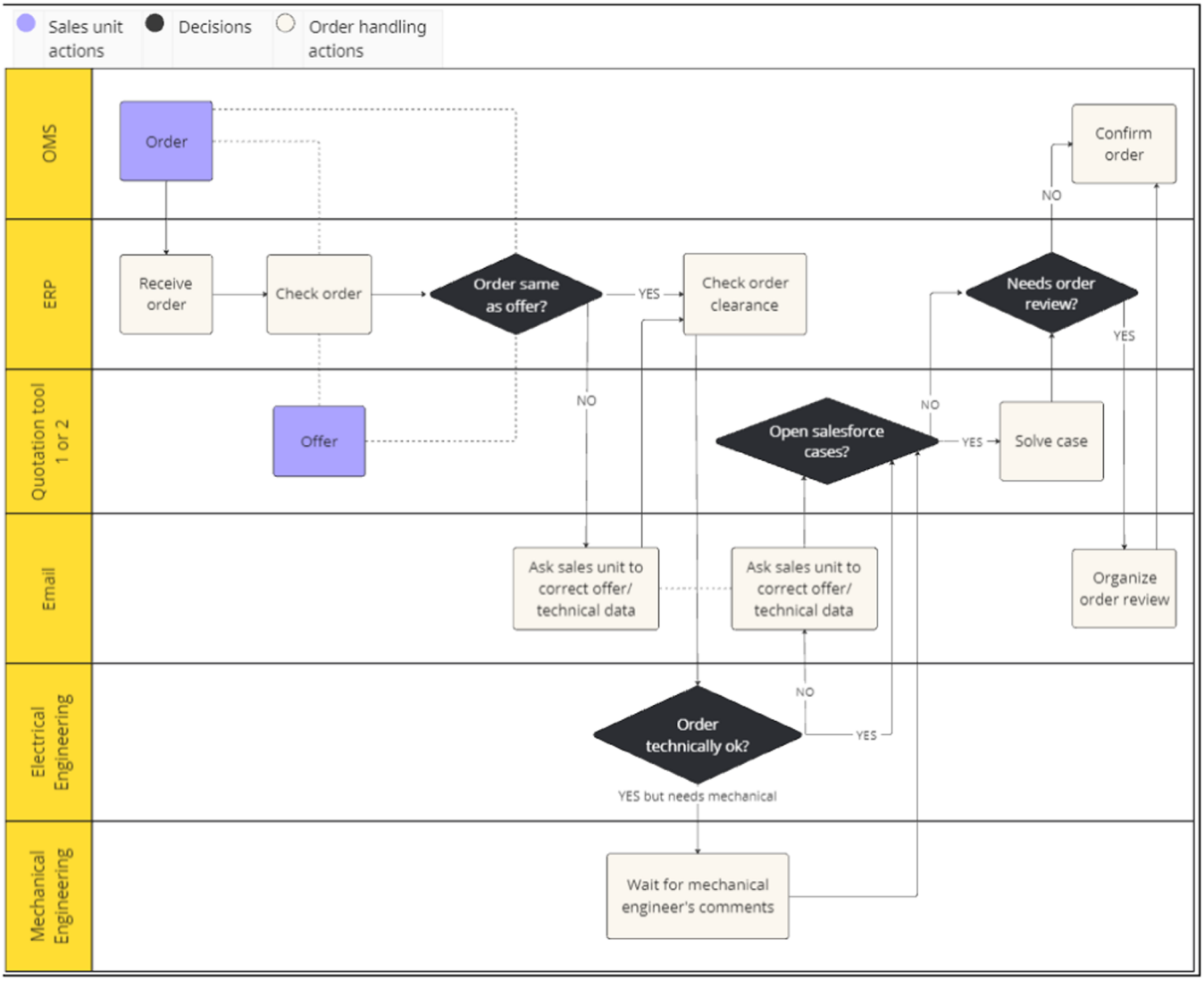


Fig. 1. Order handling process diagram (author).

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

describes this challenge as follows:

Human work resources have 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 quantity of orders that arrive can change. They are unable to forecast how many incoming order lines there will be. If they have information about important incoming projects, they can obtain information beforehand from sales. Accurate prediction of upcoming orders is not possible. There are months when there are a lot of orders coming in, and months when there aren't as many. Order handlers and order clearing engineers' workloads fluctuate due to unpredictability, which makes achieving goals more difficult. Due to a lack of resources, employees spend most of their working hours performing manual labour. They don't have enough time to finish everything that has to be done. Expectations and pressure come from their factories, customers, sales representatives, and sales units. This objection is made by the interviewee 1 as:

In order handling, it is 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, by the interviewee 4 as:

Time management, its challenge, especially in situations when engineering is late on work queue or workload is high for any other reason.

Workers have too much information to retain. Information and guidelines are available about various clients, tasks, requests, motor kinds, and motor variations. The information is dispersed throughout SharePoint, several manuals, and occasionally staff members' personal computers. Recalling everything or locating the information required to carry out the necessary order checks takes a lot of time. There may be instances where everything is fine, but they still need to complete all the checks because they can't recall the specifics of earlier instances. The interviewee 2 describes this challenge as:

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 challenging. The electrical engineer verifies that the case firm can manufacture the motors in accordance with the clients' requests before clearing the order. Order variation codes that need to be manually checked are identified by automation, but it can be challenging to identify those that are consistently clear from the remainder orders. Order clearance engineers must spend needless working hours as a result. Errors can be difficult to find in the OC phase since they are not designed during the order clearance process but rather later. Since their batch sizes are tiny and they produce a variety of customised motors, it is challenging to verify the electrical accuracy of an order without constructing the entire motor. A combination of various variant codes may result in distinct motor 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 mistaken.

Also, by interviewee 6 highlights the same problem as:

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

Due to their disparate adherence to policies, order data from various sales units varies as well. Order handlers are required to notify the sales unit if any necessary data is missing or inaccurate. Notifications are delivered to the sales units for approximately one-third of the motor order lines. One way to notify someone could be by an order without any unique shaft data. The fourth interviewee describes this challenge as follows:

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

Also, challenge is presented by the Interviewee 3 as:

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 must reach the targets. This challenge is expressed by the interviewee 4 as:

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 conclusion, all the issues are related and have a detrimental effect on workers' productivity. An excessive workload can lead to weariness, tension, and a decline in productivity. If workers have too much on their minds, they may perform below expectations. In the worst scenario, weariness and stress among staff members may lead to burnout or other health problems, which may result in a reduction in working hours and an increase in operating expenses for the business. When workers are under pressure to complete their work on time or retain all the information they need, they are more likely to make mistakes. Furthermore, human error is a constant concern in manual operations. Errors can occur, for instance, when staff members copy data from OMS to ERP. By adopting software that automates operations, like robotic process automation, these could be prevented.

The supply chain procedures may experience problems because of errors. For instance, the business may need to change the motor parts during the manufacturing process, which could result in increased operating expenses or delayed delivery. Customer delays or the requirement for quicker transportation may result from this, which could lead to inefficiencies and higher supply chain operating costs. Because they do not receive the anticipated level of service, customers may become less satisfied if the operational aim is not met. Customers choosing to utilise other manufacturers could result in a loss of revenue.

5.1.3. Evaluation of the accompanying challenges

Every difficulty has an impact on worker productivity and is pertinent to the example company. This study is limited in its ability to address all of the mentioned difficulties due to research restrictions. The process challenges that can be resolved by a range of robotic process automation systems are the subject of this research. Variable order volumes, person-bound processes, the requirement to recall a lot of information, and order clearing obstacles are pertinent challenges for this study. A presentation of the problems' applicability is seen in Table 6.

Robotic process automation cannot be used to resolve discrepancies in order data from various sales units. Given that training is likely conducted relatively differently across national borders, the sales units should be involved in addressing this difficulty. Unifying the training materials and conducting training in a same manner for each of the sales units could be one way to improve OMS order accuracy and minimise the number of notifications that need to be delivered. Furthermore, process automation is not the only way to resolve system problems. Updates or unavailable systems may cause brief system breakdowns. Although the case company upgrades its systems on a regular basis, problems can arise. The IT department, which oversees the systems and system updates, is to blame for this difficulty. Although there isn't a simple solution, staff members could aim to complete most of their job ahead of time to be ready for system updates.

5.2. Objectives of data analysis

The goals of the artefact are presented in this section. The idea is to outline the solution's goals and show how the artefact could be improved in the process. The process emphasis points are chosen to accomplish this. These decisions are made based on the examination of the process's difficulties. The process diagram's key points are highlighted, and strategies for automating these steps are offered to cope with the process's identified problems.

5.2.1. Selected process focus points

The process focal points were chosen following the examination of the order handling procedure (refer to Figs. 2 and 3). Automation could help with four pertinent process activities and address the issues found. Table 6 presents pertinent challenges. The following are process focal points:

- *Checking the order:* When the sales unit modifies data, no information flows from OMS to ERP after the OMS order has been completed and saved once. For this reason, order handlers manually verify the order in which the ERP data corresponds with the OMS order. They additionally verify that the sales unit has supplied all necessary information. In accordance with the OMS data, order handlers must update ERP data. Order handlers have a lot of steps to remember in this labour-intensive manual task that takes time. During order processing, this step of the process provides many points that need to be recalled and ties the process to specific people. It is anticipated

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

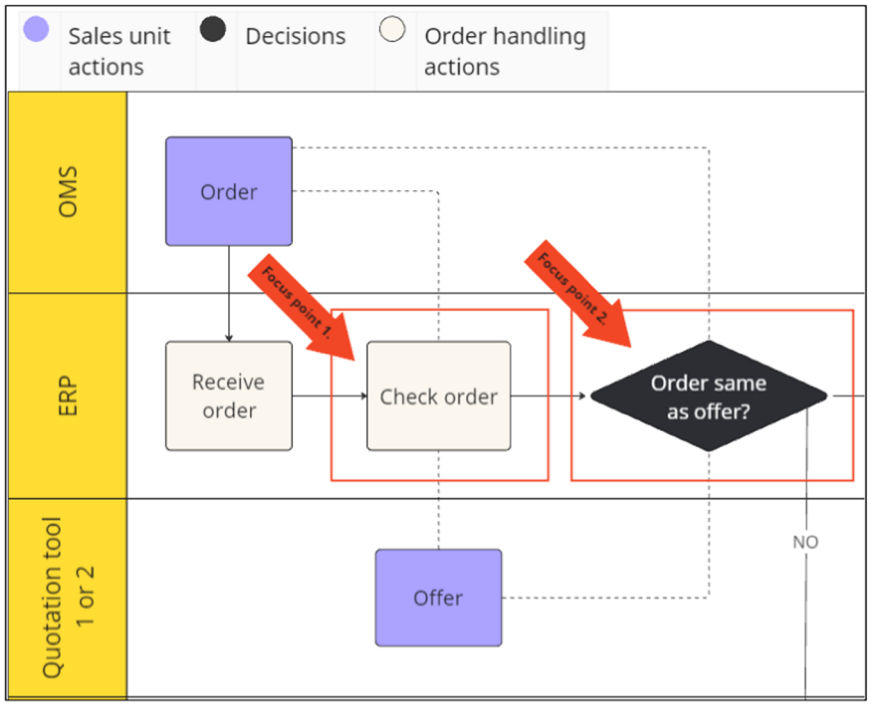


Fig. 2. Process focusses points 1. and 2. (author).

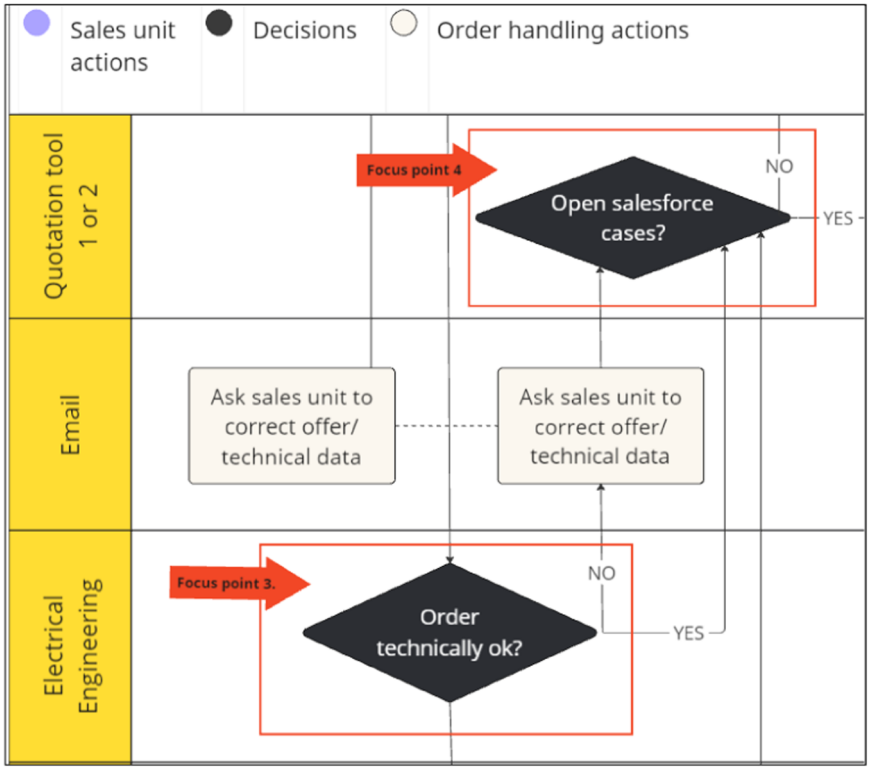


Fig. 3. Process focusses points 3. and 4. (author).

that robotic process automation will decrease manual labour and save workers' working hours by automating cross-checks. Process efficiency could be increased, and human error risk could be decreased by automating certain manual tasks.

- *Order same as offer*: The order handler looks through quotation tools 1 and 2 to see if any are present. If a quote is provided, they verify that it corresponds with the order and, if required, adjust the pricing in ERP. They must ask the sales unit to fix the error if the quotation does not match. Quotation tool 1 quotations are not the best to automate with RPA since they contain various structured data with various sales units. However, Quotation Tool 2 proposals typically have the same structure and may be good candidates for RPA

automation of the cross-checks. Additionally, quotation references might be immediately imported into the ERP system and indicate that either quotation tool 1 or quotation tool 2 has an offer for the order. Verifying that the order corresponds with the offer requires manual labour, which limits the process to specific individuals. Additionally, by reducing human labour, this automation may assist address the issue of having too many things to remember. Another way to balance the workload is to reduce the amount of manual labour.

- *Order clearance (OC)*: The electrical engineer verifies that the case firm can manufacture the motors in accordance with the clients' requests before clearing the order. If there are any variation codes in the order that need to be manually checked, automation checks them. Errors may be difficult to find in the OC phase since they are not designed during the order clearance process but rather afterwards. A combination of various variant codes may result in distinct motor codes. The order clearance procedure is too complicated to automate in its entirety. Robotic process automation could aid with order clearing issues and be beneficial for certain operations. For instance, the electrical engineer must constantly examine the electrical tool to verify if there is a calculation reference there. If the check is automated with RPA, it could lessen the amount of manual labour involved in order clearance.
- *Are there open Salesforce cases?:* To find out if there are any open cases—such as order changes that are required, customer cancellations, or quotations that are forgotten to include on OMS—the order handler must check Salesforce. The potential open Salesforce cases need to be resolved. Even in the absence of pending cases, verifying each order requires a significant amount of time. Order handlers would save time if they did not have to verify if there was a case or not, but Salesforce cases are too complex to be resolved by automation. The order handler may be able to find out whether there are open cases by checking a box in the ERP system. One could utilise the time saved to work on more strategic projects.

5.2.2. Possible improvements in the process

Employees save time and can better balance their workloads when there is less manual labour involved in the order handling and clearing process thanks to automation. Software robots can handle high order volumes and work around the clock. Less manual labour is also beneficial because software robots do the jobs, which helps with the problem of having too many things to remember. Automating manual tasks could lower the possibility of human error because well-written software bots can be relied upon. Table 7 provides an overview of the issues that the procedure seeks to resolve.

5.3. Designing the solutions

The solutions are designed to create and develop the artefact using the analytical data. This is accomplished by developing guidelines for the case firm regarding which jobs could be automated to help address the issues that have been discovered. Compared to the process diagram, the process emphasis points are shown in greater detail. Figures are used to illustrate each task, and potential automation sites are indicated. The duties are illustrated in depth using the data and reports of the case company's personnel. The solution is examined to see if it can be produced and whether it is a workable solution to the problems that have been identified.

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.

5.3.1. Order handling tasks

The job at process focusses 1, 2, and 4 involve order handling. The tasks in the process focal points are outlined in Fig. 4 and are covered in detail in this section. Order handlers are free to select the order that works best for them; tasks are not forced to be completed in a certain sequence.

The order handler verifies the data between the OMS and ERP using the focal point 1 in Fig. 4. They verify that the customer personal guarantee (PG) and delivery/consignee address in extra data B are accurate. They verify that the address, moving tag texts, variant code configuration, mounting position, colour, routing, and variant codes match the OMS data at the item level. They verify that the quantity and international commercial terms (INCOTERMS) are accurate by looking at the front page. They verify that the header lever's text and order type are correct. They also verify that the customer PG is not empty at the header level.

Verifying the quotation is the second focus point, as seen in Fig. 4. The order handler looks through quotation tools 1 and 2 to see whether there is a quotation. To confirm that the sales unit ordered the motors with the precise specifications provided, they must verify whether the data in the quotation matches the OMS data. They ascertain whether the quotation includes a price offer. If a price is not specified, the pricing must be determined using the OMS data as the foundation for the Excel spreadsheet. They verify if the quotation reference may be seen in ERP's extra data B.

The order handler must verify from Salesforce whether there are any open cases, such as order changes that are required, customer cancellations, or quotations that are neglected to be mentioned on OMS, based on Fig. 4, Focus Point 3. Together with the sales team, they must resolve any potential open Salesforce cases. Even in the absence of pending cases, verifying each order requires a significant amount of time. Order handlers would save time if they did not have to verify whether there was a case with Salesforce. However, automation is not feasible for solving complex Salesforce cases. If there were open cases, the order handler may be notified via a box in the ERP system.

5.3.2. Order clearance tasks

The order clearing task is the third process emphasis point. Figs. 4 and 5 show the tasks in the process focus point. Electrical engineers are free to select the most effective hierarchy and are not obligated to complete tasks in a particular order.

The electrical engineer verifies the electrical tool's computation reference. They verify that every variation code works with every other variant. Although some variant codes may be ordered based on the sales tool even though they are not appropriate for the ordered product, if the variation code is on the order, it should be suitable without verification. Certain variant codes may not be combinable. They can use the search function to see if any prior orders have been placed with the same combinations or to see if there are any conflicts with the variation codes. If there are problems with the variant codes, the electrical engineer opens a notification. The electrical engineer verifies if there are any minimum energy performance standard (MEPS) variations. Different country-specific needs, like electrical requirements, are the focus of MEPS versions. To verify the stamping information, they can use a grading tool. Furthermore, in cases of uncertainty, the certification team can be consulted.

The product code and material number are compared by the electrical engineer. They verify the mounting position using the product code information. The mounting position can be verified using data from the search tool. When a product code appears in red, there may be unique circumstances. It denotes the end of the product line. The variants might be anything, and the order data needs to be verified. Weight information is subject to error, so a thorough OC check is necessary. Make sure the offer texts correspond with the order by checking them.

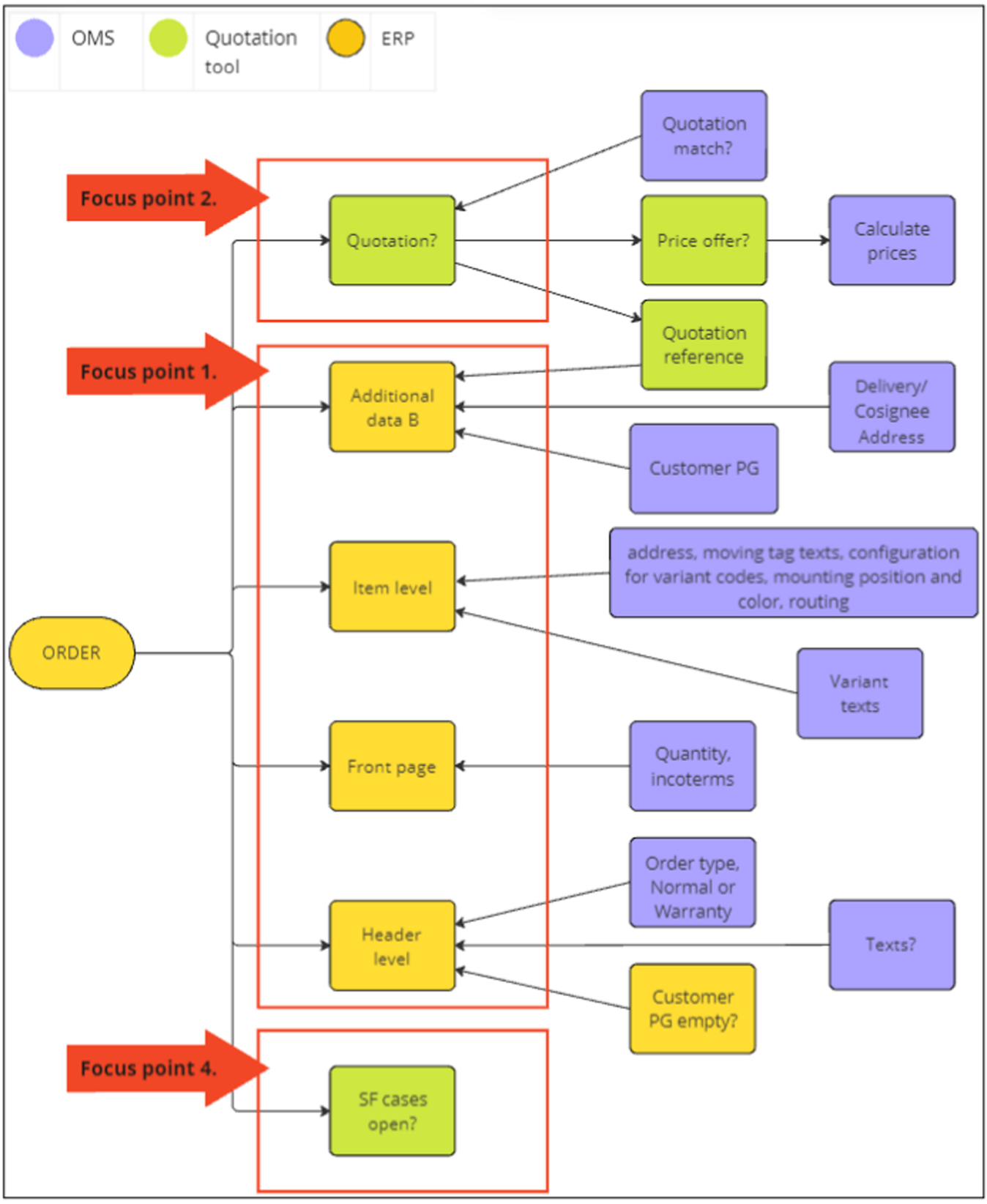


Fig. 4. Order handling tasks (author).

The specific variant codes are checked by the electrical engineer. Although there are several variations and combinations, Table 8 lists the ones that should always be verified. Verify the variant codes 002 and 095 to make sure the stamping data is accurate. The electrical engineer verifies the accuracy of the information in the offer's free text. To determine what stamping data is required, they examine using the rating tool program. Variant code 209 is examined to verify that the stamping information is accurate and that the special winding has the necessary

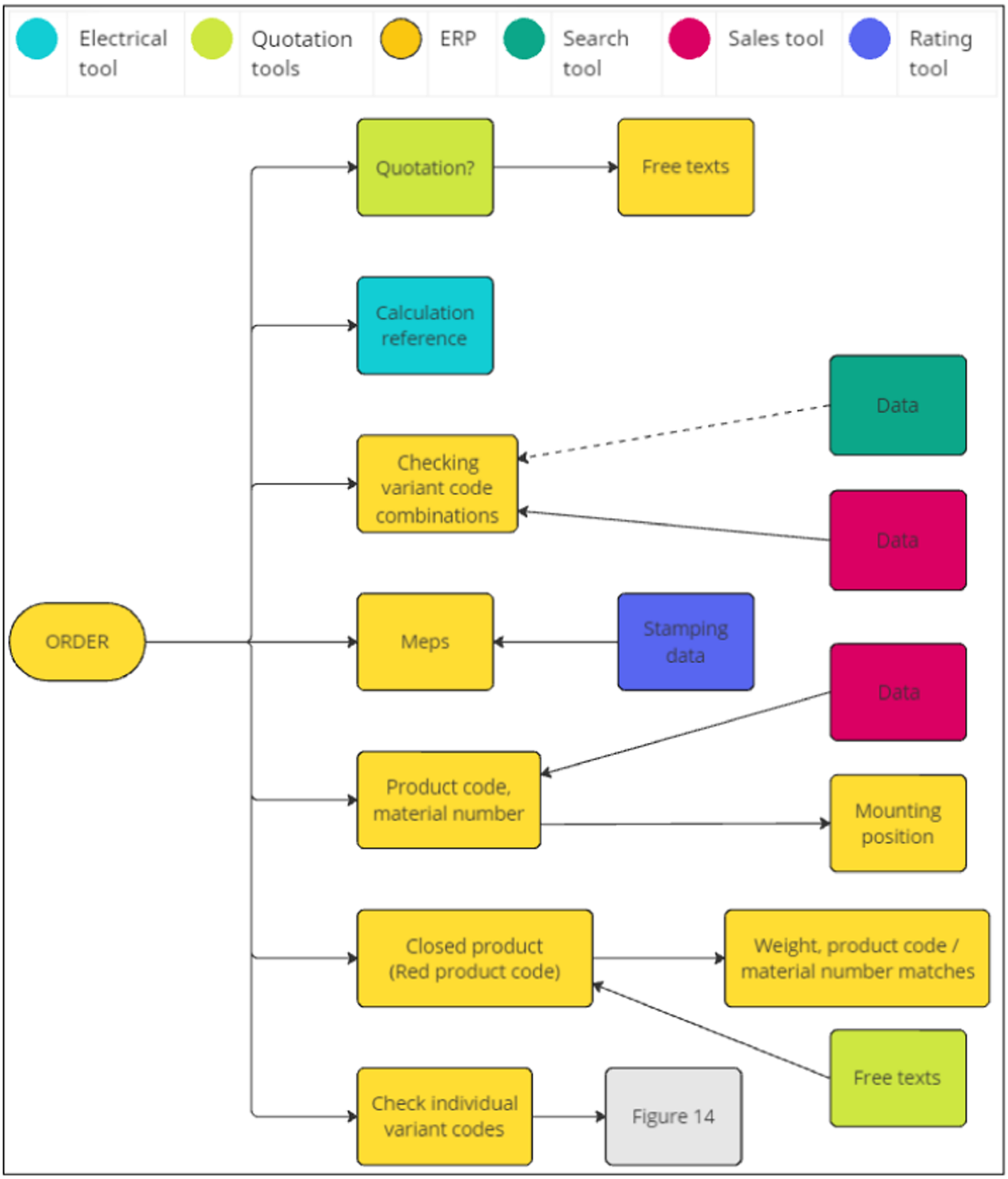


Fig. 5. Order clearance tasks (author).

data. They verify if the electrical tool or offer contains the calculation reference Fig. 6.

It is necessary to verify from the free text that the shaft reference for variant codes 070, 591, and 600 is accurate. Additionally, it is necessary to verify the accuracy of the measurements and drawings for Variant code 591 (VC 591) and VC600. It is necessary to verify the information provided by variable speed drive (VSD) variant code 163, which includes the kind of torque, speed range, required torque/power, supply voltage, and frequency. Checking the load ability is also necessary. If there is a design that is quotation-specific, the variant code xxx is utilised. These are always situation-specific and require careful examination. Free messages should always come with an offer. Mechanical

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
VC412	Special brake.
VCXXX	Quotation specific.

engineering must inspect the extended lead time part, variant code 412.

5.3.3. Suggestions for automation

The case company has another project that addresses related topics. Although it comes from a different angle, these adjustments will benefit the order handling procedure as well. It concentrates on the ordered motors' technical features. Table 9 provides a summary of the preceding activities, lists the concerns that will be handled, and outlines the timeline. The issues that will be resolved in 2024 or 2025 shouldn't be the case company's focus. There is a chance to concentrate on the issue if the repair is implemented after 2025 or not at all. If a remedy is intended for 2026 or later, it is vital to assist the order handling process in the interim by employing robotic process automation to temporarily resolve the problem.

Table 9 indicates that in 2024 or 2025, the technical tasks will be resolved. This will facilitate a more effective order clearance procedure. Certain exceptions cannot be assisted by automation and will not be handled. Partially, MEPS versions will be covered; however, in certain regions, certifications are still under discussion. The certification structure should be clearly visible in the case company to fully repair MEPS variations. Closed items are not included in the list of repairs either. These are anomalous situations that depart from the standard procedure. To avoid using exceptions or producing motors without codes from the product catalogue, the case company should think about adding all the various types of motors in its product portfolio.

However, there are still commercial responsibilities that must be completed. There won't be any fixes for simple order handling chores. To make things more automated and standardised, only quotations will be fixed. The Salesforce cases won't change. Order handlers are still required to manually and laboriously cross-check order data from OMS and ERP. Checking the data by hand for accuracy on each order is inefficient. Robotic process automation (RPA) can be used to automate tasks that require many stable systems, are large volume, and meet with standards.

Considering all the facts provided, the case company's best course of action is to use robotic process automation in conjunction with RPA specialists to automate the following process tasks to overcome the challenges:

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

Following the recommended automation, a more efficient order

Table 9
Summary of problems that will be fixed.

	Problem will be fixed		
Process task	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
Checking individual variant codes	X	X	

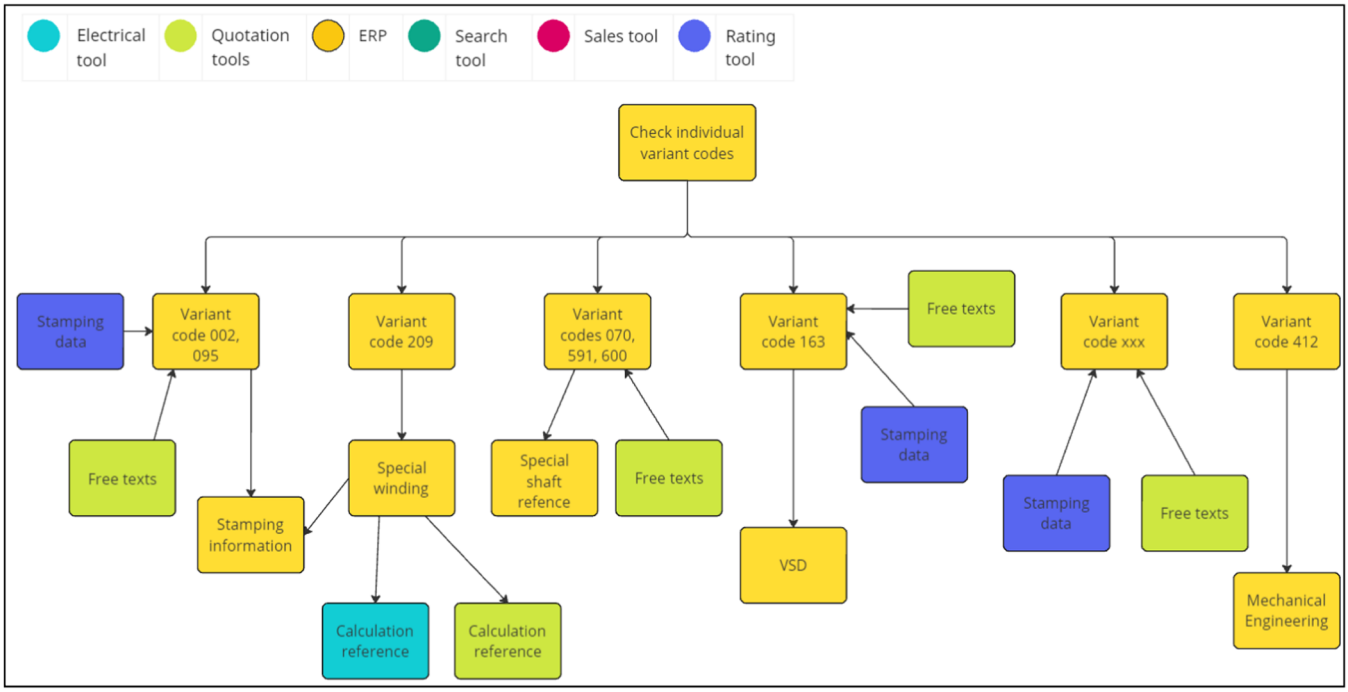


Fig. 6. Checking individual variant codes (author).

handling procedure is anticipated (see Fig. 7). By decreasing the amount of physical labour involved in the order handling process, suggested automation aids in addressing the issues raised. Reducing physical labour helps balance the workload and saves employees' time. Less manual labour is also beneficial because software robots do the jobs, which helps with the problem of having too many things to remember. Automating manual tasks could lower the possibility of human error because well-written software bots can be relied upon.

5.4. Results summary

Process descriptions and diagrams were used to offer an analysis of the order handling procedure in the results section. To comprehend the current procedure, empirical data from staff interviews was employed. The case company's manuals and instructions were also consulted for data. The investigation uncovered issues with the procedure that had a detrimental impact on the effectiveness and productivity of the order handling procedure. The hurdles that have been identified include uneven workloads caused by poor predictability, process-bound individuals, the requirement to retain a lot of information, challenges with order clearing, variations in order data from various sales units, and system malfunctions. The study's focus on utilising robotic process automation to improve order handling meant that it was unable to resolve variations in order data between sales units and system issues.

Following the analysis, the process analysis served as the foundation for determining the solution objectives. The top four process focal points that make sense to automate operations with robotic process automation were determined. It was decided to cross-check the order's OMS and ERP data because it is a laborious manual process with numerous steps that need to be remembered. As a result, the process is human bound. Is the order the same as the offer was chosen, as this ties the order processing procedure to specific individuals and generates a lot of remembered points. Order clearing was selected as a process focal area because it presents certain difficulties. Automating the entire check is

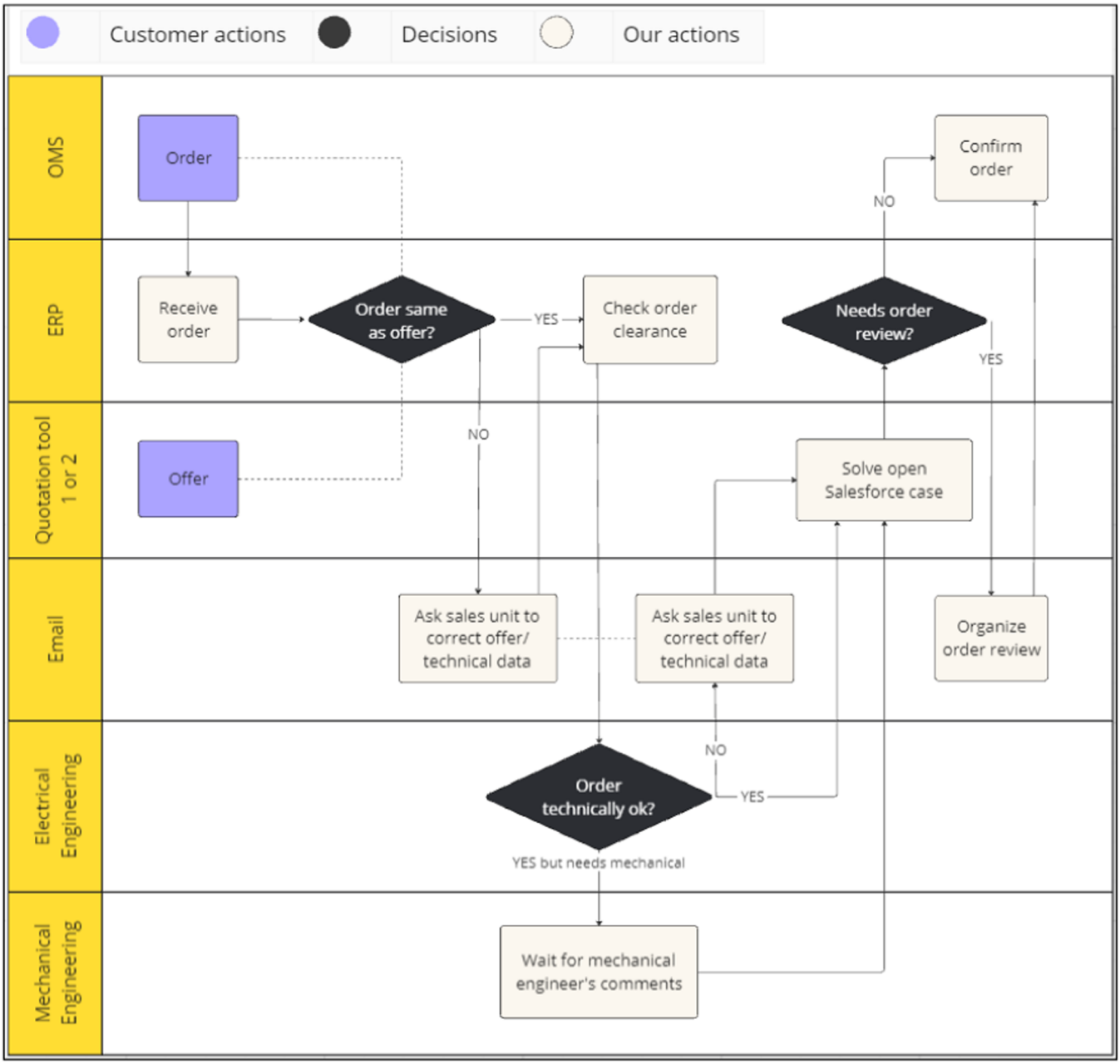


Fig. 7. Process diagram after suggested automations (author).

not possible due to the complexity of the order clearing process. Robotic process automation could aid with order clearing issues and be beneficial for certain operations. Since it is a manual process that requires a lot of time to review every order—even if there are no open cases—checking for open Salesforce cases was chosen. Because it balances workloads, automating manual labour can also help with irregular workloads.

The designing process was the final stage. The objective was to advise the case organisation on what duties must be automated to improve the effectiveness of the order handling procedure. This was accomplished by presenting the process emphasis points in greater detail than the process diagram and by utilising figures to illustrate each task. In the figures, potential automation jobs were indicated. The timeline for these changes was supplied because identical concerns were addressed by another project from a different angle. The case company shouldn't concentrate on the issues that the other project will shortly fix. The findings indicate that automating the following process tasks with robotic process automation is the best way to overcome the obstacles and improve the order processing procedure:

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

6. Managerial implications

The order handling and clearance procedure has additional areas for improvement that are not included in the results section. To ensure that motors with the incorrect variation code combinations cannot be ordered, the sales units have manuals and instructions on the products that the clients are ordering. Nevertheless, mistakes may occur, or it may be possible for the systems to inadvertently add incorrect variant codes. The lack of guidelines for engineers to report errors in the system has been recognised as the issue. To ensure that no exceptions remain in the order clearing process, the engineering department is proposing to set up a channel for reporting potential problems in the system or portfolio.

As it handles the customer's orders to make sure they are accurate and feasible to fulfil, the order handling and clearance procedure is also customer service. Although the customer's ordering experience is intended to be as seamless as feasible, the present order handling process offers excellent customer service. The customer is the sales unit in the order handling process. Even if the inaccuracies are the fault of the customer, the order handlers correct the mistakes produced by the sales units without disclosing them. While it is not feasible to eliminate human mistake, in an ideal world, systems should be designed to make errors difficult to produce. The idea is for order handlers to constantly disclose errors so that sales teams can assist them grow and provide better customer service by helping them learn from their mistakes.

Due to their disparate adherence to policies, order data from various sales units varies as well. Order handlers are required to notify the sales unit if any necessary data is missing or inaccurate, and notifications are delivered to the sales units for around one-third of the motor order lines. Given that different countries have varied training practices, it is suggested that the challenge be tackled in tandem with the sales units. To have more accurate OMS orders and reduce the number of alerts that need to be sent, one way to improve the situation would be to standardise the training materials and conduct training in a same manner for all sales units. Additionally, it would guarantee that the customer's order is completed accurately.

The systems' problems present a challenge. Since the organisation changes its systems frequently, there may be brief system faults brought on by updates or downtime. There may be issues with the systems that cannot be resolved with automation alone. Updates or unavailable systems may cause brief system breakdowns. The IT department, which oversees the systems and system updates, is to blame for this difficulty. Although there isn't a simple solution, staff members should aim to finish most of their job ahead of system updates.

7. Conclusions, study limitations and future study directions

The three research questions that were identified sought to define robotic process automation as a concept and to pinpoint appropriate automation targets within the tasks and processes of the order processing process. Examining the findings of the research framework and contrasting it with the research is the process of interpretation. The literature evaluation examined the body of research that links the application of robotic process automation to business process automation to provide a solution to the first question: "What key elements need to be considered when implementing RPA?" In this study, robotic process automation was defined as a software application that automates business processes or their segments that meet predetermined selection criteria. Frequently used evaluation criteria that have been used to determine whether a business process is suitable for robotic process automation (RPA) were discovered from earlier research.

The large process volume, standard compliance, number of systems employed concurrently, and process system stability were the most often utilised evaluation criteria. To create the most thorough automated evaluation feasible, it was advised to include a variety of factors when developing the evaluation standards. It was determined that various other business process jobs could be automated with RPA. Most of the jobs entailed streamlining company procedures and copying or transferring data between various systems. Numerous advantages and difficulties associated with robotic process automation (RPA) for corporate process automation were noted in the literature review. The most often reported benefits were the decrease in human error in the process, the notable acceleration of process turnaround times, and the ability to reallocate staff members from repetitive manual duties to higher-value jobs.

The advantages have led to improvements in information accuracy and operational efficiency within the organisations. Less has been said about the challenges than the advantages. The biggest obstacles were mistrust among employees, selecting the incorrect processes to automate, and underestimating stakeholder management. All the organization's stakeholders are involved in stakeholder management, and the biggest drawbacks have been associated with employees' reluctance to embrace change and the IT departments' lack of commitment to implementing robotic process automation on time. The likelihood that an organisation would reap the benefits of automation was directly impacted by its decision not to choose automated procedures.

To sum up, RPA can greatly improve business process automation, which will increase accuracy, productivity, and efficiency. To achieve its maximum potential, robotic process automation in an organisation must be implemented with great care, followed by rigorous implementation, ongoing research and development, and a willingness to face inevitable obstacles. The findings of this study's empirical section are used to address the second and third research questions. "What is the current state of the case company's order handling process?" is one of these research questions. and "How to use RPA to improve an order handling process?"

First, process descriptions and diagrams were used to analyse the order handling procedure. Employee interviews were used to assess the current process and identify any issues. Additionally, pertinent manuals and instructions served as a data source. Only pertinent issues were covered because the research was restricted on utilising robotic process automation to improve the order handling procedure. Following the analysis, the process analysis served as the foundation for determining the solution objectives. The best prospects for robotic process automation jobs were determined to be relevant process emphasis points.

The designing process was the final stage. The idea was to make recommendations on which order processing tasks should be automated to improve efficiency. This was accomplished by presenting the process emphasis points in greater detail than the process diagram and by utilising figures to illustrate each task. In the figures, potential automation jobs were indicated. The plan was to look at other projects to find out

which jobs will soon receive improvements and recommend automating the ones that don't. After the investigation, the recommended automation will be put into practice using the information system approach.

In conclusion, by minimising manual labour, automating the order handling process with RPA would simplify the procedures and aid in resolving the issues that have been discovered. Other organisations might utilise this information as a guide to automate their business operations through RPA implementation. The primary empirical steps can be applied to other business processes, such procurement, even if the tasks and business procedures are different from those in this study. The literature study generalises RPA to business process automation rather than focussing on it specifically in order handling automation. This restricts this study's application to business process automation.

7.1. Study limitations

The lack of expertise in robotic process automation in the assessment of RPA's applicability constitutes a research limitation. The opinions were informed by the knowledge gathered from the literature review as well as the experience of end users. The business process was mostly understood through a limited number of employee interviews, which is considered as a limitation to generalize the study outcomes. Additionally, the knowledge and expertise of the interviewees on RPA were limited, which restricts the efficient use of robotic process automation in this study. Their limited knowledge on RPA may have been put to better use by providing a more thorough explanation of how to apply the research findings to the example company's business process's robotic process automation.

Furthermore, this study was restricted to application programs, or robotic process automation. RPA based on artificial intelligence (AI) with more sophisticated capabilities, such decision-making, may have been applied in the study. This might have led to the creation of further avenues for order handling automation. To sum up, this study was conducted with the intention of applying it to other comparable robotic process automation interpretations for the case company. RPA is scalable because it is simple to extend to additional activities or functions once it has been put into practice. Although this study concentrated on a particular business process, the next RPA project can benefit from using the starting point instructions. All things considered, the study was enlightening and gave the case company a wealth of new information regarding robotic process automation and its order handling procedure.

7.2. Future study directions

By using RPA bots, one may complete repetitive, routine operations much more quickly and accurately than a human could, which lowers errors and boosts productivity significantly. Compared to AI, they are less intelligent; instead, they merely adhere to a set of preset rules and are employed in tasks that call for little to no human judgement. Its ability to save costs, minimise errors, and improve business processes has led to a higher degree of implementation by various corporate concerns. RPA's full potential, however, is shown when it is coupled with artificial intelligence (AI), as AI lends cognitive capabilities to the automation process. The primary tasks that AI is linked to are those that call for intelligence comparable to that of humans, such as pattern recognition, data analytics, and decision-making.

Businesses can advance their automation processes into more complicated ones that are beyond the capabilities of standard RPA by integrating AI with RPA. Based on these advantages, it is advised that more study be done on the application of AI-based RPA in business process automation, taking the order handling process into consideration. Moreover, AI-based based RPA can also be studied within the case company's other business processes such as production, scheduling, transportation and delivery instead of only order handling process. Furthermore, this study only considered qualitative data from the case company, which can be extended to study with the quantitative data to have an in-depth study and can be replicated to other companies too.

CRediT authorship contribution statement

Sini Pelkonen: Writing – original draft, Visualization, Validation, Software, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Ahm Shamsuzzoha:** Writing – review & editing, Visualization, Validation, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Conceptualization.

Declaration of Competing Interest

We are happy to declare that there is no conflict of interest in this article.

Appendix 1. Interview questions

Basic information
Please, introduce yourself. Name, position and how long have you worked in current position?
Process in general

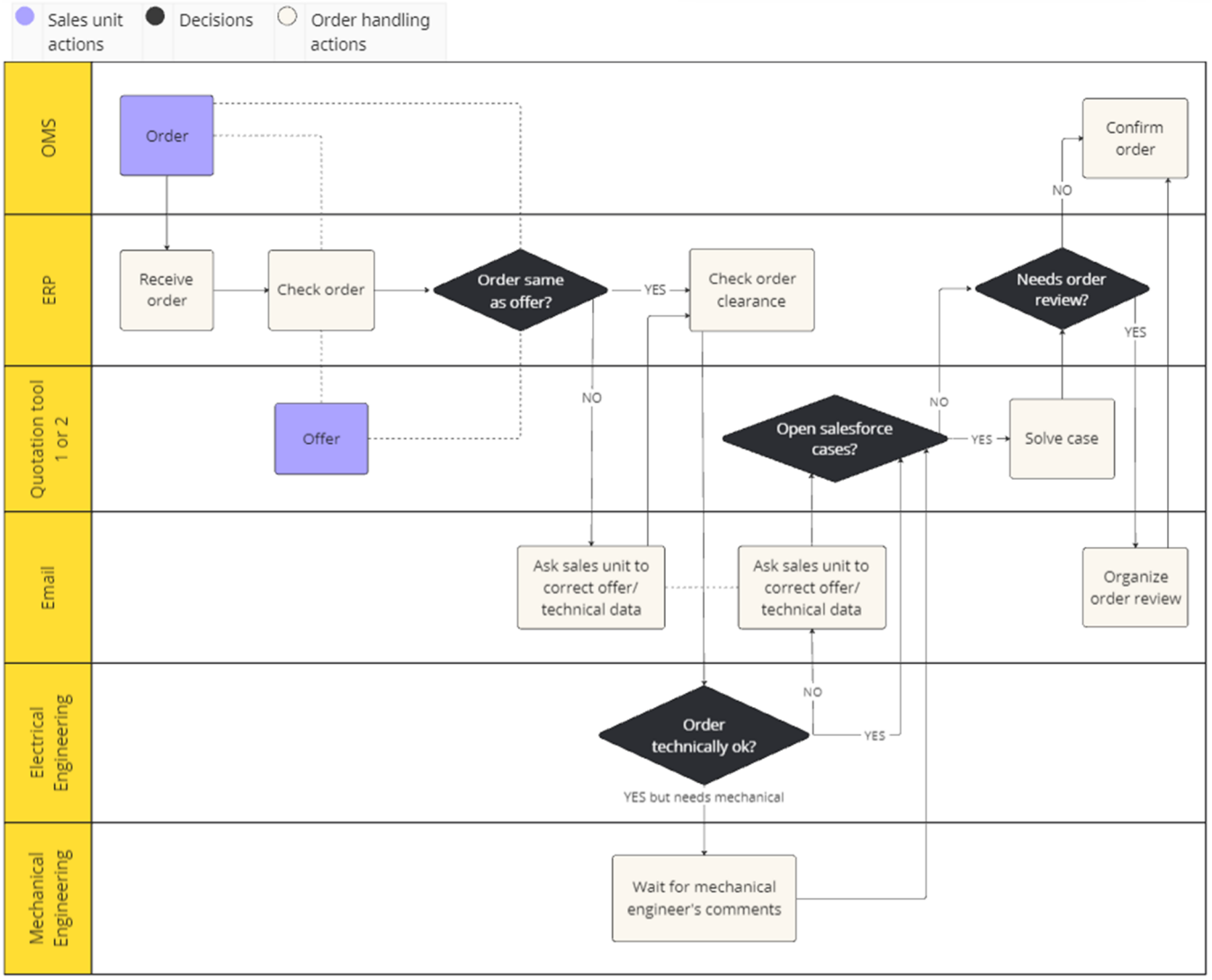
1. How would you define order handling / order clearance process?
2. Which steps are included in order handling / order clearance process?
3. Which applications/systems do you use in order handling / order clearance process?
4. What is your main task in your work?
5. How do you perform your main task?

Challenges in process

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

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

Appendix 2. Process diagram



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