Critical Success Factors for Robotic Process Automation Implementation

Chun Pong Lok

A dissertation submitted to
Auckland University of Technology
in partial fulfilment of the requirements for the degree
of
Master of Business (MBus)

2021

Department of Business Information Systems
Faculty of Business, Economics and Law

Supervisor: Bill Doolin

ABSTRACT

Robotic Process Automation (RPA) has become a popular topic in the information technology and digital transformation communities since the last decade. The deployment of RPA technology may reward organisations with an improvement in productivity and quality and a substantial return on investment. However, the implementation of RPA has not been a smooth journey for some companies. They have encountered difficulties during the implementation, or their projects have been abandoned and replaced by other solutions. The purpose of this dissertation is to identify critical success factors (CSFs) for RPA implementation to improve the chance of success and enable organisations to achieve the full potential and benefits of RPA.

The method of investigation was a systematic literature review on academic articles since 2010 presenting cases studies of RPA implementations. A thematic analysis was carried out on 20 selected RPA case studies from the academic articles, first to produce a primary set CSFs, and then to refine the preliminary result to a final set of CSFs. There were 14 CSFs derived from the thematic analysis. After further analysis of the findings and relationships among CSFs, a set of 7 fundamental CSFs and 7 secondary CSFs were established.

There is limited academic literature available on factors contributing to RPA implementation success and the topic has not been systematically examined. The empirical identification of relevant CSFs is a useful contribution to both theory and practice in this area. A comprehensive analysis of each CSF's findings and their key aspects produces a better knowledge of the implementation issues and the relevant CSFs that can be applied to tackle particular implementation issues.

Keywords: *Critical Success Factors, Implementation, Robotic Process Automation.*

TABLE OF CONTENTS

LIST OF TABLES

ATTESTATION OF AUTHORSHIP

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements) nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.

31st May, 2021

Chun Pong Lok

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to the people who have supported me throughout my research journey. First and foremost, I would like to thank my supervisor, Bill Doolin, for his guidance, insightful comments and suggestions. I am deeply indebted to his invaluable assistance at every stage of the research project, from formulating the research question to reviewing the final draft. Without his tremendous effort, it would be impossible for me to complete my dissertation. I would like to offer my special thanks to my colleagues, Margie Raiyawa, Celia Alcanites and Rozanne Bloomfield, who have covered my work during my study leave to dedicate all my time to this research. Lastly, my appreciation also goes out to my study buddies, Megan Pham and Sameer Khan, for their support and for providing the essential study materials.

CHAPTER 1. INTRODUCTION

Digital transformation provides opportunities for companies to excel through the pervasive application of cutting-edge digital technologies. Robotic process automation (RPA) is one of the technological innovations in digital transformation (Lacity & Willcocks, 2016). The term "Robotic Process Automation" was coined in 2012 by Blue Prism, which is one of the main RPA providers. The RPA technology is a software application or software robot that can be trained to carry out tasks in a business process that were previously done by a human. Software robots can work 24 hours a day, 7 days a week, and they cost employers approximately one-third of an offshore worker or one-fifth of an onshore employee (Taulli, 2020a). According to two RPA providers – UiPath and Nice, other RPA benefits cover the following four areas (NICE, 2020; Ostdick, 2016a):

- *Technology* – No alteration to existing applications is required, as RPA works with the existing IT infrastructure. Less coding requirements and reusability of components may speed up the software development and deployment process.
- *Process* – The software robot can complete the same task five times faster than a human. Companies implementing RPA have experienced error reduction, quality improvement, consistent performance, and compliance with privacy regulations.
- *People* – Mundane work is taken over by software robots, freeing employees to engage in higher-value tasks, in turn enhancing their work experience and job satisfaction.
- *Business* – A possible financial reward through return on investment (ROI) can be achieved as RPA typically costs less than average workers. Cost savings enable the organisation to become more competitive. Flexibility on scaling ensures sufficient "robot" resources to meet seasonal demands. Customer satisfaction can be obtained as employees have more time to engage with clients.

RPA can operate in any department in an organisation like finance, HR, legal and sales (Taulli, 2020a). It is widely adopted by a wide range of industries, from accounting to pharmaceuticals (Blue Prism, 2020b; UiPath, 2021b). There is a growing demand for RPA. Forrester Research (2019) forecasted the growth of RPA services to reach $ 12 billion by 2023 (Joseph et al., 2019). However, there have been some drawbacks to RPA implementation. The implementation of RPA has not been a smooth journey for some companies. For example, EY (2017) reported that 30-50% of RPA projects were halted, were abandoned or other solutions were adopted. A Knowledge Capital Partners (KCP) report disclosed that 25% of the issues experienced in RPA projects related to tool selection, 75% related to management mistakes. The report also indicated that in some cases, RPA capabilities might have been overstated (Willcocks et al., 2019).

1.1 Research objectives and question

When implementing new information technology is associated with problems or high levels of project failure, a common corrective approach is to investigate the critical success factors (CSFs) related to successful implementation. CSFs are defined as the key activities and procedures where ‘things must go right’ for a project or organisation to succeed (Howell, 2010; Leidecker & Bruno, 1984). Given the relative newness of RPA and the problems with its implementation signaled in industry reports, and the limited contemporary literature on this topic, it is worthwhile to investigate the causes of RPA implementation failure and the CSFs needed to increase the chance of success. This leads to the following research question underpinning this study:

What are the critical success factors for Robotic Process Automation implementation?

The research presented in this dissertation is a comprehensive exercise in searching for the CSFs of RPA implementation through a systematic literature review. An in-depth understanding of RPA critical success factors and the implementation issues identified enables organisations to explore different management strategies and achieve the best results from RPA (Syed et al., 2020). It also provides insights and a practical guide for subsequent RPA projects.

1.2 Structure of the dissertation

This dissertation contains six chapters - introduction, literature review, methodology, findings, discussion and conclusion.

This introduction chapter has provided a brief overview of RPA technology, its benefits and some drawbacks associated with its implementation. Based on this statement of the research problem, the research objectives and the research question were then presented.

Chapter 2 is the literature review. It explores various aspects of RPA technology, including its definition, history, benefits, issues and implementation problems. The concept of critical success factors (CSFs) is then introduced as a possible solution to boost the chance of success of RPA implementation. Prior research on CSFs for the implementation of Enterprise Resource Planning systems, a well-established organisational information technology, is a useful starting point in understanding the range of likely CSFs for RPA implementation and the phases that RPA implementation projects are likely preceded through.

Chapter 3 outlines the research design used for this study – a systematic literature review. It then describes the methods used for the data search, data selection and data analysis.

Chapter 4 presents the findings of the study. Each CSF identified from the systematic literature review is described and presented, with attention given to its key aspects, together with the rationale for the importance of the CSF.

Chapter 5 interprets the original findings, then expands the analysis to the occurrence of CSFs across different phases, top-down relationships and interrelationships among CSFs, and the application of the identified CSFs to the issues identified in industry reports. After compiling all the findings, a set of fundamental and subordinate CSFs is derived.

The dissertation ends with the Conclusion, which summarises the research findings and analysis, outlines the limitations of this research, and provides topics for future research.

CHAPTER 2. LITERATURE REVIEW

This chapter first provides an overview of RPA, including definitions, history of development and benefits. Implementation remains a critical problem of RPA development for some companies. Some are unable to achieve the full benefits, and some have abandoned the RPA project altogether. The investigation of the possible causes of failure can form the starting point of an inquiry into possible solutions and the identification of CSFs for RPA implementation.

2.1 Definitions of RPA

RPA is a software-based technology that executes rule-based procedures automatically to perform a task originally done by people (Lacity & Willcocks, 2016). RPA software can interact with an application programme interface of the business system and operate directly within its underlying infrastructure. RPA uses 'software robots', software applications that mimic human activities such as keying data and completing web forms. Desktop RPA tools capture keystrokes and mouse clicks used to perform a task on a desktop computer in a similar way to recording a macro (Willcocks et al., 2017). The recorded action or task is saved in a library. Particular actions can be re-run automatically when triggered by either a human or a process trigger. The RPA software then replays the keystrokes (Lacity & Willcocks, 2016). RPA is considered a lightweight automation technique with a short implementation timeframe as developers are seldom required to modify the existing systems during the development.

2.2 History of development

The development of RPA has taken shape since early 2000. RPA is an extension of traditional automation and workflow automation technologies. Traditional automation has been used since the 1920s, when manufacturing started taking off. Workflow automation software captures relevant fields from customer and invoice details and sends notifications to employees. This process can reduce manual data entry, increase speed, and improve efficiency and accuracy. RPA software combines workflow automation with other advanced tools such as screen scraping, optical character recognition (OCR) and, more recently, artificial intelligence technologies (Ostdick, 2016b).

Early RPA development relied on both screen scraping and workflow automation. Screen scraping is a software program to extract or copy the data from one system running on a visual display and transfer them to a file or another system (Imanuel, 2018; Ostdick, 2016b). Workflow automation allows users to organise workflows using drag and drop functions or macro recorders to record the entire process. When executing the RPA program, the software extracts the on-screen information and automatically enters it into another system or file (Ostdick, 2016b). The whole process is similar to replaying the keystrokes used by a human in performing the task. In the production environment, software robots will be configured to complete the workflow of a process. For example, after completing the configuration for the invoice generation process, the software robot can open e-mails, extract PDF files from e-mails, enter relevant content from the PDF files into the ERP system and send error notifications to their human colleagues (Moffitt et al., 2018). During data processing, OCR technology is used to scan and extract the relevant details from non-digital documents. The scanned information is then converted to a standard format that the software robots can handle (Alberth & Mattern, 2017). The advanced OCR application can convert handwritten characters to text (Tzeng, 2020).

RPA is still a developing technology. The latest development incorporates machine learning and natural language processing (Galer, 2018). The standard RPA software application is programmed to run pre-defined rules on structured data, e.g., extract data from a sales order and create a sales invoice, but both are required to be in similar data formats. Machine learning is employed to digest the content of unstructured data. RPA equipped with machine learning can process unstructured data from sales orders in different formats and create sales invoices (Capacity, 2017). Natural language processing offers text analytics functions to interpret phrases and speech. It can detect the urgency of the message, prioritise the workflow and notify the intended recipient (Smartbridge, 2021).

RPA is suitable for different industries and companies that are required to process rule-based and repetitive tasks. Industries currently using RPA include accounting, banking, healthcare, insurance, pharmaceuticals, retail, telecommunication, and utilities. Table 2.1 provides a snapshot of these industries and exemplar companies that employ RPA for particular services.

Industry	Company	Service	Source
Accounting	PwC	Internal training programs	(UiPath, 2021b)
Banking	Co-operative Bank	Financial services	(Blue Prism, 2021b)
Healthcare	Mid Essex Hospital	Self-service kiosks	(Blue Prism, 2021a)
Insurance	Zurich Insurance	Claim Validation processes	(Blue Prism, 2021e)
Pharmaceuticals	Walgreens	HR shared services	(Blue Prism, 2020b)
Retail	Foodstuffs	Bank statement import	(UiPath, 2021a)
Telecommunication	Telefonica O2	Business process management service	(Blue Prism, 2021c)
Utilities	Npower	Invoice statement generation	(Blue Prism, 2021d)

Table 2. 1 Industries and companies employing RPA

2.3 RPA benefits

RPA is highly interoperable, capable of operating on any platform including mainframes, client servers or cloud systems. It is also lightweight, agile and non-invasive (Lacity & Willcocks, 2016). Upgrade or replacement of existing platforms is not necessary, and application interfaces do not require connecting with other systems such as Oracle, Siebel, PeopleSoft, Salesforce.com (Willcocks et al., 2017). It is highly flexible and scalable, with a large number of software robots able to be deployed quickly and at minimal cost (Dilla et al., 2015). RPA systems can support rapid development since they store a large number of reusable business components (Eddy, 2015). Each component is simple to create, even with limited knowledge of programming. There are no restrictions on the number of functions that can be automated (Imanuel, 2018). It is equipped with a library to accumulate knowledge of workflow and processes and becomes a knowledge repository for further process improvement (Taulli, 2020a).

Employee morale can be improved when a co-existing environment for both employees and software robots has been created, given that the robots take away the more repetitive and tedious jobs. Workers are thus released to engage in higher-value tasks and to perform more knowledge-based and creative functions, including personal interaction with clients, problem-solving and decision making (Dilla et al., 2015; Hofmann et al., 2020; Lacity & Willcocks, 2015). In some cases, robots have received such a good reception. They have been given a human name, e.g. “Poppy” in Xchanging (Willcocks et al., 2017). Positive employee experiences of RPA can improve employee retention rates and reduce employee recruitment and training costs.

The implementation of RPA can reduce processing time and improvement in accuracy (Connolly, 2018). Improvements in the processing speed, reliability and accuracy are due to standardisation of processes during the RPA development and reduction of human errors as software robots have taken over processes (Willcocks et al., 2015; Wright et al., 2018). When processes are mapped correctly, then tested and monitored to eliminate errors, optimisation of the sub-processes is possible (Dilla et al., 2015).

The efficient and faultless processes may improve customer satisfaction, retain existing customers and acquire new customers (Dilla et al., 2015). High volume, repetitive and manual processing tasks with non-integrated legacy mainframe systems are perfect candidates for RPA since high volume and standardised processes offer a better chance to reduce cost (Lacity & Willcocks, 2016). Deloitte (2018) conducted a survey and discovered that 90% of respondents experienced an improvement in quality/accuracy, and 59% achieved cost reduction. Other significant benefits reported include an increase in productivity (86%), and compliance (92%) (Wright et al., 2018).

2.4 RPA Issues and implementation problems

Apart from the drawbacks outlined in the introduction chapter, Deloitte's report also revealed that only 3 percent of organisations have been able to implement 50 or more robots (Wright et al., 2018). Forrester Research conducted a survey to rank risks or challenges in RPA projects by their severity: 9 issues are listed in Table 2.2 (Forrester Research, 2019). It is important to investigate the root causes of each issue to explore whether they are the underlying cause of a failure.

Rank	Issue
1	The tool does not perform the tasks that it is supposed to
2	A lack of understanding of RPA architecture and deployment options
3	Insufficient governance of RPA projects
4	ROIs do not meet business goals
5	The insufficient pool of trained resources to design and implement RPA technology
6	Insufficient pool of trained resources to support and upgrade RPA technology
7	Excessive dependence on outside contractors to transfer technology
8	Difficult to estimate the total cost of ownership for robot software license and internal support
9	Insufficient change management to deal with cultural issues

Table 2. 2 RPA risks and challenges (from Forrester Research, 2019)

2.4.1 Tool does not perform the tasks that it is supposed to

"Tool does not perform the tasks what it is supposed to" was ranked as the top challenge. A few reasons will cause the tool to fail to perform what it is supposed to do – selecting a wrong tool, overstatement of the tool capability by the RPA provider, underestimating the complexity of the processes, and selecting a bad or a broken process.

- *Selection of a wrong tool* – A variety of RPA products are available from different vendors when selecting a tool to automate a business process. In some cases, the selected tool would not perform the tasks that it is supposed to or did not achieve the desired result. A KCP report found that 25% of the implementation problems originated from inappropriate tool selection (Willcocks et al., 2019). Choosing the wrong tool may render a company vulnerable to "lock-in" with the same RPA vendor, where switching to another RPA vendor would be costly (Taulli, 2020c; Willcocks et al., 2019).
- *Overstatement of the tool capability by the RPA provider* - "Bold" claims of the tool capability by the RPA vendor and partner may lead clients to set an unrealistically high expectation on its performance (Boulton, 2018; Earle & Mason, 2019).
- *Underestimating the complexity of the processes* - There may be an underestimation of the complexity of the processes being automated. When a business process is too complex to automate, workflow knowledge of the whole process is required (Bloomberg, 2018). Some processes even require redesign before automation to reach the optimal level (Tornbohm, 2018).
- *Selection of a bad or a broken process* - RPA cannot rectify a bad or a broken process on its own. For example, if a process requires multiple manual approvals, the whole process can be delayed when one approval has not been actioned. Selection of a bad or broken process for RPA implementation without addressing the underlying issue creates new problems elsewhere and affects the expected performance and ROI of the RPA (Taulli, 2020a; Trefler, 2018).

2.4.2 Lack of understanding of RPA architecture and deployment options

RPA architecture provides the structural components, including the RPA platform, tools, infrastructure elements and configuration management (JavaTPoint, 2018a). RPA deployment can be chosen from On-Premises or RPA-As-A-Service models. The process solution of the On-Premises model is situated on an organisation's own servers and behind its firewall, whereas the RPA-As-A-Service model is provided by third-party RPA service providers in a cloud environment. The on-premises model requires more capital investment in exchange for better control, security and flexibility as the organisation will install its own RPA infrastructure. The RPA-As-A-Service model incurs less capital outlay, faster deployment and upscaling, but it is more vulnerable to cyber-attacks and security breaches (Taulli, 2020b). A lack of understanding of RPA architecture and deployment options may affect the effectiveness of RPA implementation, the total installation cost of RPA infrastructure and maintenance, the vulnerability of security and the timeliness of reporting (Barrett, 2019).

2.4.3 Insufficient governance of RPA projects

IT governance is described as a framework for an organisation that maintains the alignment between IT strategy and business strategy. This framework covers a wide range of areas, including system resilience, risk management, compliance measures, data protection and cybersecurity (Lindros, 2017). At the implementation stage, IT governance oversees connectivity, monitoring and user acceptance testing (UAT).

Treating RPA as an ordinary piece of software may lead to limited governance preparation (Willcocks et al., 2019). Companies may postpone or ignore the basic security issues like sharing human credentials with software robots and segregation of duties among software robots until the program is ready to go live. However, protection of confidential information, financial accountability, data retention and disaster recovery cannot be ignored even at the development stage. A full audit trail and important security and compliance structures must be in place before the implementation (Zumerle & Thornbohm, 2019).

When the number of software robots increases, monitoring and security measurements should also increase. It is challenging to manage a large number of software robots without close collaboration between the organisation's IT and business teams (Bloomberg, 2018; Taulli, 2020a). Inadequate governance of RPA projects can be a critical issue for the company's processes. When there is a security breach, it may inflict colossal damage.

2.4.4 ROIs do not meet business goals

Reasons that the ROI from an RPA project may not meet business goals include overly high expectations, a delay in implementation, hidden costs, and high maintenance costs. About half of the RPA projects do not yield the expected ROI. High expectations around labour-saving through the reduction of human employee FTE can be perceived. However, as Boulton points out, the automation of 30 percent of tasks for most of the occupations does not convert to a 30 percent reduction in costs (Boulton, 2018).

RPA is designed to automate tasks. It is far from automating the whole process. A task is only a small procedure in a broader process. A successful RPA implementation requires comprehensive planning to interconnect a substantial number of tasks within a group of business processes. Automation of the remaining 30% of a business process may require more time because some processes require redesign and optimisation before the commencement of the automation (Taulli, 2020a; Trefler, 2018).

A quality software robot will take 18 months on average to develop, and only 39% of software robots are deployed on time (PEGA, 2019). When there is an increase in the duration of the development, there will be an increase in the cost, hence affecting the ROI (EY, 2017). Deloitte's survey found that 63% of respondents have failed to implement the RPA project on time (Wright et al., 2018).

RPA investment is not a one-off cost. It is an ongoing investment as reworking, updates and changes take place during the RPA life circle. A survey from PEGA (2019) showed that 87% of respondents encountered software robot breakdown after the implementation (PEGA, 2019). Any future interface updates may require an update to all software robots using the same application to avoid the risk of broken software robots (Walter, 2019). Savings from automation start diminishing when the cost of maintenance increases (Kokina & Blanchette, 2019). Other hidden costs include change management costs related to introducing the RPA technology into an organisation (Willcocks et al., 2019).

2.4.5 Insufficient trained resources

According to a KCP survey, only 55% of the respondents added training cost to the total cost of ownership and most focused on the direct utilisation of RPA software. The skills shortage on RPA development increases the human cost and worsens the underfunded training resources (Willcocks et al., 2019). Insufficient provision of training resources to design and implement, support and upgrade the RPA technology may delay its implementation and hinder the achievement of the full RPA potential.

2.4.6 Excessive dependence on outside contractors to transfer technology

Most subject matter experts can automate simple processes in a short period. They learn how software robots operate, identify use cases for automation and program RPA software. Some sophisticated and scalable processes require skills, extensive testing and rework. Lengthy training of up to 12 weeks with supervision and coaching from RPA providers is required before production-grade automation can be produced (EY, 2017).

2.4.7 Total cost of ownership

The total cost of ownership contains the total technical cost, human cost, acquisition of hardware and software, operation, replacement and upgrades throughout the whole RPA life cycle (Willcocks et al., 2019). Further breakdown of the total cost of ownership into direct and indirect costs is as follows:

Direct costs

- Licenses
- Development
- Operations
- Integration
- HR
- Process design
- Consulting

Indirect costs

- Training
- Retraining
- Change management

For software acquisition alone, RPA providers offer an annual license fee with or without a minimum commitment but compensated by adding an enterprise server license. In general, the minimum robot commitment period is usually three years. Some providers offer pay per transaction supported by a robot or even hourly use of the software robot (Ray & Miers, 2019). RPA vendors such as UiPath charge a studio license fee, a license fee per software robot and an orchestrator license to manage a team of software robots annually (Taulli, 2020c). When the total cost of ownership for robot software license and support is not transparent, the budget may quickly be overrun.

2.4.8 Change management

Change management is vital as employees make the change happen (Voehl & Harrington, 2016). Change leadership and the culture of continuous improvement are two essential elements to promote business process automation (Hultin et al., 2017). A lack of change leadership and low incentive to continuous improvement in the company culture will cause an undesirable outcome. For example, Telefonica O2 requested its business process outsourcing partner in India to implement RPA but failed. The financial incentive to the project was insignificant to the business process outsourcing in India (Lacity & Willcocks, 2016). Insufficient change management to deal with cultural issues may affect employee engagement and even encounter resistance which may disrupt the RPA development (Willcocks et al., 2019).

2.5 Critical Success Factors

Prior research on the implementation of new technologies or information systems has focused on CSFs. CSFs are defined as the key activities and procedures where 'things must go right' for a project or organisation to succeed (Howell, 2010; Leidecker & Bruno, 1984). The identification of CSFs may help an organisation discover the crucial factors that must be focused on in an implementation project.

Key activities or CSFs for implementation of a new technology may cover planning, project management, IT support and governance. More attention will be given to those factors that will facilitate the implementation of new technology by providing early detection of the issues and a better understanding of the process. The most common causes of failure during the implementation can be eliminated or avoided (Ngai et al., 2008). The use of CSFs will increase the chance of success for installing a new system on time and within the budget. They are the conditions that must be fulfilled to implement a new technology successfully (Finney & Corbett, 2007).

2.5.1 Development of CSFs for RPA

RPA is a relatively new technology and literature on CSFs of RPA implementation is limited. In contrast, a substantial body of work has examined numerous implementation issues encountered in enterprise resource planning (ERP) systems implementation. ERP is a more mature technology. The literature has identified the CSFs involved in solving those issues and weighed the importance of each of them. Like RPA, ERP aims at improving internal business processes and overall business performance via process automation. Similar benefits to those claimed for RPA, such as reduction of errors and higher productivity, can be achieved (Chand et al., 2005). Given this, CSFs for ERP implementation from well-established literature may suggest an initial range of CSFs likely to be encountered in RPA implementation. A small-scale literature search on CSFs for ERP implementation was conducted to form the initial matrix of potential RPA CSFs. Three key academic articles were used – "ERP implementation: a compilation and analysis of critical success factors (Finney & Corbett, 2007); "Enterprise resource planning: A taxonomy of critical factors" (Al-Mashari et al., 2003) and "Examining the critical success factors in the adoption of enterprise resource planning" (Ngai et al., 2008). Table 2.3 shows a set of potential CSFs that could be used at the early stage of the thematic coding exercise to identify RPA CSFs in this study. Six main categories are created to map the CSFs that appeared in these three pieces of ERP literature, and these form initial groups for exploring the CSFs of RPA implementation here.

Category	CSF (ERP Implementation)	Reference
Planning	Business plan and vision	(Finney & Corbett, 2007; Nah et al., 2001; Ngai et al., 2008)
	Project management	(Finney & Corbett, 2007; Nah et al., 2001; Ngai et al., 2008)
Support		
Internal	Top management support	(Finney & Corbett, 2007; Nah et al., 2001; Ngai et al., 2008)
	User training and education	(Somers & Nelson, 2001)
External	Vendor	(Ngai et al., 2008)
	Consultants	(Finney & Corbett, 2007)
Change Management	Culture	(Finney & Corbett, 2007; Nah et al., 2001; Ngai et al., 2008)
Governance	Monitoring and evaluation of performance	(Nah et al., 2001; Ngai et al., 2008)
Process	Business process reengineering	(Finney & Corbett, 2007; Nah et al., 2001; Ngai et al., 2008)
System	Development & testing and troubleshooting	(Nah et al., 2001; Ngai et al., 2008)
	Legacy systems management	(Finney & Corbett, 2007; Nah et al., 2001; Ngai et al., 2008)

Table 2. 3 CSFs for ERP implementation

While exploring the CSFs on ERP implementation, two phenomena were observed. First, the degree of importance for each CSF may vary in different ERP implementation phases (Somers & Nelson, 2001). Second, different stakeholders may interpret the definition of success differently as they have different expectations (Al-Mashari et al., 2003).

Analogously, we might expect the degree of importance for each CSF to vary in different RPA implementation phases. Four RPA implementation phases are used in this research, taken from the RPA life cycle. In general, the phases of the RPA life cycle are discovery, solution design, development, UAT, deployment and execution of software robots (JavaTPoint, 2018b). This classification is more in-depth in technical development than management, where planning is essential. The planning phase is taken from the project life cycle and incorporated here as one of the RPA phases. To simplify the mapping process, the solution design phase and UAT are merged into the development phase. The deployment and maintenance phases and execution of software robots are combined into one phase and replaced with a new phase name, i.e., delivery. The modified four RPA phases are discovery, planning, development and delivery as shown in Table 2.4.

Project life cycle	RPA life cycle	Modified RPA phases
Conceptualisation	Discovery	Discovery
Planning		Planning
Execution	Solution design Development User acceptance test	Development
	Deployment Execution of software robots	Delivery
Termination		

Table 2. 4 Development of the modified RPA phases

CHAPTER 3. METHODOLOGY

Methodology is a plan or strategy to solve a research problem in a systematic manner (Kothari, 2004). This plan comprises research designs, methods, approaches and procedures. The execution of the plan may involve data gathering and analysis, participants and the use of tools or devices (Hudson & Ozanne, 1988; Kivunja & Kuyini, 2017).

3.1 Research design

A systematic literature review was selected as the research design for this research. It provides a holistic view of the subject being investigated and offers a set of systematic tools to mitigate risk or bias (O'Brien & McGuckin, 2016). The process is transparent and replicable (Ginieis et al., 2012). It also identifies areas of uncertainty and whether further research is required (O'Brien & McGuckin, 2016).

The use of the systematic literature review is an effective way to gain insight into the relatively new and emerging RPA technology. The process involves collecting a substantial volume of relevant information from reliable sources (O'Brien & McGuckin, 2016).

This research was carried out primarily using a qualitative approach through systematically reviewing all relevant literature, processing the findings through synthesis and analysis, and presenting the findings as CSFs. Although some basic elements of potential CSFs were borrowed from earlier ERP studies, there was no underlying theory to start with. The approach to address the research question was still broadly inductive. A thematic analysis was employed to analyse the qualitative data collected from secondary literature on RPA implementation and this will be explained in later paragraphs.

3.2 Methods

This section provides a complete account of the procedures used for data collection and analysis, including the procedures used to collect and convert the raw data to become the evidence to address the research question. These procedures involved three major steps - data search, data selection, and data analysis. Data search covers the literature search techniques. Data selection sets inclusion and exclusion criteria for relevant studies, including scope, language, period and the quality of documents. Data analysis applies techniques to synthesise the data through coding the data and then categorising the expected and unexpected. Theme descriptions are added to explore the inter-relationships among themes. Patterns are identified and meanings of all final themes are interpreted to build evidence for later discussion (Creswell, 2014; O'Brien & McGuckin, 2016; Templier & Paré, 2015).

3.2.1 Data search

As RPA technology is still contemporary, there are relatively few academic studies of CSFs for RPA implementation. Data were collected from multiple sources in an effort to minimise the issues of incomplete, obsolete, inaccurate or biased data. The main focus was still on academic articles, thesis and conference papers which contained case studies on RPA implementation. Three main online database resources were used:

- Scopus
- Business Source Complete (EBSCO)
- Core.ac.uk

Other online databases like Emerald Insight, Australia / New Zealand Reference Centre (EBSCO) and ACM Digital library were used but yielded either duplicate records or non-relevant articles.

The data gathering techniques included searches for keywords, titles, authors and citations. Keywords include RPA, Robotic Process Automation, implementation, success, failure and Critical Success Factors. Boolean search techniques were applied to expand or narrow the scope of the search result.

For example, using "AND" and "NOT" to narrow.

- RPA and case study not AI

"OR" to expand

- RPA or Robotic Process Automation

The nested searching technique was used to form a combining search e.g.

("RPA" or "Robotic Process Automation") and ("case study" or "case studies")

The search strategy was to begin the search with the following order of priority:

1. Online database for academic journals and publications including conference papers
2. Citation search from the reference section of those collected articles
3. Local and overseas student theses

Any references made in each article were treated as a potential source of information and followed up as appropriate to enlarge the search scope. More attention was given to articles that show evidence of observation and conversations with the stakeholders. For example, a description of the system without IT support initially by an HR manager in one of the articles – "It was like driving a Ferrari with a lawnmower engine" (Lacity & Willcocks, 2016). It demonstrated that early IT support was important.

A substantial volume of articles was required to mitigate areas of uncertainty and bias. Case studies from RPA providers were initially collected but not considered for the dataset as they promoted their own success stories, vendor selection and support unwittingly became critical factors. Non-journal literature published by computer magazines did not report a case in detail like academic journals.

3.2.2 Data selection

Only articles published in the English language were included. The selection period started from 2010 and onwards as minimal articles could be found before 2010 for RPA technology. All references were kept in Endnote - a software tool to organize bibliographies, citations and references. Duplicate entries could be identified and removed easily. The next step was to review the materials collected and remove any that did not discuss actual RPA projects or address success factors for RPA implementation. Apart from the language and the period of concern, extra filters like document types and subject areas were applied to sources with a high volume of the initial output, e.g., Scopus. Document types were restricted to journals or articles and subject areas to computer science, social sciences, business management, accounting, economics and finance. Articles from the same author but for a different case study were reassessed again whether they should be included. This process significantly reduced the number of articles within scope to 55.

A second review process removed articles that contained irrelevant or unsuitable case studies that were, for example, duplicate, too short, or too specific articles. For example, some articles only focused on a particular factor or topic like project management or process mining. Table 3.1 shows the resulting 17 articles after an intensive search through the online database from the three online sources. All these articles contained at least one RPA implementation case study and provided sufficient information to carry out the thematic analysis.

Source	Number of articles	Relevant	Accepted
Scopus	7831	14	6
Business Source Complete (EBSCO)	634	24	4
Core.ac.uk (Core)	143	17	7

Table 3. 1 Data selection

A further 3 articles of interest were identified from the reference sections of previously selected journal articles. These 3 articles were available to the public on the Google Scholar database. Therefore, Google Scholar was used to retrieve the documents and their citation details. This gave a total of 20 articles retrieved from the intensive literature search, which formed the data set for this study. This was the targeted minimum number of articles within the timeframe available for this research. The 20 selected articles were used to populate a literature matrix. Table 3.2 is an extract of the literature matrix, which includes the following column headings:

- Article identification number (ID)
- Title
- Author
- Publication
- Country
- Year
- Type
- Reference

ID	Title	Author	Publication	Country	Year	Type	Reference
1	Robotic Process Automation at Telefonica O2	Mary C. Lacity, Leslie P. Willcocks	Mis Quarterly Executive	UK	2016	Journal	(Lacity & Willcocks, 2016)
2	Robotic process automation: strategic transformation lever for global business services?	Mary Lacity, Leslie Willcocks, Andrew Craig	Journal of Information Technology Teaching Cases	UK	2017	Journal	(Willcocks et al., 2017)
3	How Robot/human Orchestration can help in an HR department: A case study from a pilot implementation	Dalibor Simek and Roman Sperka	Organizacija	Czech	2019	Journal	(Šimek & Šperka, 2019)
4	How OpusCapita Used Internal RPA Capabilities to Offer Services to Clients	Petri Hallikainen, Riitta Bekkhus, Shan L. Pan	Mis Quarterly Executive	UK	2018	Journal	(Hallikainen et al., 2018)
5	Impacts of Robotic Process Automation on Global Accounting Services	Dahlia Fernandez, Aini Aman	Asian Journal of Accounting and Governance	Malaysia	2018	Journal	(Fernandez & Aman, 2018)
6	A structured approach to implementing Robotic Process Automation in HR	Sathiyaseelan Balasundaram, Sirish Venkatagiri	Journal of Physics: Conference Series	UK	2019	Journal	(Sathiyaseelan & Sirish, 2020)
7	Lightweight IT and the IT function: Experiences from Robotic Process Automation in a Norwegian Bank	Anette Stople, Heidi Steinsund, Jon Iden, Bendik Bygstad	Norsk conference for organisasjoners bruk at IT	Norway	2017	Conference Proceedings	(Stolpe et al., 2017)
8	Robotics process automation at TECHSERV: An implementation case study	Lila Carden, Tiffany Maldonado, Carol Brace and Marie Myers	Journal of Information Technology Teaching Cases	UK	2019	Journal	(Carden et al., 2019)
9	Robotizing Global Financial Shared Services at Royal DSM	Mary Lacity, Leslie Willcocks, Andrew Craig	The Outsourcing Unit Working Research Paper Series	UK	2016	Journal	(Lacity et al., 2016)
10	Robotic Process Automation: Mature Capabilities in the Energy Sector	Mary Lacity, Leslie Willcocks, Andrew Craig	The Outsourcing Unit Working Research Paper Series	UK	2015	Journal	(Lacity et al., 2015)
11	Robotic Process Automation: The Next Transformation Lever for Shared Services	Mary Lacity, Leslie Willcocks	The Outsourcing Unit Working Research Paper Series	UK	2015	Journal	(Lacity & Willcocks, 2015)
12	Robotic process automation and the work identity of accountants	Charlotte Minogue	University of Turku	Finland	2019	Thesis	(Minogue, 2019)
13	Early evidence of digital labour in accounting: Innovation with Robotic process Automation	Julia Kokina, Shay Blanchette	International Journal of Accounting Information Systems	USA	2019	Journal	(Kokina & Blanchette, 2019)
14	Robotic Process Automation in Public Accounting	Lauren A. Copper, D. Kip Holderness Jr, Trevor L. Sorensen	American Accounting Association	USA	2019	Journal	(Cooper et al., 2019)
15	Using Robotic Process Automation (RPA) to enhance item master data maintenance process	Andreas M. Radke, Minh Trang Dang, Albert Tan	Scientific Journal of Logistics	Poland	2020	Journal	(Radke et al., 2020)
16	Influence of contextual factors on the adoption process of Robotic process automation	Katriina Juntunen	Uppsala University	Sweden	2019	Thesis	(Juntunen, 2018)
17	Workflow Methodology Development of RPA Solution for a Vietnamese Bank: A case study of Korkia Oy	Duc Tran, Thu Ho	Laurea University of Applied Sciences	Finland	2018	Thesis	(Duc & Thu, 2018)
18	Managing Robotic Process Automation: Opportunities and Challenges Associated with a Federated Governance Model	Teemu Kämäräinen	Aalto University School of Business	Finland	2018	Thesis	(Kämäräinen, 2018)
19	Automation of Financial Management Processes by Utilizing Robotic Automation - A Finnish Banking Case	Juho Vanhanen	Lappeenranta-Lahtin University of Technology LUT	Finland	2020	Thesis	(Vanhanen, 2020)
20	Developing organization's processes with robotic process automation – a case study	Jari Myllymäki	University of Vaasa	Finland	2019	Thesis	(Myllymäki, 2019)

Table 3. 2 Literature matrix

3.2.3 Data analysis

The data analysis process involved a thorough reading of the 20 articles containing useable RPA case studies identified during the data collection stage. A mixture of 'a priori' and 'inductive' codes were used. 'A priori' codes in this research were the codes given to the CSFs that were borrowed from the existing ERP literature. The a priori codes and the sources of the EPR literature can be found in Table 2.3 in the literature review chapter. The a priori codes were only used if evidence for their application was found in the data. Perhaps unsurprisingly, given their broad applicability, all but one of the a priori codes proved to be relevant in this analysis. Inductive codes were codes that were developed in the process of conducting the thematic analysis.

The conduction of thematic analysis involved thematic coding (Guest et al., 2012). Each instance of an RPA implementation issue and a potential CSF suggested by recommendations or solutions was coded. The phases of implementation in which the issue or CSF occurred were also coded where applicable. The coding process created themes with similar traits, meanings, ideas and properties. Further data refining was achieved by categorising expected and unexpected factors. Similar themes were grouped and reduced to a smaller number of categories, and the final result is a list of RPA implementation CSFs.

Table 3.3 shows the final set of categories and CSFs, which is a combination of ten a priori codes from Table 2.3 and four inductive codes generated from thematic analysis. The four new inductive codes are centre of excellence, IT support, quality assurance and process selection. The key aspects of each CSF and the reasons for their designation as the critical factors will be provided in the next chapter.

Category	CSF	A Priori Code	Inductive code
Planning	Business Plan and Vision	✓	
	Project Management	✓	
Support - Internal	Top Management Support	✓	
	Centre of Excellence		✓
	User Training and Education	✓	
	IT Support		✓
Support - External	RPA Vendor	✓	
	RPA Partner	✓	
Change Management	Change Management	✓	
Governance	Monitoring and Security	✓	
	Quality Assurance		✓
	User Acceptance Test	✓	
Process	Process Redesign	✓	
	Process Selection		✓

Table 3. 3 CSF matrix for RPA implementation

Other modifications included dropping the category ‘system’ and a priori CSF ‘legacy systems management’ from Table 2.3, and renaming the CSF ‘Development & testing and troubleshooting’ to ‘user acceptance test’ (UAT), then moving it to the category ‘Governance’. Other CSFs were given a more appropriate name from ‘vendor’, ‘consultants’ and ‘culture’ to ‘RPA vendor’, ‘RPA partner’ and ‘change management’, respectively. The term ‘RPA partner’ was more widely used than consultants in most of the RPA literature. Culture was not the only element under change management. Other elements within the change management category included re-organisation of company structure and promotion of training and education. They were all grouped to a collective CSF – Change Management to simplify the mapping process.

A coding matrix was the primary tool to record the data from the thematic analysis. It contained the following columns.

- Article ID – same ID as in the literature matrix, it could be used to trace back to the source document.
- Short code – a short form of the initial code for a CSF, used as factor abbreviation and table filter in the analysis process.
- Category – a higher-level grouping of related CSFs.
- Initial code – the name given to a CSF identified in the data.
- Phase – the implementation phase in which the CSF occurred.
- Data – raw content extracted from the article without any modification, it contained either explicit or implicit meanings of identified CSFs.
- Page number – the page number of the article referring to the data extract.

The same expression could contain multiple meanings. Consider the following example: "By establishing a proactive planning and building strong governance for RPA implementation, the organisation will have a stronger footing over the automation project and is able to ensure that RPA implementation happens as planned, particularly within the expected timeframe and budget" (Fernandez & Aman, 2018, p. 128). This statement was interpreted as reflecting two CSFs: governance and project management. The personal judgement of the researcher was applied to determine whether it should be treated as two CSFs. Although the interpretation of the findings was subjective, different methods could be used to allow triangulating evidence from multiple sources. This would produce corroborating evidence (Gray, 2018). More details of the different approaches used, including frequency analyses for CSF occurrences in different implementation phases, top-down relationships and interrelationships between CSFs, and CSF applicability to reported RPA implementation issues can be found in the discussion chapter.

While adding data to the coding matrix, the process of synthesising was taking place. The first step was to compare whether a possible CSF associated with the data extracted from the article existed in the matrix or a new CSF was required to be established. Two themes might refer to the same CSF. However, they needed to be contrasted in terms of the tone of language. Take the following examples: “significant launch problems and growing pains … could have been avoided if the IT department had been involved earlier” (Lacity & Willcocks, 2016, p. 32) and “the biggest lesson about starting the RPA journey is that it should be a cojoined collaboration between IT and the business” (Lacity & Willcocks, 2016, p. 34). The former sentence revealed that IT support was required at an early stage, while the latter sentence confirmed that IT support was a critical success factor. The narrative of each sentence was added to the theme description section and it would be extracted to validate the arguments made in the findings chapter. Some CSFs could be combined to form a bigger group. For example, top management support, IT support and user training and education were grouped together in a category with the heading of internal support. An example of the coding matrix is provided in Appendix 1.

A CSF matrix was constructed to map all findings from the coding matrix. Table 4.1 in the next chapter presents the result of the findings from the thematic analysis.

CHAPTER 4. FINDINGS

This chapter presents the findings of the systematic literature review after carrying out the research process described in the previous chapter. Each CSF is analysed in a similar pattern using four interrogative questions - when is it required, what is involved, how does it work, and why is it critical. The key aspects of a CSF that emerged from the analysis form the focal points for the description of each CSF below. Each CSF may have different key aspects, including the roles played by actors associated with a CSF, and the activities, procedures and methods involved in the operation of a CSF. They are used to gather the answers from the four interrogative questions and to generate some insights for the following discussion chapter.

4.1 Results

The findings are based on analysing the data collected from the 20 articles identified in the final data set. The analysis produced a set of 14 CSFs. The number of times each CSF occurred in the 20 articles ranged from 5 to 17. For example, the CSF, 'User Acceptance Test' was mentioned in only 5 of the 20 articles. At the other extreme, the CSF 'Process Selection' appeared 17 times.

Table 4.1 shows the distribution and frequency of appearance of each CSF across the selected articles. The first column of the table shows the high-level categories of CSFs. The next column displays the factor abbreviations used as short codes and table filters in the analysis process. The full name given to each CSF is presented next. The article ID numbers are listed at the top of the table. Corresponding details like the title of the article, author and publisher for each article can be found in Table 3.2, the literature matrix, in the previous chapter. Articles containing the relevant CSF are indicated with an "x" inside the table. The last column provides the frequency or the total number of occurrences of each CSF from the total of 20 articles.

			Article ID																				
Category	CSF ID	CSF	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	F
Planning	PB	Business Plan and Vision		x			x	x		x	x		x	x	x	x	x	x	x	x	x		14
	PPM	Project Management		x				x	x	x	x					x	x	x	x		x	x	11
Support - Internal	SITM	Top Management Support	x		x	x	x	x		x	x		x			x		x	x				11
	SIIT	IT Support	x	x		x	x		x		x	x	x				x	x		x	x		13
	SICE	Centre of Excellence				x		x	x			x	x		x			x		x	x	x	10
	SIUT	User Training and Education			x	x	x	x				x		x	x	x	x	x	x	x	x	x	14
Support - External	SEC	RPA Partner	x		x	x			x	x	x	x			x			x	x	x	x	x	13
	SEV	RPA Vendor	x	x		x	x			x			x			x			x				8
Change Management	CMR	Change Management	x	x			x	x			x		x	x	x			x	x	x	x		12
Governance	GM	Monitoring and Security	x				x	x	x			x	x		x	x		x		x	x	x	12
	GQA	Quality Assurance			x	x		x		x				x	x		x		x			x	9
	GUA	User Acceptance Test						x		x	x										x	x	5
Process	PS	Process Selection	x	x	x	x		x	x	x		x	x	x	x	x	x	x	x		x	x	17
	PR	Process Redesign			x						x		x		x		x	x				x	7

Table 4. 1 Summary statistics of CSFs

In the following sections, each CSF identified in the analysis is described. For each factor, the key aspects listed in Table 4.2 are outlined, together with the rationale for the importance of the factor. Where appropriate, the relative weighting of the importance of each factor is discussed. Four RPA implementation phases first introduced in the literature review are used to identify when the particular factor was most applicable. All references in this chapter are retrieved from the selected data set of 20 articles, and article IDs are used as references to improve the readability.

Focus	CSF	Key aspects
Planning	Business Plan and Vision	Short-term and long-term goals Cost and benefit analysis Risk and contingency planning
	Project Management	Project planning Project execution
Support - Internal	Top Management Support	Roles
	IT Support	Roles
	Centre of Excellence	Roles
	User Training and Education	Methods
Support - External	RPA Partner	Roles
	RPA Vendor	Roles
Change Management	Change Management	Activities
Governance	Monitoring and Security	Activities
	Quality Assurance	Procedures
	User Acceptance Test	Procedures
Process	Process Selection	Criteria
	Process Redesign	Methods

Table 4. 2 Key aspects of each CSF

4.2 Planning - Business Plan and Vision

During the discovery phase of an RPA initiative, the top management team and project managers developed a strategic plan to define a clear RPA vision and set up short-term and long-term goals for the RPA implementation. These goals could be based on a range of possible elements, including:

- from an end-to-end process to an end-to-end solution (8)
- the level of automation (9)
- the level of digital transformation (11)
- reaching the maturity of enterprise capability in the long run (11)

In addition, to the goal-setting process, a cost and benefit analysis was frequently conducted, and some forms of risk and contingency planning might be performed. Finally, in one case, the project timeframe, continuous improvement and scaling were also considered under the business plan and vision (2).

4.2.1 Short-term and long-term goals

The short-term goal could be automating a local tax system from an end-to-end process to an end-to-end solution (8). The long-term goal could be extending the automation to other finance departments such as accounts payable, accounts receivable, and credit management (9). In one case, the adoption of RPA was a short-term goal towards digital transformation for the company (18). The long-term goal would be combining other technologies like virtual assistants and cognitive computing to take the digital transformation to the next level (11). The ultimate goal for RPA development would be reaching enterprise capability (11). According to one of the findings, the enterprise capability was to construct an RPA management platform with thousands of robots in operation:

> *"This objective assists the bank in achieving their long-term goal as building up RPA management platform orchestrating thousands of robots in various banks around Vietnam."* (17, p.7)

At the planning phase, requirements on human, technical and financial recourses were identified and defined for the short-term pilot projects (8) and a long-term scaling plan for later development. Integration of hardware and software tools with the RPA technology, system access and network connectivity were the essential elements that required comprehensive planning (8). Collaboration between internal and external resources was the next important element that required setting up a project team to implement project management in the short-term and creating centres of excellence to provide standardised RPA protocols and expanding similar RPA processes in the long term (11)(13).

4.2.2 Cost and benefit analysis

Before drawing up a business plan, the top management team would consider the benefits, costs, risks and timeline of the RPA implementation. The possible external benefits were gaining a competitive advantage, repositioning as a technology company, digitalisation for companies, creating new business initiatives and enhancing customer experience (13)(14)(16)(18). The possible internal benefits included reduction of labour hours, reallocation of employees to more value-added activities, reduction of FTEs, ROI, reductions of errors, and building an enterprise capability (11)(12)(13)(14)(19). Finally, the RPA implementation should align with business strategies (10).

The cost for implementation included software purchases and subscription, hiring of RPA consultants, releasing existing human resources to form an RPA team, monitoring and maintenance, scaling and setting up a Centre of Excellence in the long run (9)(11)(12)(13)(14).

4.2.3 Risk and contingency planning

There are undoubtedly some issues and challenges during the implementation, such as disaster recovery due to a system failure, external threats and breaching of intranet security or system security (6)(8). All these possible risks would be taken into consideration.

4.2.4 Rationale

A well-prepared business plan and vision is a prerequisite. It provides a clear path for RPA development (8). The business plan and vision was an effective tool to justify an RPA investment, prepare for the integration of the new technology, and achieve stakeholder buy-in for the RPA implementation (15).

While evaluating the costs and benefits of the RPA technology, the planning team could draw an RPA budget and measure the ROI. Planning for resource allocation and adoption of change management would lead to better integration of the new technology. Planning would also provide a better understanding of the RPA technology and reduce challenges and resistance at the later stage (15). The importance placed on good planning is illustrated in the following quotes:

> *"At the initial stage, the organization should be in good preparation for the integration of the new technology. In this phase, it is most important to get buy-in to the adoption of RPA from stakeholders as it will be able to mitigate the challenge relates to lack of understanding."* (15, p.137)

> *"Planning is very important for RPA implementation. The RPA can be said to reach matured phase and it showed that our planning is successful and went well."* (5, p.128)

4.3 Planning - Project Management

According to the findings, project management could take place from the discovery phase through to the delivery phase. It provided leadership for the project team members to engage in project-related activities, including project planning and project execution (2)(8).
During the discovery phase, the project team and the senior management carried out a feasibility study on both financial and technical aspects, such as whether implementing RPA could reduce cost and increase performance (8)(9). After assessing different RPA vendors and narrowing down the list to a potential RPA vendor, the project team then invited the vendor to perform a proof of concept (POC) project, which was regarded as the most effective way to obtain support from top management (16). After a satisfactory result from the POC project, the project team proposed a business case for the RPA project (8)(9).

4.3.1 Project planning

After the approval of the business case, the RPA project moved to the planning phase. The next task for the project team was to define the project scope, including project objectives, total costs, deliverables, functions and timelines (8). The project team prepared or updated the RPA budget (2)(19) and assembled an RPA team comprising RPA consultants, business process experts and program managers (2)(7)(9).

In the cases studied, risk and security management and change management activities were documented next (8)(14)(17). The project team went through risk identification activities, e.g., risk of software robot breakdown, legal compliance, intranet and data security (8)(14)(17). On change management activities, planning of new organisation structure, job reallocation and communication with all stakeholders involved were also investigated at this stage (8)(15). Training courses and training materials were prepared, covering advanced level and continuous training (2)(6)(14)(19)(20). With respect to software robot development, the project team assisted the selection of processes through documenting the process maps, process and technical design and UAT (8)(9)(19)(20). Reports for monitoring RPA performance were also created in this phase (9).

4.3.2 Project execution

During the development phase, the execution of the agreed plan took place. The project team started building or configuring software robots (2)(7)(9). The complete processes went through UAT (8)(9)(19)(20). Any issues would be fixed and re-tested. After verifying tasks and activities, the process would be signed off and moved to the production environment (8). When the process was up and running during the delivery phase, the project team engaged in performance assessment and documentation on lessons learned (8)(9)(16)(19).

Table 4.3 summarises the various project management activities occurring across different phases of RPA implementation.

Phase	Activity	Article ID
Discovery	Feasibility study Proof of concept project Business case	(8)(9) (16) (8)(9)
Planning	Project scope Team building Budgeting Risk and security management Change management Training Documentation of processes, technical design, UAT	(8) (2)(7)(9) (2)(19) (8)(14)(17) (8)(15) (2)(6)(14)(19)(20) (8)(9)(19)(20)
Development	Execution of the agreed plan Development of software robots User Acceptance Test Verification on tasks and activities	(8) (2)(7)(9) (8)(9)(19)(20) (8)
Delivery	Monitoring of software robot performance Performance assessment Documentation on lessons learned	(8) (8) (8)(9)(16)(19)

Table 4. 3 Phases and activities for project management

4.3.3 Rationale

Project management was essential for RPA implementation because it provided a framework to implement an RPA project as planned and within the expected timeframe and budget (5). This framework covered the activities listed in Table 4.3. Comprehensive planning on these activities was considered crucial. Two particular issues arose from one of the findings. First, insufficient training affected the selection of the right process and applying the best solution for a selected process. Second, without a formal RPA budget, overestimating the cost-saving would seriously affect the ROI (18). Training on process selection and budgeting were included under project management.

> *"At the process level, employees try to use the concept in all kind of processes without considering the current state of the process and what is the best solution for the process development. At the managerial level, managers budgeting unrealistic cost savings by RPA without considering realities and opportunities."* (18, p.29)

Activities like team building, risk management and communication were planned and executed better through project management.

Team building

When a team was assembled through a project management process, team members were assigned to the project team who could devote their time for a particular task (7):

> *"In order to evaluate the processes and decide which were more suitable for automation, a dedicated team that included the RPA team's project manager was given the authorization to prioritize the processes according to specific criteria."* (7, p.6)

Risk management

Risk identification was one of the project management activities. The following risk from one of the findings was identified at an early stage:

> *"Other risks included disruption to operations during the pilot and external threats related to breaching the intranet security due to the new security methods related to the software and hardware resources."* (8, p.76)

The answer to this risk was to recruit an IT security specialist and train the engineers to deal with security breaches from external sources. These activities would be planned earlier to mitigate the possible disruption before the implementation (8).

Communication

Communication with the stakeholders involved was also one of the routine activities in project management. It would facilitate coordination amongst teams. The following example from one of the findings shows that a problem arose when effective communication amongst teams was not in place:

"The lack of communication is a big challenge. In some cases, the hub has tested the same robot for five weeks after us, but we have already made the same tests." (18, p.34)

4.4 Internal Support - Top Management Support

Top management support could come from the CIO, CEO, CFO, head of a department, or senior managers team. They might take an active role or accept the advice from their subordinates to engage in the RPA project (1)(3)(4)(8)(9)(11)(16). According to the findings, top management support could be grouped into several supporting roles such as project initiator, project sponsor, project negotiator, change manager, and project planner. Table 4.4 shows the supporting roles and activities performed by members of top management.

4.4.1 Key roles of management support

During the discovery phase, a project initiator investigated the RPA benefits of whether the adoption of RPA technology would align with the business strategies (4)(8), participate in POC pilot project (9)(11), or make a business case (6). A project sponsor offered financial and human resources for the RPA project (4)(9)(14)(16). A project negotiator sought better terms and conditions with the RPA vendor and its partner (3)(17). In the planning phase, a change manager organised the changes in the organisation structure and training for staff to acquire new skills; conveyed the RPA benefits and the decision of role changes amongst the stakeholders; and boosted staff morale (1)(5)(9)(16). A project planner assisted planning, especially in regard to recruitments, preparation of IT infrastructure and capabilities, and set up organisational policies such as firewall, servers and securities during the development phase (4).

Role	Activity	Article ID
Project initiator	Initiated the RPA project Engaged in POC pilot project Made a business case	(4)(8) (9)(11) (6)
Project sponsor	Provided staffing for RPA team from internal resources and recruitment	(4)(9)(14)(16)
Project negotiator	Negotiated terms and conditions with RPA vendor and consultant	(3) (17)
Change manager	Engaged in change management • Prepared the organisation for changes • Reskilled workers • Communicated about RPA benefits, changes, issues and challenges to all stakeholders • Injected positive attributes	 (1)(5)(9) (9) (1)(4)(5)(6)(8)(11)(16) (16)
Project planner	Prepared organisational and technological capabilities and recruitment Set up RPA guidelines organisational policies	(4) (4)

Table 4. 4 Supporting roles and activities performed by senior management

4.4.2 Rationale

Top management support was considered to be a critical factor, especially in the supporting roles of resource provision, change management and communication.

Resource provision

The RPA project required substantial human and financial resources to form an RPA team, set up the IT infrastructure and purchase software licenses (4)(9)(14)(16). The approval of and commitment to consistent funding from top management were indispensable. However, the financing of RPA development was not a one-off demand. It also required constant investment, e.g., in maintenance costs and consultancy fees on any upgrades and scaling. One interviewee from the findings stressed the importance of top management support on resource provision as follows:

> *"This would not be possible without the top management support, because we need the consulting to be in the budget and we need the okay from the management that we are putting time and effort on this, we have the license, the tool. So all these things have a cost, so those have been approved by the top management."* (16, p.61)

Change management

The implementation of the RPA project might require the establishment of a new organisational structure, with the creation of new roles and responsibilities (1)(5)(9). These changes would affect some stakeholders. The support of top management encouraged cooperation amongst teams and the participation of the stakeholders. The support could also cover mediation to resolve conflicts, improve staff morale and create a continuous improvement culture. When top management support and change management operated simultaneously, it would become one of the best practices identified from the findings.

> *"The best practices include senior management support, control by business operations/shared services, talent redevelopment, and change management to prepare the organization for changes caused by automation."* (9, p.3)

Communication

Top management support in relation to communication provided an authoritative message on vision and strategy, RPA benefits, impact on roles and new opportunities, especially at the early stage of the development. This support could give a clear direction and impart positive attitudes to the implementation team, and discuss what issues and challenges were lying ahead (1)(4)(5)(6)(8)(11)(16). The following extracts from the findings were delivered by two senior members of two different companies.

> *"The management commitment to RPA was perceived to be reflected in the development of a clear Digitalisation strategy and vision, which communicated a detailed shared goal to the organization."* (16, p.68)

> *"A senior executive stressed that RPA had to be a balanced sell… 'I can show them something that will make their lives better."* (11, p.27)

4.5 Internal Support - IT Support

4.5.1 Roles of IT support

The organisation's IT team played multiple roles in RPA development, such as engaging in software negotiation, verifying the RPA software to meet the requirements of governance policies and proposing a business case during the planning phase. At the development phase, the IT team set up an RPA test environment for development and UAT, constructed the RPA network infrastructure, maintained governance and security of the RPA system, and provided IT support.

At the planning phase, the IT team assessed whether the software was compliant with IT policies during the acquisition of the RPA software (11)(15). The team might engage in software negotiation and prepare a business case for the RPA project (4).

After the approval of the business case, the IT team was responsible for delivering and supporting IT infrastructure and architecture (2)(11). The team built, configured and then optimised the RPA network infrastructure, including servers and virtual machines, which should be consistent across the whole organisation (1)(10)(20). The IT team arranged fast access for software robots to the systems, applications and virtual servers (4)(10). Their involvement included configuring applications and systems to allow the software robots to access them (4). The ongoing and increasing requirement for software robot maintenance would take up a considerable amount of IT resources to provide RPA solutions on the existing IT infrastructure (7)(9).

The IT department played an important role in the development, testing and production phases of the RPA project (4)(9). The team worked with other business departments to identify potential processes to be automated and considered whether RPA was the best alternative for automation (16). Once the process was selected, the team would resolve any ad hoc issues and provide assistance for more complex issues during the RPA development (13). Some might program software robots, prepare training materials (12)(16) or supervise the UAT (4). The IT team would set up an RPA help desk to support and maintain daily operation once after the implementation (4)(9)(13). Table 4.5 shows a summary of phases and activities for IT support.

Phase	Activity	Article ID
Planning	Software negotiation	(4)
	Verification of software	(11)(15)
	Proposed a business case	(4)
Development	Constructing RPA network infrastructure	(2)(11)
	Setting up an RPA test environment	(4)
	Preparing training materials	(12)(16)
	UAT supervision	(4)
	Maintaining governance and security	(7)(9)
	Providing IT support	(4)(9)(13)

Table 4. 5 Phases and activities for IT support

4.5.2 Rationale

IT support was crucial for the RPA development of network infrastructure and governance. The IT team optimised the infrastructure capability to ensure its availability, data integrity, the continuation of service, security and flexibility to scale and incorporated the best practices to the network solutions (7)(9)(10). Inadequate optimisation of the network infrastructure could slow down the operation (10).

The RPA operation must meet the IT security and governance requirements of the organisation (9), and be compliant with relevant regulations (13). One of the respondents in the findings stressed that IT cooperation on security and governance was indispensable, especially when the number of software robots reached the enterprise scale:

"When considering enterprise grade robotic solutions then collaboration with IT is a must. Any enterprise class robotic system needs to meet the IT security and governance requirements of the organization." (9, p.15)

Most of the RPA technical issues required IT solutions, e.g., connection with other applications and computer's firewalls (19). One respondent from the findings indicated that insufficient IT support assigned to RPA development was a stumbling block:

"One respondent described that the lack of dedicated IT resourcing and support from their side has been a big issue and barrier in the process." (16, p.60)

Finally, one director from the findings explained that the IT team would take over the RPA maintenance and support after the business user set it off (9):

"The business user will drive the solution but at a certain point, of course, IT also has roles within this: it's an IT solution in the end, so there needs to be maintenance and support and input also from IT side." (9, p.15)

4.6 Internal Support - Centre of Excellence

A Centre of Excellence (CoE) was a central office where a dedicated RPA team was situated that actively supported and implemented the RPA projects for other divisions (4)(10). The team members included a program sponsor, program manager, members from a leadership team, RPA manager, developer, configuration coordinator, and portfolio analyst (4)(10).

4.6.1 Roles of Centre of Excellence

In its early stage, the CoE acted as an information centre to collect and identify RPA issues (16). It continued to build its RPA capability to become a self-sufficient governance body (4)(6). It first standardised the RPA implementation processes, conformed to the deployment technology, and developed the best practices to implement RPA (7)(16). It would become the first line of support for RPA projects. Further development would be in the areas of governance, security, compliance, and support (10)(13). When the number of software robots was increasing, monitoring their performance would become part of the maintenance (20). It also offered training and training materials to employees who need to automate their tasks (16). Table 4.6 shows the roles and activities associated with each role of the CoE.

Role	Activity	Article ID
Information centre	Collected and identified RPA issues Provided advice and best practices	(16) (7)(16)
Governance body	Conformed the deployment technology Developed best practices to implement RPA Maintenance and upkeeping Improvement of security	(7) (16) (20) (10)(13)
Training centre	Offered training and best practices (16)	(16)

Table 4. 6 Roles and activities for Centre of Excellence

4.6.2 Rationale

The internal support from the CoE was identified as a CSF because it encouraged best practices, complied with security and audit requirements and achieved a better ROI and RPA success. It also promoted self-sufficiency on RPA implementation and robust control on governance.

Self-sufficient RPA development

In some cases, it was considered preferable to establish RPA capability internally sooner than rely on external support from RPA consultants (6). A dedicated RPA team or CoE collected the lessons learned and established the good practices to develop and roll out RPA quicker and cheaper:

"As the centralised CoE and related capabilities weren't in place in time as planned, the external partner's resources were still needed in developments, implementations and maintenance of RPA. So currently it is taking quite a long time, even though we have many resources form the external partner, from the idea to actually getting the RPA automation done. And all the analyses and decision makings take too long time and it is too expensive." (16, p.60)

Centralised governance

A CoE took over daily management of the RPA process and provided a centralised governance body that oversaw governance issues, security and compliance. It would have better control over RPA projects (10):

"The control room team then took over full management of the live RPA process, including interacting with the business operations folks to coordinate the daily stream of work, the output reports and exceptions. Besides the normal control room work, OCofE aimed to continually improve the solution." (10, p.12)

The CoE could become a one-stop shop for software robot development, deployment, maintenance, support, and continuous improvement. It also served as a research centre to develop future automation and technology strategies and a training centre for those who obtained the skill for RPA implementation (18).

4.7 Internal Support - User Training and Education

User training and education started during the development phase. Training could be carried out in the form of on-the-job training, online training, learning from peers, and workshops delivered by RPA partners, the core RPA team or a training hub (4)(10)(14)(15)(16)(17)(18). Trainees were mainly the subject matter experts and employees involved in RPA implementation (17). The RPA team would first gather the information on the requirement of training through discussions with the stakeholders involved and arrange workshops for them (17).

4.7.1 Training methods

The training was usually conducted in three stages - inducting, training and then mentoring (6). Induction was for employees who were new to RPA technology (6). Training could be in different levels, and intensity started with programming RPA software, in-depth training sessions, advanced training and refresher training (3)(4)(6)(12)(14). Trainees would become more involved in computer programming and development in the advanced training (14). Key people were grouped together since their knowledge was similar with a common understanding of the technology (4).

The training materials included how software robots operated, how to program RPA software, identify key business processes for RPA programs and use cases for automation (4)(14). Image-by-image manuals were popular and recommended by the trainees (19). Training materials could be provided and also obtained online (15).

4.7.2 Rationale

User training and education was made one of the CSFs because it was considered a critical activity to equip the affected individuals with RPA skills during the transition period. They could then develop their RPA skills and capabilities and finally engage in continuous improvement.

Transition to a new role

Training played a key role to ease the pressure for the employees who would take over a new role and did not possess the requisite skills (12). Sufficient and decent training was crucial, or it would affect the RPA performance when the RPA tools were difficult to use. This was emphasised in one of the findings:

> *"If RPA tools are not easy to use and if users are not able to access quality RPA training, RPA performance will be negatively impacted."* (13, p.8)

Another finding indicated that training was regarded as one of the vital activities for change management to overcome the skill barrier by equipping individuals with the necessary skill:

> *"These barriers can be related for example to skill limitations, hence empowering individuals involved in change through training is perceived as a crucial activity to reach success."* (16, p.75)

Development of self-efficacy

User training and education was a crucial factor since training provided an involvement channel for the individuals to gradually develop their RPA skills and capabilities, obtain knowledge and improve self-efficacy (16). Trainees would be expected to program their own software robots after the completion of the training (6)(14)(16).

Continuous improvement

Training also became an element of continuous improvement quoted by a respondent from one of the articles:

> *"The goal of the team is to achieve as high success rate as possible. According to respondent 6, the success rate is already "quite high" but they are still attempting to improve it through constant training of the solution."* (19, p.57)

It was also emphasised by the continuous improvement manager from another article:

> *"The continuous improvement manager recognizes the importance of support and training to employees and strives to give the best to all employees."* (5, P.128)

4.8 External Support – RPA Partner

According to the findings, the support from the RPA partner was prominent in the first three phases of the RPA implementation. At the discovery phase, the RPA partner might need to pass the competency test during the POC project (16). The RPA partner offered support in the planning and development phases.

4.8.1 Roles of RPA partner

The RPA partner played three significant roles during the first three phases, consultant, developer and trainer. Each role involved several activities. Table 4.7 shows a breakdown of the activities for each role. At the planning phase, the RPA partner would carry out activities as a consultant, provided advisory support on the capability and limitations of the selected software (1)(19). The RPA partner also created an implementation plan. It covered the scope of automation, resource requirement, governance, training, testing and deployment (1)(3)(7)(10). The RPA partner then assisted the company in forming a cross-functional team that included RPA software experts, subject matter experts, project managers and IT managers (9)(19).

During the development phase, the RPA partner engaged in the development activities by examining the existing processes and manuals with other team members from the company (4). The RPA team with the support of the RPA partner selected the suitable processes and requested necessary business and technical resources (17). The RPA partner organised the technical resources to start a pilot program (3)(4). The development activities for the pilot program included robot configuration, user acceptance test and setting up the governance structure and policies (8). The RPA partner also offered IT support when problems arose (19). Through collaboration with the subject matter experts, the first set of automated processes developed (10). The software experts from the RPA partner provided the training materials and started training the subject matter experts at the same time (2)(3)(7)(10).

Role	Activity	Article ID
Consultant	Provided short-term consulting and advisory support Communicated clearly on RPA capabilities and limitations Created an implementation plan Assembled a team	(1) (19) (1)(3)(7)(10) (9)(19)
RPA developer	Prepared the scope of process automation • Examined the existing processes via reviewing system manuals and service descriptions • Determined the suitable processes to be automated at what level and their business and technical requirements • Developed the first set of automated processes with a team of subject matter experts • Provided technology and resources to start a pilot program • Commenced the development activities • Offered IT-support when problems occur	 (4) (17) (10) (3)(4) (8) (19)
Trainer	Trained the client's employees in configuration and maintenance of the software and the system Provided training materials, support and mentoring	(7) (2)(3)(10)

Table 4. 7 Three significant roles of the RPA partner and the related activities.

4.8.2 Rationale

According to the findings, RPA was an "emergent technology" and internal resources did not possess the necessary skill set to lead the development (8, p.74). The RPA partner would be hired and work with the trainees for about a month and then scale down to once a week in the following 8 weeks (1). The support from the RPA partner was considered to be a CSF because of the extensive knowledge and expertise required for RPA implementation.

<u>Expertise and experience of RPA partner</u>

RPA implementation required extensive technical knowledge and expertise on robot configuration, RPA programming skills, systems and infrastructure building and maintenance, technical and business requirements, process selection and business process knowledge (4) (7)(9) (17). One of the articles provided the following comment:

"It is important to encourage collaboration between the business professionals and RPA specialists because implementing the robot required a wide range of expertise, such as systems and infrastructure knowledge, RPA programming skills and business process knowledge." (4, p.45)

Another article suggested that the abilities of the RPA partner to select suitable processes and RPA tools to optimise the outcome, prepare the test, deploy RPA to the environments, and construct and update programming scripts were prerequisite skills before the commencement of the RPA project (4)(17):

"It is important for an RPA consultant to acknowledge the flow of a business process. It gives an opportunity to inspect whether a process can be automated or not, which level of automation a process can be developed and which requirements in concern of both business and technical sides are in need for an RPA implementation." (17, p.19)

In some cases, the RPA partner was also responsible for providing training manuals and monitoring the budget (19). System users could obtain adequate knowledge and information through training and knowledge transfer (5).

Process issues, infrastructure issues or robot issues were common in the early phases (20). Not until the internal CoE and related capabilities were set up, was the support from the RPA partner no longer needed in developments, implementations and maintenance (16).

4.9 External Support – RPA Vendor

At the discovery phase, senior figures of the related department such as the head of the department, senior management or the project team selected a suitable RPA vendor (1)(2)(7)(9)(11). They might conduct a formal vendor search (1) with the criteria like the capability of handling a high volume of transactions and multiple users (4). Others used checklists that contained the resource agreement and validation requirement (17). After the appointment, the RPA vendor would engage with the relevant stakeholders, including the client and RPA partner and assist them in implementing the RPA project (8). Their roles included the provision of the tools and training materials (17).

4.9.1 Roles of RPA vendor

RPA vendors provided the software and RPA partners to deliver the service for RPA implementation. They also provided the tools and training materials for the companies to pursue their automation goals. The training materials included the steps from start to reaching the enterprise model (2). Companies could plan further ahead with the well-structured documentation.

4.9.2 Rationale

Selection of the right RPA vendor is a CSF given that the functionality and reliability of the software provided by the RPA vendor may affect the overall performance of the RPA implementation. Although RPA vendors did not play a major role during RPA implementation, the selected RPA vendor could play an important role in education and support (2). The company might need to refer back to training materials from the RPA vendor regularly. The RPA vendor was expected to provide and update their training materials with the latest developments:

> *"System suppliers are important to enable the system users to gain sufficient knowledge and information."* (5, p.123)

4.10 Change Management – Change Management

According to the findings, senior management supported and managed the change management process (11). The change management activities during the planning phase included the promotion of the RPA technology (11), preparation of a new organisation structure (1)(2)(5)(9), and encouraging stakeholder involvement (12). Other change management activities such as the provision of training and retraining, and preparation of a long-term supporting structure took place during the development phase (11)(16). Table 4.8 shows the phases and activities of change management.

Phase	Activity	Article ID
Planning	Promotion of the RPA technology Preparation of a new organisation structure Encouraging stakeholder involvement	(11) (1)(2) (5)(9) (12)
Development	Provision of training and retraining Preparation of a long-term support structure, e.g., CoE	(11) (16)

Table 4. 8 A summary of change management activities

4.10.1 Change management activities

The promotion of RPA technology could occur through the communication of the facts and RPA benefits, e.g. RPA freeing employees from tedious and repetitive work to perform cognitive tasks and more exciting work (1)(5)(10)(18), or work requiring advanced knowledge and decision making such as strategic planning (17).

The senior management team prepared the organisation for structural changes caused by RPA implementation at the planning phase (9). This included preparation of the deployment and redeployment of stakeholders affected by the change, such as senior executives, business groups, employees working in shared services, and the IT function. The affected employees were redeployed to other service areas (1) while some were recruited to the RPA project team (2). Software robots and remaining employees would share their tasks (5)(9). All decisions on structural changes should be communicated to all affected individuals, e.g., the avoidance of layoffs or reductions in staff to be managed by attrition (2)(11).

Another way to promote the new technology was to encourage stakeholders to be actively involved in the RPA development at the planning phase, e.g., creating, coordinating, or monitoring software robots (12). Employees moving to perform higher-level tasks would be given training to upskill (2)(17), including on-the-job training and learning from peers at the development phase (16). Managers assisted the career development of the employees affected by the deployment of RPA (15).

Setting up the CoE could provide long-term support that offered training and best practices, promoting shared value on quality and improvement (10)(16).

4.10.2 Rationale

Change management was critical because of scepticism around the implementation of new technology, especially for those who suffered from a bad experience in prior technological implementations. This led to a cautious approach towards the new technology or reluctant adoption of the new technology (12). One of the findings showed the existing doubt of the new technology:

> *"I have to mention that there have been many growing pains when we have implemented something new. There have been occasions where they have not worked after implementation so we have had to do several remedial tasks to make it work, which has been more work than before the implementation."* (12, p.53)

Skill limitation was a stumbling block when implementing the change. Active involvement in training by the stakeholders was regarded as an essential element by one of the findings:

> *"These barriers can be related for example to skill limitations, hence empowering individuals involved in change through training is perceived as a crucial activity to reach success."* (16, p.75)

Learning from peers and on-the-job training could help develop individual skills and capabilities and contribute to the self-efficacy beliefs of the individuals (16). The long-term support from CoE would assist the development of a culture of continuous improvement in the long term.

Promotion of active involvement could change stakeholders' perceptions from pessimistic to optimistic (12), leading to their acceptance or even support of the change rather than resisting it:

> *"Individuals are more informed when they are involved in the development, which can shift their perceptions from negative to positive."* (12, p.53)

A senior automation executive from one of the findings emphasised the importance of this shift in organisational culture:

> *"The biggest challenge… is the kind of cultural change that you need for automation."* (11, p.21)

4.11 Governance – Monitoring and Security

4.11.1 Monitoring and security activities

The organisations implementing RPA developed a governance framework and policies during the planning phase (10)(13). The IT team performed software verification using the established policies from the framework (1). The governance structure was created in the form of a hub or centre of excellence (10). The hub or CoE established the governance framework for the business (10) to maintain and monitor the RPA platform (18). A dashboard was created to capture the error rate, uptime, downtime and maintenance time (14).

In terms of risk management, it is important to investigate and understand the risk of each software robot and information security (19), formalise the monitoring process and establish the mechanisms (7). The implementation of these mechanisms was intended to ensure reliable reporting and compliance with relevant regulations (13). Table 4.9 shows the governance activities and phases related to monitoring and security.

Phase	Activity	Article ID
Planning	Governance framework and policies Software verification	(10)(13) (1)
Development	Create governance structure Monitoring & maintaining Managing risk	(10) (7) (16)

Table 4. 9 Phases and governance activities related to monitoring and security

4.11.2 Rationale

Monitoring and security under governance were important to RPA implementation success (13). They could identify the weaknesses of IT infrastructure and bring risk under control (13). The financial or reputational risk could be caused by external threats related to breaching the intranet security (8)(13).

There were requirements of RPA platform, IT infrastructure and information storing on software robots' activities to meet government legislation, e.g. to meet the European General Data Protection Regulation (GDPR) (18). For internal control, segregation of duties was required to be observed even the tasks were performed by software robots. These are vulnerable to cyber-attacks (13).

Software robots required constant monitoring and maintenance. They were susceptible to a breakdown due to changes or upgrades in IT systems (18). When a failure occurred during a critical time, the result would be devastating as the manual workforce was no longer available (16). It was a major concern of a respondent from one of the findings:

> *"I am personally concerned about failure in critical time during for example or just before closing and if something breaks and we don't have manual workforce anymore in the company to cover it up. Then we are in a big trouble."* (16, p.50)

When the number of robots increased, monitoring became critical due to the processing speed of RPA. Mistakes could occur rapidly and in a significant number (16).

Business continuity and incident management were critical issues (16). Apart from a system failure, a cyber-attack could bring the whole business operation to a standstill. One of the findings indicated that organisations should plan and set up RPA governance proactively to safeguard a successful RPA implementation (5)(13):

> *"By establishing a proactive planning and building strong governance for RPA implementation, the organization will have a stronger footing over the automation project and is able to ensure that RPA implementation happens as planned, particularly within the expected timeframe and budget."* (5, p.128)

4.12 Governance - Quality Assurance

From the findings, organisations looked into four areas for quality assurance. They were reliability, utilisation, process adherence and data analysis. In terms of reliability, organisations would examine how often the system would fail and be unable to perform some processes (4)(12). Utilisation focused on the processing rate of the software robots with no human intervention (13). With regard to process adherence, the concern was whether software robots adhered to pre-programmed process steps as user rights were restricted to their own authority to program the software robots. Unexpected errors could be traced and resolved by the relevant users (15). Finally, data analysis involved a reporting process identifying any unstructured data and reporting them to the system users. The system users could correct any shortfalls of the operation based on the collected data (15).

At the planning phase, organisations prepared the test and quality check plans for quality assurance (19). The RPA team would execute the test and quality plans for the pilot processes during the development phase. At the delivery phase, all the quality tests and checking would be repeated in the production environment, and a survey would be carried out to assess the RPA performance.

4.12.1 Quality assurance procedures

The procedures of quality assurance included testing, error log inspection, reporting and taking surveys. Tests were carried out by humans to check any malfunction, including tests to discover the situations in which the RPA would fail. The outcome would be recorded and became exceptions in production (4)(12). The proposed solutions would be tested thoroughly to ensure the quality of reliability and utilisation before moving to the production environment (20).

Quality checks were performed via the inspection of the error logs to ensure the software robots adhered to pre-programmed process steps and yielded the correct results (12)(15). Reports were created, such as a management information report to record the processing rate, operational issues, and unstructured data for data analysis and corrective measures (6)(13). Finally, the organisation could conduct a survey to assess the performance after implementing the RPA project (8). Table 4.10 shows a summary of phases and procedures associated with quality assurance.

Phase	Procedure	Article ID
Planning	Creation of tests, quality check plans	(19)
Development	Conducting Tests Performing quality check and performance reports on pilot processes Data analysis and Correction	(4)(12)(20) (13)(15) (15)
Delivery	Conducting Tests Performing quality check on processes and performance reports in production Data analysis and Correction Carrying out a survey	(4)(12)(20) (12)(13) (15) (8)

Table 4. 10 Phases and procedures for quality assurance

4.12.2 Rationale

Quality assurance was critical for the success of the RPA implementation. Quality control measures should be tracked and reviewed by a human at any time (17). Quality assurance was identified as one of the CSFs because of its role in increasing reliability and providing assurance of correct functionalities and process adherence.

Increasing reliability
Routine quality checks would increase the reliability of RPA and ease any scepticism of RPA capability amongst the users (12). Tests were carried out from time to time to examine the possibility of whether the software robots would create errors or even fail to run to prevent the reoccurrence of the errors or lessen the damage (4).

Assurance of proper functionalities, process adherence and data accuracy
As RPA could run without supervision, there was a risk of malfunction (12). Routine inspection of error logs and management information reports would ensure proper functionalities and process adherence (3)(15). Unexpected errors could be traced back to the root cause. They could be resolved by relevant users (15). From the findings, some organisations, such as healthcare providers, required 100% data accuracy:

> *"As the master data's accuracy directly affects the quality, production and deliverable of many life-saving products, the act of ensuring 100% data entry adherence with additional logs to trace back using RPA is relatively of high value."* (15, p.136).

4.13 Governance - User Acceptance Test

4.13.1 User acceptance test procedures

As early as the planning phase, the RPA partner, service provider, RPA developer, or subject matter experts created templates for the test plan (8). The subject matter experts conducted the user acceptance testing in the testing environment with the test data during the development phase, e.g., running the configured software according to the test plan (19). During the UAT, problems were first identified, then documented and finally rectified (8)(19). RPA developers fixed the issues, and the affected process was re-tested. The subject matter experts then performed a similar test in the production environment. The process owner signed off the UAT when the result was satisfactory. At the last stage, the process moved to the production environment (8). Table 4.11 shows the phases and procedures carried out during the UAT process.

Phase	Procedure	Article ID
Planning	Creation of a test plan	(8)
Development	Execution of test plan	(8)
	Detection of shortcomings	(19)
	Modification of the software	(19)
	Documentation	(8)
	Further test in the production environment	(19)
	Signing off	(8)

Table 4. 11 Phases and procedures for user acceptance test

4.13.2 Rationale

UAT was critical for RPA implementation because it could achieve objectives such as risk mitigation, quality assurance and collecting information for lessons learned (8)(20). During UAT, identified errors were fixed and re-tested. This exercise reduced the risk of a reoccurrence of the same issue after the implementation in the production environment. All activities from error identification, error rectification, documentation of issues and releasing the process to the production environment ensured quality assurance. A central place such as a CoE kept the documents for errors as lessons learned for future development. As it was described in one of the articles, satisfactory UAT provided a consistent process:

> *"Then you really have to make sure while you are making it that you test it enough that you see does this actually hold up, is it stable enough."* (20, p.38)

As suggested by another article, UAT could not be rushed through, or it would cause more remedial work:

> *"At times, the implementation process and especially the testing phase, is rushed, which causes accountants to work more in order to supplement the unfinished system or application."* (12, p.53)

UAT answered the question of whether RPA did what it was intended to. One of the respondents gave the following comment:

> *"People had to test them and certify that they are comfortable that the robot is doing exactly what they would do manually."* (9, p.14)

4.14 Process - Process Selection

The process selection took place during the discovery and development phases. Stakeholders might include subject matter experts, RPA consultants, the IT team, business project managers and the project sponsor. These formed the RPA team. The team prepared a POC to demonstrate how RPA software automated a simple process important to an organisation (1). Then they evaluated and decided whether RPA could be adopted and implemented. After the approval of the business case, more processes would be looked into and selected for production during the development phase.

4.14.1 Process selection criteria

From the findings, the suitable processes could be grouped in terms of process characteristics, processes associated with human interaction, or processes associated with operation.

- The first group referred to the process's own characteristics. These included a high transaction volume, repetitiveness, structured data, low complexity, rule-based process but unambiguous rules, data in digital form, low risk, and significant amounts of time and resources required.
- The second group involved processes associated with human interaction and the consequent constraints on the use of human resources. The process could be labour intensive, prone to human errors, of low cognitivity, and involve minimal exception handling. A reduction in the use of human resources after automation would achieve more savings.
- The final group was associated with the operation. Operating through multiple systems would incur more cost, and operating under an unstable environment would cost more on maintenance. For example, frequent system upgrade would increase the maintenance cost to reconfigure the software robots.

Table 4.12 shows a list of the process characterises corresponding to the process nature, processes associated with human interaction, and processes related to the operation.

Process	Characteristic	Article ID
1. Process nature	High transaction volume	(1)(2)(8)(13)(14)(15)(19)
	Repetitive	(3)(8)(13)(15)(17)
	Structured data	(14)
	Low complexity	(1)(8)(13)(16)
	Rule-based process but unambiguous rules	(2)(4)(8)(10)(13)(20)
	Data in digital form	(13)(14)
	Low risk	(8)
	Significant amounts of time and resources	(3)(4)(15)(19)
2. Process associated with human interaction	Labour intensive	(13)(17)
	Prone to human errors	(19)
	Low cognitive	(20)
	Minimal exception handling or human intervention	(10)(13)(14)
3. Process associated with operation	Operating through multiple systems	(13)
	Operating in a stable environment and hence less software robot maintenance	(19)(20)

Table 4. 12 Process characteristics

The RPA team organised meetings and workshops with the relevant stakeholders to identify the potential processes for RPA implementation through validation, assessment, evaluation and classification (6). Validation involved determining the degree of process maturity and whether it was a stable process. If the process was stable, the process could be standardised and adopted by different teams and branches. The outcome was also predictable. The team also assessed the requirement for human intervention and whether RPA could execute the process. The evaluation included the nature of the process (e.g., high transaction volume but low degrees of complexity) and the complexity of the process (e.g., the total time required to complete the process). Finally, the team classified the processes from their findings that were suitable for RPA implementation.

To perform their role, the RPA team developed decision aids such as flowcharts, process analysis toolkits and scorecards (13). The full life cycle of a process and its description were documented under a business diagram with detailed interpretation (17). The process was scored based on the criteria listed above. General surveys were also used to collect information on the potential processes (12).

4.14.2 Rationale

Process selection was a CSF because selecting an appropriate process for RPA implementation would maximise cost savings (13), reduce processing time and improve quality with fewer errors (20). The RPA team used the criteria mentioned above to map the potential processes (19) and prioritise the most important processes (7)(17). As a result, the team could select processes with the best return, low risk, low complexity and minimum exceptions. An optimal process with the least exceptions would reduce the maintenance cost. On the contrary, the development cost and time would increase to automate an incorrect or broken process because of excessive maintenance and exception handling after the implementation. The selection of the right process at the right time would yield a different result:

> *"The downside of this (project) was, if we implement the wrong processes at the wrong time, as in my opinion happened in this our (death record information) process. You have to carefully consider the situation, is it the right time and process. I don't see any other downsides (to RPA). I see that it is a reliable way of doing things, and it serves the other procedures well."* (19, p.66)

Finally, successful implementation of pilot processes could build up the confidence to handle more complex processes and receive a better reception from wider audiences (13)(14)(16).

4.15 Process - Process Redesign

Process redesign was required when some existing tasks within a business process could not be automated, or there was a requirement to reduce the processing time during the RPA development (9). The original process would be modified to make the automaton worthwhile (9). Process redesign was conducted in the development phase by the RPA team.

4.15.1 Process redesign methods

From the findings, there were several process redesign methods adopted by the companies. These methods included changes to the task sequence, the number of tasks within a process, and the format and structure of the data. Table 4.13 shows the methods that were carried out to change either the process or data to conform with RPA development before automation could take place. The first set of methods deal with the process involved: resequencing processes by rearranging the sequence of some tasks within a process (9); eliminating legacy tasks rather than automating them if they were not essential (9)(11); merging tasks where they could be combined (3); or breaking down the process into detailed tasks until structured data could be formed and automated (15). The second set of methods deal with the data involved: standardising data to ensure that data from the targeted systems had similar columns and formats with the master data (15); simplifying data when it was required to be synchronised between two systems; or complete data accuracy and adherence were required (15).

Phase	Method	Article ID
Development	Process • Resequencing • Eliminating • Merging • Breaking down	 (9) (9)(11) (3) (15)
	Data • Standardising • Simplifying	 (15) (15)

Table 4. 13 Phases and methods for process redesign

4.15.2 Rationale

Process redesign was an important factor for integrating RPA with the company's existing systems. Unsuitable processes and unstructured data were fixed during the development phase. The consequent reduction of exceptions and improvement in RPA utilisation would enhance the chance of RPA implementation success.

RPA integration

Where some tasks within a process were not suitable for automation, changes to the process using the above methods could be considered (16). Unstructured data would slow down the progress when creating routine tasks for the software robots. One of the findings revealed that data simplification and process standardisation were crucial during the development of the software robots:

> *"Because RPA is a program that can only work with structured data, this phase would help in reducing the potential noises and unstructured factors in the master data, which would then make the implementation smoother. Data simplify and process standardizes are also discussed to be vital in the successful outcome of RPA integration."* (15, p.137)

Reduction of exceptions

Process redesign could reduce exceptions and improve the performance of the software robots when following the best practices (9)(13). Exceptions were the tasks that could not be automated, and they would be handled separately by the users. Reduction of exceptions would reduce passing tasks between software robots and users:

> *"The RPA team also had to redesign the process for automation so that the robots and humans were not constantly passing steps to one another."* (9, p.7)

RPA utilisation

When master data and processes were simplified and standardised, more processes could be automated in the same way. Process redesign would boost the RPA utilisation to a larger scale (16).

CHAPTER 5. DISCUSSION

The rationales for 14 CSFs derived from 20 articles have been explained in chapter 4. This section presents an analysis of these findings, the relationships among the 14 CSFs, and their possible matching to the 9 key issues and implementation problems outlined in the literature review. The analysis of findings examines the relative frequencies of the 14 CSFs, and includes a discussion of the 4 newly identified factors, the occurrence of CSFs in particular RPA implementation phases, and top-down relationships and interrelationships between the CSFs. As the rationale of each CSF has already been presented in chapter 4, possible solutions to tackle the 9 issues mentioned in the literature review can be determined. Analysis across all the findings derives a set of the most fundamental CSFs for RPA implementation.

5.1 Analysis of the findings

Table 5.1 is the summary of the findings, showing the frequencies of each CSF from 20 selected articles. While 10 of the 14 CSFs identified in this research also appear in prior studies of other information technology implementation CSFs, such as ERP systems, 4 were inductively derived CSFs that emerged from this analysis of RPA implementation case studies: process selection, IT support, centre of excellence and quality assurance. Process selection was the most frequently occurring CSF, mentioned in 17 out of 20 articles. Its significance is appropriate given that goal of RPA operation is the automation of business processes. The selection of processes for automation is thus an elementary activity for RPA implementation. Other reasons for its importance can be found in section 4.14.2.

The second newly identified factor was IT support, which appeared in 13 of the 20 articles. IT support is important in RPA implementation because of its prominent roles in the development of sound network infrastructure and provision of IT support and governance.

The other two newly identified factors were a CoE and quality assurance. The CoE recruited experts from different departments to maintain the RPA operation and engage in new RPA projects. It promoted self-sufficiency, continuous improvement and centralised governance. Quality assurance was crucial due to its role in the provision of assurance of consistent performance and process adherence.

CSF	Frequency
Process Selection	17
Business Plan & Vision	14
User Training & Education	14
IT Support	13
RPA Partner	13
Change Management	12
Monitoring & Security	12
Project Management	11
Top Management Support	11
Centre of Excellence	10
Quality Assurance	9
RPA Vendor	8
Process Redesign	7
User Acceptance Test	5

Table 5. 1 Summary statistics of CSFs

5.1.1 CSF occurrence in different implementation phases

Another way of considering the relative importance of the 14 CSFs is to explore their occurrence across the 4 different phases of RPA implementation outlined in the literature review (chapter 4 included a description of the phases in which each CSF occurred). Table 5.2 shows the phases where the 14 CSFs were required. Four CSFs occurred or were required in all RPA implementation phases from the findings: top management support, project management, IT support, and RPA partner.

CSF \ Phase	Discovery	Planning	Development	Delivery	Frequency
Top Management Support	x	x	x	x	4
Project Management	x	x	x	x	4
IT Support	x	x	x	x	4
RPA Partner	x	x	x	x	4
Centre of Excellence			x	x	2
User Training and Education			x	x	2
Change Management			x	x	2
Monitoring and Security			x	x	2
Quality Assurance			x	x	2
Process Selection	x		x		2
Business Plan and Vision		x			1
RPA Vendor	x				1
User Acceptance Test			x		1
Process Redesign			x		1

Table 5. 2 CSF occurrences across implementation phases

5.1.2 Top-down relationships and interrelationships

Top-down or hierarchical relationships between CSFs are where a particular CSF involves decision-making authority toward other CSFs, or other CSFs are under the influence of the particular CSF within the hierarchy. Mapping CSF relationships through the top-down approach from the findings identified both hierarchical relationships and other interrelationships among CSFs. Table 5.3 presents this mapping of the relationships between the 14 CSFs.

Top-down relationships

Section 4.4.1 presents the key roles of top management support. Stakeholders from top management support could engage in activities from selecting of RPA vendor and RPA partner, business plan and vision, project management, change management, provision of resources to form a project team, setting up a CoE and provision of training resources. All CSFs having a top-down relationship with top management support are marked with an “x” under the top management column in Table 5.3.

The following top-down relationships are also evident in table 5.3, and their corresponding sections from chapter 4 are listed at the top of the table.

- The business plan and vision team planned the imminent RPA budget for the project to procure the RPA software, hire RPA consultants, form RPA teams, establish the system security and monitoring facilities, and set up the CoE in the long run.
- Project management was the CSF having the largest number of top-down relationships with other CSFs. The project team assembled an RPA team, planned activities like IT support, training, and governance, including monitoring and security, quality assurance, UAT, and assisted process selection and redesign.
- The IT support team assisted in the setting up of CoE and validation of the RPA software and took part in monitoring and security, quality assurance, and UAT.
- User training and education covered the content of RPA training, including process selection and process redesign.
- RPA Partner offered IT support, training, supervised process selection and redesign.
- RPA vendor produced online materials for user training and education.
- CoE took over project management roles to offer IT support, training, monitoring and security and quality assurance.
- Change management promoted user training and education.
- Quality assurance covered the monitored UAT.

Interrelationships among CSFs

Other interrelationships between CSFs were identified during the exploration of top-down relationships. For example, user training and education could be initiated by the RPA partner, taken over by the project management team, and then later incorporated into the responsibilities of the CoE. User training and education could be promoted by the change management team to encourage stakeholder involvement. For monitoring and security, these activities could be planned during the business planning stage, then managed by the project management team, executed by the IT team, and finally taken over by CoE.

The occurrence frequencies of the 14 CSFs in different phases and their interrelationships explain why some CSFs are more significant than others. Importantly, however, those CSFs that appeared in less than 10 of the 20 case studies examined are still crucial as their interrelationships with other CSFs remain strong. The frequencies of top-down relationships and interrelationships are recorded in table 5.3 for later analysis.

Section	4.4.1	4.2.1 & 4.2.2	4.3.1 & 4.3.2	4.5.1	4.6.1	4.7.1	4.8.1	4.9.2	4.10.1	4.11.1	4.12.1	4.13.1	4.14.1	4.15.1	
CSF	Top Management Support	Business Plan and Vision	Project Management	IT Support	Centre of Excellence	User Training and Education	RPA Partner	RPA Vendor	Change Management	Monitoring and Security	Quality Assurance	User Acceptance Test	Process Selection	Process Redesign	**Frequency of Interrelationship**
Business Plan and Vision	x														1
Project Management	x	x													2
IT Support	x	x	x		x		x								5
Centre of Excellence		x													1
User Training and Education			x		x		x	x	x						5
RPA Partner	x	x	x												3
RPA Vendor	x	x													2
Change Management	x	x	x												3
Monitoring and Security		x	x	x	x										4
Quality Assurance			x	x	x										3
User Acceptance Test			x	x							x				3
Process Selection			x			x	x								3
Process Redesign			x			x	x								3
Frequency of Top-Down Relationship	6	7	9	3	4	2	4	1	1	0	1	0	0	0	

Table 5. 3 Top-down relationships and interrelationships among CSFs

5.2 Revisiting nine RPA issues

Nine major issues and implementation problems for RPA revealed by the Forrester report were outlined in the literature review:

1. The tool does not perform the tasks that it is supposed to
2. A lack of understanding of RPA architecture and deployment options
3. Insufficient governance of RPA projects
4. ROI does not meet business goals
5. Insufficient pool of trained resources to design and implement RPA technology
6. Insufficient pool of trained resources to support and upgrade RPA technology
7. Excessive dependence on outside contractors to transfer technology
8. Difficult to estimate the total cost of ownership for robot software license and internal support
9. Insufficient change management to deal with cultural issues

The following paragraphs provide the possible causes for each issue, then associate the issues with possible CSFs that may tackle or alleviate the problems. The results are summarised in Table 5.4 at the end of this section.

1. The tool does not perform the tasks that it is supposed to

Selecting a wrong tool, overstatement of the tool capability by the RPA provider, underestimating the complexity of the processes, and selecting a bad or a broken process are the possible reasons listed in section 2.4.1 for why the tool fails to perform as it is supposed to.

Not all RPA vendors provide homogenous tools, and some tools require more programming skills. General claims like easy to implement, no coding, no customisation and system integration could be overstated (Boulton, 2018). The selection of the right RPA vendor and RPA partner is crucial. The top management team should first evaluate the RPA vendors to pick up the right tool or software. This may alleviate the issue of the tools do not perform the tasks that they are supposed to. The senior management team can go through a scorecard for vendor evaluation to select the most eligible RPA vendor.

Success implementation also depends on the automation of the right processes (Paredes, 2019). Selection of a wrong process or bad process will create excessive maintenance and exceptional handling (EY, 2017). The following procedures involve other CSFs to ensure the implementation of the right process:

- Work through the process selection criteria from the list given in section 4.14.1 to find the processes with the best return, low risk, low complexity and minimum exceptions.
- Analyse the process complexities to avoid targeting the problematic processes
- Redesign the process to let various software robots work together (Boulton, 2018).
- Optimise the workflows of some processes before automation (ACCA, 2018).
- Carry out the UAT to verify whether the RPA software is proper for the process before going live (Seasongood, 2016).

Possible CSFs – top management support, RPA partner, RPA vendor, user acceptance test, process selection, and process redesign.

2. A lack of understanding of RPA architecture and deployment options

IT infrastructure can be overlooked to support of a rapid implementation at the early stage (EY, 2017; Preimesberger, 2016). The IT team plays a vital role in delivering RPA infrastructure and hardware to support the RPA software (EY, 2017; Seasongood, 2016). IT involvement must start early to understand the RPA architecture, which covers RPA tools, platform, infrastructure and configuration management (ACCA, 2018). IT team can discuss and negotiate the best option of the tools and RPA infrastructure with the RPA vendor and partner for the company.

Section 4.8.2 shows the expertise and experience of the RPA partners. They can assist what the best-fit architecture and deployment option for the company and its budget. RPA partners can also collaborate with the IT team in future scalable deployments of RPA.

Possible CSFs - IT support, RPA vendor, and RPA partner.

3. Insufficient governance of RPA projects

Constant monitoring and maintenance over a large number of software robots are critical tasks, especially there is a possibility that they may fail or make errors. Quality assurance is the next critical factor that ensures reliability, data accuracy and process adherence. More reasons for monitoring and security and quality assurance as CSFs have been explained in sections 4.11.2 and 4.12.2. They have interrelationships with other CSFs. Business plan and vision prepares governance over a large number of software robots and ensure that they are IT compliant. Project management sets up the monitoring process, e.g., reporting system or dashboard (Boulton, 2018), which reduces the risk and minimizes the impact from failure. IT team provides support to secure RPA technology (Wright et al., 2018), ensures better performance and reliability (ACCA, 2018). The CoE takes over monitoring tasks after they have been set up.

Possible CSFs - project management, IT support, CoE, RPA partner, monitoring and security, and quality assurance.

4. ROI does not meet business goals

High expectations from management on saving labour cost through reducing FTE will be difficult to achieve (Boulton, 2018). RPA development can be treated as a long-term investment than a short-term one-off project (Boulton, 2018; Lacity et al., 2016). A complete evaluation of costs and benefits and a realistic ROI will first be considered before planning the short-term and long-term business goals as listed in section 4.2.1.

Underestimation of the complexity of the RPA implementation may end up with schedule or cost overrun. Proper project planning will reduce the risk of project overrun. When project planning is inadequate, it may lead to project risks like slow robot performance, too complex and expensive to implement (Alberth & Mattern, 2017). Complete automation of an end-to-end process is also difficult to achieve, and extreme automation will suffer from diminishing returns and hence the reduction of ROI (ACCA, 2018). Automation of a series of scattered sub-processes will leave many exceptions which the software robots cannot handle. The expected savings become impossible to reach (EY, 2016).

Possible CSFs - business plan and vision and project management.

5. & 6. Insufficient trained resources to design and implement RPA technology and to support and upgrade RPA technology

Insufficient trained resources make user training and education become an important CSF. More attention will be focused on training materials for design and implementation. According to table 5.3, user training and education involves other CSFs because of their interrelationships. The RPA project team was responsible for preparing technical design documents and assisting in process selection, as mentioned in section 4.3.1. For the RPA implementation, the knowledge transfer of the RPA technology would rely on the RPA provider, e.g., RPA vendor and RPA partner. For support and upgrade materials after the implementation, CoE would take over from the project team.

Possible CSFs - project management, CoE, user training and education, RPA partner, and RPA vendor

7. Excessive dependence on outside contractors to transfer technology

At the early stage of RPA development, reliance on outside contractors is unavoidable. CoE is likely to be set up after implementing preliminary processes or project since it requires the accumulation of experience. The project management team should coordinate with the RPA vendor and RPA partner and focus on knowledge transfer, training and education in the short run. If scaling is the organisation's long-term goal, CoE will be included in the plan at the business planning and vision stage. The construction of a self-sufficient RPA unit or CoE is one solution to reduce the reliance on outside contractors or RPA partners to transfer technology, as discussed in section 4.6.2. A business-driven CoE is the most suitable establishment to monitor and upgrade a team of the virtual workforce (EY, 2016).

Possible CSFs – business plan and vision, project management, CoE, user training and education, RPA partner, and RPA vendor.

8. It is difficult to estimate the total cost of ownership for robot software license and internal support

At the business planning stage, licensing costs, infrastructure costs, other implementation costs such as design and developers and maintenance costs are considered during the cost and benefit analysis (ACCA, 2018). Insufficient business planning would cost more for additional licenses, external and internal support. Good project planning could reduce unexpected expenses and an over-ambitious automation plan. During the selection of RPA vendor and partner, poor screening may hire inexperienced RPA vendor and RPA partners and result in an incorrect estimate. Organisations should request RPA providers to provide a clear breakdown of total implementation cost to reduce the risk of any hidden costs (Rashid et al., 2020).

Possible CSFs - business plan and vision, project management, RPA partner, and RPA vendor.

9. Insufficient change management to deal with cultural issues

According to section 4.10.2, change management is the main CSF to deal with cultural issues. Building an RPA culture requires communication with the stakeholders involved to realise the benefits and future implications for their roles and responsibilities, this will minimise resistance (ACCA, 2018). Business planning and vision prepares the adoption of change management. Top management support encourages cooperation amongst teams and stakeholder engagement, redeploys employees to more interesting roles through organisation restructure, releases the resource to engage in change (Seasongood, 2016). Project management ensures effective program delivery and manages employee engagement (ACCA, 2018). Stakeholder engagement in RPA projects can reduce resistance (Wright et al., 2018).

Possible CSFs - top management support, business plan and vision, project management, and change management.

Table 5.4 is constructed by mapping the possible CSFs across each of the above nine issues. The top three CSFs with over 5 appearances are project management, RPA partner, and RPA vendor.

CSF \ Issue	1	2	3	4	5	6	7	8	9	F
Top management support	x								x	2
Business Plan and Vision				x			x	x	x	4
Project Management			x	x	x	x	x	x	x	7
IT Support		x	x							2
Centre of Excellence			x		x	x	x			4
User Training and Education					x	x	x			3
RPA Partner	x	x	x		x	x	x	x		7
RPA Vendor	x	x			x	x	x	x		6
Change Management									x	1
Monitoring and Security			x							1
Quality Assurance			x							1
User Acceptance Test	x									1
Process Selection	x									1
Process Redesign	x									1

Table 5. 4 Mapping of possible CSFs to resolve RPA implementation issues

5.3 Analysis of the overall result

Table 5.5 shows the consolidated results from tables 5.1 to 5.4. By adding all the frequencies for each CSF across these four tables to obtain the total, a measure of the overall significance of each CSF can be obtained. This overall result thus incorporates the original CSF results from the analysis of 20 RPA case studies with an analysis of their phase occurrences, their relationships and the application of those CSFs to documented issues in RPA implementation.

CSF \ Result	Findings Summary	Phase occurrence	Top-down relationship	Interrelationship	Solution	Total
Top Management Support	11	4	6	0	2	23
Business Plan and Vision	14	1	7	1	4	27
Project Management	11	4	9	2	7	33
IT Support	13	4	3	5	2	27
Centre of Excellence	10	2	4	1	4	21
User Training and Education	14	2	2	5	3	26
RPA Partner	13	4	4	3	7	31
RPA Vendor	8	1	1	2	6	18
Change Management	12	2	1	3	1	19
Monitoring and Security	12	2	0	4	1	19
Quality Assurance	9	2	1	3	1	16
User Acceptance Test	5	1	0	3	1	10
Process Selection	17	2	0	3	1	23
Process Redesign	7	1	0	3	1	12

Table 5. 5 Consolidated results

Table 5.6 compares the original result of the first ranking exercise from the findings in chapter 4 and the ranking from the overall result in table 5.5, which is the collection of all results from table 5.1 to table 5.4. The purpose of this exercise is to see if there are any changes in the relative ranking of the CSFs.

Rank	CSF	Total	Original position	Change
1	Project Management	33	8	7
2	RPA Partner	31	5	3
3	Business Plan and Vision	27	2	-1
4	IT Support	27	4	0
5	User Training and Education	26	3	-2
6	Top Management Support	23	9	3
7	Process Selection	23	1	-6
8	Centre of Excellence	21	10	2
9	Change Management	19	6	-3
10	Monitoring and Security	19	7	-3
11	RPA Vendor	18	12	1
12	Quality Assurance	16	11	-1
13	Process Redesign	12	13	0
14	User Acceptance Test	10	14	0

Table 5. 6 Comparison of rankings between table 5.5 and table 5.1

The noticeable rise in ranking position is project management, which goes up 7 places and the remarkable drop is process selection, which moves down by 6 places. Other CSFs that move up in relative ranking include RPA partner, top management support, CoE, IT support, and RPA vendor.

The top half of table 5.6 can be considered as a set of fundamental CSFs for RPA implementation. Each of them plays a critical or unique role in RPA implementation. Top management support provides the essential human and capital resources, formulates a business plan and vision, and sets the short-term and long-term goals to meet the business strategies. The RPA partner organises the procurement of software and knowledge transfer. The project management team executes the RPA project on time and within the budget, while the IT team installs the necessary RPA infrastructure and offers IT support. User training and education is vital in equipping affected employees with the necessary skills and attitude to effectively engage with the RPA initiative and participate in continuous improvement. As noted earlier, process selection is critical in RPA implementation, given that the primary focus is the automation of business processes. The remaining CSFs can be considered as subordinate factors because of their lower overall ranking and involvement in top-down relationships, which have already been discussed in section 5.1.2.

CHAPTER 6. CONCLUSION

This research provides an insight into best practice for RPA implementation by identifying a set of 14 CSFs through thematic analysis of RPA case studies from 20 selected articles, the result of a systematic literature review. Findings from the initial analysis include a description of the key aspects of each CSF and the rationale for their significance. Further analysis incorporated the frequency of occurrence of each CSF in the data set with their distribution over implementation phases, involvement in relationships with other CSFs, and their relevance to reported implementation issues, to derive a final ranking of fundamental and secondary CSFs for RPA implementation.

The total number of CSFs for RPA implementation derived from the thematic analysis of 20 selected articles was 14. Ten CSFs were consistent with CSFs appearing in the existing ERP literature. Four newly identified CSFs specific to RPA implementation were inductively generated from the investigation: a centre of excellence, IT support, quality assurance and process selection. Table 3.3 above provides a list of the 14 CSFs identified in this study. Sorting these 14 CSFs in descending order of the frequency of their occurrence in the data set produced an initial ranking of the set of CSFs that became the original findings of this research (see table 5.1 above). In the findings chapter, the rationale for the importance of each CSF was examined. However, the frequency of occurrence in the accounts of the case studies of RPA implementation may not alone indicate the significance of a particular CSF. Therefore, some CSFs that were popular in the thematic analysis might not necessarily be the most critical. Thus, further analysis was conducted on the findings. This subsequent analysis revealed various hierarchical relationships and interrelationships between many of the CSFs. For example, both top management support and business planning and vision had at least 6 top-down relationships with other CSFs, while both IT support and user training and education had 5 interrelationships with other CSFs.

Further analysis included the requirement of different CSFs across some or all phases of RPA implementation, and the opportunity to apply the identified CSFs to nine RPA implementation issues and problems reported in the literature. A final ranking of the set of CSFs was obtained by compiling the frequency totals obtained from the original findings, distribution across implementation phases, the extent of top-down relationships and interrelationships between CSFs, and their potential application to reported implementation issues. When comparing the original and final rankings of the 14 CSFs, 5 CSFs remained in the top 7 positions (see table 5.6 above). These were process selection, business plan and vision, user training and education, IT support and RPA partner. Change management and monitoring and security were replaced by project management and top management support.

In order to further refine the set of 14 CSFs from the findings, 7 fundamental CSFs were defined by dividing the total set of CSFs in two based on their overall ranking in table 5.6. The 7 highest ranked CSFs are top management support, project management, RPA partner, business plan and vision, IT support, user training and education, and process selection. This set is relevant to the business as a whole since it covers the alignment to strategic planning at the corporate level, allocation of human and capital resources at the department level and user training and education to the individual level. The remaining 7 CSFs can be treated as subordinate to the fundamental CSFs since they occur in top-down (hierarchical) relationships with them. Table 6.1 shows the complete set of 14 CSFs identified in this study, divided into 7 fundamental CSFs and 7 subordinate or secondary CSFs.

Fundamental CSFs	Secondary CSFs
Project Management	Quality Assurance
RPA Partner	RPA Vendor
Business Plan and Vision	Centre of Excellence
IT Support	Monitoring and Security
User Training and Education	User Acceptance Test
Top Management Support	Change Management
Process Selection	Process Redesign

Table 6. 1 Fundamental and secondary CSFs for RPA implementation

6.1 Implications for theory and practice

The list of CSFs for RPA implementation produced from this study provides researchers with a framework upon which to base further research. The ultimate objective of this research was to identify the real “critical” factors which could improve the chance of success than searching for a set of factors with a higher number of frequencies. Otherwise, the preliminary result from table 5.1 would have satisfied the requirement. Further investigation with other conditions confirmed that 5 CSFs at the top 7 positions in the preliminary result remained at the top 7 positions in the final result. The final outcome was thus reliable. The top position - process selection - was replaced by a more prominent factor - project management. As well as identifying the most critical CSFs in RPA implementations, the study also suggested in which phase particular CSFs were more significant. Further, fundamental and subordinate CSFs were distinguished. Overall, this study makes a contribution through the identification of four new CSFs that are specific to RPA implementation, proposed hierarchical relationships and interrelationships between CSFs, and the association of particular CSFs with major implementation challenges.

From a practitioner perspective, this study provides organisations contemplating RPA initiatives as well as RPA project champions with a clear set of empirically derived factors that are critically important to RPA implementation success. Given their potential applicability to commonly reported causes of failure, paying attention to these CSFs will improve the chance of a successful RPA implementation. Further, the findings can be used to predict and allocate resources to those CSFs that are most relevant in a particular implementation phase.

6.2 Limitations

Given the relatively short history of RPA, case studies of RPA implementation are limited. The thematic analysis was conducted on only 20 published RPA case studies with sufficient detail to derive CSFs confidently. Only case studies that covered contemporary RPA implementation, and written in English were included in the data set. There was no consideration of the industrial type. Different industries have different foci. For example, from the findings, accountancy and insurance place more consideration on governance, especially in monitoring and security.

Further, the investigation was carried out using secondary sources. There was a possibility that not all the factors might have been accounted for by the original authors. The authors could elaborate on the content that they were more familiar with and only touch lightly on unfamiliar topics.

Finally, the development of the RPA technology is also ongoing. RPA technology is not static but evolving with supplementary technologies like machine learning and natural language processing. With these developments, new CSFs may emerge, or the relative importance of those CSFs identified in this study may change. Thus, there is no definitive or ultimate set of CSFs for RPA implementation.

6.3 Future research

While RPA projects are often regarded as requiring lightweight IT project management (Lacity & Willcocks, 2015; Vanhanen, 2020), project management was the highest-ranked CSF from the overall analysis. This will be an interesting topic to conduct further research to gather information on the extent to which organisations are using formal project management approaches in their RPA implementations, the rate of success of those projects, and a comparison of different industries and countries.

REFERENCES

ACCA. (2018, September 21). *Embracing robotic automation during the evolution of finance*. The Association of Chartered Certified Accountants. Retrieved May 5, 2020 from https://www.charteredaccountantsanz.com/news-and-analysis/insights/research-and-insights/robotics-automation-paper

Al-Mashari, M., Al-Mudimigh, A., & Zairi, M. (2003). Enterprise resource planning: A taxonomy of critical factors [Article]. *European Journal of Operational Research, 146*(2), 352. https://doi.org/10.1016/S0377-2217(02)00554-4

Alberth, M., & Mattern, M. (2017). Understanding robotic process automation (RPA). *Journal of Financial Transformation, 46*, 54-61.

Barrett, B. (2019, January 3). *RPA deployment options: On-Premise vs. RPAaaS*. Ashling Partners. Retrieved May 20, 2020 from https://insights.ashlingpartners.com/rpa-deployment-options-on-premise-vs.-rpaaas

Bloomberg, J. (2018, November 6). *Why you should think twice about Robotic Process Automation*. Forbes. Retrieved May 22, 2021 from https://www.forbes.com/sites/jasonbloomberg/2018/11/06/why-you-should-think-twice-about-robotic-process-automation/#57a5c0b05fe1

Blue Prism. (2020a). *How Blue Prism's digital workforce is increasing Walgreens's HR shared service efficiency by 73%*. Blue Prism. Retrieved April 12, 2021 from https://www.blueprism.com/uploads/resources/case-studies/blue-prism-Walgreens-case-study_190111_192430.pdf

Blue Prism. (2020b). *Intelligent automation makes HR more human at Walgreens*. Blue Prism. Retrieved May 21, 2021 from https://www.blueprism.com/uploads/resources/case-studies/BP-CS-Walgreens-FINAL.pdf

Blue Prism. (2021a). *For Mid Essex hospital, improving patient experience called for intelligent automation*. Blue Prism. Retrieved May 21, 2021 from https://www.blueprism.com/uploads/resources/case-studies/BP-CS-Mid-Essex-NHS-Patient-Care-FINAL.pdf

Blue Prism. (2021b). *Intelligent automation frees employees to connect with customers at Co-operative Bank*. Blue Prism. Retrieved May 21, 2021 from https://www.blueprism.com/uploads/resources/case-studies/BP-CS-Coop-Bank-FINAL.pdf

Blue Prism. (2021c). *London School of Economics - Blue Prism software robots case study at Telefonica O2*. Blue Prism. Retrieved May 21, 2021 from https://www.blueprism.com/uploads/resources/case-studies/TelefonicaOUWP022015FINALPOSTED.pdf

Blue Prism. (2021d). *npower processes 18 million transactions in a year thanks to intelligent automation*. Blue Prism. Retrieved May 21, 2021 from https://www.blueprism.com/uploads/resources/case-studies/npower-BluePrism-Story.pdf

Blue Prism. (2021e). *Zurich UK invests in customers and employees with a successful intelligent automation program*. Blue Prism. Retrieved May 21, 2021 from https://www.blueprism.com/uploads/resources/case-studies/BP-CS-Zurich-UK.pdf

Boulton, C. (2018, September 4). *What is RPA? A revolution in business process automation*. IDG Communications Pty Ltd. Retrieved May 5, 2020 from https://www.cio.com/article/3236451/what-is-rpa-robotic-process-automation-explained.html

Capacity. (2017). *What is the difference between machine learning (ML) and robotic process automation (RPA) technology?* Capacity. Retrieved May 24, 2021 from https://capacity.com/rpa-and-workflows/faqs/what-is-the-difference-between-machine-learning-ml-and-robotic-process-automation-rpa-technology/

Carden, L., Maldonado, T., Brace, C., & Myers, M. (2019). Robotics process automation at TECHSERV: An implementation case study. *Journal of Information Technology Teaching Cases, 9*(2), 72.

Chand, D., Hachey, G., Hunton, J., Owhoso, V., & Vasudevan, S. (2005). A balanced scorecard based framework for assessing the strategic impacts of ERP systems. *Computers in Industry, 56*(6), 558-572. https://doi.org/10.1016/j.compind.2005.02.011

Connolly, B. (2018, August 8). *Governing automation: How to ensure humans and 'bots' can co-exist*. IDG Communications Pty Ltd. Retrieved May 24, 2021 from https://www2.cio.com.au/article/644775/governing-automation-how-ensure-humans-bots-can-co-exist/

Cooper, L. A., Holderness, D. K., Sorensen, T. L., & Wood, D. A. (2019). Robotic Process Automation in Public Accounting. *Accounting Horizons, 33*(4), 15-35. https://doi.org/10.2308/acch-52466

Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications.

Dilla, R., Jaynes, H., & Livingston, L. (2015). *Introduction to Robotic Process Automation A Primer*. Institute for Robotic Process Automation. Retrieved May 4, 2020 from https://irpaai.com/ebook-primer/

Duc, T. M., & Thu, H. T. M. (2018). *Workflow Methodology development of RPA solution for a Vietnamese bank: a case study of Korkia Oy* [Master's thesis, Laurea University of Applied Sciences]. https://www.theseus.fi/handle/10024/148869

Earle, G., & Mason, M. (2019). *Four bad ways to use RPA*. ThoughWorks. Retrieved May 24, 2021 from https://www.thoughtworks.com/insights/articles/four-bad-ways-use-rpa

Eddy, D. (2015, April 27). *Top 10 robotic process automation system features*. UiPath. Retrieved May 24, 2021 from https://www.uipath.com/blog/what-to-look-for-top-10-rpa-system-features

EY. (2017). *Get ready for robots*. EY. Retrieved May 20, 2020 from https://assets.ey.com/content/dam/ey-sites/ey-com/en_gl/topics/emeia-financial-services/ey-get-ready-for-robots.pdf

Fernandez, D., & Aman, A. (2018). Impacts of Robotic Process Automation on Global Accounting Services. *Asian Journal of Accounting & Governance, 9*, 123-131. https://doi.org/10.17576/AJAG-2018-09-11

Finney, S., & Corbett, M. (2007). ERP implementation: a compilation and analysis of critical success factors. *Business Process Management Journal, 13*(3), 329-347. https://doi.org/10.1108/14637150710752272

Forrester Research. (2019, March). *The impact of RPA on employee experience*. Forrester Consultant. Retrieved December 25, 2019 from https://dfe.org.pl/wp-content/uploads/2019/04/Forrester_RPA-Impact_Employee-Engagement.pdf

Galer, S. (2018, November 6). *Build intelligent bots in three minutes: SAP intelligent robotic process automation*. SAP. Retrieved May 20, 2020 from https://news.sap.com/2018/11/intelligent-bots-sap-intelligent-robotic-process-automation/

Ginieis, M., Sánchez-Rebull, M.-V., & Campa-Planas, F. (2012). The academic journal literature on air transport: Analysis using systematic literature review methodology. *Journal of Air Transport Management, 19*, 31.

Gray, D. E. (2018). *Doing research in the real world*. Sage.

Guest, G., MacQueen, K. M., & Namey, E. E. (2012). *Applied thematic analysis*. Sage Publications.

Hallikainen, P., Bekkhus, R., & Shan, L. P. (2018). How OpusCapita Used Internal RPA Capabilities to Offer Services to Clients. *MIS Quarterly Executive, 17*(1), 41-52.

Hofmann, P., Samp, C., & Urbach, N. (2020). Robotic process automation. *Electronic Markets, 30*(1), 99-106. https://doi.org/10.1007/s12525-019-00365-8

Howell, M. T. (2010). *Critical success factors simplified : implementing the powerful drivers of dramatic business improvement*. CRC Press.

Hudson, L. A., & Ozanne, J. L. (1988). Alternative ways of seeking knowledge in consumer research. *Journal of consumer research, 14*(4), 508-521.

Hultin, J., Trudell, C., Vashistha, A., & Glover, T. (2017). *Implications of technology on the future workforce*. D. B. B. W. U. States.

Imanuel. (2018). *The 12 best robotic process automation software for your business*. Pat Research. Retrieved May 20, 2020 from https://www.predictiveanalyticstoday.com/what-is-robotic-process-automation/

JavaTPoint. (2018a). *RPA Architecture*. Java T Point. Retrieved December 25, 2019 from https://www.javatpoint.com/rpa-architecture

JavaTPoint. (2018b). *RPA life cycle*. JavaTPoint. Retrieved April 10, 2021 from https://www.javatpoint.com/rpa-life-cycle

Joseph, L., Clair, C. L., O'Donnell, G., Sharma, A., Dangi, S., & Nagel, B. (2019, July 10). *The RPA services market will grow to reach $12 billion by 2023*. Forrester. Retrieved May 20, 2020 from https://www.forrester.com/report/The+RPA+Services+Market+Will+Grow+To+Reach+12+Billion+By+2023/-/E-RES156255#

Juntunen, K. (2018). *Influence of contextual factors on the adoption process of Robotic process automation (RPA): Case study at Stora Enso Finance Delivery* [Master's thesis, Uppsala

Universitet]. https://www.diva-portal.org/smash/record.jsf?pid=diva2%3A1223866&dswid=9983

Kämäräinen, T. (2018). *Managing robotic process automation: Opportunities and challenges associated with a federated governance model* [Master's thesis, Aalto University]. http://urn.fi/URN:NBN:fi:aalto-201806273666

Kivunja, C., & Kuyini, A. B. (2017). Understanding and applying research paradigms in educational contexts. *International Journal of higher education, 6*(5), 26-41.

Kokina, J., & Blanchette, S. (2019). Early evidence of digital labor in accounting: Innovation with Robotic Process Automation. *International Journal of Accounting Information Systems, 35*, N.PAG-N.PAG. https://doi.org/10.1016/j.accinf.2019.100431

Kothari, C. R. (2004). *Research methodology : methods & techniques* (Second revised edition. ed.). New Age International (P) Ltd., Publishers.

Lacity, M., & Willcocks, L. (2015). Robotic Process Automation: The Next Transformation Lever for Shared Services. *London School of Economics Outsourcing Unit Working Papers(7)*. https://s3.eu-central-1.amazonaws.com/fleming.events-webfiles/redactor/SmV3wRUSKoK1NHJ1ZF2ggoj5PvicU1V5NxPtZFiZ.pdf

Lacity, M., Willcocks, L., & Craig, A. (2016). Robotizing global financial shared services at royal DSM. *London School of Economics Outsourcing Unit Working Papers(2)*. http://www.umsl.edu/~lacitym/OUWP022016Post.pdf

Lacity, M., Willcocks, L. P., & Craig, A. (2015). Robotic process automation: mature capabilities in the energy sector. *London School of Economics Outsourcing Unit Working Papers(6)*. http://eprints.lse.ac.uk/64520/1/OUWRPS_15_06_published.pdf

Lacity, M. C., & Willcocks, L. P. (2016). Robotic Process Automation at Telefónica O2. *MIS Quarterly Executive, 15*(1), 21-35.

Leidecker, J. K., & Bruno, A. V. (1984). Identifying and Using Critical Success Factors. *Long Range Planning, 17*(1), 23-32. https://doi.org/10.1016/0024-6301(84)90163-8

Lindros, K. (2017, August 1). *What is IT governance? A formal way to aligh IT & business strategy*. CIO. Retrieved May 20, 2021 from https://www.cio.com/article/2438931/governanceit-governance-definition-and-solutions.html

Minogue, C. (2019). *Robotic process automation and the work identity of accountants* (Publication Number 3) [Master's thesis, University of Turku]. https://www.utupub.fi/bitstream/handle/10024/147633/Minogue_Charlotte_opinnayte.pdf?sequence=1

Moffitt, K. C., Rozario, A. M., & Vasarhelyi, M. A. (2018). Robotic process automation for auditing. *Journal of Emerging Technologies in Accounting, 15*(1), 1-10. https://doi.org/10.2308/jeta-10589

Myllymäki, J. (2019). *Developing Organization's Processes With Robotic Process Automation-A Case Study* [Master's thesis, University of Vaasa]. http://urn.fi/URN:NBN:fi-fe2019121648427

Nah, F. F.-H., Lau, J. L.-S., & Kuang, J. (2001). Critical factors for successful implementation of enterprise systems. *Business Process Management Journal, 7*(3), 285.

Ngai, E. W. T., Law, C. C. H., & Wat, F. K. T. (2008). Examining the critical success factors in the adoption of enterprise resource planning. *Computers in Industry, 59*(6), 548-564. https://doi.org/10.1016/j.compind.2007.12.001

NICE. (2020). *What are the benefits of robotic process automation?* NICE Ltd. Retrieved May 2, 2021 from https://www.nice.com/rpa/rpa-guide/the-benefits-of-rpa/

O'Brien, A. M., & McGuckin, C. (2016). *The systematic literature review method : trials and tribulations of electronic database searching at doctoral level*. SAGE.

Ostdick, N. (2016a). *The beneifts and challenges of RPA implementation*. UiPath. Retrieved May 2, 2021 from https://www.uipath.com/blog/the-benefits-and-challenges-of-rpa-implementation

Ostdick, N. (2016b). *The evolution of robotic process automation (RPA): past, present, and future*. Uipath. Retrieved May 20, 2020 from https://www.uipath.com/blog/the-evolution-of-rpa-past-present-and-future

Paredes, D. (2019, October 3). *University of Auckland taps RPA and now champions it in the wider community*. IDG Communications Pty Ltd. Retrieved May 4, 2020 from https://www.cio.com/article/3514801/university-of-auckland-taps-rpa-and-now-champions-it-in-the-wider-community.html

PEGA. (2019, September 10). *Survey: most businesses find RPA effective but hard to deploy and maintain*. PEGA. https://www.pega.com/about/news/press-releases/survey-most-businesses-find-rpa-effective-hard-deploy-and-maintain

Preimesberger, C. (2016, December 5). *10 Success Factors for Deploying Software Robots in the Enterprise*. QuinStreet, Inc. Retrieved May 4 from https://www.eweek.com/enterprise-apps/10-success-factors-for-deploying-software-robots-in-the-enterprise/

Radke, A. M., Minh Trang, D., & Tan, A. (2020). Using Robotic Process Automation (RPA) to enhance item master data maintenance process. *Scientific Journal of Logistics, 16*(1), 129-140. https://yadda.icm.edu.pl/baztech/element/bwmeta1.element.baztech-2bd2b0dc-5717-4bc5-8840-669b3c19d8d7

Ray, S., & Miers, D. (2019). *How to choose your best-fit vendor for RPA software platforms* https://www.gartner.com/document/3940017?ref=lib

Sathiyaseelan, B., & Sirish, V. (2020). A structured approach to implementing Robotic Process Automation in HR. *Journal of Physics: Conference Series, 1427*(1), 1.

Seasongood, S. (2016, Annual2016). NOT JUST FOR THE ASSEMBLY LINE: A Case for Robotics in Accounting and Finance. *Financial Executive, 32*, 31-39.

Šimek, D., & Šperka, R. (2019). How Robot/human Orchestration Can Help in an HR Department: A Case Study From a Pilot Implementation. *Organizacija, 52*(3), 204-217. https://doi.org/10.2478/orga-2019-0013

Smartbridge. (2021). *Natural language processing in RPA*. Smartbridge. Retrieved May 5, 2021 from https://smartbridge.com/automation/explore-rpa/nlp-in-rpa/

Somers, T., & Nelson, K. (2001). The Impact of Critical Success Factors across the Stages of Enterprise Resource Planning Implementations. *Hawaii International Conference on System Sciences, 8*, 8016. https://doi.org/10.1109/HICSS.2001.927129

Stolpe, A., Steinsund, H., Iden, J., & Bygstad, B. (2017). Lightweight IT and the IT function: experiences from robotic process automation in a Norwegian bank. Norsk konferanse for organisasjoners bruk at IT,

Syed, R., Suriadi, S., Adams, M., Bandara, W., Leemans, S. J. J., Ouyang, C., ter Hofstede, A. H. M., van de Weerd, I., Wynn, M. T., & Reijers, H. A. (2020). Robotic Process Automation: Contemporary themes and challenges. *Computers in Industry, 115*, 103162.

https://yadda.icm.edu.pl/baztech/element/bwmeta1.element.baztech-2bd2b0dc-5717-4bc5-8840-669b3c19d8d7

Taulli, T. (2020a). RPA foundations. In T. Taulli (Ed.), *The Robotic Process Automation Handbook : A Guide to Implementing RPA Systems* (Vol. 1st ed, pp. 1-25). Apress.

Taulli, T. (2020b). RPA skills. In T. Taulli (Ed.), *The Robotic Process Automation Handbook : A Guide to Implementing RPA Systems* (Vol. 1st ed, pp. 27-51). Apress.

Taulli, T. (2020c). RPA vendor evaluation. In T. Tom (Ed.), *The Robotic Process Automation Handbook : A Guide to Implementing RPA Systems* (Vol. 1st ed, pp. 101-114). Apress.

Templier, M., & Paré, G. (2015). A framework for guiding and evaluating literature reviews. *Communications of the Association for Information Systems, 37*(1), 6.

Tornbohm, C. (2018). *Robotic Process Automation: 8 Guidelines for Effective Results* https://www.gartner.com/document/3880371?ref=lib

Trefler, A. (2018, December 2). *The big RPA bubble*. Forbes Media LLC. Retrieved December 25, 2020 from https://www.forbes.com/sites/cognitiveworld/2018/12/02/the-big-rpa-bubble/#68f3c0ea68d9

Tzeng, T. (2020). *Combining OCR with AI and RPA for advanced data analysis*. UiPath. Retrieved May 21, 2021 from https://www.uipath.com/blog/unstructured-data-analysis-with-ai-rpa-and-ocr

UiPath. (2021a). *Foodstuff: RPA gave employees their lives back - no working weekends or unreasonable hours*. UiPath. Retrieved May 22, 2021 from https://www.uipath.com/resources/automation-case-studies/foodstuffs-used-rpa-to-automate-simple-processes

UiPath. (2021b). *PwC unlocks the keys to true digital transformation*. UiPath. Retrieved May 22, 2021 from https://www.uipath.com/resources/automation-case-studies/pwc-digital-transformation

Vanhanen, J. (2020). *Automation of financial management processes by utilizing robotic process automation: a Finnish banking case* [Master's thesis, LUT University]. http://urn.fi/URN:NBN:fi-fe202001081475

Voehl, F., & Harrington, H. J. (2016). Remembering. In *Change Management : Manage the Change or It Will Manage You* (pp. 1-42). Productivity Press.

Walter, A. (2019). *The dark side of Robotic Process Automation*. IDG Communications Pty Ltd. Retrieved December 25, 2019 from https://www.cio.com/article/3433181/the-dark-side-of-robotic-process-automation.html

Willcocks, L., Hindle, J., & Lacity, M. (2019). *Keys to RPA success*. Knowledge Capital Partners. https://issuu.com/knowledgecapitalpartners/docs/keys_to_rpa_success_--_becoming_str

Willcocks, L., Lacity, M., & Craig, A. (2017). Robotic process automation: Strategic transformation lever for global business services? *Journal of Information Technology Teaching Cases, 7*(1), 17-28. https://doi.org/10.1057/s41266-016-0016-9

Willcocks, L. P., Lacity, M., & Craig, A. (2015). The IT function and robotic process automation. *London School of Economics Outsourcing Unit Working Papers(5)*. http://eprints.lse.ac.uk/64519/1/OUWRPS_15_05_published.pdf

Wright, D., WitheriK, D., & Gordeeva, M. (2018). *The robots are ready. are you?* Deloitte. Retrieved May 20, 2020 from https://www2.deloitte.com/bg/en/pages/technology/articles/deloitte-global-rpa-survey-2018.html

Zumerle, D., & Thornbohm, C. (2019). *Top four security failures in robotic process automation* (ID G00344636) Gartner.

APPENDIX

Example of the coding matrix

ID	Short Code	Category	Initial Code	Phase	Data	Page no.
1	SIIT	Support -Internal	Support -Internal - IT Support	Development	Initial mistakes - deploying RPA software without involving the IT department	P.25
1	SITM	Support - Internal	Support - Internal -Senior Management	Planning	When the Head of Finance told Butterfield about Blue Prism software.	p.26
1	PS	Process	Process - Selection	Development	Butterfield decided in 2010 to conduct two pilot projects on high-volume, low-complexity processes to prove the concept	p.26
1	SEV	Support- External	Support- External - Vendor	Development	Blue Prism's consultants worked onsite and configured the RPA software to perform what people normally did to execute the processes	p.27
1	SEV	Support- External	Support- External - Vendor	Planning	The head of back-office services to do a formal vendor search by issuing a request-for-proposal	p.28
1	GM	Governance	Governance - Monitoring	Development	Blue Prism became part of O2's technology offerings after the IT department verified the software met its governance requirements	p.28
1	PP	Process	Process - planning	Development	Small-scale pilot trials that aimed to test the technical viability and financial value of the RPA product	p.29
1	CMR	Change Management	Change Management - Job Role	Deployment	Some of O2's U.K. based people were redeployed to other service areas	p.28
1	STW	Support -Internal	Support -Internal - IT Support	Deployment	O2 runs the software incurred significant launch problems and growing pains, which could have been avoided if the IT department had been involved earlier.	p.32
1	STW	Support -Internal	Support -Internal - IT Support	Development	It was like driving a Ferrari with a lawn mower engine	p.32
1	CMR	Change Management	Change Management - Job Role	Planning	The operations groups adopting RPA had promised their employees that automation would not result in layoffs. Workers were redeployed to do more interesting work.	p.32
1	COM	Communication	Communication	Planning	Extrapolating from that lesson, the best time to communicate that the organisation is considering RPA is at the proof-of-concept/controlled experiment stage.	p.33
1	STW	Support -Internal	Support -Internal - IT Support	Development	The biggest lesson about starting the RPA journey is that it should be a cojoined collaboration between IT and the business.	p.34