



## **DEVELOPING BUSINESS PROCESS AUTOMATION STRATEGY**

Case: Finnish Financial Industry Organization

Lappeenranta–Lahti University of Technology LUT

Master's Programme in Industrial Engineering and Management, Global Management of  
Innovation and Technology, Master's thesis

2022

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## ABSTRACT

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Master's thesis

2022

108 pages, 22 figures, 2 tables and 2 appendices

Examiner(s): Professor, D.Sc. (Tech) Ville Ojanen and Associate Professor, D.Sc. (Tech) Lea Hannola

Keywords: business process, business process automation, business process management, business process automation strategy, financial industry

In the field of financial industry, there is a need for both cost-efficiency and revenue growth through digital transformation. Similarly, business process automation is becoming more and more popular way of attaining cost-efficiency and revenue growth among organizations, also in financial industry. In process automation the general target is to minimize costs by minimizing the need for human interaction in manually intensive processes. Moreover, the utilization of operational intelligence enables end-to-end automation of complex process flows.

Even though business process automation is already evident in the financial industry, there are some gaps in theory and practice. The field lacks unified framework of business process automation tools and technologies and their utilization methods. Moreover, the literature is missing considerations of continuous development and process improvement in automation area. Due to the lack of unified visibility in the field, there is no clarity on the strategy of business process automation and its considerations. Thus, the thesis aims to contribute to creating framework for characteristics regarding business process automation strategy by evaluating business process automation from multiple viewpoints.

Based on the results of literature review and case study, the most important factors to be influenced by the strategy are the business process automation governance, technological capabilities and business understanding and co-operation. These include the ability to manage processes through data, consider the whole value stream which guides separate processes and thus generate value for the customer. As the thesis contributes to business process automation strategy creation for a Finnish financial industry organization, the viewpoint of financial industry is brought into the discussions. Thus, the viewpoint of financial industry contributes to both the theoretical viewpoints of technologies and strategy. The results might be applied also to other industries, but the organizations need to evaluate the nature of their industry and market to test the framework to their business context.

## TIIVISTELMÄ

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### **LIIKETOIMINTAPROSESSIEN AUTOMAATIOSTRATEGIAN KEHITTÄMINEN**

Case: Suomalainen finanssialan organisaatio

Tuotantotalouden diplomityö

2022

108 sivua, 22 kuvaa, 2 taulukkoa ja 2 liitettä

Tarkastaja(t): Professor, D.Sc. (Tech) Ville Ojanen and Associate Professor, D.Sc. (Tech)

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Avainsanat: liiketoimintaprosessi, liiketoimintaprosessiautomaatio, liiketoimintaprosessijohtaminen, liiketoimintaprosessiautomaatiostrategia, finanssiala

Liiketoiminnan digitalisoituessa finanssiala tarvitsee ratkaisuja kustannustehokkuuden ja liikevaihdon kasvattamisen ylläpitämiseksi. Samanaikaisesti liiketoimintaprosessiautomaation mahdollisuudet kustannustehokkuuteen ja liikevaihdon kasvattamiseen muuttuvat entistä suositummaksi, myös finanssialalla. Liiketoimintaprosessien jatkuva kehittäminen, parantaminen ja automatisointi mahdollistaa kustannustehokkuuden ja liikevaihdon kasvattamisen esimerkiksi minimoimalla ihmisen työnteon manuaalisissa työtehtävissä. Lisäksi älykkään teknologian hyödyntäminen mahdollistaa kokonaisvaltaisen liiketoimintaprosessiautomaation myös vaativimmissa prosesseissa.

Vaikkakin liiketoimintaprosessiautomaatio on näkyvää finanssialalla, aukkoja niin teoreettisessa kuin käytännön viitekehyksissä on löydettävissä. Kirjallisuudesta puuttuu kokonaiskuva liiketoimintaprosessiautomaatiosta käytettävistä teknologioista ja niiden käyttömahdollisuuksista. Lisäksi kirjallisuus ei ota riittävästi huomioon jatkuvaa kehittämistä ja prosessien parantamista liiketoimintaprosessiautomaatiosta. Puuttuvien osa-alueiden vuoksi myöskään liiketoimintaprosessien automaatiostrategia ei ole selkeä. Tämän diplomityön tavoitteena on muodostaa viitekehyksen liiketoimintaprosessien automaatiostrategian ympärille.

Tutkimuksen tulosten perusteella tärkeimmät strategiassa huomioonotettavat osa-alueet ovat liiketoimintaprosessien automaation kokonaisvaltaisen hallitseminen, teknologiset kyvykkyydet sekä liiketoimintayhteistyö ja -ymmärrys. Osa-alueet pitävät sisällään mahdollisuuden johtaa prosesseja dataan perustuen, arvovirtajohtamisen hyödyntämisen prosessien johtamisessa ja täten arvon tuoton prosessien osalta. Koska osana diplomityön tavoitetta on kehittää strategiaa myös suomalaiselle finanssialan organisaatiolle, toimialan kontekstia on evaluoitu osana prosessiautomaation teknologioiden hyödyntämistä ja strategisia tarpeita. Tulokset ovat sovellettavissa myös muille toimialoille, mutta organisaation tulee itse arvioida toimialan luonne ja organisaation tarpeet hyödyntäessään tutkimuksen tuloksia.

## ABBREVIATIONS

AI	Artificial Intelligence
ADMS	Automated Decision-Making Systems
API	Application Programming Interface
BPM	Business Process Management
CoE	Process Automation Center of Excellence
DL	Deep Learning
DMN	Decision Model and Notation
DRD	Decision Requirement Diagram
FTE	Full-time Equivalent
IA	Intelligent Automation
iBPMS	Intelligent Business Process Management Suites
IDP	Intelligent Document Processing
IPA	Intelligent Process Automation
KYC	Know Your Customer
ML	Machine Learning
NLP	Natural Language Processing
NLG	Natural Language Generation
OCR	Optical Character Recognition
RPA	Robotic Process Automation
RDA	Robotic Desktop Automation
VSM	Value Stream Mapping

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# 1 Introduction

Digital transformation is the top business imperative of our day while digital business process automation is one important means to improve customer experience. Thus, companies have started to invest in IT and automation strategy more and the speed for digital transformation is even more evident. (Kir and Erdogan, 2021) Belanche et al (2019) states that the digital transformation and business process automation activities are evident also on financial industry where the digitalization and business process automation have been identified as key elements in the strategies of organizations. Even though business process automation is already evident in the financial industry, there are some gaps in theory and practice.

The field lacks unified framework of business process automation tools and technologies and their utilization methods. Moreover, the literature is missing considerations of continuous development and process improvement in automation area. Due to the lack of unified visibility in the field, there is no clarity on the strategy of business process automation and its considerations. Thus, the thesis aims to contribute to creating framework for characteristics regarding business process automation strategy by evaluating business process automation from multiple viewpoints. The thesis consists of a case study for a Finnish financial industry organization and thus the viewpoint of financial industry is considered throughout the thesis. Due to the nature of the case organization, the research regarding current state of business process automation concentrates in this theses more on knowledge-intensive business processes in the financial sector and related industries.

## 1.1 Background

The importance of information technology (IT) has risen due to digitalization of organizations. (Urbach et al., 2019) Digital transformation also affects and improves organizations' business processes. Business processes are automatized to reduce manual work and human error. The term Business Process is identified from information systems' perspective for this research. *Business process* consists of set of activities which are in a

coordinated logical order. It can be described as interactions between agents, software or human which are performed in defined order. The business processes are based on the targets and goals of the organization. The conceptualization of business process has created a need for Business Process Management (BPM). (Crick et al., 2017; Goedertier et al., 2015)

*Business Process Management (BPM)* is a discipline which unifies operations and technology to manage, develop and design business processes and is in a central role in creating competitive advantage in organizations (Beverungen et al., 2021). BPM aims to develop and re-design or re-engineer existing business processes (vom Brocke et al., 2010). The management approach analyses, designs and implements processes across cross organizationally. Business Process Management offers different tools, models, and methods to define organizational processes and workflows. The aim is to find processes that brings value to their stakeholders. (Badakhshan et al., 2019)

*Business process automation* or *process automation* aims to automate the processes identified by businesses. Business process automation considers the automation possibilities, tools and technologies utilized for automating processes. Business process have been automated decades with various information systems and integration of the systems. However, these kind of legacy automation solutions and technologies lack flexibility required in knowledge-intensive business processes and thus cannot compete with recent, more automated and intelligent solutions (Kir and Erdogan, 2021). At the same time, business models and business processes are becoming more dynamic which creates new requirements and more pressure on traditional automation systems to provide more dynamicity (Sallos et al., 2017). Thus, in recent years more intelligent and dynamic automation technologies are developed.

Smeets et al. (2021) states that there are many technologies to utilize in knowledge-intensive business process automation. Some examples of intelligent technologies supporting automation of knowledge-intensive processes are Robotic Process Automation (RPA), Artificial Intelligence (AI) and Process Mining (van der Aalst et al., 2018). From a general market point of view Robotic Process Automation (RPA) and Process Mining seems to be the technologies which currently gains most interest (Grisold et al., 2021; Hofmann et al., 2020). A foundational question in both research and practice is which processes or parts of

the processes should be automated and which should be taken care of by humans. The question is not new but the recent technological development in automation gives more choices.

Regarding successful business process automation, the co-operation between IT and business is essential. Thus, the context of structured governance among business process automation is a critical factor. Moreover, the organization need to withhold different capabilities for enabling the fulfilment of business need in scope of business process automation. Besides governance, the capabilities consist of process automation methods, technologies and the people and culture among the continuous development of business process automation. (vom Brocke et al., 2021) *Automation strategy* guides the capabilities, operations and targets of process automation activities. It forms a combined view for the alignment and future of process automation in the organization. The strategy should be considered from multiple viewpoints such as the internal capabilities but also from the external insights. (Bernardo et al., 2017)

Regarding the context of financial industries, process automation activities are needed to enable cost-efficiency and revenue growth. Financial industry struggles with low profit generation but similarly new innovations and disruptive solutions are exploited for customers' consumption and its digital possibilities. Thus, process automation activities are needed from two viewpoints, to ensure efficiency in processes, especially regarding costs but to innovate automated digital solutions to ensure customer satisfaction and revenue growth. Thus, strategically business process automation plays a critical role. Therefore, there needs to be an own business process automation strategy established to ensure successful process automation activities. (Liermann and Stegmann, 2021; Ludwig et al., 2021)

Similar needs are also in the case organization. The case organization has been deliberately developing business process automation since 2016. They have renewed their automation strategy in 2019. Since then, their maturity on process automation has grown significantly. Thus, the current automation strategy is not sufficient. This thesis' aim is to contribute on their automation strategy creation by researching and evaluating automation strategy and its categories such as continuous development. Moreover, the case organization seek to better understand different process automation technologies and their utilisation possibilities in

financial industry through the thesis. To mirror the findings from the literature review to the case organization, its employees are interviewed.

## 1.2 Research gap and research scope

In utilization of information technology in organizations, there are identified challenges in the co-operation of business functions and IT functions. This is the case also with the process automation technology that should enhance internal and external customer experience and support cost efficiency. One of the challenges is the increasing need for time-to-market regarding the solutions in development. Environments of modern organizations are dynamic and thus they require agility and flexibility from business but also from IT applications and software. Similarly, they need to adjust their competence to new disciplines, devices, and technologies. (Badakhshan et al., 2019; Gebhart et al., 2016) To conclude, automation strategy, co-operation with business and business needs are required to be clear to take the most out of the IT portfolio.

Because of the above-mentioned reasons IT needs to be able to co-operate efficiently and in an agile manner with the business functions of organizations to ensure successful digital transformation also regarding business process automation and its technologies. These characteristics are also important from the viewpoint of financial industries. (Liermann and Stegmann, 2021; Urbach et al., 2019) Similarly, business operations need to figure out how to adapt and integrate to the dynamic field of IT and constant improvement of technologies. Thus, there needs to be a common governance and way of working on how to align business and IT, their strategies, co-operation and continuous development, also regarding business process automation. (Crick et al., 2017) To find answers for that, next the frames for the thesis are described through identifying the research gap, and research scope. The aim is to clarify and point out the academical contribution regarding the thesis.

### 1.2.1 Research gap

The research gap was already touched in the background section. However, to further define the gap, few other viewpoints need to be considered. Current literature on Business Process Automation has concentrated widely on Robotic Process Automation (RPA) and its utilization methods (Ng et al., 2021). IBM (2021a) discusses that even though RPA is popular and utilized among reducing repeatable manual workflows and lately induced with AI, there are several other technologies to consider for workflow automation. Additionally, the academical context often lacks clarity regarding business process automation as the theoretical implications mostly focus on one niche of business process automation.

Thus, the automation technologies and the literature regarding automation is quite scattered. The complex nature of business process automation and all its aspects are not considered or analysed in the needed extent. In many cases, the discussion is rather one dimensional and concentrates only on one technology for example regarding RPA as visible in Hofmann et al. (2020), Javed et al. (2021) and Smeets et al. (2021) but also in financial industry use cases.

Thus, there is a lack of theoretical implications regarding unifying process-agnostic technologies for process automation, organizations' automation strategy, continuous development of business processes and their automation efforts and the collaboration with technology and business functions. To conclude, more research is needed regarding how to strategize continuous process automation development and align it with business strategy also from the viewpoint of business. For example, all the different implications of Bernardo et al. (2017) considers the field only from IT perspective.

### 1.2.2 Research scope

The focus of the research is the business process automation strategy and process automation technologies. The first aim of the thesis is to understand business process automation and its utilisation. However, the main scope should focus on business process automation strategy. The strategy is needed for the case organization but also to cover the lack of automation strategy discussion in literature. Due to the needs of the case organization and research gap

focus areas of automation strategy for further evaluation are business process technologies and continuous development and cooperation of business and IT.

Further research of business process automation technologies is selected due to the targets of case organization but also literature requiring more research on combining the process-agnostic technologies within business process automation. As there are many different solutions for process automation, only some are selected for further analysis and evaluation. Regarding the continuous development and co-operation, the discussion focuses mostly on process analysis and enhancement and co-operation methods due to the needs of case organization. Lastly, the empirical study focuses on only one case organization. As it is not viable to focus on the whole automation strategy and its categories, focus areas for the case study are selected together with the case organization based on the insights from the literature review.

### 1.3 Research questions and objectives

As stated, the research focuses on the development of business process automation strategy. To understand the phenomena around business process automation, there is a need to understand the technologies and tools among business process automation. As the research is focused for financial industry, the specific context of the industry regarding business process automation needs to be considered. However, the field of business process automation requires both, IT and business, so co-operation is part of the research area. Lastly, there needs to be implications on the strategy development and the needs focusing on IT but considering business. To cover all the needs and fill the research gap, the main and supportive research question in below table 1 are formed.

Table 1 Main and supportive research questions.

How to improve business process automation, continuously enhance processes and align IT and business co-operation with the help of business process automation strategy?	Which ICT technologies are needed regarding process automation?
	How are the identified technologies utilized in financial industry?
	What strategical areas should be considered from IT and Business Process Management? What are the implications for the future?
	How Business and IT co-development is ensured strategically for continuous development and process enhancement?

To ensure that the research questions will be answered, there are few objectives considered for the research. Regarding literature review there are few different viewpoints to evaluate. First being the aim to understand the nature of the process-agnostic technologies for process automation and their scope and challenges. Secondly, to analyse the use cases regarding process automation in financial industry and the utilization methods of the process automation technologies

Lastly, literature review should aim to understand the strategical viewpoint and its future perspectives regarding process automation, co-development and business needs. Regarding the empirical research the aim is to gain insights on what are the technological and business needs regarding business process automation in the financial industry. Thus, it is possible to summarize theoretical implications and empirical insights into managerial implications and reach the research gap.

To answer to the research question and provide the objectives, multiple different sources of information is used. Main source of information is peer-reviewed academical articles. However, the research area is rather dynamic, so conference papers and lecture notes are utilised to attain the most recent research in the area. Additionally, some book sources and information from consultancies such as Gartner and product vendors are used to bring different viewpoints to the discussion.

## 1.4 Methodology

The research will be exploratory as its aim is to seek new insights regarding the technological maturity of the case organization and new horizons in the field of business process automation especially related to their upcoming renewed business process automation strategy. Exploratory research also offers flexibility in case if there rise new areas of focus throughout the research process. Thus, the aim is to have a literature search and review conducted with case study. (Saunders et al., 2016; Yin, 1994)

The study is conducted of one case, but the case organization has multiple different business units that the case study covers. The research method is qualitative. For qualitative method, the sampling method utilized is purposive as the aim is to study a particular group in-depth. Thus, the sample can be more representative as the aim is to have deep insights of the current state and future needs of the case organization. (Saunders et al., 2016)

The thesis included seven interviews within the case organization. The interviews were semi-structured but consisted mostly of open discussion based on “stories” the interviewees told of the interviews’ themes. By collecting data through interviews, the case study will get deep insights of current state and needs for future. The interview type is semi-structured. A list of themes conducted during interview are given to the participants, but the actual interview is aimed to be a natural flow of interaction with spontaneous generation of questions based on the themes outlined. The conversational interview is chosen due to the different backgrounds of the participants. Thus, it allows interviewee to deep-dive in areas of their expertise and discuss a bit more lightly on other topics. (Saunders et al., 2016)

The aim of the interviews is to discuss viewpoints of technology and business especially regarding process enhancing, its related technologies and the future of continuous development of business processes. This will give opportunities to analyse the future needs from a business perspective. The analysis method for the interviews is narrative. The aim is to retrieve insights for different pre-defined themes through the interviews by letting interviewees tell “stories” of the themes, so how the themes are visible in their work and the

insights drawn from there. By understanding the themes and insights, the development and managerial implications for the future strategy can be formed for discussion. Also, to understand the current state, some case organization specific documentation is used. The research was done during a short period of time. (Saunders et al., 2016)

## 1.5 Structure of the thesis

The structure of the thesis and the chapters' inputs and outcomes are presented in the figure 1 below. The thesis starts by defining the research in the introduction based on the needs from the case organization and financial industry but also from literature and its gaps. The literature review consists of four separate chapter. Each of the chapter considers business process automation from a different viewpoint. First part of the literature review concentrates on the theoretical background of business process automation and the theoretical implications in the field to create an understanding of the researched area also from a viewpoint of financial industry.

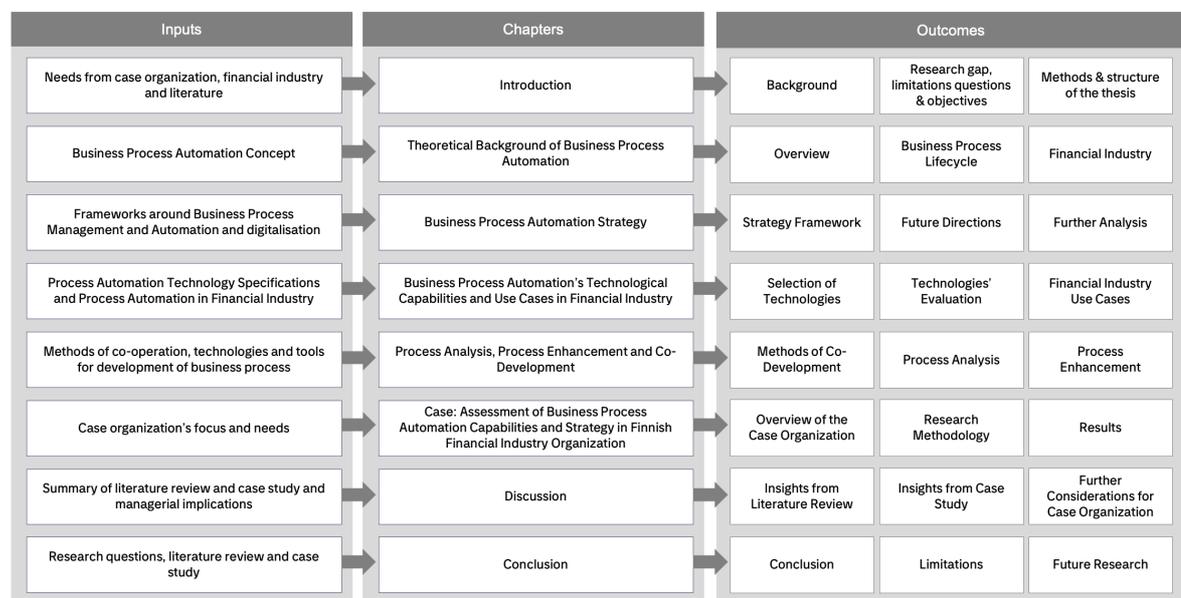


Figure 1 Inputs, chapters and outcomes of the thesis.

The theoretical background of business process automation will be followed by a chapter regarding theoretical implications on developing business process automation strategy. This

consists of forming a framework for strategy and operations development. Thus, the chapter is also contribution to the research questions and objectives. Moreover, it includes future considerations regarding business process automation and its strategy and considerations for further literature review in the thesis.

The last two chapters of literature review focus on further defined areas of automation strategy, first being the evaluation of business process automation technologies. The use cases from financial industry are similarly portrayed from the perspective of the technologies. The target is to understand the concrete implementations of business process automation technologies in the researched industry. The last chapter of literature review considers process analysis and enhancement from a business and technological perspective. Its aim is to evaluate the technologies used for process analysis and enhancement but also the needs for co-development.

The literature review will be followed by empirical research which is a case study as already stated. The case study consists of research in a Finnish Financial Industry organization. It covers the analysis of the current state of the case organization which considers the formation of the themes regarding data collection and purposive selection of the participants of the interviews. The data collection will be done through interviews with employees of the case organization. The data analysis gathers the insights from the interviews into results. The results are combined with the theoretical implications from literature review to form managerial implications. Those are covered in discussion chapter. Lastly, the thesis will be concluded in the last chapter. It includes the conclusions on the contribution to the research questions and objectives and the field of business process automation itself. Moreover, it covers the limitations of the research and future possibilities in the scope of research.

## 2 Theoretical background of Business Process Automation

Rimol (2021) states that Business Process Automation can be seen as an unambiguous discipline which combines different tools and technologies to provide an automated workflow for different processes. Santos et al. (2020) however discusses that automation is ensured by a set of technologies but also integrations to for example retrieve data from different systems without changing the IT infrastructure. This chapter aims to analyse the theoretical implications of the meaning of business process automation to set a base for further analysis.

### 2.1 Overview

Business process automation is defined differently depending on the study, organization and consultancy. There are different terms for business process automation such as: workflow automation, intelligent automation (IA), intelligent process automation (IPA) and hyperautomation. (IBM, 2021a; Ng et al., 2021; Rimol, 2021) Common to all definitions is that business process automation utilizes process-agnostic software which can be used for different use cases and processes in IT and business. Thus, companies can utilize same licenses and be more cost-efficient. (Rimol, 2021)

Business processes has a special feature compared to other processes. A single business process can include various tasks in different areas of business but also provide different information sources for other processes. Thus, business processes are not always linear and can have variety of dependencies which sets a challenge in automation possibilities. The nature of business process is usually complex and can be rather difficult to analyse and model to a coherent process flow. (Kuandykov et al., 2020; Ng et al., 2021) To clarify the discussion around business process automation, the theoretical overview acknowledges business process management, automation utilization and the overview of business process lifecycle.

### 2.1.1 Business Process Management (BPM)

Business Process Management (BPM) offers a theoretical framework around business process automation. BPM brings together engineering, management and IT. Whilst it is challenging to ensure successful collaboration, some BPM models aim to break free from the challenges and offer solutions for seamless collaboration. (Beverungen et al., 2021) Vom Brocke et al. (2010) identifies that the key characteristic of BPM is to develop, analyse and re-design or –engineer existing business processes. However, it should be acknowledged that in IT, abbreviation BPM is often used for the software used to automation business processes.

Sikdar and Payyazhi (2014) acknowledges that BPM is in a central role in creating competitive advantage in organizations. Even though BPM provides functioning models to build a foundation for creating and managing business processes, there is not a consensus on the right scope of BPM. Thus, BPM does not offer specific guidelines or frameworks. (vom Brocke et al., 2014) Although, one of the aims of BPM is to support communication between IT and stakeholders. Thus, the activities around process improvements, such as process modelling, should be easy to understand for every stakeholder around BPM. However, to succeed in that, it is crucial to have a clarity of the process' tasks and workflow, what their aims are and how they generate value for the whole value stream. Thus, the processes need to be analysed and designed successfully. (Kahloun and Ayachi-Ghannouchi, 2020)

Moreover, IT leaders should have knowledge of the business operations to understand the need of business process automation. Thus, IT and business need to build a close collaboration and IT need to be stakeholder oriented in their actions. (Urbach et al., 2019) Vom Brocke et al. (2014) also states that there is a need for IT and business to identify and agree on the ways of work for business process management. Moreover, Sikdar and Payyazhi (2014) has identified that any BPM improvement initiative fails due to an unsuccessful implementation of improved business processes.

### 2.1.2 Business Process Automation Utilization

There is a discussion that automation would take over the jobs which are based on repeatable and structured work. It is forecasted that during the early 2020s 60% of jobs would be involved with automation and at least some of the job tasks are replaced by automation. (Coombs et al., 2020) However, studies have been showing that automation and human interaction complements each other. The co-operation with automation and humans is to emerge through increasing automation efforts rather than robots taking away humans' work. (Shestakofsky, 2017)

In the utilisation of process automation, there is two categories for technologies: direct solutions and indirect solutions. Direct solutions are the technologies designed particularly for process automation which is also the core focus of the technological evaluation in this thesis. Indirect solutions consist of technologies which support process automation. These solutions consider for example artificial intelligence (AI), analytics and sensors. (Grisold et al., 2020; Ng et al., 2021)

The target for process automation and the processes needed to be automated differ based on the industry and organization. Moreover, organizations' have different strategical targets for increasing automation level within processes. (vom Brocke et al., 2014). However, organisations' internal processes are often similar, so common solutions for those have been proposed also in literature, for example for financial administration. Organisations are filled with process automation utilisation potential and thus a criterion for evaluation of potential processes for automation are created as seen in figure 2 below. The automation process criteria guide in the characteristics process need to have to be automated. (Polak et al., 2020)

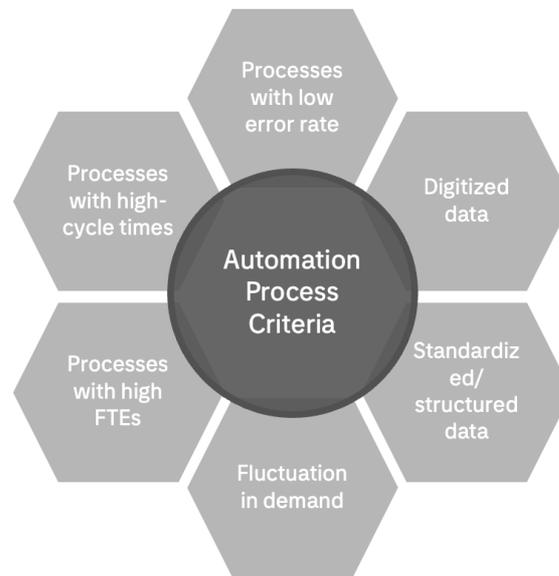


Figure 2 Automation Process Criteria (Polak et al., 2020).

The figure 2 above considers six different criteria for evaluating processes. Processes should withhold at some characteristics from the criterion to be valid to automate. Major of them concentrates on the type of a process but also on the data available. From a business case perspective, not all processes are effective to be automated due to the lack of value added by the automation efforts. Often automation is targeted for cost-efficiency or better employee or customer experience. So, if the targets cannot be met with automation purposes nor the automation offers extra value for example through offering better data possibilities, it is not wise to automate a process or a task. (Ng et al., 2021; Polak et al., 2020)

However, processes need to be analysed to identify the automation possibilities. Thus, a process modelling capability and a pro-automation organizational culture needs to be built. Moreover, right technologies play a key role to improve employee experience, minimize human interaction and attain cost-efficiency. So, even though a criterion can help in identifying the processes for automation, that is only a start. Organizations need to understand the complexity of process automation and business processes to succeed in disrupting their processes with automation. This needs a strategical alignment, defined ways of work, continuous learning and development and technology portfolio fit for purpose. (vom Brocke et al., 2018, 2014)

### 2.1.3 Continuous Development –Business Process Lifecycle

A challenge in BPM is to identify suitable processes. Moreover, as stated, there are challenges also regarding the implementation of automated processes. However, business process lifecycle can guide on developing the ways of work by offering a framework around business process development and enhancement. (vom Brocke et al., 2010) The lifecycle consists of different steps which are often iteratively repeated to enhance the process and improve its automation as seen on the figure 3 below. Thus, it guides to continuously develop business processes. The model is formed together from three different model suggestions. (Bernardo et al., 2017; de Morais et al., 2014; Meroni, 2019) By understanding the lifecycle and taking proper care of each section, the capabilities of processes can be enhanced. Moreover, the processes can be modelled and automated better for the purpose through correct analysis and monitoring activities. (vom Brocke et al., 2014)

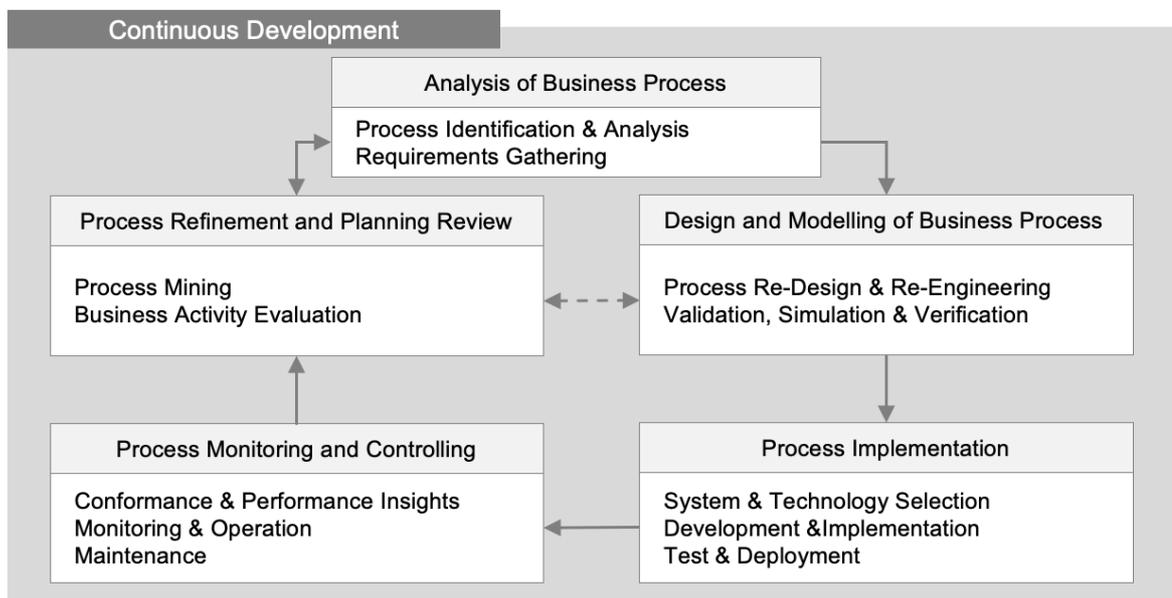


Figure 3 Detailed view of business process lifecycle model – *Continuous Development* (combined from Bernardo et al., 2017; de Morais et al., 2014; Meroni, 2019)

It has been stated that the key for successful process creation is the vision for the development of the process. However, processes and operations change. Thus, the lifecycle model aims for continuous development. (Ensslin et al., 2017) By developing the process

continuously, it is possible to enhance the business capabilities but also the technological maturity within that process. Thus, the actions within the process lifecycle states the needs for technological capabilities IT need to provide. (Bernardo et al., 2017)

Although, the lifecycle uncovers the technological needs, there also needs for business involvement. In that context, the ways of work and the co-operation within business and IT plays an important role. (Bernardo et al., 2017) Business side knows the process and can analyse and identify it within the means of process flow and how it should generate value. Thus, they can give the directions regarding the process dimensions, for example the requirements, repetitiveness and variability. Moreover, business involvement is crucial when modelling the process and designing the enhanced process flow. The process automation can be only developed and implemented successfully if business is sharing knowledge and resources with IT. Thus, the co-operation between business and IT is extremely important. (Brocke et al., 2016)

The *Process Implementation* phase involves the business process automation technologies and tools selection. Thus, the previous phases must be well conducted to select correct technologies. Overall, the co-operation with business is not only that business gives inputs to IT. (Brocke et al., 2016) IT needs to in this phase consult business to select correct automation technologies and prioritize the development actions. Moreover, IT need to have a clear process regarding development activities and enough resources to conduct the development, test and deployment. (Bandara et al., 2021)

During the *Process Implementation* phase, capabilities for *process monitoring and controlling* are created. The governance of business process automation needs to be well thought out so that the implementation is successful. The *process monitoring and controlling* phase enables for improved analysis and management of processes. Thus, the process performance can be analysed from the viewpoint of business. Moreover, the monitoring consists of monitoring the performance of process from IT perspective. Thus, it can be ensured that the processes operate as they should, and the solutions can be maintained accordingly. (de Morais et al., 2014; Meroni, 2019)

Based on the results of process monitoring and controlling, a diagnosis and analysis of process' current state can be made. During that stage, possible further development items and automation possibilities can be identified. For example, process monitoring should enable the analysis of possible bottlenecks or other critical points in the process flow. If process monitoring is not able to enable the analysis, process mining can be utilized. After the phase of *process refinement and planning review*, there can be a need for further process analysis. However, if the further development areas are clear, the next step can be directly process re-design. It needs to be also understood that there might be multiple phases conducted simultaneously such as process mining and process analysis. However, business process lifecycle identifies different phases to clarify structure around continuous development of business processes. (de Morais et al., 2014; Meroni, 2019)

## 2.2 The Role of Business Process Automation in Financial Industry

Financial industry, especially banks are forced to seek possibilities for cost-efficiency due to low interest rates and thus low profit generation. Similarly, new competitors are entering to the market with digitized solutions for efficient consuming. Disruptive change is also evident regarding payment services such as PayPal or Klarna. Thus, digital transformation and digitally handled and automated processes are required. (Liermann and Stegmann, 2021; Ludwig et al., 2021) Financial industry is filled with potential automation of business processes based on the variety of use cases. The industry has implemented especially RPA quite well to their processes. (Smeets et al., 2021) Kedziora and Penttinen (2020) have found out that for example, Nordea bank has over 300 processes automated only with RPA.

Figure 4 below illustrates the possibilities digitalization has for cost-efficiency and revenue growth. As stated, financial industry has a lot of evidence on process automation regarding internal processes. Thus, strategically the automation activities should concentrate in the future on the client interfaces and channels and their processes to increase customer satisfaction and revenue growth. Even though disruptive solutions are required to be able to compete in the market the focus should also be in continuously improving the current processes to attain customer satisfaction. (Liermann and Stegmann, 2021; Ludwig et al., 2021)

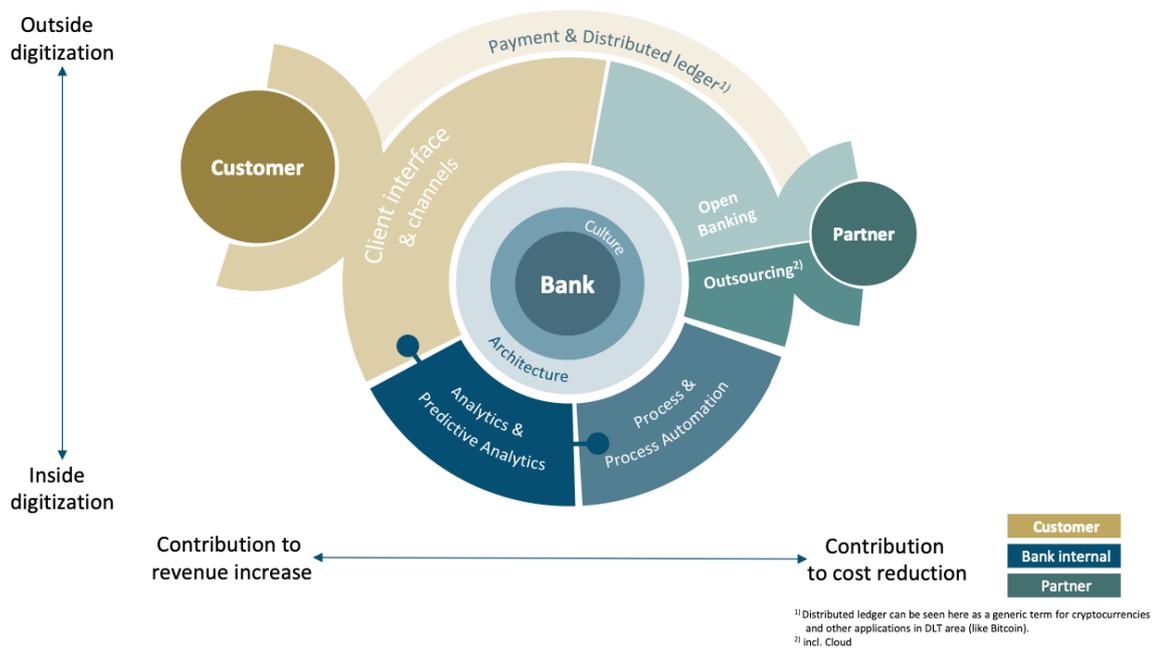


Figure 4 Overview of digitalization areas in Financial Industry (Liermann and Stegmann, 2021).

Although there are multiple possibilities, also strategically, regarding business process automation in financial industry, challenges are evident without proper governance. These are especially related to balancing between governmental regulations and exploiting innovations. Moreover, there still is a lot of paper-usage regarding the processes with customers. Thus, it can expose challenges in data redundancy and inconsistencies in automation and therefore resulting in inefficiency. (Marek et al., 2021) However, there are many areas in financial industry where data is available. Although data availability is better on internal processes such as anti-money-laundering. (Baader and Krcmar, 2018)

As the offering regarding financial industry are different kinds of services, user-centricity and service design is needed. Thus, strategically automation activities should concentrate on both customer satisfaction and cost-efficiency. By increasing process automation and efficiency, customers can get answers and decisions faster than with human interaction. Similarly, customer satisfaction can be improved, and cost-efficiency is attained as there is no need for human interaction. (Buijs et al., 2021) However, it is important to understand that customers' competence in utilizing digital services is not in sufficient level in some cases. Thus, during digitalization the digital inclusion need to be considered. Thus, the

importance on user-centricity grows especially in financial industry as the services they are providing are essential for everyone. (Mhlanga, 2020)

Through increased digitalization targets and activities in financial industry, process automation is usually part of the business' strategy. Thus, the automation activities are often systematically lead inside the organization. However, to ensure successful results, the governance need to be included to the strategy, which also includes the important co-operation between IT and business. Moreover, the governance strategy should include overseeing and managing the process performance and continuous improvements. (Bandara et al., 2021; Liermann and Stegmann, 2021) Also, the prioritization, ensuring end-to-end process identification and alignment with business should be included. As the organizations in financial industry can consist of multiple business units, it should be strategically ensured that the automation initiatives are organization wide and thus the organizational structure should enable it. (Azemi and Bala, 2021)

### 3 Business Process Automation Strategy

As process automation has its complex nature, it is recommended to tackle the possible challenges and enable success with correct automation strategy and its alignment with organizational strategy. (Ensslin et al., 2017) Its focus on process improvement plays a big role in successful business process management and automation as it forms guiding principles and evaluates the successfulness of business process automation activities and strategy. (Kahloun and Ayachi-Ghannouchi, 2020) Although, there are identified challenges which act as barriers for successful operations. Especially, in aligning with business strategy, meeting stakeholders' expectations and executing processes flexibly. (Ensslin et al., 2017)

Thus, automation strategy needs to consider the area from multiple different viewpoints, especially having visibility on the whole process lifecycle which was already presented. The automation strategy framework aims to form an understanding of the strategical themes as seen below in figure 5. The framework is derived from multiple viewpoints and directions where the business process lifecycle acts in a centric role. The framework is conducted from the IT perspective and the characteristics needed to consider for successful strategy and operations. (Bernardo et al., 2017; Meroni, 2019)

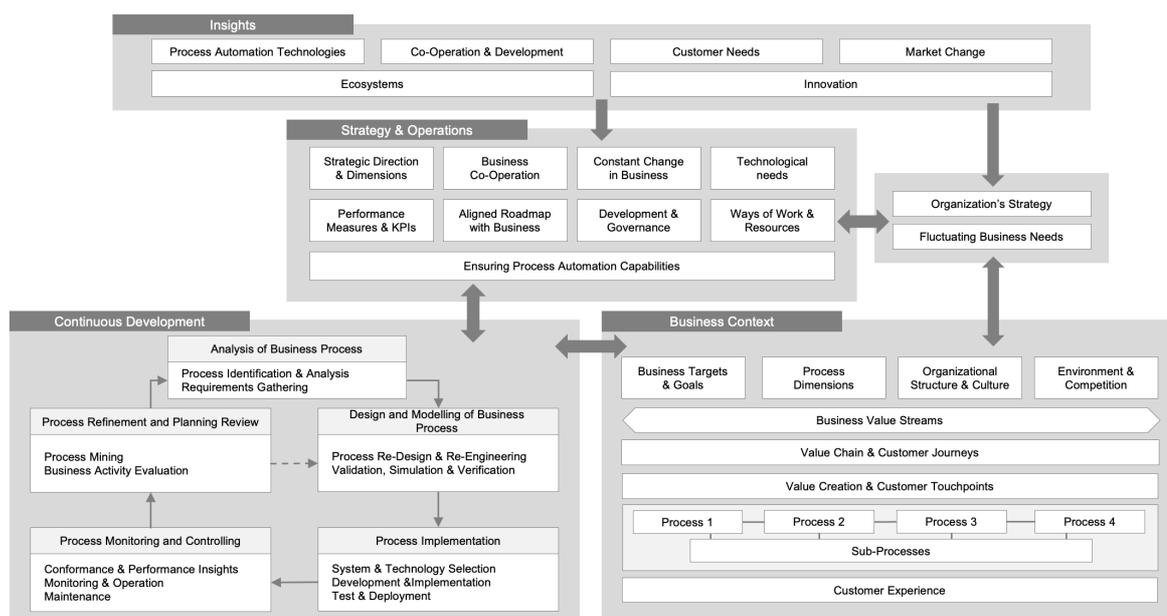


Figure 5 The strategical Business Process Automation framework (combined from Bernardo et al., 2017; Meroni, 2019; vom Brocke et al., 2021)

Strategically, the business process lifecycle (*Continuous Development*) in the figure 5 above is important as organizational strategies often have targets for process efficiency, automation and cost reductions. Thus, the lifecycle needs to be understood and managed well to direct the strategy formation but also to be able to deliver the guidelines from the strategy. (vom Brocke et al., 2014) Even though Business Process Lifecycle is transforming the digital organization and responding to the strategic decisions other guiding layers are needed. Organizations need an external output (*Insights*) and innovation to understand the future trends and possibilities among its business and process automation. (Bernardo et al., 2017)

The middle layer (*Strategy and Operations*) forms focus areas into strategy and roadmap from internal and external insights. The layer receives inputs from *Insights* but also from Strategy of an organization as a long-term guideline and Changing Business Needs as a short-term needs. The *Strategy and Operations* layer influences on the last layer (*Continuous Development*). (Bernardo et al., 2017) However, the *Business Context* also has an influence on the Continuous Development. It determines the targets for the automation from the side of the business. Although, it also influences to the *Strategy and Operations* through Strategy of an organization and Business Needs. (Brocke et al., 2016) To understand the areas of strategic framework better, the layers it includes are next evaluated separately.

### 3.1 Insights – Business and Process Automation Technologies and Innovation

In today's market, organizations need to act fast to grow their revenue and keep their market share. Thus, they need to adapt and overcome the challenges they face in implementing new technologies, answering to the needs of customers for quicker services and responding to overall change and requirements in the market. (vom Brocke et al., 2021) Thus, there is a need for continuous sensing and monitoring of the area of process automation, development and business and market of an organization as illustrated in the figure 6 below. Organizations should continuously seek cooperative development opportunities, process automation technology innovations and new market areas and changes in competition. (Bernardo et al., 2017)

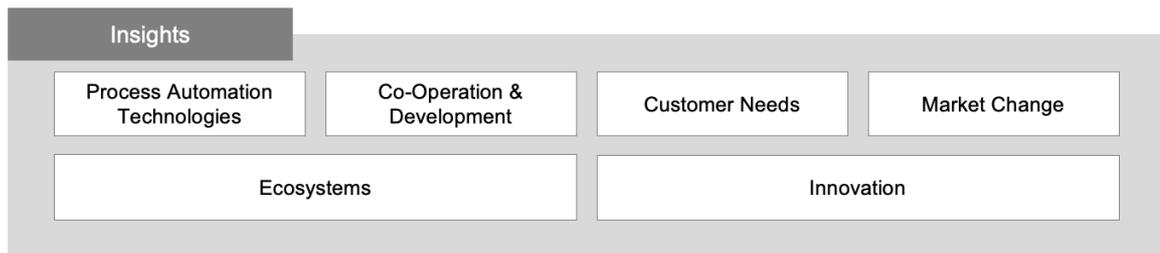


Figure 6 *Insights* in Strategy Framework (Bernardo et al., 2017; vom Brocke et al., 2021).

Regarding areas of process automation technologies and commonly IT (development and ecosystems), it is important to evaluate constantly new possibilities and disruptions. Even though it is not viable to deploy every innovation of technologies or solutions, ecosystem creation can increase revenue by 40%. Thus, insight gathering on how to build ecosystems is important. Moreover, open innovation can grow revenue by 20%. (Payraudeau et al., 2021) Open innovation is a substantial evidence of business performance and new revenue stream creation. The organizations which possess more external knowledge achieves better performance. Thus, networking and partnering with different external sources in automation area is crucial for growth. (Chesbrough, 2017)

To be able to answer to customers' needs or analyse new disruptions regarding the operations in organization, gathering insights from market change and customer needs is important. Regarding customer needs, it is important to analyse the possible change in consumption and how it affects to the process. Through analysis, the new use cases can be identified to improve processes and customer satisfaction. (Buijs et al., 2021) Regarding market change, it is important to seek disruptions on customer journeys and value creation but also the change caused by external interaction such as change in economy. However, the responsibility for this is more on the business. Although, the importance on establishing continuous communication between business and IT rises. (Liermann and Stegmann, 2021)

### 3.2 Strategy and Operations – Strategy creation

Since organizations' target is usually revenue growth and process automation targets are cost efficiency, it is viable to consider both of those regarding strategy. This also takes roots in

the organizational and ICT strategy as those guide the targets for revenue growth, cost efficiency and digitalization. (Payraudeau et al., 2021) Figure 7 below is summarizing the characteristics needed to be evaluated in the means of *strategy and operations*. Regarding strategy, a model for governance is essential to establish. This will include the co-operation with business, process performance management, ways of work, development and responsibilities. (Bandara et al., 2021)

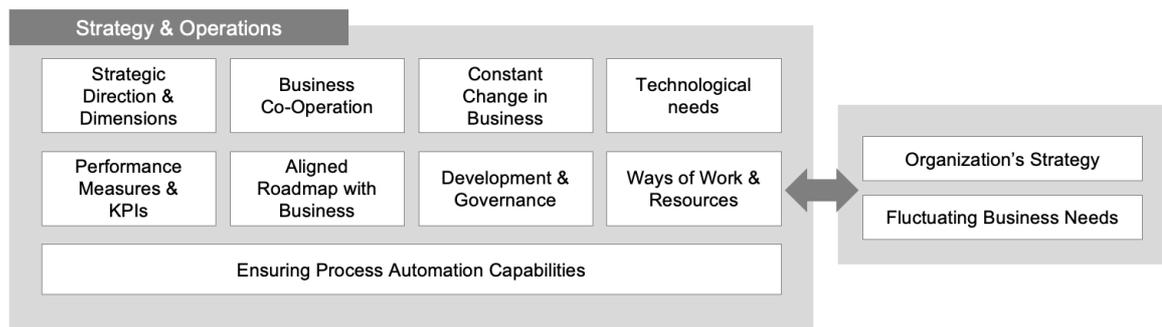


Figure 7 *Strategy and Operations* in Strategy Framework (combined from Bandara et al., 2021; Bernardo et al., 2017).

Moreover, organizations need to understand their own roadmap and strategical choices for the future from the viewpoint of business, IT and process automation. That will be directing the improvement areas in processes, productivity, new revenue generation and cost-efficiency. (vom Brocke et al., 2014) The ability to align strategy with business in order to adapt and act on their needs is essential for enabling continuous growth. Thus, the strategy and operations should consider continuously strategy of an organization and short term business needs directed by external insights and internal operations. There should be focus on enabling disruptive solution but also continuously changing needs for process improvements. Thus, the overall process automation capabilities, including technologies, should be continuously evaluated. (Liermann and Stegmann, 2021)

Regarding ensuring the process automation capabilities, strategic alignment, methods and people and culture need to be considered besides governance. This will include the knowledge of process automation in business and promoting and establishing a culture of continuous development. (vom Brocke et al., 2021) Thus, the cooperation regarding daily and long term managerial operations are needed to be established. Moreover, there needs to be structured processes for process improvements to be effective in the activities and reach

the desired targets for automation. To be able to strategically manage processes, the focus should also be in data enablement and process monitoring. (Bandara et al., 2021; Marek et al., 2021)

### 3.3 Business Context – Business Operations and Value Streams

Even though process automation capabilities regarding IT play a big role in succeeding with process automation, the processes need to be considered from business point of view especially on how to improve them to generate more value. Often there is not enough visibility for the *Business Context* regarding process improvement and automation initiatives. Thus, the layer of *Business Context* is brought into the strategy framework as seen in the figure 8 below. (de Morais et al., 2014) Moreover, it gives input to the IT from different viewpoint regarding strategy of an organization and operations such as the revenue and business targets, organizational structure and culture enabling process enhancement and the environment and competition regarding the market of an organization. (Brocke et al., 2016)

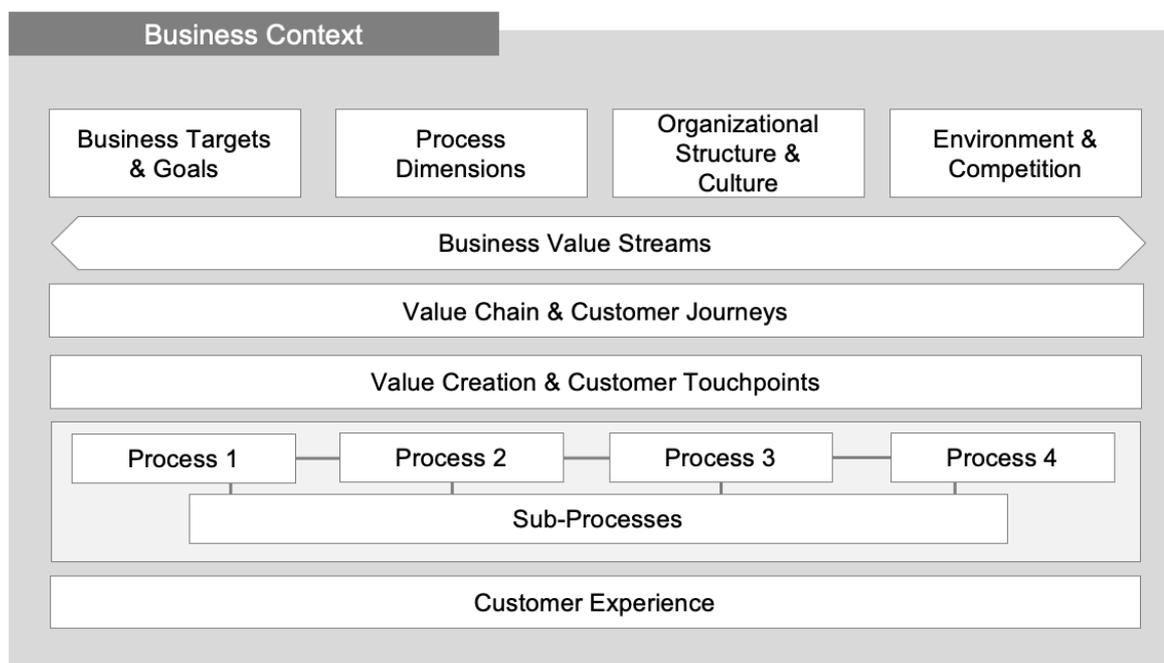


Figure 8 *Business Context* in Strategy Framework (combined from Baag et al., 2019; Brocke et al., 2016; Buijs et al., 2021).

To ensure focus on business in business process enhancement and automation, the mindset should be shifted from a functional or technological approach to process approach. It implies that the processes should not be managed in isolation anymore. As seen from figure 8 above the processes should be managed based on understanding the value streams, the value chains and customer journeys within the value stream. (de Morais et al., 2014) Thus, the value creation, customer touchpoints and each customer facing process or support process can be identified from a viewpoint of the whole customer journey or value stream. Thus, the service and processes can be developed and managed more efficiently to ensure alignment within the whole value stream. (Baag et al., 2019)

The processes need to be managed and developed by having a visibility to the whole value stream. So, processes and their role need to be understood from multiple levels: value stream, customer journey and touchpoint and most importantly the process itself, to be able to generate more value. At the end, the value is dictated by customer. Thus, user-centricity is needed, and the end-to-end customer journey should be considered. Even though the value streams and processes are in scope of business context, the improvements need a multidisciplinary team consisted of IT and business. Each of the processes in the value stream contributes to the process lifecycle but similarly giving inputs for the business context. For example, process mining can be utilized to establish end-to-end understanding of the whole value stream. (Baag et al., 2019; Buijs et al., 2021)

### 3.4 Future Directions for Business Process Automation Strategy

As cost-efficiency and revenue growth are the targets also in the future, the future directions regarding business process automation strategy should be evaluated from those viewpoints. Commonly, digitalization and automation initiatives are still in a dynamic phase and new innovations are continuously generated. (Liermann and Stegmann, 2021) A form of digitalization is the phenomena of virtual enterprises. In the figure 9, the outlook of virtual enterprises is showcased. Virtual Enterprise consist of ecosystems, cloud utilization but moreover, intelligent and automated workflows infused with data. (Payraudeau et al., 2021)

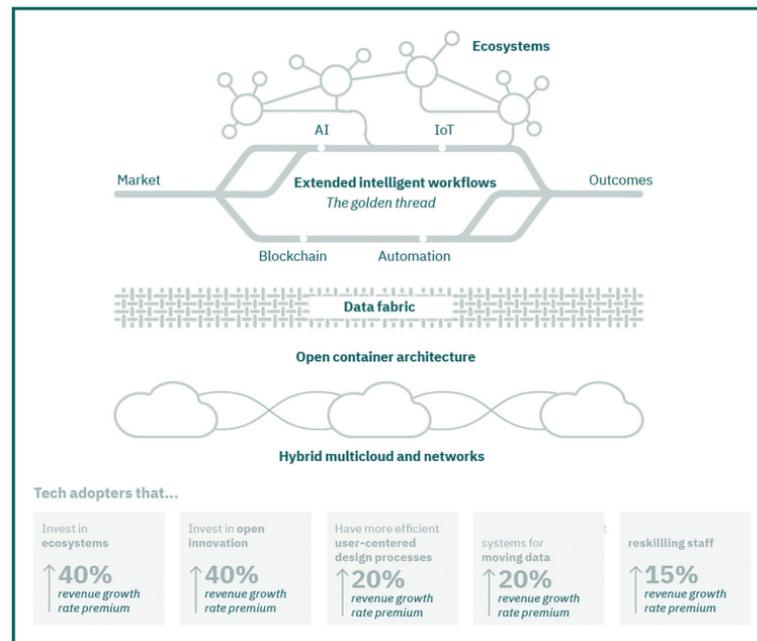


Figure 9 Virtual Enterprises (Payraudeau et al., 2021).

Virtual enterprises concentrate on innovation possibilities and integrating it as a part of the purpose and strategy of an organization. From a strategical point of view sustainable revenue growth is often a key point in organizational strategy. Thus, the impact that process automation for digital transformation of an organization and the journey in becoming a virtual enterprise is rather substantial. (Ludwig et al., 2021; Payraudeau et al., 2021)

Disruptions especially within process automation technologies can reshape automation possibilities substantially. A major focus is on the enablement of more advanced automation through the growing maturity of AI and Operational Intelligence. However, there are already challenges on utilizing all the current process automation technologies in their full potential. Thus, organizations need to focus in growing their maturity and capabilities regarding process automation and data. (Ahmad and Looy, 2020; Ng et al., 2021)

Customers and business are requiring constantly faster innovations and solution deployments. Thus, the co-operation and standardized way of work regarding process improvements are even growing importance in the future. (Díaz et al., 2021) There should be a true focus on improving the IT and business cooperation and alignment to enable the competitive advantage through technology adoption. Moreover, the increased speed

considers also the information sharing and process capabilities as customer needs are constantly shifting. Thus, agility and open innovation are needed. This consist also deeper knowledge of business regarding IT and the growing importance of user-centricity and customer experience. (Ahmad and Looy, 2020)

Process mining is enabling possibilities for improved business intelligence throughout processes. Through the risen focus on process mining, the interest regarding business process management and automation has been rising. Another aspect is process monitoring. The need for improved process monitoring is evident as the need for management of processes rises through risen automation activities. Thus, there should be growing focus on the data and monitoring enablement throughout the processes. Possibly this affects positively also regarding increasing focus on process improvements and process automation. (Ahmad and Looy, 2020; de Morais et al., 2014)

Because of the increased focus on process improvements and automation, a recent trend citizen development draws attention within organizations. Citizen development enables the shift from development activities only in IT unit to also business stakeholders being developers. (Ramel, 2015) The current technologies are enabling more and more possibilities for citizen development through low-code solutions and platforms. Thus, business stakeholders can quickly and intuitively make own automation activities by themselves. However, there needs to be comprehensive structure, framework and governance for enabling citizen development in business units. (Institute, 2021)

### 3.5 Considerations for Further Analysis

Based on the business process automation strategy framework creation and the discussion in the chapter regarding the overview of business process automation, the literature focused on process automation capabilities and the continuous development. Especially the technologies and methods for process enhancement were brought up from different viewpoints such as business process lifecycle, process automation utilisation, BPM, governance and strategical considerations. (Brocke et al., 2016; vom Brocke et al., 2014)

This focus also supports the needs of case organization regarding the business process automation capabilities, co-operation and methods for process enhancement activities.

Thus, the first focus area on further theoretical analysis is the evaluation and possibilities of process automation technologies. That will include the use cases for financial industry. The area is analysed to showcase the capabilities the technologies withhold. Another area of focus is the process analysis, enhancement and co-operation. The aim is to form a picture of the ways of work and the areas needed for managing the continuous development before and after the automation activities. The focus is on process analysis through process modelling and process mining and the process enhancement especially regarding process monitoring. Lastly, both focus areas are summarized together to form a coherent view of the areas.

## 4 Technological Capabilities of Business Process Automation and Use Cases in Financial Industry

As stated in the overview, the focus of business process automation technologies will be in direct solutions designed for process automation. In short, business process automation does not have only a certain type of technology for automating processes. Rather, the technologies help from different viewpoints and there seem to be hesitations on what to use and when. (van der Aalst et al., 2018) Thus, it needs to be acknowledged that only one technology does not meet the needs of complex business processes as business processes or business process automation is not unambiguous. To be able to select correct technologies, organizations need to be invested in both, understanding the business processes they have and the nature of the technologies that exist. (Smeets et al., 2021)

Polak et al. (2020) has identified several internal automation possibilities among finance which also can be considered as a use case for financial industry. For example, there are high automation potential in reporting area, especially regarding budgets and forecasts but also risk and compliance and controls. Other potential automation areas found are audits and fraud management. Some of the processes can be executed by only RPA but some would need supporting technologies such as artificial intelligence and base the automation on data and learning. (Ng et al., 2021) Next, the use case evaluation focuses on RPA possibilities in financial industry.

### 4.1 Business Process Automation Technologies

There are a great number of solutions in the business process automation technology portfolio and all of those require deep understanding of the possibilities they have. To clarify the portfolio of technologies in the chapter, the technologies are grouped into six different groups as seen in figure 10 below. These are the groups mostly discussed by IT vendors providing technologies and tools particularly for business process automation. (Coombs et al., 2020; IBM, 2021a; Panetta, 2020; Rimol, 2021)

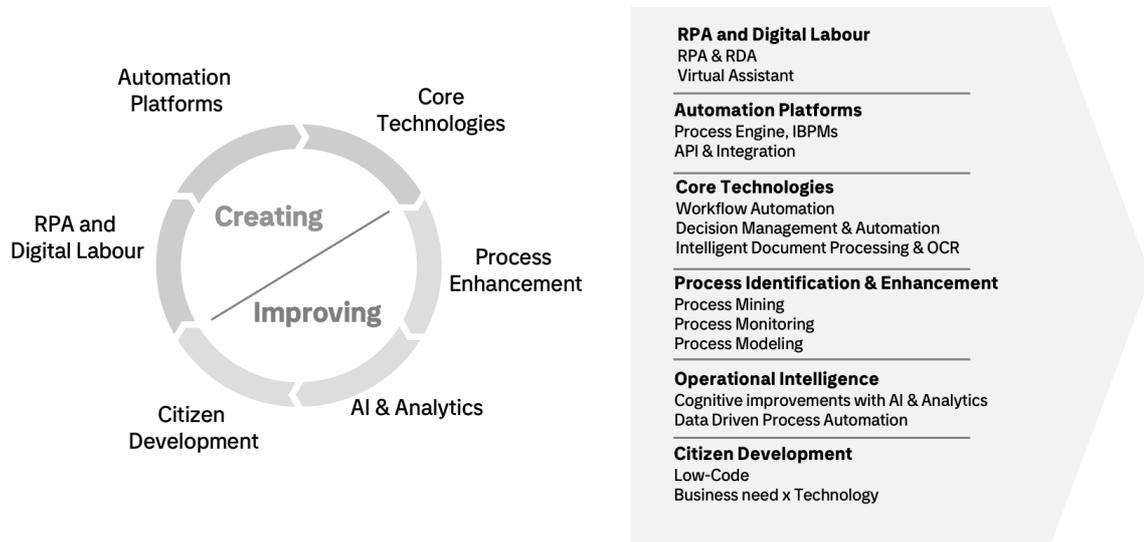


Figure 10 Process automation tools and technologies chosen for evaluation ( combined from Grisold et al., 2020; IBM, 2021b; Javed et al., 2021; Rimol, 2021).

*Creating* consist of technologies used for automation and *Improving* consist of the tools and technologies for improving processes and automation. RPA and other forms of digital labor is defined into its own team. Digital labour is used regarding different process automation robotics which replace human labour in processes. The reason for that is that those technologies present the robotics in process automation. (Hyun et al., 2021) Category, Core technologies, includes the traditional direct solution technologies used for business process automation. Those technologies form a basic automation but also an enhanced automation with intelligent possibilities. (IBM, 2021a) Lastly, automation platforms consist of different kinds of platforms aiming to unify process automation technologies and data into one system as Simm et al. (2020) and Zaman et al. (2020) have identified.

The themes and their technologies and tools evaluated in the *Improving* category includes technologies and solutions impacting to process efficiency, process analysis and enhancement. This considers the business process also before and after it is automated. Process Modelling handles the manual side of modelling processes. Process Mining, however, analyses the log data from the process and forms a true process flow. Lastly, process monitoring is an important factor for understanding the KPIs around processes and process efficiency. However, these are evaluated in a separate chapter as Process Analysis

and Enhancement also includes the co-operation between business and IT and thus is not fully technology focused. (de Weerd et al., 2013; Goedertier et al., 2015; Meroni, 2019)

It needs to be clarified that there are other automation solutions evident either in the IT systems themselves or for example through document management. However, these are not analysed as a part of the technological evaluation due to the selected focus on the direct solutions. As stated, direct solutions are technologies designed for process automation and thus solutions which are not directed for particularly process automation are left out from the evaluation. As Citizen Development Low-Code, AI and Operational Intelligence and Application Programming Interface (API) and integrations are not designed particularly for process automation, but are an important part of the solutions, those are presented briefly before evaluating the business process automation technologies. (Grisold et al., 2020; Overeem et al., 2021)

#### 4.1.1 Low-Code in Business Process Automation

Overeem et al. (2021) identifies that low-code platforms enable citizen development, meaning that people with no or limited skills in software engineering and development can create different applications, products and platforms. Many of the business process automation technologies and tools use low-code technology to simplify the usage of the tool but also to shorten the development period. Low-code platforms, emerged in recent years, are now a major trend, commonly in software development but also in business process automation. (Bock and Frank, 2021) Figure 11 below shows an example of the development of low-code UI.

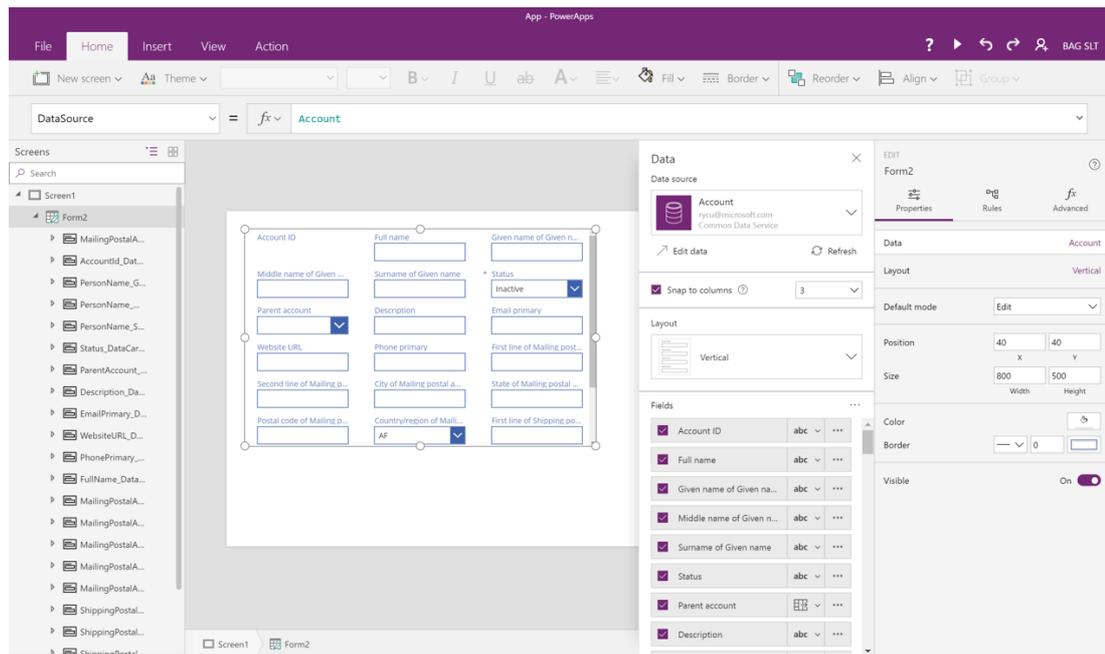


Figure 11 An example of low-code UI development (Cunningham, 2017).

By utilizing low code, it is quick and efficient to make for example a user interface for human interaction with process automation technologies. Figure 11 above shows an example of the development of low-code UI. Many development areas are thus including low-code as a part of their technology portfolio to improve efficiency. Low-code is used also in other context than UI building such as business process flows, automating process flows and creating chatbots and business rules can be done with low-code technologies. For example, IBM and Microsoft are offering these kinds of capabilities or some of those. (IBM, 2021b; Microsoft, 2021)

#### 4.1.2 API and Integration in Business Process Automation

Another critical aspect to solve the needs of complex process flows are the utilization of APIs and integration. APIs act as doors to different sources of information. Those can be to external or internal information of organization, so for example to different systems. Often there is an integration layer in the architecture of an organization which governs the APIs and integrations. (Weir, 2019) As data plays a major role in process automation, that capability is often crucial due to the need of retrieving certain information through the process or even to receive a trigger for starting the process flow. Thus, many platforms offer

integration and API capabilities or different kind of connectors to simplify the development of process automation. (IBM, 2021b; Microsoft, 2021)

With these tools and technologies, it is possible to retrieve data or share data with other systems inside and outside of the organization. APIs are often used in process engines which guides the utilization of process automation tools. (Zaman et al., 2020) Regarding the needs of process automation in scope of integrations, one of the main purposes is to connect multiple systems during the process to enable automation in longer process flows. Moreover, as stated APIs can retrieve and share data throughout the process and thus coupled with automation tools to automate different parts of the process. (Simm et al., 2020)

#### 4.1.3 AI and Operational Intelligence

As stated, AI and other intelligent technologies are supporting process-agnostic technologies to have more intelligent and independent solutions. Thus, AI and operational intelligence is introduced before the technologies. Artificial Intelligence (AI) is expected to outperform human labour due to the recent development of AI. (Coombs et al., 2020) AI is simulating human behaviour and intelligence and thus can conduct same processes, make decisions, predict outcomes or detect same information than humans. For example, AI can be used for data classification or decision making. (Polak et al., 2020)

However, the issue with utilizing AI and other intelligent technologies is that the organization process automation is not mature enough nor is the data. Either they have not developed the basics of automation, or their data storage is not modern, nor the data is structured enough. (Gotthardt et al., 2020) The utilization of AI has many purposes, for example, productivity increase, improvement in accuracy and more efficient business operations. Machine Learning (ML) has also its use cases in solving actual “real-life” issues and problems. ML can also be used in predictive operations and decision automation. (S.patil et al., 2021) ML utilises available data and uncovers hidden patterns and knowledge through learning from the data set. (Al-Anqoudi et al., 2021)

It can also be used for example for business process re-engineering, but also Natural language processing can be utilized for that. Natural language processing (NLP) is used for

identifying natural language, speech or text, for example voice feedback from customers. It utilizes artificial intelligence to make sense of the input given through natural language either through pre-processed data or algorithms. Natural language generation (NLG) however, uses similar approach to create natural language, usually text. (Gotthardt et al., 2020; Mustansir et al., 2022) To conclude, these approaches serve different purposes with process-agnostic technologies. The approaches will be analysed together with the technologies to form an understanding on how these approaches complement the technologies.

Regarding financial industry, it needs to be acknowledged that especially intelligent approaches need to be considered thoroughly due to the nature of financial industry. There are different regulations and laws affecting to the utilization of automation. However, regulations might be helpful when utilising intelligent automation. For example, AI and ML is often used in banks, especially in fraud detection and anti-money-loundering processes and solutions. EU has own regulations regarding the fraud management offers guidelines also to the usage of intelligent technologies. (Gotthardt et al., 2020; Ng et al., 2021)

Within Fraud detection and ML utilisation, there are although some challenges especially related to data. Utilisation of ML needs certain amount of data with good quality to be able to execute the process. However, there are some challenges faced on the availability of the data. For example, to execute fraud detection on whether credit card has been misused, data such as transaction amount, date, time and address are needed. In some cases, the data might not be available which causes problems on successful fraud detection. (Mehbodniya et al., 2021; Mishra and Pandey, 2021)

## 4.2 Robotic Process Automation (RPA) and Digital Labour

There are different implementations of digital labour, a robot executing business processes or tasks automatically. Operational intelligence can be used within the robotics to enhance the capabilities of digital labour. (Hyun et al., 2021) Regarding the field of digital labour, Robotic process automation (RPA) is the most researched area in business process automation. The main idea of RPA is to have a software robot to complete repetitive, simple and manual workflows. (Zhang and Liu, 2019)

However, as Javed et al. (2021) and Romão et al. (2019) have identified, there are different notations of RPA and recently it has been implemented together with AI. Besides RPA, other technologies for digital labour are Robotic Desktop Automation (RDA) and virtual agents. The technologies can be divided into three categories as presented in the figure 12 below: Attended (RDA), Unattended (RPA) and Intelligent or Hybrid robots (IPA applications). (Javed et al., 2021; Liermann and Stegmann, 2021)

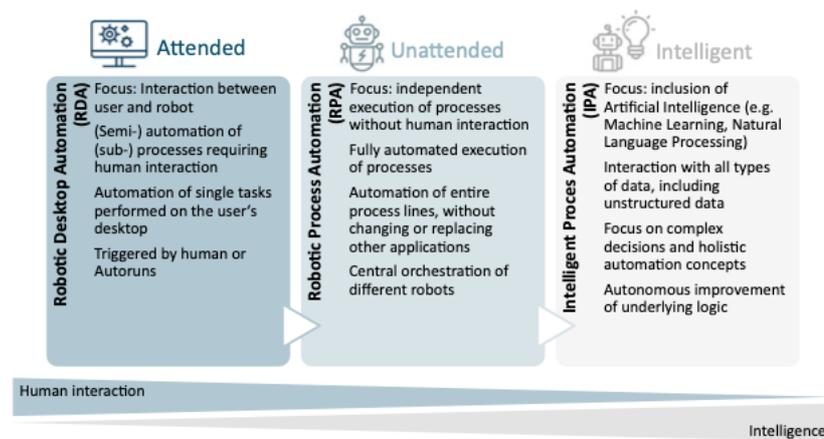


Figure 12 Types of robots in process automation (Liermann and Stegmann, 2021).

The attended automation is distinguished from a characteristic that they work on the device of an end user. The attended robots are triggered by user and those are used for simple manual processes as a part of tasks of a user. Unattended robots are deployed in machines at physical server (on-premises) or virtual machines in cloud (off-premises). Compared to attended robots, unattended ones can be scheduled to execute themselves without a trigger and the execution can be based on a queue in a workflow. Unattended robots are for more data-intensive and higher volume processes than attended robots. (Javed et al., 2021; Liermann and Stegmann, 2021)

Lastly, intelligent or hybrid robots are infused with operational intelligence. Thus, they are capable for more complex processes which might for example deal with unstructured data. To conclude, attended robots require human interaction but as stated also in figure 12 above, the need for human interaction is minimized once moving into more intelligent solution.

(Javed et al., 2021; Liermann and Stegmann, 2021) Next, all these types of robots and its technologies are analysed and evaluated.

#### 4.2.1 Robotic Desktop Automation (RDA) – Attended Robots

Robotic Desktop Automation (RDA), also known as desktop RPA, is a common technology among digital labour. The technology is based on different functionalities and “screen scraping technologies”. (Smeets et al., 2021) The functionalities refer to the execution of scripts and macros and the latter one to the functionality, where information is read from screen or text. The idea of RDA is that it will monitor, and record actions of a user (human) and then does the pre-defined routine tasks based on the monitored information. RDA is and built on a desktop of a user, not to a server. (Willcocks et al., 2017)

However, RDA is only capable for simple tasks when it is called by a human or a set of keystrokes. Thus, a large implementation of RDA regarding tasks, workflows and processes is not feasible and is difficult to manage. However, it is simple to use and works well as a fast desktop assistant. (Willcocks et al., 2017) To conclude, RDA is a viable solution for a suitable purpose. Depending on the application area and the need for automation, RDA might be the most feasible solution compared to other digital labour technologies such as RPA. For example, RDA is used for calculations made from information which is “screen scraped”. Thus, also in financial industry it is a great asset for increase the speed of tasks in customer service. (Smeets et al., 2021)

#### 4.2.2 Robotic Process Automation (RPA) – Unattended Robots

Robotic process automation (RPA) has attracted organizations to initiate automation activities due to digital transformation. RPA is an interesting choice for companies due to cost-efficiency and scalability. (Hofmann et al., 2020) Besides, being a cost-effective way to automate tasks, RPA can generate a substantial Return of Investment (ROI) if used successfully to reduce human effort. Also, the costs of supporting the robots are quite low compared to other available automation solutions. (Javed et al., 2021) That is why new vendors have entered to the market. In the market, RPA is a quick way to establish

automation in business processes. The technology is a way to replace human effort in repetitive tasks. (van der Aalst et al., 2018)

RPA is also attractive to organizations as its technology is mature and it has a quite low threshold to automate tasks with a cost-effective manner. It does not require heavy IT concentration or investments and is rather easy to deploy. Additionally, its advantage is in its high transaction volume and applicability to notice human errors. (Hofmann et al., 2020; Kedziora and Penttinen, 2020) Without supportive technologies or solutions, RPA is not suitable for more complex processes. Thus, there has been a discussion that organizations' automation maturity is growing, and they are moving beyond RPA to other automation solutions. (Rimol, 2021)

However, Hyun et al. (2021) states that RPA is a suitable solution to keep for automating more complex processes' repetitive and manual workflows. There are many processes in financial industry which can be automated with RPA a quite low threshold. The common use cases are showcased and shortly explained in the table 2 below. (Ng et al., 2021; Smeets et al., 2021)

Table 2 Process automation use cases in financial industry (Smeets et al., 2021).

Use Cases	Explanation
Securities Settlements Auditing	The same team as above, is auditing securities transactions which are in different applications. Data is gathered from applications and team is using a spreadsheet for completing the auditing. With RPA, the work is possible to automate fully. RPA can retrieve and transfer data between applications and audit it for example regarding consistency or based on predefined rules.
Digital Product Closures	Processes for online purchase of services and products have been made possible for customers. The solution could have been built with other technologies than RPA to enable straight integration to the core banking system of an organization. However, that was not possible in short term and RPA was utilized. The solution consists of customer inputting needed data digitally. The data is checked and transferred to a correct service provider automatically. Even though the solution is not ideal, it still cuts costs and minimises the processing time.

Authorisation Management and IT	IT department is responsible of employee ID and credentials, accesses and authorisations and resetting password. If the tasks are not automated, this requires a lot of manual effort from human worker. The tasks to conduct are rather similar even though the reason for editing access would be different (e.g., onboarding or leaving from the company). In principle, all of these should be able to automate with RPA easily. Although, the automation effort of course depends on the quality of the data and systems used.
Provision of Rule Reporting	There is a need for daily and weekly reports from different sources of information and systems. The information sources are not only internally but consist also of external websites. Thus, there are no single interface premade to offer reporting from various sources. In this case, all the data is in structured format and can be accessed easily by the reporting team. To automatize the routine task around reporting, RPA is utilized. RPA is retrieving information from all the needed sources and continue with quality assurance of the information and lastly conduct the report.
Trading	Trading is involved with continuous need for monitoring the thresholds' prices. By monitoring the prices, correct changes for buying, selling or limiting orders are made. Traders need to do extensive manual work to ensure successful price monitoring. Robots are introduced to the solution to monitor prices for traders. The robots will alert or email traders if there is change. The changes will be noted due to predefined rules. The robots can even take immediate action if the rules will allow.
Compliance	There is a unit for monitoring and checking different activities and processes. RPA is utilized to execute routine test to the different monitored activities. This will enable employees to have capacity for more complex monitoring and checking tasks.

The table 2 above showcased six different possible solutions regarding financial industry. However, as these were cases where RPA was applied, the processes were simple, routine-based and manual. Even though there are more complex processes to be automatized, the solutions showcased are a great example of potential savings by only having few technologies for automation purposes. Additionally, other potential use cases have been identified such as *closing accounts, making statements, preparing auditing reports, online applications for end users to complete e.g., loan or insurance application, executing chargebacks and many more.* (Ng et al., 2021; Smeets et al., 2021) It seems that financial

industry has adopted RPA as a process automation tool quite efficiently. However, there are many use cases regarding the utilization of other process automation technologies.

#### 4.2.3 Virtual Agents – Hybrid Robots

Virtual agents aim is to replicate human and is used for example to assist users in navigation or act as a chatbot to help in conducting different tasks. The solutions are especially implemented to user facing processes and services to improve customer satisfaction and revenue. The technology can be utilized to provide service at any point of a day but also to reduce costs due to minimizing human labour. The solutions can be infused with operational intelligence, such as AI or be rules-based. With rules-based solution, the assistants' journey is particularly predefined. Within use case as a chat bot, it affects to the feeling of real human interaction as the conversation might not be versatile enough. (Belanche et al., 2019; Etemad-Sajadi, 2014; Krämer et al., 2018)

Belanche et al. (2019) states that by including operational intelligence, virtual agents can be developed to be more human-like. Although, there is a discussion, whether virtual agent can truly replicate the social interaction needed by human. The interaction might not fulfil the true social needs and substitute human interaction but is an option for filling a part of the need. (Krämer et al., 2018) Virtual agents infused with intelligence are popular in financial sector and different organizations have branded their own robots. Bank of America has launched a chatbot, Erica, who serves more than a million customers. Bank of Tokyo on the other hand has a humanoid Neo, a small bank teller. AI is a great advantage in financial sector and has clear opportunities. With infused AI, banks can provide service to customers with better value and thus increase revenue through satisfied customers. (Belanche et al., 2019; Ng et al., 2021)

Moreover, as discussed about intelligent approaches of digital labour, virtual agents can be equipped with NLP to discuss with people as “humanly” as possible. These approaches can help in improving service quality significantly. (Hyun et al., 2021) However, as this kind of approach is disruptive and not yet fully advanced to level of human interaction, the adoption of virtual agents has been rather slow. There is a need for understanding the end-users and

finding out the determinants and motivation for adopting virtual agents into use. Moreover, the utilisation of virtual agents has been facing some legal issues. (Belanche et al., 2019)

In an example solution for increasing productivity in insurance organization, role of a virtual agent was to retrieve data from multiple sources and convert it to a file format. AI was utilized to read, interpret and understand massive amount of unstructured and multilingual data retrieved from different partners. It would also perform data validation and massaging according to the business rules and generate an output file. As all the policy documents were created manually before implementing the solution, the lead times were extremely long, and the company lost its customers. Due to the implemented solution, the productivity rose 87,5% and accuracy improved from 70% to 90%. (Datamatics, n.d.)

#### 4.3 Core Technologies for Basic and Enhanced Process Automation

Core technologies refers to the traditional direct automation capabilities to handle the process flow. These considers the workflow automation, decision management and automation and document smart-scanning and processing. These technologies are directed for process automation can be used for designing and managing the business processes, to execute and monitor decisions and to capture unstructured data. (Grisold et al., 2020; IBM, 2021a)

The selected core technologies are also a choice for both, basic and enhanced business process automation. Basic automation is rules-based and often human triggered and no operational intelligence is used. Enhanced process automation includes intelligent technologies such as intelligent document processing and can handle structured and unstructured data. (Feng and Chen, 2021; Polak et al., 2020) This chapter will showcase the utilization of basic and enhanced process automation within the selected technologies of core technologies for business process automation.

#### 4.3.1 Business Process and Workflow Automation Systems

Romão et al. (2019) identifies that the use of business process and workflow automation system is to control, manage and execute tasks and workflows inside processes set by a human. It should be noted that literature considers business process and workflow as synonyms even though process consists of different workflows. Thus, workflow is more like a subcategory of the process. (Goedertier et al., 2015) Another identified challenge is the lack of leveraging data inside the system. Usually there needs to be a separate analytics solution implemented for retrieving insights of the process. (Romão et al., 2019)

The automated process is guided by different rules and predefined order of actions which either the user needs to conduct, nor the workflow automation system executes. Rules need to be unambiguous rules and has low cognitive requirements. Thus, there is a limited need for exception handling and once processes and rules become more complex, the solutions are harder to maintain. However, in financial industry workflow automation can for example used in a form of application to which customer can add information when visiting bank. Another use case is a mobile application for maintaining ATMs. The automation was used to inform regarding the needs of routine inspections. As many workflow automation solution includes low-code development, the solutions are quick to develop and deploy and thus answering to instant needs (Brown, 2022; Ezekiel et al., 2019; Lübke et al., 2021)

#### 4.3.2 Decision Models and Automation

Decision Modeling and Automation is not a new topic of discussion. Bringing data together with decision models has been helping decision-making already roughly four decades. (Bucklin et al., 1998) Decision models are logic and rule-based models which guides and automates the decision-making of automated business processes. There is an own language presented for decision modelling in 2015, a Decision Model and Notation (DMN). The language is divided into two levels, first acknowledges the decision requirement diagram (DRD) which withholds the decision requirements and the dependencies between the elements of the decisions presented in the diagram. The second level withholds the decision logic which presents the logic behind each decision. Usually, the logic is presented as a table. (Quishpi et al., 2021)

However, decision automation has shifted from logic and rule-based models into more AI infused decision making. In decision automation, AI can be used to collect and interpret data and with predictive human analytics predict a behaviour and decide an outcome. (Polak et al., 2020) Automated decision-making systems (ADMS) are self-learning which gather and process data. By conducting the data gathering, the system can make judgements and decisions without human interfering to the situation. (Mökander et al., 2021) Compared to the rules-based decision management and automation, the difference is that ADMS includes self-learning. By ensuring that the intelligently enhanced decision automation has proper design and testing activities, decision automation has promising possibilities. Regarding decision efficiency and quality, decision automation can make better decisions than the experts in the targeted field. (Langer and Landers, 2021)

By having self-learning technologies incorporated to decision-making, there are little to no interference on human emotions or bias. That is why it is extremely important that the decision automation system and design is well planned, developed and tested. (Langer and Landers, 2021) Thus, there are ethical considerations when taking ADMS as a part of automation portfolio of an organization. As decisions are not rules-based, rather conducted by a self-learning software, there might be issues in individual privacy and human self-determination. (Mökander and Floridi, 2021) Although, it can be argued that cognitive abilities of AI overrule that. In decision automation, AI bases the autonomous decision and action on prescriptive and predictive analytics which implies that AI can withhold more information and analytics to base the decision on rather a human made decision. (Wagner, 2020)

#### 4.3.3 Document Smart-Scanning and Document Processing

Document Smart-Scanning is a key technology in finance industry domain due to its capabilities in extract needed data out of documents. Thus, human effort can be directed elsewhere than extracting data from documents. However, current technologies often still need some human assistance or validation of information extracted. The technology suits best for the use cases when document layout stays rather same such as in invoices or claim letters. (Feng and Chen, 2021; Riba et al., 2022)

The capability of OCR and IDP is to handle document and content processing multiply by coupling them with operational intelligence such as natural language detection and voice processing. (Feng and Chen, 2021) The solution is often used for gathering textual content from different documents and printings. The technology has usually its own workflow in the whole process flow to be able to extract data as seen in figure 13. The workflow has five different main steps: *original image*, *pre-processing*, *segmentation*, *OCR/IDP* and *post-processing*. (Reul et al., 2019)

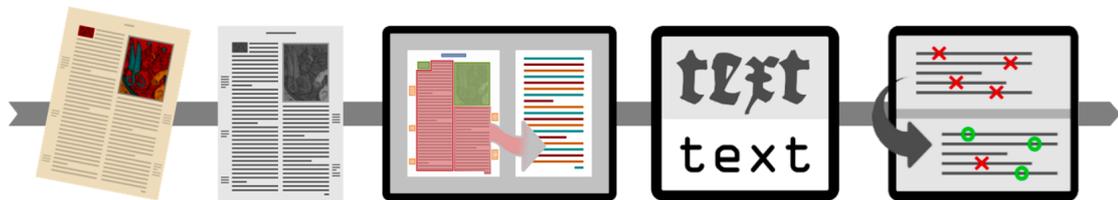


Figure 13 OCR workflow, main steps: original image, pre-processing, segmentation, OCR, post-processing (Reul et al., 2019).

Regarding the flow presented in figure 13 above *Original image* means the document the data is going to be extracted from and is in an analogical form. *Pre-processing* is the scanning activities and the preparation for further processing of the document. *Segmentation* consists of one or more steps depending on the document where text regions, non-text areas and individual text lines are identified. *OCR* is the phase where the segmented text regions are converted into digital textual representation from the printed document. In this step, different models or intelligent technologies can be utilized based on the type of the document. *Post-processing* is a last step of the OCR workflow. In this step, the output from the previous phase is further improved for example by utilizing language models (Calvo-Zaragoza et al., 2018; Reul et al., 2019)

In Financial Industry the technology is implemented for example for solutions regarding *mortgage document processing*, *opening a bank account*, *fraud detection*, *customer data customization* and *invoice processing*. In *mortgage document processing* the idea was to utilize intelligent data capture for extracting data from different forms and documents related to mortgage. With the fraud detection case IDP and AI was used together to identify

potentially fraudulent cases. The solution consisted of IDP capturing data from paper documents which were transferred to AI infused detection engines to form structured data and analyse it. (Datamatics, n.d.)

Regarding *customer data customization*, a team handling customer securities account is getting digital and analogue data from various sources. Customer related data, which is received digitally, is processed and validated by RPA robots. Data is then imported to pre-defined applications or databases. OCR is used as a supportive solution to process analogue input. This automation application does not automatize the whole process but minimizes human effort substantially. (Smeets et al., 2021)

Lastly, *invoice processing* is quite manual intensive process as invoices need to be checked and validated before sending or continuing to payment. If the invoice is able be retrieved in digital for or an analogue (a piece of paper) information can be changed (scanned) to digital format, invoice processing can be automatized. This can be done by utilising OCR and for example RPA. A case study where these technologies were used to automate invoice processing process showed extensive cost- and FTE-savings. The case organization saved 67 FTEs which is bout 4 million in cost savings. Similarly, the processing time changed to roughly 30s from 6-8 min. (Smeets et al., 2021)

#### 4.4 Unifying Technologies and Data with Automation Platforms

As organizations have long processes consisting of variety of tasks and needs usually a one technology is not sufficient to carry out the whole process. Thus, automation platforms are carried out to handle the long process flows by offering multiple different tools and integrations. The main concept for automation platform is to build an ecosystem and digital environment by utilizing process-agnostic software to meet the needs of many and possibly complex business processes but also reduce costs. As stated, automation platforms and process engines are used for harmonizing the process automation technology portfolio but also for orchestrating the process flow consisting of multiple different automation technologies. (Burke, 2020; Gartner, 2021)

Similarly, the figure 14 below aims to summarize the different layers of process automation, the modelled process, automation platform or the orchestration of needed technologies with process engine and data. All these need to function together to create successful process automation. (Rimol, 2021; Simm et al., 2020) One of the offerings regarding that are Intelligent Business Process Management Suites (iBPMS) which includes for example process automation technologies, data, integrations and operational intelligence. (Burke, 2020; Gartner, 2021)

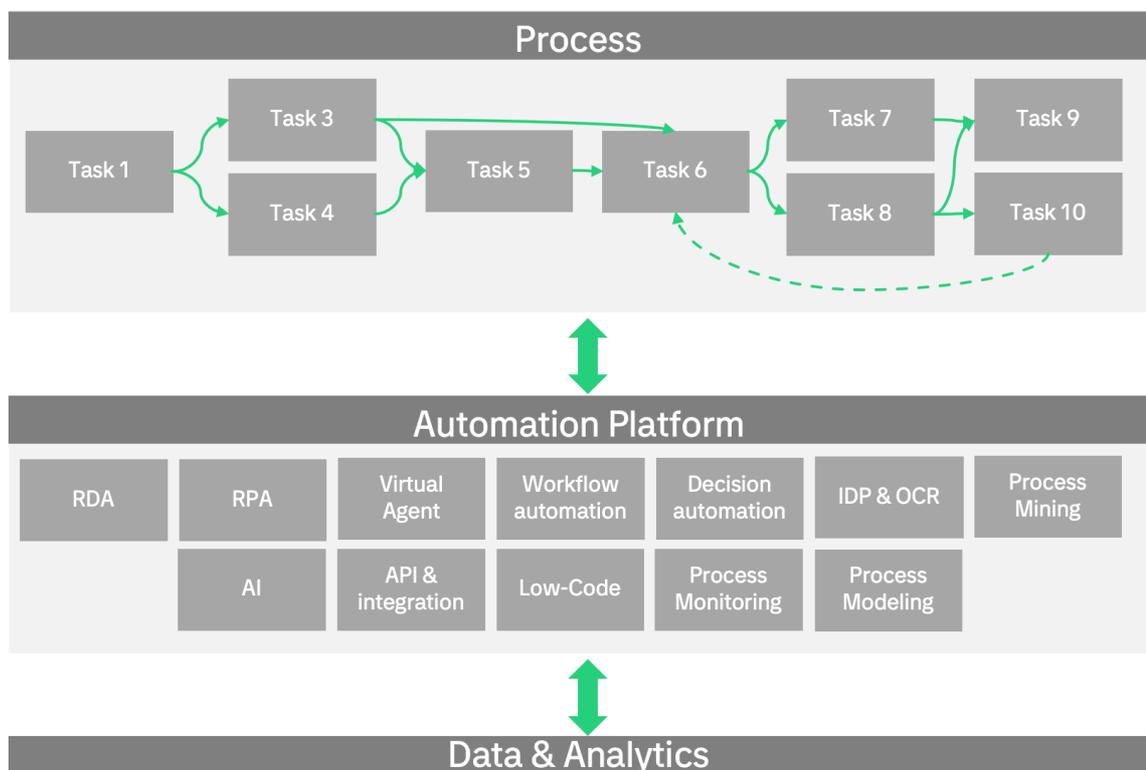


Figure 14 Simplified illustration of automation platform entity (Burke, 2020; Gartner, 2021; Rimol, 2021).

An example use case regarding automation platforms in financial industry is a know your customer (KYC) process automation. The KYC process consists of policies, procedures and systems monitoring the customer to reduce risks, avoid illicit transactions and improve customer relationship. The KYC process is also tied with the regulations and laws globally but also country wise. The process is often rather manual, and the analysis takes a lot of effort. In case of a mistake, the results can be severe and costly for the financial organization. Thus, a system with automation is recommended to use to minimize the risk of human error. (Appian, n.d.)

KYC could be handled with workflow automation. However, by utilising automation platform and its integrations, the process is easier as it can be connected for example to signing services. Moreover, with a platform, it is easier to include data analytics or monitoring solutions needed for KYC. KYC is also usually a part of larger customer relationship and lifecycle management operations. Thus, automation platforms can be utilised to handle the whole operations and all the processes included in it. (Appian, n.d.)

The automation platforms showcase well the complexity and versatility of process automation. To automate long process flows, there is not a one technology to take care of all. Thus, processes need to be modeled and possible mined to be able to decide on the suitable technology or technologies for automating the process. At the end of the day, everything will be depended on the data available. Without great data practice and coherent and structured data, there is no possibilities for an organization to proceed with automation efforts. (Belanche et al., 2019; Polak et al., 2020)

For example, NLP can be used in extracting data with IDP from documents with natural language to have information for decision making with decision automation. Later, API and integrations are used to move data and that is done by RPA. Similarly, the whole process is monitored, and the log data is utilized for process mining to find end-user patterns and profiles. (Ng et al., 2021) However, a utilization of different technologies expands IT portfolio. Automation platforms are created to tackle the technological versatility needed for process automation. (Rimol, 2021; Simm et al., 2020)

## 5 Process Analysis, Process Enhancement and Co-Development

As already stated, the most critical cooperation between IT and business concentrates most on the stages before and after automation development and activities. In those stages, the focus is on process analysis and enhancement. Process analysis considers process modelling and identification of automation possibilities. Process modelling is evaluated from a viewpoint of creating stakeholder-centric process models and automation identification evaluates the process based on its complexity and thus possibility for automation. (Comuzzi et al., 2013; Lübke et al., 2021)

Process Enhancement, however, concentrates on the process monitoring and process mining and their effect on managing and developing processes further. Process monitoring is also analysed from a technical viewpoint such as the data quality and its needs. Process mining is more from a technological perspective considering also use cases from financial industry. To avoid the discussion being too technological as cooperation with business is essential, the ways of work for co-development are also presented. (Comuzzi et al., 2013; Lübke et al., 2021) It needs to be acknowledged that there are other activities and areas for process analysis and enhancement. However, the showcased themes are selected due to the interests of the case organization.

### 5.1 Process Analysis

Before the development activities, the processes need to be analysed and modelled as stated in the business process lifecycle. There are a variety of methods, mostly focusing on Lean such as Six Sigma or Kaizen. (Liermann and Stegmann, 2021) Within Lean, the focus is on Value Stream Mapping (VSM). The tool considers process identification and improvement. However, it does not consider automation possibilities as is. So, there needs to be a separately organized effort from IT to business for communicating the automation possibilities and its use cases. (Baag et al., 2019) Moreover, the automation possibilities should be identified to be able to select the correct technologies.

### 5.1.1 Process Modelling

The business process should be visualized as a set of activities. Some of the activities are core activities and some supportive. It should be determined whether the processes generate value and how they contribute to achieving organizational goals and aligning with business strategy. Also, it should be considered on how the processes can be linked to each other. (Sikdar and Payyazhi, 2014) Thus, process modelling initiatives are needed. However, process modelling needs to be comprehensive and understandable for all the stakeholders around the process. Otherwise, there is a risk for misunderstanding and errors and difficulties in process efficiency. (Lübke et al., 2021)

To answer the need for understandable, process modelling, different modelling initiatives have been created. Business process management its own notation towards process modelling, Business Process Model and Notation (BPMN), a standard framework for business process models. BPMN is aimed to provide an understandable process model which both technical and non-technical stakeholders will understand. (Lübke et al., 2021) Additionally, Goedertier et al. (2015) identifies that there are other process modelling languages such as Petri Net based modelling, Unified Modeling Language (UML) activity diagram and event-driven process chain.

Process modelling divides into two ends of a spectrum, *declarative* and *imperative* process modelling. The aim for declarative process modelling is to focus on the activities that should be done and their order. However, it does not guide on how the business goals should be achieved. An example of a declarative process model is showcased in the figure 15 below. Thus, declarative process model is not suitable for automation purposes. Especially in rules-based automation, processes need to be clearly defined and it requires an order on which the process flow will be conducted. (Goedertier et al., 2015; van Dongen et al., 2021)

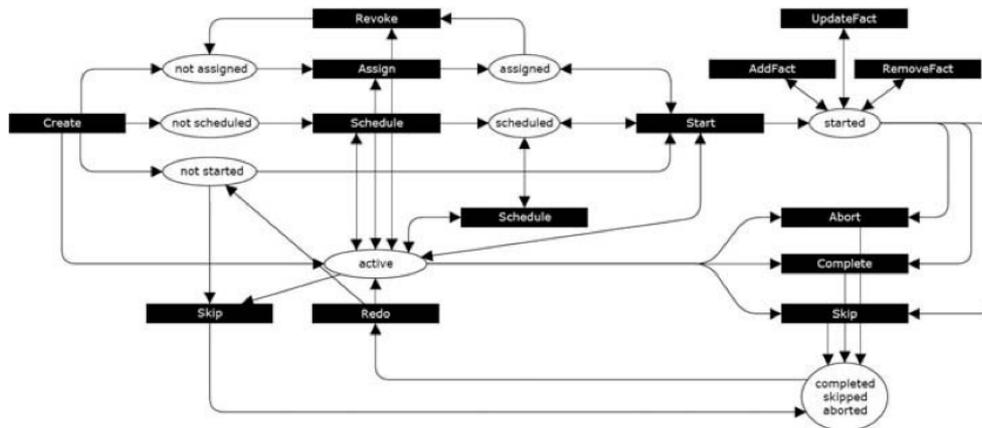


Figure 15 Declarative process model (Goedertier et al., 2015).

*Imperative* process aims for defining a precise model and is used more commonly in process automation modelling. It includes the control-flow and rules throughout the business process. As seen in figure 16 below, the model is much more structured compared to the process flow in declarative modelling. The imperative process model includes the dependencies between the steps and roles. Moreover, the activities from process trigger point (start) are illustrated and those are in sequence until the end of the process. Often, the events, objects and data is defined in the process model. (Goedertier et al., 2015; Meroni, 2019)

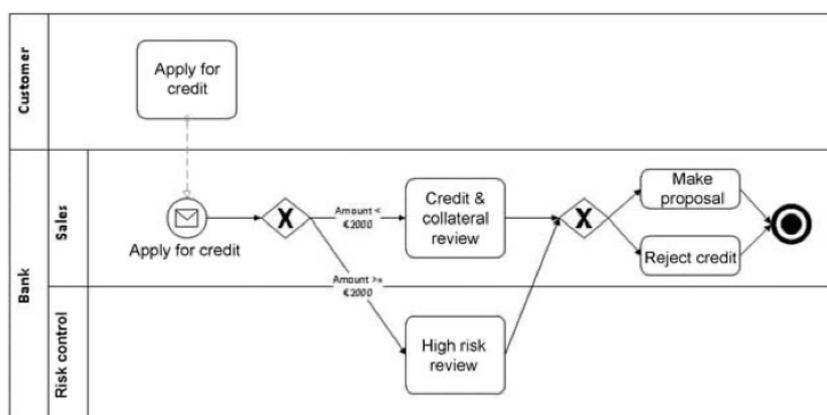


Figure 16 Imperative process model (Goedertier et al., 2015).

Vom Brocke et al. (2010) states that while modelling processes, it is also important to agree on which parts of the processes will be automated and which need human interaction. Business and IT should prioritize on which processes to automate first. This is often based

on the value generation of the process and impact of automation but there might be other characteristics stated by the organization based on the needs of the process. Some characteristics affecting to the modelling are for example different kinds of regulations and policies. (Brocke et al., 2016; Sikdar and Payyazhi, 2014)

Regarding identifying the value generation of processes, Value Stream Mapping (VSM), is recommended for Financial Industry. VSM is a tool for implementing and utilizing lean methodology for process identification and enhancement. (Baag et al., 2019) Moreover, there have been studies where Six Sigma has been utilized for process improvement purposes. In one study, a Portuguese Financial Industry Organization, GE Money Portugal, utilized Six Sigma and lean for improving utilization of processes and tools. (Delgado et al., 2010)

Although, lean includes many methodologies for process efficiency such as TRIZ. However, they lack process modelling and automation possibility identification which is why process modelling is important to include within VSM. (Baag et al., 2019) Even though, process modelling aims to visualize the whole process flow into actions and decision with cooperation of business and IT, in some cases, manual process modelling, and business and IT collaboration are not sufficient to deliver meaningful results. Thus, there might be lack of identification in automation potential or all the tasks and rules the process requires and full potential of process automation and redesign is left unused. (Ezekiel et al., 2019)

### 5.1.2 Automation identification

As stated, the correct automation technology for automation activities is depended on the target of the process and what is expected to be automated. The technological evaluation included few use cases from financial industry to showcase the possibilities of the technologies. However, the technological possibilities are also linked to the complexity of the process and how well the process is analysed and modelled. Moreover, the business targets and the sought customer experience need to be considered while selecting automation possibilities. (Ng et al., 2021; Smeets et al., 2021) Thus, the figure 17 below is created to understand the scope for technologies based on the process.

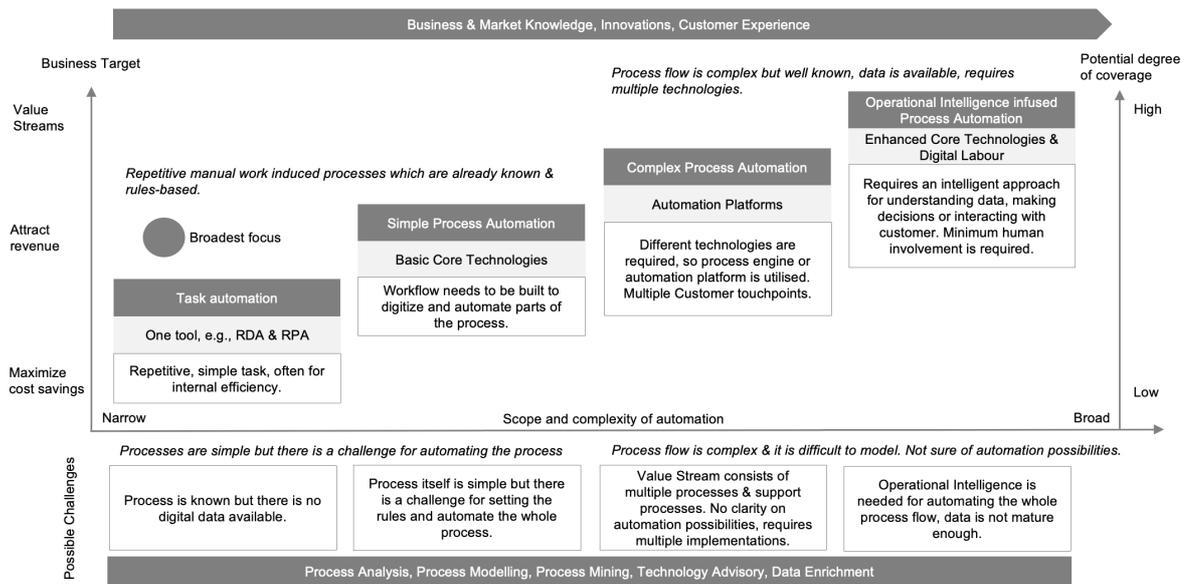


Figure 17 Automation identification (combined from Baag et al., 2019; Ng et al., 2021; Smeets et al., 2021).

The figure 17 above aims to summarize the technological categories based on what the process is based on the analysis. The technologies are divided into four different categories based on the complexity and needs of processes commonly. The figure 17 also considers the possible challenges each category might have regarding the analysis phase. Although it needs to be acknowledged that all the categories are needed in longer and complex process flows. As noticed in the technological evaluation, operational intelligence might be coupled with RPA. Thus, when reaching for the ultimate automation coverage, the technology utilisation is more of a sum of the categories. (Ng et al., 2021; Smeets et al., 2021)

Moreover, it is not viable to utilise operational intelligence or complex automation platforms to every process. Thus, more cost-efficient and simpler options need to be withheld in the technology portfolio such as RPA. Moreover, based on the literature and use cases, the broadest focus is on the RPA still, even though there are many other solutions available. However, the processes infused with RPA can be further automated with other solutions to reach wider automation coverage in the long process flow. Although, it can be viable to reach first for the low hanging fruits with RPA to have the quick wins and have business excited about process automation. (Javed et al., 2021; Ng et al., 2021; Smeets et al., 2021)

## 5.2 Process Enhancement

Process Enhancement focus on the latter steps of business process lifecycle after the development and implementation of the automation activities. To enable efficient process enhancement activities, processes should be able to be evaluated based on data from the process. As stated in the business process lifecycle, process monitoring capabilities should be enabled. Thus, continuous improvement and development based on data can be ensured. (Ensslin et al., 2017; Kahloun and Ayachi-Ghannouchi, 2020)

As stated, manual process modelling capabilities are not always sufficient. In those cases, process mining can be used for improving the analysis stage. Moreover, process mining helps in enhancing processes by analysing the data and discovering for example bottlenecks. (de Weerd et al., 2013) Process mining has gained interest in practice quite recently. The aim of process mining is to identify business processes with the help of technology. However, there is a hesitation whether process mining is used in optimal level in practice. Recently, more research has been made also in managerial side of process mining. (Grisold et al., 2021)

### 5.2.1 Process Monitoring

By monitoring business processes, organizations can see the impact the process has to customer needs, avoiding mistakes, reducing variability, improving lifecycles, and increasing productivity. The importance of each characteristic is different based on the process and strategy and need of an organization. (Ensslin et al., 2017) Business process monitoring provides information for detecting improvement areas. By the means of process monitoring, it is possible to for example find resource allocation problems and bottlenecks. (Kahloun and Ayachi-Ghannouchi, 2020; Meroni, 2019)

Díaz et al. (2021) identifies that DevOps model also offers frameworks for measuring and taking KPIs as a part of processes. Process monitoring can be used for evaluating process performance and efficiency at its current state but also for predicting and forecasting future information, performance and behaviour. With predictive analysis, it is possible to detect

and define potential future problem areas and thus preventive actions can be made already beforehand. Predictive process monitoring relies on its insights from data and event logs from real-time data and its analysis and prediction. (Kratsch et al., 2021; Santoso and Felderer, 2020)

Process monitoring is used for example in insurance claim processes to predict, how long processes' cycle time will last or what will be the predicted outcome. Thus, organizations can act proactively and avoid unexpected situations such as service-level agreement violations or other business constraints. (Kratsch et al., 2021; Santoso and Felderer, 2020) In the analysis of processes, different tools and techniques can be used. One of those is ML and deep learning (DL). When infusing the monitoring process with intelligent technologies, there is no need for extremely defined rules regarding monitoring. Within ML techniques, for example decision trees, random forests and support vector machines are often used. DL is often used when there is a need to help the prediction of the next events during the process execution. (Kratsch et al., 2021)

It is suggested that process performance and quality is considered by process monitoring. The process monitoring and especially process enhancement activities should be a critical focus point regarding the future operations in the field of business process automation. Based on the business process lifecycle, data and process monitoring enables improvement analysis for process performance. Thus, processes can be enhanced even more efficiently once process and value stream management are based on data. Moreover, successful process monitoring enables customer-centric focus and ability to manage and understand the whole process. (Ensslin et al., 2017; Kahloun and Ayachi-Ghannouchi, 2020)

### 5.2.2 Process Mining

Process mining has gained interest in practice quite recently. The aim of process mining is to identify business processes with the help of technology. However, there is a hesitation whether process mining is used in optimal level in practice. Recently, more research has been made also in managerial side of process mining. (Grisold et al., 2021)It offers a solution

when there are challenges in process modelling or when companies want to analyse the process and its users for some other means (Holz et al., 2021).

Holz et al. (2021) states that with process mining, it is possible to analyse the data and log inputs from already conducted processes. Moreover, de Leoni et al. (2016) identifies that process mining can be used for process discovery and identifying bottlenecks by replaying the process. Although, Kang and Kim (2021) adds that it can be also used for analysing and identifying user behaviours based on the event logs. It can be particularly seen as a missing link between the data analysis, BPM and process model-based process analysis and creation (de Leoni et al., 2016).

Process mining can be for example utilized in fraud detection in financial industry. Regarding fraud detection, there are often challenges in identifying deviations from the business processes related to it manually. Thus, process mining can be utilized to raise the issues and deviations from the standard processes related to fraud. (van der Aalst et al., 2010) Moreover, process mining can be used to mine the fraud processes to identify the false positives. So, the cases where basic process automation has identified the case as fraud, but it hasn't been so. Overall, in financial industry, the focus is commonly on reconstructing, visualizing and detecting the true process flow based on the data from the process. (Baader and Krcmar, 2018)

Compared to common process automation software and systems, process mining is bringing another dimension to business process automation. Process automation software is not able to provide an analysis of the process and suggest the most suitable scenario for the combination of workflows and human actions involved during process. (Romão et al., 2019) De Weerd et al. (2013) concludes that process mining, however, is responsible of the “diagnosis” of the process. Meaning that it analyses the detailed flows of the processes.

The aim for process mining is to gain understanding on how processes are executed by analysing and visualizing business processes. It is a set of analysis techniques which is used to analyse and exploit log data and digital traces which were identified from different digital technologies utilized throughout the process. (Grisold et al., 2021) As stated and seen in a figure 18 below, process mining gathers the information from the log data from IT systems.

By analysing the data, the tool will for an actual sequence of process. (Liermann and Stegmann, 2021) The event log data is a key enabler for analysis of process mining. By capturing the data, it is possible to find insights and answers to the possible problem areas in processes. (de Leoni et al., 2016)

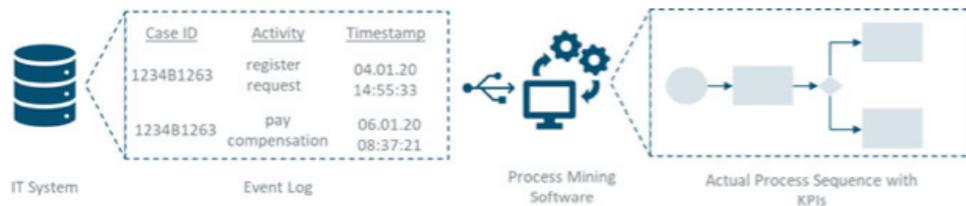


Figure 18 A simplified illustration of process mining analysis from event log (Liermann and Stegmann, 2021).

To capture the log data, the data needs to be structured in a process-oriented way. Moreover, it is suggested that besides event logs, process models and conformance checking results should be utilized to enrich the data for process mining. If process mining activities are not done with proper planning, especially regarding data, the results are often quite poor. (Qafari and van der Aalst, 2020) However, in current situation, organizations focusing on digital transformation often possess well-structured data storages and log and execution data are captured. Although, it requires still effort to extract and convert the data in a form possible to use for process mining analysis. Thus, process mining is not the simplest technology to utilize in process automation technology portfolio. (de Weerd et al., 2013)

As stated, process mining can be used to track a true process flow. To succeed in that, the process needs to be identified and possibly modelled and scoped before process mining as illustrated on the left side in the figure 19 below. By executing process mining, it is possible to see the real process flow and identify whether process is executed in similar way than it was modelled. Thus, bottlenecks and steps which are repeated multiple times can be found. (Liermann and Stegmann, 2021) Moreover, process mining can be utilized for root cause analysis. Although, root cause analysis is often coupled with utilization of data mining and machine learning. (Qafari and van der Aalst, 2020)

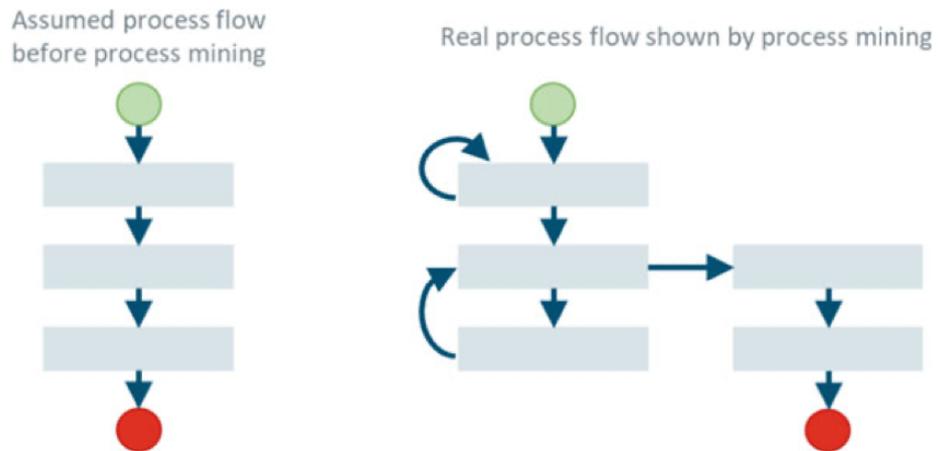


Figure 19 A simplified view of process model before and after process mining activities (Liermann and Stegmann, 2021).

As stated through the visualization of figure 19 above by Liermann and Stegmann (2021), it is possible to analyse the manually modelled process to a real adaptation of the process flow. Once process mining activity is conducted, the aim is to identify the possible challenges in the process. After the identification, the aim is to find the real issue behind the identified areas and evaluate whether it makes sense to redesign the process. So, even though the activities are important before process mining activities, there needs to be a proper concentration and process for process redesign. (Qafari and van der Aalst, 2020)

To conclude with, the main purpose of process mining is often found development items for process efficiency. Thus, process mining can enable cost-savings, more efficient lead times and better process quality. However, as stated it is rather challenging to adopt as it needs concentration on data and its quality but also the analysis of the hurdles during the process to take the most out of the tool. (de Weerd et al., 2013; Qafari and van der Aalst, 2020)

### 5.3 Co-Development and Business-Centricity

To produce successful business process automation, the focus needs to shift from function and flow-oriented approach to user experience, value generation and process-oriented approach. From IT perspective this means for example that the language used in business process automation and modelling needs to be user friendly and understandable.

(Fleischmann and Stary, 2012) Thus, tools for business-centric co-development and ways of work need to be understood. There are few different viewpoints – user-centricity, customer-centricity and business-centricity. User-centric design can increase the revenue growth by 20%. (Payraudeau et al., 2021)

As stated, the successful of business process automation development is depended by the co-operation between IT and business. DevOps models consist of Development (Dev) and Operations (Ops), so the operations during and after development and deployment. The aim is to align both characteristics with each other and avoid delays or bottlenecks on deployments. (Hemon et al., 2020) It offers a solution for collaboration, support new ways of working and is popular in software intensive organizations. The model plays a fundamental role when there is a great dependency on operational efficiency. It also answers to the need of agility, resiliency and need for faster-time-to market. (Díaz et al., 2021)

Overall, the positive and development-oriented communication and culture needs to be ensured. Thus, change management initiatives are needed. Kotter has a model leading change to tackle challenges through change management. It consists of eight different steps and the aim is to involve business throughout the operations. One of the first steps of the model consist of quick wins, meaning showing progress, for example with small development implementations. Thus, the business can be kept interested on automation activities. (Brocke et al., 2016; Kotter, 2012).

Lastly, the whole business and IT operations among business process automation needs an agile approach. The importance is the avoidance of silos between IT and Business and their separate teams. The communication needs to be constant and rapid processes and operations. Moreover, the nature of the co-operation and development needs to be continuous and iterative. Thus, the technological and process efficiency maturity can be achieved. This enables the movement from function-oriented approach to process and value stream management. (Baag et al., 2019; Hemon et al., 2020)

## 6 Case: Assessment of Business Process Automation Capabilities and Strategy in Finnish Financial Industry Organization

The aim of this chapter is to analyse the focus areas of literature review from the viewpoint of the case organization. The research focuses on one case organization. However, the organization consists of multiple different businesses which differentiates the case research from the normal singular case company study. Even though the case organization will stay anonymous, an overview of its nature and its relation to process automation will be showcased to understand the targets of the upcoming research.

The case organization will be further described as case organization. An explanation of the data collection and analysis method will follow, focusing on describing the methodologies but also justifying the way the research is conducted. The results of the data collection will be analysed based on the means of narrative analysis to retrieve insights for managerial implications. Lastly, everything will be summarized and the considerations and recommendations for the case organization are showcased.

### 6.1 Overview of the case organization

The case organization operates in financial industry in Finland. It has multiple different business lines for different areas in the industry. The case organization is divided into tribes and their software development and digitalization follow their own agile principles. To guide the tribes, there are units which support in their areas of expertise such as with process automation. As a matter of fact, intelligent automation is one of their key focus areas in their renewed organization wide ICT strategy.

So, they have established a Center of Excellence (CoE) for process automation. The unit is responsible of the development, governance and the technologies related to process automation. Similarly, they are in constant dialogue with the business units to drive the benefits of process automation forward. Next, the process automation journey and its current

state in the case organization are showcased to understand the relation to the interviews and their analysis. Lastly, the research targets from the point of view of the case organization are established.

### 6.1.1 Process Automation Journey

The organization started its process automation journey in a quite common way with RPA. The first RPA implementations were launched during 2016. In the next year, they already exceeded the 50 implementations of RPA. They established the RPA in a manner that the return of investment for developing, deploying and governing RPA was reached in average of 5-6 months. This milestone was acquired already in 2018. During the same year, they started to combine RPA with other technologies to widen the scope of its utilizations. They introduced OCR, AI like approach and APIs to RPA process automation. Latest additions to the technologies related to RPA and digital labour are Open-source RPA, Robotic Desktop Automation (RDA) utilization and Virtual Assistant, a chatbot. The first two has been acquired in 2019 and the latter one in 2020.

For the last three years, so from 2019 onwards, the case organization has been adopting also other technologies in the scope of process automation than only RPA related. In 2019, the organization started to for capabilities to cover end to end automation in their process flows. As discussed during the literature review, RPA is not able to conduct end to end automation in more complex process flows even if it would be equipped with supporting technologies such as APIs and OCR. Thus, the case organization adopted Business Process Management and Automation System. From that point onward, the case organization started to adopt more technologies around the system to ensure end to end automation also in process flows that require different automation approaches.

They have also enhanced their capabilities to utilize operational intelligence, such as AI, to improve the automation capabilities and thus are shifting into intelligent automation focused automation efforts. They have adjusted their ways of work and governance of automated processes with the rising scope and need for process automation among business lines. They want to ensure that the business will take the responsibility of the continuity of the process automation journey in their own units. Moreover, they have created a model for process

monitoring to ensure that the automation efforts have been successful, and they serve the purpose they were designed for.

### 6.1.2 Current State

Currently, the case organization has done roughly 400 process automation implementations. Currently, they have approximately 60 experts around process automation in scope of the CoE. They offer help and tools for the business line and guides them throughout the process by helping them forming out the process model and automation scope, developing the applications and governing and analysing the outcome.

They have quite wide technology portfolio, and they have multiple new options, especially technologies infused with AI in piloting phase. To summarize, the case organization withholds all the technologies in their portfolio which are showcased during literature review. The technologies are either already implemented or in the piloting phase. Thus, they have capabilities to automate more complex process flows for example through utilizations of process engine. Some examples of their automation efforts are the utilization of robots in processes which do not require human involvement. For example, there is a robot used in customer service to detect false information and asking customer service representatives to correct them. Only in a one month, the robot had noticed over 3000 cases.

With the help of different automation application deployments, the case organization have gained a great number of benefits. They have been able to minimize human effort in the processes and have for example saved 5,5 FTE due to automation application. Moreover, they have attained extra revenue by 730 000€ due to automating back-office processes from one process flow. Automation has also been used for compliance in different areas of financial regulation. Thus, the compliancy in risk management has also been able to implement to the processes.

The process automation activities are organized through having specialists also in business units. The business units have their own process enhancement specialists or teams which act as an advisor to the business and oversees process enhancement. These teams are supported by several internal stakeholders such as process automation CoE whenever they need advice

regarding the processes they are developing. Commonly, they align and are organized within agile principles and methodologies. This withholds the aspect that the process automation CoE does not have the ownership of the automated processes. The ownership is in the business unit where the business process is located in.

### 6.1.3 Targets and Focus of Research

So, as stated, the case organization is in a relatively mature state with process automation in scope of technology portfolio. Moreover, CoE has already established a way of working between CoE and business lines related to the development of process automation application. Thus, the focus areas drawn from literature review concentrates on specific details of process automation. Moreover, CoE is planning to renew their automation strategy. Thus, the targets of the new strategy gave some focus areas for the research. So, there are two viewpoints, to get new insights and next steps for the identified areas and to have a background for the upcoming strategy work.

The focus areas locate in the phases before and after development of the process automation solutions. Regarding the first steps of process management and automation lifecycle, the focus is on recognizing the automation potential and the true nature of the process. This is done by focusing on the process analysis areas such as process modelling and automation identification. Regarding process enhancing areas, also process monitoring and mining are in the focus due to the latter parts of the lifecycle.

Regarding the process monitoring, the focus is on identifying the possibilities of process enhancement after the process has already been automated. Moreover, focusing on the whole lifecycle, the idea is to deep dive into the co-operation of CoE and business lines especially regarding the continuity of development and governance. The focus area also considers the notation of citizen development. This is heavily related on the future automation strategy as already stated by the literature review, the co-operation is a key for the successful continuity of the process automation journey.

## 6.2 Research methodology

As already been clarified, the research will be a case study among one organization covering multiple different business lines. The case study aims to explore new insights for the case organization to consider as a base for their future automation strategy but also as a viewpoint for next steps. Thus, narrative analysis is used for data analysis. The data is collected through interviews and latter analysed by forming different themes based on the interviews. Figure 20 below showcases the whole research process.

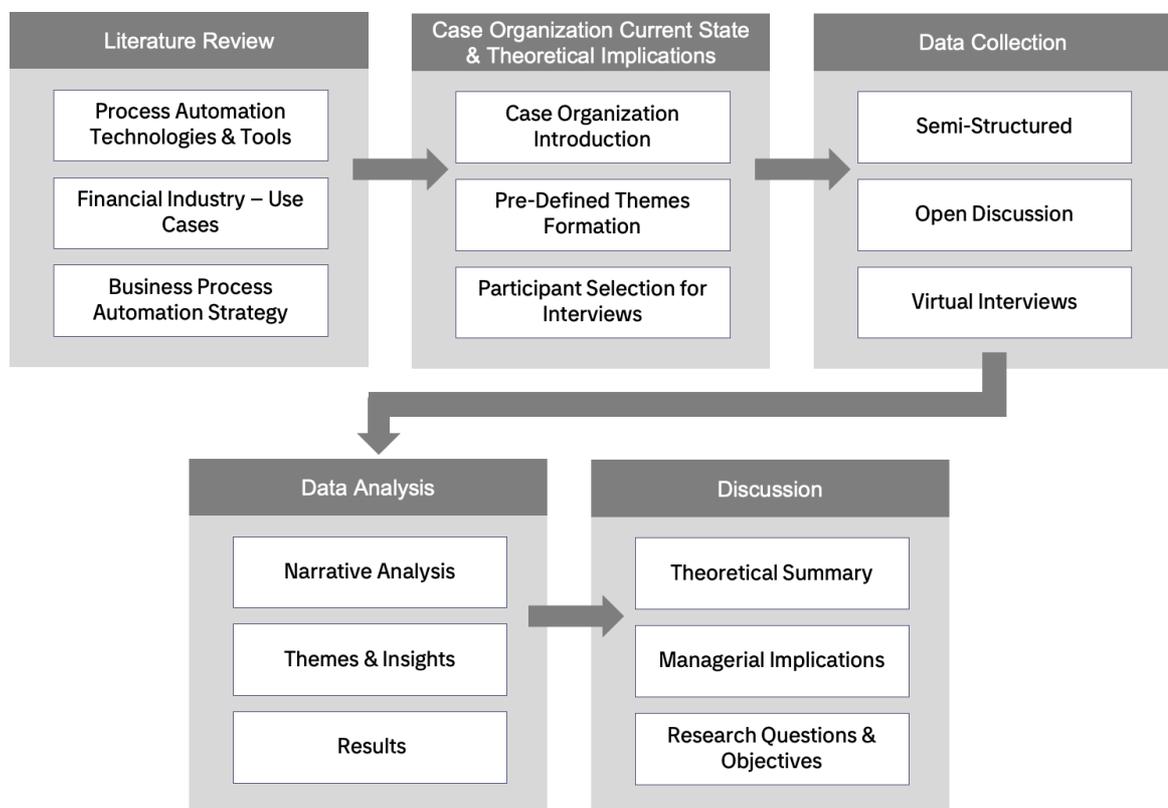


Figure 20 Research Process.

As illustrated in the figure 20 above, the first step of the research was a literature review. Due to the explorative nature of the research, the target was to gather insights commonly regarding the tools and technologies utilized within process automation. Thus, concrete insights regarding the possibilities of business process automation were formed. To understand the field in financial industry, use cases were researched to gain insights on how business process automation is implemented in real case scenarios.

Lastly, the gathered information was formed into theoretical implications regarding business process automation strategy elements. Thus, the theory offered insights regarding what to include into a business process automation strategy. As there were multiple viewpoints regarding the research question, the theoretical implications were in a strong focus. Moreover, as there is a lack of unified theory around the field, the literature review needed to concentrate, especially regarding the strategy, to form a framework for the strategy development.

The insights from the literature review gave directions for the empirical research, so for the case study. Based on the understanding gathered during literature review, few different themes could be formed. This was supported by the introduction to the case organization and the insights from their current state. Based on the pre-defined themes formed from theory and the current state and targets of the case organization, the participants were selected. A purposive method was used to ensure that the participants had an enough level of knowledge regarding the subject as business process automation can be quite complex.

Due to the complex nature of business process automation, the data collection aimed to be quite flexible. Thus, the discussion with participants were guided only by the pre-defined themes which were shared with participants before the interview. In that sense, the interviews were semi-structured. However, otherwise the discussion was open. As the analysis method were narrative, the data collection was focused on letting and enabling the participants to tell “stories”. Thus, the participants could talk about business process automation from their experience and viewpoints. The interviewer just guided the discussion by asking as unbiased questions as possible regarding the themes to continue “stories” or start a new one.

After the data collection, the data were analysed based on the narrative methods. The aim was to gather insights for the pre-defined themes to form managerial implications with the theoretical implications from the literature review. Moreover, the target was to gather separate insights for the case organization to develop their strategy but also form next steps and recommendations for future research.

Analysis will be presented as a form of results and the managerial implications regarding the themes are showcased in the discussion. As stated, the direction for discussion is to review the theoretical implications and summarize it to form managerial implications with the insights from case study. Moreover, the discussion will start to summarize how the whole research contributed to the research questions and the objectives. Next data collection and data analysis methods are presented to form a more detailed picture of those areas in the case study.

### 6.2.1 Data collection method

Data was collected through one-to-one interviews with persons pre-selected by the case organization. The selected persons all represented different business units and roles, but they all heavily work with process automation in the organization. The data was collected within two weeks. Every person was interviewed once, the interviews were held through online meeting and the discussions were recorded for further analysis. The interviews lasted between one to one and a half an hour. Due to the narrative analysis, the aim was to keep the role of the interviewer as unbiased as possible and enable the “story” telling. Thus, interviewer aimed to only ask more questions regarding the theme based on the discussion conducted during the interview.

All the participants had been working with process automation already for several years. Thus, they possess enough knowledge of the status of process automation in their organization and business unit and thus are eligible to give insights for the interview. That being stated, the data collection and the results are valid in that sense. However, a pre-hesitation for the data collection validity was the fact that all the seven persons interviewed had different roles and different backgrounds. So, the results of the interviews might have been too far apart to compare and drive conclusions from.

Seven persons were selected for interviews, three of them represented the process automation Center of Excellence and four represented different business lines, either internal operations or from a certain service. The persons selected from the CoE divided into three different roles, a Tech Lead, Release Engineer and Business Analyst. Each of them had a different technological focus area and thus gave answers from different viewpoints.

The Tech Lead was chosen due to the person having a full visibility regarding the technologies and operations of the process automation CoE. Thus, the participant was able to give a common point of view regarding the vision of CoE regarding the current state and future. However, the Release Engineer were chosen due to the visibility on the processes inside CoE and thus co-operation with business. Moreover, the person had knowledge and insights on continuous improvements of processes but also the operations of CoE. Lastly, the Business Analyst had been involved heavily in Process Mining activities. Thus, the participant had a great outlook on that area but commonly also in process analysis and process enhancement activities.

The business line representatives were a Business Developer, Head of Operations, Product Owner and a Specialist regarding automation. The Business Developer and Head of Operations located in a business unit regarding insurance services. The Business Developer had a technical background and had been working with process automation, especially RPA, from the beginning of its journey in the case organization. Thus, the person was able to give an overview of the journey of process automation throughout the years. Another point of focus were lean thinking and process mining as process mining was something recently piloted within their services.

The Head of Operations gave a managerial outlook on the discussion. The participant could give insights on how they manage the process improvement activities for example regarding strategy and operations. The Product Owner operates in anti-financial-crime area. There has been a lot of automation activities recently in the area and thus the participant could give insights overall on the needs for automation. The fourth participant, Specialist, works in the business side regarding process automation. The participant handles the daily operations regarding monitoring activities and oversees the development. The person co-operates heavily with CoE and thus could give an overview of the day-to-day operations and processes.

The interviews' themes were predefined, so the type of the interviews was semi-structured. A different set of themes were defined based on whether the interviewed person had technical background or solely business background. The themes are showcase in Appendix

1 and Appendix 2. However, the aim was to have an open discussion and let the discussion flow as its own pace. The themes were just forming the framework of the focus and knowledge needed to be gathered during the interview. Only the start of the discussion was same in every case. The interview started with a question regarding the role of a person and its relation to process automation in their case organization.

The data collection method was successful. By having an open discussion, the interviewer could target the questions related to the themes based on the storyline. Thus, it did not matter that the selected persons had different backgrounds as it was possible to have a discussion of the same area within their level of knowledge and from their viewpoint. Also, the discussion flowed well, and it was not restricted by the interviewer. Thus, the interviewed persons had freedom to speak from their own experiences. The pre-hesitation did not become a truth, rather the interviews with seven persons were enough to form a unified view of the status of the case organization and future viewpoints of process automation.

### 6.2.2 Data analysis method

For data analysis method, narrative analysis is used. As the scope of the research is an explorative approach, narrative analysis suits for it as its aim is to find insights and perspectives through the data collection. As already stated, the interviews were held with an open discussion where participants could talk about process automation from their perspective. The “stories” they told based on the themes were utilized to retrieve insights. The aim was to constantly pay attention to the things participants said and how they told them. Thus, it was possible to get the participants to continue to tell their story and similarly give space for them to share perspectives and insights. As stated, there were pre-defined themes to guide the data collection. Figure 21 below showcases them, and the main insights retrieved from the data collection and analysis.

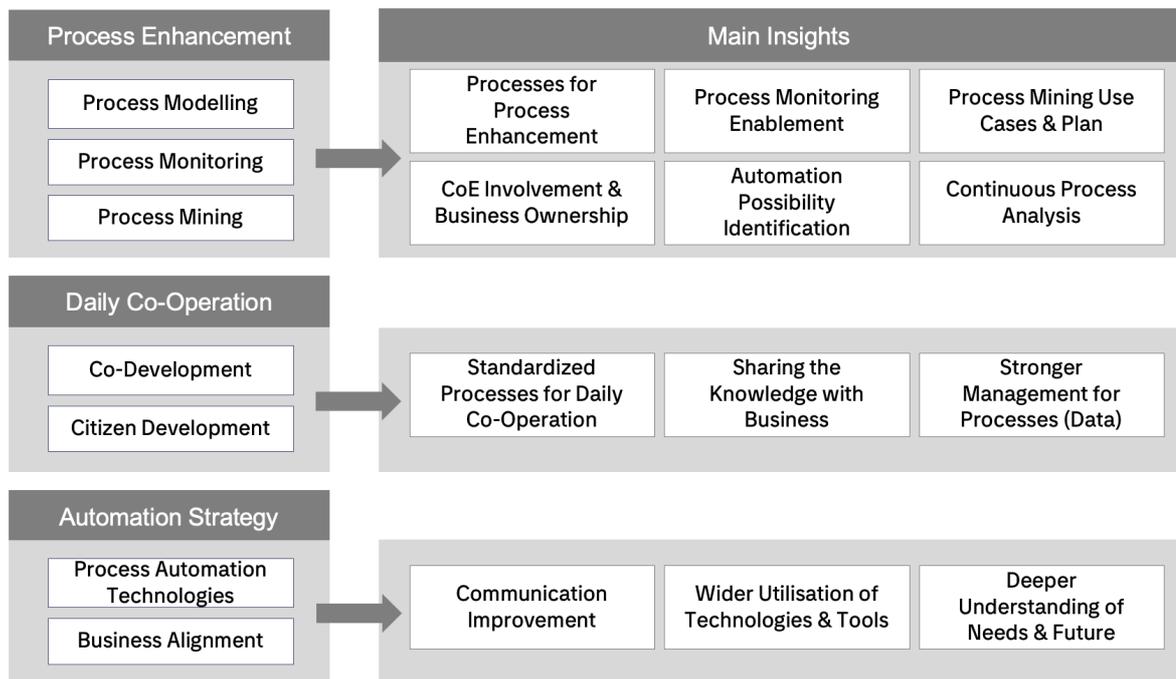


Figure 21 Initial themes and main insights after data collection and analysis

Even though there are challenges in the narrative analysis, main ones being the rather small sample size and the possibility for the interviewer to be too bias, the collection and analysis were successful. The insights were rather unified even though the sample size were quite small. However, the interviewees talked about their perspectives and insights openly which contributed to the insight formulation. The insights are showcased in more detailed level next through results.

### 6.3 Results

To reach anonymity also within the persons interviewed, the data collection is divided between themes rather than answers from single persons. The collected data is presented through seven different themes which also guided the interviews. First, the process enhancement and its related technologies are deep-dived into. Secondly, the discussions regarding co-operation and communication are presented. Lastly, strategical considerations based on the insights regarding the future are showcased.

As an overview of the results, the business lines are happy with process automation CoE and the process automation activities within their business units. They feel that process automation helps their day-to-day work and business lines are happy to be a part of developing new solutions. There were no major improvement areas. The areas of improvement are more focusing on fine tuning the ways of work of CoE and aligning better with business. All in all, there were wishes on more personalized services, better visibility on the operations, more knowledge of the technologies and their utilization and improving the communication flow.

Another area is related to the process automation journey. As stated, the process automation CoE withholds all the presented technologies related to process automation. They have set ways of work and they are constantly seeking for improving their operations. To summarize, they have all the basics covered and they are rather satisfied with the current situation. Based on the interviews, identified areas of improvement regarding the process automation journey relate to the next step to grow their process automation maturity, especially regarding data and possibly operational intelligence. Moreover, the focus is in continuously improving their internal services and seeking innovations.

### 6.3.1 Process Enhancement and Process Analysis

The interviewed persons see process enhancement possibilities in all the categories presented during literature review, process modelling, monitoring and mining. However, most of the enhancement is done through their standardized process for process analysis which considers only modelling at this point. The enhancement done through process modelling, monitoring and mining is discussed later but other aspects are gone through during this chapter. Aside from process analysis, the enhancement is retrieved from input gotten through subject matter specialist in their own business units.

As stated, the process enhancement starts within the case organization through process analysis. The analysis is a set process created by their internal operations unit specializing in Lean thinking. It is conducted usually independently by process enhancers and business lines within business units. Thus, the aim for automation and process improvements need to come from business unit. It was stated that it is important that the leads of business units

strive the benefits of automation. The process analysis was seen a beneficial standardized process within every interview.

Based on the process analysis, they gather areas to be developed. However, these areas are sometimes also given by business without analysis. Business lines are actively seeking areas of improvement. Some of the improvement areas are identified based on the data, which will be covered during discussion on process monitoring. However, some rise from specialists conducting tasks during the process. Moreover, in some case regulations and laws and the changes in those will define the process and dictate when it needs enhancement or changes.

The areas need for development are prioritized based on the business case and urgency. Some of the processes do not primarily need automation as a first step. They might streamline the process only by restructuring the tasks during the process and thus reach more efficient results. Thus, not all the enhancement actions are visible for the process automation CoE. However, based on the interviews processes are continuously developed further. So, if they don't focus on automation possibilities first, they might develop those in next phases. Automated processes are also developed further based on the needs and the lessons learned.

### 6.3.2 Process Automation Discovery, Technologies and Process Modeling

Process Modelling is going well but the improved utilization of data through process mining is awaited. The modelling phase is part of process analysis. However, it depends on a bit of how processes are manually modelled. There was an implication that the processes are in fact modelled with BPMN. Although, it was not implied commonly. Overall, the processes are often modelled in high level. Thus, there could be a need for further process analysis in regards of automation possibility identification. Moreover, even though some prioritization is conducted regarding the process improvement selection, often there is a lack of analysis on the effect of automation activities before development. Although, the effect is calculated after automation deployment. However, there is no standardized calculation method. It was wished that there could be a standardized process for that.

Usually, process automation CoE does not participate to the primary phases of process analysis nor before the analysis. However, it was stated during the interviews from both

sides, Business and CoE, that CoE could start participating to the process enhancement activities within the business lines already during the first stages of process analysis or even earlier. For example, process automation CoE could be advising with quick wins regarding automation. Often some small development possibilities are discovered already in initial stages of analysis. Thus, it would be beneficial for acting on those possibilities already on early stages. It was also identified that there are of course some resourcing and time restrictions which affect to the availability on advisory within smaller cases.

Related to the process automation participation in the process analysis, it was stated that there are a lot of places where automation utilization could be improved. The target for the future is to cut of costs and get rid of bottlenecks throughout the processes. However, it was evident throughout the discussions but often the participants from business side might not know enough about the technologies aside RPA. Thus, they are not able to grasp the possibilities of other process automation technologies and identify the utilization methods in their processes.

Another point of consideration regarding the utilization of other technologies than RPA was the data quality and enrichment and integrations. Even though commonly data is in a good shape, it need enrichment especially for operational intelligence. However, there has been some challenges regarding integrations and thus connecting to different systems. Legacy systems and their data might be a hurdle for further enrichment of data but also automation possibilities in some cases.

Lasly, regarding continuous development, some are waiting for the results for the first deployments to understand the possibilities of the technologies they are utilizing for the first time. However, inputs for process enhancements and continuous development are coming from multiple viewpoints. The challenge is more on prioritizing those. They also see that there are still some restrictions before succeeding in automation longer process flows. For example, there might be a lot of paper documents throughout the process.

### 6.3.3 Process Monitoring, Continuous Process Analysis and Development

As stated, the processes are analysed continuously based on the data they are currently extracting. Often once one part of the process is automated, there is already a new area identified either already from the start of process analysis or during development. However, the “monitoring” might not be based on the tools and the data. Also, employees might identify improvement actions in already automated processes based on how they are operating. All in all, the monitoring is becoming more and more important also regarding process automation and they are already improving processes based on the monitored data. However, they state that they are not yet where they would want to be in regards of process monitoring.

Commonly, the quality of process automation is monitored to identify errors and bugs and the quality has been great. If possible, the monitoring is done with the own monitoring possibilities of a product. However, it was stated that those don't often have all the characteristics needed for monitoring. Thus, other monitoring tools have been acquired to help with monitoring the automated processes.

This data is monitored in process automation CoE but followed also in the business units, especially by the people responsible of automation. CoE and business units have a shared responsibility of that area. It was stated that there had been some issues around communication the side of CoE in case of bugs and errors which prevented the utilization of automation. However, there has been improvements regarding the communication and now business is more aware when issue will be solved and how it impacts to their work.

In many areas, processes are quite solely monitored through the led time and process quality. If those areas are going down, the automation areas are investigated and improved. This has been caused for example by not having resources to build monitoring and data visualization to share the data to stakeholders. If those are not built, manual analysis can be quite time consuming which does not encourage action regarding data analysis. However, in some areas the monitoring and reporting has been improved lately.

For example, through changing database and having a dedicated person in responsible of monitoring, a business unit has been able to make a huge improvement in their process monitoring activities. They have visualized data for stakeholders to create visibility to processes. Now that they are saving time, as it is a lot quicker to check the status than trying to use excel to understand the reporting.

Also, the stakeholders have been able to impact on the data visualization and reporting which have ensured that the reporting is based of users' actual needs. Now, team leads, and team members can follow and are really interested on the actions they are making throughout the process and their impact. It is also easier for the team leads to lead the operations of the teams. It was stated that there has been a true cultural change regarding data utilization among stakeholders due to improved efforts in data visualization.

It was quite commonly stated in the interview that they would want more visibility through monitoring to for example understand the improvements automation has made. Some of them has been calculating FTE savings by themselves but they state that they would want a unified monitoring for that one to really compare the improvements in an organizational level. Business and CoE seek for improving their data utilization and having more data available throughout their process for data visualization.

They see that they could enhance the culture of leading based on data, not assumptions. For example, how process has been improving, following the KPIs, workflows and workloads. They want to know who does and what and what is the ratio between automation and manual work. Some were wondering, what would be the responsibilities or assistance of process automation CoE regarding improving monitoring in an organizational level within automated processes. In some cases, the data conducted by process engine will help in monitoring activities.

#### 6.3.4 Process Mining in Case Organization

Process mining in the case organization is relatively a new phenomenon. They have piloted the technology and conducted proof of concepts. During the time of the interviews, they were preparing the technology for upcoming first development and applications. Their

journey to this point has lasted roughly two years. The most challenging part during the time has been the selection of correct process mining technology to suit their needs. There are a lot of possibilities available in the market which seem rather like each other but still having different notation which affect to the selection. Another consideration has been the level of utilization of the technology and thus the different pricing models amongst the vendors.

Internally, the technology is not a service yet and the planning and launch is ongoing. They have pondered whether they will be having too time-consuming challenges regarding the data quality and thus a correct and efficient use of the technology. Thus, they are starting small and slowly with the utilization of the technology. Then if there are any issues with the data, they have competence and resources to tackle it and they can learn of the process needed for successful and efficient planning, development and deployment.

Another point of consideration before launching process mining fully internally is to ensure correct processes, enough resources and an internal marketing plan. They want to ensure that they possess enough knowledge and resources to develop the process mining applications wherever needed and that there will be competent people to guide them through the process. Moreover, they want to launch the technology systematically internally. Thus, they need to have a marketing plan. This will include material in their internal information sources but also material to present the possibilities to different business units. This is something done for every technology process automation CoE has.

There were a variety of possibilities recognized regarding the utilization of the technology. Regarding insurance area where the actual deployments will happen first, the aim is to be able to visualize the truthful process. They see that common manual process modeling is not adequate and thus are thrilled to have real data from logs to back up the process. Moreover, they want to compare the results of process mining to their own process models. With that, they aim to see how well they managed to model the process manually and get insights on between the assumed flow versus the truth.

Another point of focus regarding process mining was the identification of KPIs of the process. They thought that with process modeling, they can set targets and monitor the true efficiency of the process. Thus, they can identify better the bottlenecks they are having and

find automation possibilities. As stated, they were keen on back up the results on the data, not just assumptions through the manual process analysis.

Moreover, the business lines want to get insights of automation possibilities throughout the process with the help of process mining. They want to get as good understanding of the process as possible. Thus, they want to see for example, if same task is done repeatedly and why does that happen. They are also interested to utilize process mining in processes which flows cross-organizationally to see the process and possibly streamline it. Researching and analyzing the process flows cross-organizationally is something where people identified opportunities which have not yet been founded. The co-operation cross-organizationally will be analyzed in more detail during next phases of data collection.

#### 6.3.5 Co-operation and Co-Development

Often the input for co-operation comes from business lines. Commonly, business lines are rather independent within the process automation actions. This is partly due to the specialists in the business units and rather standardized processes around the automation activities. The standardized processes are developed for giving clarity on the actions needed to be done and so that actions are not dependent on a particular person. For example, in case of bug in applications, the CoE has a process on how to inform on the bug from business line to CoE but also from CoE to business line. Thus, everyone will have the same level of access to the information. All in all, the already standardized processes are felt beneficial and good.

Even though the specialists in the business lines are managing quite well the process enhancement and automation operations within the business lines, there are also a need for CoE participation. In one of the business lines, there were two dedicated developers for them as they have a lot of automation development on-going. It was seen beneficial and fruitful as the developers were able to get to know the business area and the processes around it and have a wide visibility on the area. Thus, the development actions were more efficient as there was no need on developers to get to know the area first. Moreover, the results of development were seen successful.

Similar model as stated above regarding the assigned developers were wished for other actions too during the discussions. It was stated that as the areas are rather specific, it would be great if CoE would have assigned persons for each area of business lines, so for example, insurance, banking and internal operations. Then, the persons could really get to know the business area and thus give more personalized service and advice towards the business.

Regarding the co-development, business lines felt that they get help they need from CoE always and that in usual everything goes well. However, regarding the actual development, there are challenges and areas to improve regarding the timing and schedule. Often, the projects run overtime and the deployment of the solution is later than planned. Although, it was stated during the discussions that sometimes challenges regarding development affect to the schedule which is okay but often the case is not that.

As a part of co-development, citizen development was discussed during the interviews. Commonly, the feedback was positive but there were some hesitations towards it. Everyone thought that it is rather mandatory step. Moreover, it was stated by many that either citizen development is something that is already happening inside the organization, or they are practicing it. However, it was stated that all the utilization ways might not have been identified fully yet. It was also referred that utilizing automation will become as basic as using a computer and thus citizen development is required.

The area which caused most concerns regarding citizen development was the resourcing and discovering and implementing its ways of work. Even though everyone had rather positive outlook on citizen development, it was identified especially from business that it is not viable that they would start to automatize whole process flows. The automation activities would consider more the internal tasks that the teams have in business units. So, quite high-level automation.

It was identified that there is a need for centralized operations in scope of technologies, governance and resources. Although, the high-level task automation would enable more knowledge inside teams regarding automation. Lastly, the participants stated that in case of citizen development would become more standardized inside the organization there should be a clear plan for it. It should include the responsibilities and governance of development

activities and have a clear structure and standardized processes. Moreover, the implementation should be done incrementally and in a slow phase.

#### 6.3.6 Communication

As stated, majority of co-operation activities and moreover communication is done in a satisfied level from process automation CoE. It was also stated that the initial for communication needs to come from business lines and usually only when help is needed. In some cases, the business unit had recurring meetings with CoE such as biweeklies or monthlies. Another form of communication was joint meetings provided by CoE where they present automation area. Additionally, a form of communication was through already stated standardized processes which were stated to be efficient and well fitted.

Overall, the communication has been good, and everyone was able to communicate with CoE with a low threshold but there were some areas of improvement identified. However, it was also stated that there had been more challenges regarding communication before and that there has been a lot of improvements since. From the point of view of business, the overall communication was seen as unstructured. It was for example stated that before starting the biweeklies the communication was a bit disconnected and that there was not a good dialogue ongoing with the CoE. Biweeklies and monthlies have been seen beneficial regarding having the active dialogue especially due to on-going development activities. These recurring meetings were something that was wished to be continued also in the future.

Regarding recurring meetings but also commonly about communication, it was stated that business lines could have better visibility on the process automation area. This discussion was conducted from multiple viewpoints both, from business and CoE. Especially from business side, the need was to get more personalized services regarding the automation possibilities and knowledge sharing. They wanted to understand more the possible technologies they could utilize in their processes. For that they felt that they could benefit from educating business side regarding automation but also establishing personalized use cases regarding automation. As the plan for process mining is not yet fully resolved, it could be a place to test out the personalized service.

Another point of insights was the technological knowledge of automation from viewpoint of business. It was identified that business lacks knowledge and visibility on possible automation solutions other than RPA. Business wished for similar personalized service as already discussed. Regarding communication they would benefit for increased focus on business-specific use cases. Thus, CoE should strive for improving and maintaining the knowledge of business needs and targets. Moreover, as stated in the interviews that automation should be a day-to-day topic of discussion everywhere, the communication should strive for giving automation discussion as low threshold as possible and thus spreading the knowledge regarding possibilities for automation.

### 6.3.7 Strategic Considerations

The strategic implications were discussed through two viewpoints: what should be included and how strategy of CoE aligns with strategy from business lines and organization. As already discussed regarding improvement on alignment with business lines' strategy, more deliberate communication and alignment needs to be included. Moreover, as there are already "process automation enablers" among business, it would be strategically beneficial to improve their knowledge but overall rise the automation knowledge among business. This would include the already discussed demos, case presentations and a common discussion around the topic. It was stated in the interviews that the automation should become a day-to-day topic and seen as business as usual.

Even though there is a common agreement that the process automation technologies are sufficient and great for the purposes there were wishes to continue focusing on those regarding strategy. However, as the technological maturity is in a good shape, the implications were more on utilizing the technologies in wider perspective and thus introducing new possibilities on already automated processes. Moreover, there were implications on improving the operational intelligence such as AI and data maturity. If needed, new technology selections should support those areas. Especially data is also related to the ability to manage processes and continuous development better but of course enable operational intelligence.

Regarding managing processes, it was stated from multiple viewpoints that more focus should be in understanding business, their processes and the value creation. Thus, efficiency and customer experience could be improved. For CoE the role and strategy direction would be an enabler. This quite well summarizes the needs from different aspects. CoE should strive also strategically to enable managing value streams and the processes better and more efficiently. This considers the process enhancement methods but also the service they are offering for business. Thus, that aspect acts as a base for the separate insights and directions discussed during the results. Overall, the unified insight was in understanding processes and value streams better which compliments automation usage, process efficiency and customer experience.

To enable value stream management and automation, strategically CoE need to consider the co-operation with business, strategy and roadmap alignment and overall visibility of their actions to business. More visibility and roadmap and strategy alignment were brought up during the discussions. Business and CoE feels that they are not aligned enough regarding their roadmaps and future needs or directions. Business would want to get more visibility on the future of process automation and what can be done with it especially regarding their own area.

Similarly, they would want to communicate to CoE their roadmap and strategy for the future and how those impact to the targets of process automation. This kind managerial co-operation with CoE and business seemed to lack a bit even though otherwise the co-operation was identified to be successful in a high level. Thus, as CoE has now concentrated on the daily operations and continuously developing those which has been successful, the commitment and focus should next move more into the strategical and steering operations too.

## 7 Discussion

Based on the findings during literature review and case research, successful business process automation strategy considers technologies and tools, processes and business. Although, data possibilities are too a critical factor in the scope of business process automation, and it is growing through advanced innovations happening in the field. Thus, there are multiple areas to be considered in regards of business process automation strategy. To summarize the main findings from literature review and interviews regarding the business process automation strategy and commonly operations to succeed in process automation, a figure 22 below is presented.

	Automation Technologies	Continuous Process Development and Enhancement	Cooperation and Communication
Future Considerations	AI and operational intelligence	Disruptions & Innovations	Value Stream mindset
	Ecosystems		
Enhanced Capabilities	Wider Utilisation of Technologies & Tools	Stronger Management for Processes (Data)	Communication Improvement
	Deeper Understanding of Needs & Future	Automation Knowledge Sharing	Business Targets & Roadmap Alignment
Basic Capabilities	Performance – Process Monitoring	Governance	Standardized Processes for Daily Co-Operation
	Technological needs	Ways of Work & Resources	Business Co-Operation
	Automation Possibility Identification	Continuous Process Analysis	

Figure 22 Summary of main findings of business process automation strategy and operations.

The figure 22 above consists of three different layers, the basics, enhanced level and the further considerations. The basic capabilities summarize the categories IT needs to withhold to develop process automation. As already stated, the case organization were well

established already regarding the basic capabilities. The enhanced level is for growing the maturity of process automation once all the basics are covered. For the case organization, these can be considered as next steps to look at. Lastly, the further considerations consist of the categories discussed in the literature but also in the interviews regarding the areas to look and research more in the long run. The discussion on all the three levels focuses on three categories: automation technologies, continuous process development and enhancement and governance and cooperation. Thus, regarding managerial implications, these three areas should be focused on.

### 7.1 Automation technologies

Regarding automation technologies, especially based on the interviews, identifying correct process automation technologies for processes is strategically important factor. As discussed throughout the research, the major focus of automation activities was on RPA. It seems that this is the case with financial industry too and the use cases are rather RPA-focused. Strategically, this can cause a lot of consumption for RPA, but the potential of other available technologies is left unused. This can cause challenges in governance but also in exploiting the technology portfolio. As a recommendation for the case organization too, the possibilities of the whole process automation technology portfolio should be uncovered. Strategically, these areas are important to identify, as there can be a lot of potential to automate complex process flows but it needs a bit more effort to find it.

As already stated, data and its quality are a critical factor in successful process automation. Without a great data quality and enough digitized data around the process, the aims of process automation or utilization of process automation technologies fail. It is evident especially, when organizations' process automation maturity grows into a point where process monitoring, or monitoring or operational intelligence is needed. For example, with use cases regarding fraud detection and machine learning, the importance of data was highlighted. However, it was also stated that financial industry has been focusing more and more into data availability and quality. Thus, the biggest hurdles might have been overcome but the work around data is always ongoing.

If considering the case organization, overall, the foundation of the CoE and process automation in the case organization is successfully built. Regarding the maturity of technologies and operations of CoE, they are in an advanced level compared to the use cases during the literature review. Thus, the focus should be on raising the maturity on managing the processes and co-operation with business. As the technological maturity is in a rather advanced level, the aim would be to concentrate on data and operational intelligence improvement. Lastly, as summarized from theoretical and case perspective in discussion, the way to grow maturity is to enhance the wider utilization of automation technologies and aim for value stream level automation.

Even though the discussion within literature review and interviews did not concentrate heavily in ecosystems, it needs to be acknowledged that it should be investigated regarding future considerations. Since business process automation is a dynamic field, a focus should be strategically too on innovation possibilities. Thus, open innovation practices and the possible revenue growth is rather interesting. Although, it needs to be thought out especially in financial industry, what can be the means of outbound open innovation.

## 7.2 Continuous Process Development and Enhancement

As stated during literature review and case study, it is viable to understand the the whole value streams the processes operate in. This is also strategically viable so that business needs are correctly met and that the processes and automation activities could be lead through value streams. However, to enhance the processes, business' knowledge on automation possibilities and continuous enhancement should be improved. Especially, the focus should be on sharing business-specific targeted information. Similar personalized service was sought from the business side of case study. The CoE of the case organization could discuss about the possibility to assign certain people to be the experts of certain business area. Thus, the personalization could be reached more efficiently.

Through literature review and case study, it was evident that there needs to be a plan built for enabling the identification of automation technology possibilities in processes. One way was to include IT to the process enhancement and improvement activities earlier so that they

can advise on the technological possibilities. Especially, there should be a focus on helping the business to find the “true” process flow under one automated repetitive task and focus on finding the correct solution in the longer run for the whole process flow. This is also related to moving from lower end of process complexity to higher end of complexity. Moreover, this kind of approach can help in discovering innovations and disruptions in processes.

Lastly, the process enhancement should be coupled up with more managerial touch of process monitoring and the process data and analysis. As stated also in the literature review, managing processes through data is critical in the means of process enhancement. This was also highlighted during the interviews within the case organization. Commonly, there seems to be a lack of process monitoring regarding the business needs for monitoring data and analysis. Thus, overall, but also in the case organization, the focus should be more on enabling process enhancement through process data. For example, process mining could be a useful technology to utilise for that.

### 7.3 Co-Operation and Communication

Regarding the development of business process automation strategy, clear evidence was that efficient and successful co-operation needs to be established, and silo formulation is avoided. Thus, strategy needs to include governance also in the sense of co-operation, ways of work and alignment of business and IT in scope of roadmaps and strategy. The implication was evident in both literature review and case study. With a successful governance of processes and their automation technologies, automation efforts can be also better reused for other purposes within the organizations.

Communication was stated to be a critical factor of succeeding in business process automation activities. The roots lie in the fact that business is managing and having all the insights of the process. IT however owns the technologies and tools to automate and enhance the process. Thus, both parties need to communicate and collaborate with each other. As stated already, multidisciplinary teams are required for ensuring the continuous communication flow in daily operations. However, the communication outside of the daily

operations are just as important. By the means of more managerial communication regarding needs and targets, it is easier to align the roadmaps and strategy between business and IT.

Also, as next steps for case organization, it would be recommended based on the interviews to focus on communication improvements. Even though it was stated that there have been improvements, there were still areas of improvement needed. This was mostly related to having a constant dialogue with business regarding the aims of process automation and needs of business. As already done with some business lines, recurring meetings could be a step to take with other business lines too. Moreover, there were discussions on visibility and knowledge on automation possibilities. Thus, actions to provide more personalized services are recommended.

Lastly, literature review and case study considered citizen development as a possible area of strategy regarding future. As automation solutions are including more and more tools for citizen development the direction for strategy would be also to build base for enabling citizen development. However, it needs cultural change and heavy preparation and planning to launch it successfully. Based on the literature review and the case study, it was evident that there should be a clear structure, processes and governance for citizen development for correct adoption. Moreover, the level of citizen development should be increased incrementally similarly ensuring that operations around it is unified regarding governance and IT architecture.

## 8 Conclusions

As an overview, the research considered business process automation from multiple different viewpoints to establish framework for business process automation strategy. However, mostly due to the scattered academic field and dynamic nature of business process automation technology, there were some limitations in utilization of theoretical implications. Although it enables wide variety for future research. The contribution, its limitations and further research are evaluated next.

### 8.1 Conclusions

To conclude with, the theoretical implications and the case study were quite well aligned. Thus, the strategy framework and its focus areas presented in the literature review can be implemented from a viewpoint of managerial implications. The framework includes the capabilities of business process automation technologies, the need for constant and successful co-operation with business and IT regarding daily and managerial operations. It also includes the viewpoint and needs of business and customers. Moreover, it covers the continuous process enhancement through continuous development and business process lifecycle management. To simplify the answer to the main research question *How to improve business process automation, continuously enhance processes and align IT and business co-operation with the help of business process automation strategy?* the strategy areas to enable improvements are on continuous development, automation technologies and governance and co-operation as presented in discussion.

Moreover, the research was conducted from viewpoints of business process automation technologies, co-operation of business and IT functions, continuous development of business processes and business process automation in financial industry. Additionally, the context of financial industry is evident through strategy and cases study. However, apart from the complex organization and regulative nature of the industry, the implications do not differ from common implications for the field. Although, the customer needs, value streams and processes differ based on the industry and organization. Therefore, the sub-questions are also covered throughout the literature review but also through the case study. The literature

review included a wide technological evaluation regarding business process automation and its possibilities. Moreover, the technologies were evaluated from the viewpoint of financial industry.

The co-operation with business and IT functions, continuous development and the strategical implications were heavily covered in the case study but also thoroughly evaluated in the chapter 3 Business Process Automation Strategy. Additionally, both, literature review and case study included the outlook of future implications for automation strategy. By evaluating and analysing the field of Business Process Automation from all the stated viewpoints, it was possible to unify the field and form managerial implications regarding the strategical dimensions in this research.

The research contributed to the literature by discussing the subjects from different viewpoints and including different authors into the discussion. Moreover, the research presents a framework for process automation strategy. Thus, the whole research gives a multidisciplinary outlook on business process automation and thus contributes to the academic needs of having research which unifies different aspects of business process automation. The discussion enables the formation of managerial implications even though the research is rather focused to the literature review.

## 8.2 Limitations

Even though the technologies presented and the utilization possibilities of them in financial industry and business process automation has been already evident long time, there are still limitations regarding the usage of the theoretical implications. First, there are no clarity of the terms and their meanings. Business Process Management (BPM) is of course its own theoretical framework. However, it does not include the automation possibilities and their meaning. Thus, there is a lack of common theoretical framework of the phenomena of Business Process Automation.

The technologies within Business Process Automation are usually presented separately, so there is no clear contribution in combining the various topics within Business Process

Automation. The area has been taking further steps due to the risen needs of digitalization which partly explains the novelty of the topic in combining the technologies. Additionally, the area is extremely dynamic, and it changes in a fast phase, especially within market and technology vendors. This forms challenges for the academic research as the theoretical implications might not be valid as it is during the time of publication. Thus, the articles and proceedings selected for this thesis were also emphasized on the latest years of publications.

Moreover, there are great number of possibilities for utilization of the technologies, also within financial industry. Even though the possibilities were also presented through theoretical implications at some level, the focus was on creating more efficient business processes. However, some of the technological areas focused also on other improvement areas such as better customer satisfaction. Lastly, regarding the business process automation technologies, the use cases and the phenomena were discussed mostly on the viewpoint of RPA.

Another point of view is the limitation in the strategical implications regarding the focus area. There were strategical contributions in a focused level of technological utilization. Meaning by that, the implications for example, regarding the selection of processes to automate or the selection of correct tool within a certain technology. While focusing on an organizational level of business process automation strategy, there was a lack of proceedings in the area. However, literature of common organization strategy and digitalization strategy fulfilled the area.

### 8.3 Future research

Future area of research regarding the case organization concentrates on the areas identified during the thesis but not touched upon further. The largest identified area would be to research on the process monitoring capabilities among business processes. There was still a lack of decision-making and management regarding processes and process enhancement based on data. Thus, researching on that area would be the most beneficial regarding the long-term actions on process enhancement as based on interviews it is highly needed.

Regarding academia there were multiple areas identified for future research. Even though this thesis contributed to combining the theories of business process automation, there is still research regarding the area. Thesis acted as a summary of the technologies. Thus, the upcoming research could deep-dive into the utilization of the technologies together and their possibilities. The key factor would be to unify the utilization of the technologies and provide frameworks for the process automation ecosystems or platforms.

Moreover, the research on terms and framework for business process automation would be a fruitful area regarding the future. As stated above, there could be future research regarding framework for technology utilization. However, another theoretical framework area should include the terms and the theoretical side of the focus area, not just the utilization possibilities. Perhaps the framework regarding BPM could be widened more into automation perspective.

As the thesis focused on the process enhancement, that includes other areas than just automation. Thus, there could be further research on the process enhancement and its related areas of focus. This would include automation but also monitoring and the co-operation and design needed for successful enhancement. Moreover, the targets of the enhancement operations and the steps after development process could be further looked at. However, there is already research on the processes' lifecycle through BPM, but it could be looked solely from a point of view of process automation and its effect on the lifecycle.

Lastly, as stated in the limitations, there were a lack of strategical implications regarding business process automation. The effect and needs of automation were hardly discussed from a strategical point of view. Moreover, there were a lack of unifying business process automation and management to value creation. The discussion was mostly focusing on the viewpoint of IT and there was little evident regarding business. Thus, the business process automation operations and strategy could be researched more from the scope of business.

## References

- Ahmad, T., Looy, A. van, 2020. Business Process Management and Digital Innovations: A Systematic Literature Review. *Sustainability* 2020, Vol. 12, Page 6827 12, 6827.
- Al-Anqoudi, Y., Al-Hamdani, A., Al-Badawi, M., Hedjam, R., 2021. Using machine learning in business process re-engineering. *Big Data and Cognitive Computing* 5.
- Appian, n.d. Reduce complexity and compliance risk.
- Azemi, E., Bala, S., 2021. Exploring BPM Adoption and Assessing the Strategic Alignment of Processes at Raiffeisen Bank Kosovo. *Business Process Management Cases Vol. 2* 277–288.
- Baader, G., Krcmar, H., 2018. Reducing false positives in fraud detection: Combining the red flag approach with process mining. *International Journal of Accounting Information Systems* 31, 1–16.
- Baag, P.K., Kavitha P., Sarkar, A., 2019. Application of Lean Tool for Process Improvement of Bank Branches. *IIM Kozhikode Society & Management Review* 8, 131–142.
- Badakhshan, P., Conboy, K., Grisold, T., vom Brocke, J., 2019. Agile business process management: A systematic literature review and an integrated framework. *Business Process Management Journal* 26, 1505–1523.
- Bandara, W., Merideth, J.C., Techatassanasoontorn, A.A., Mathiesen, P., O'Neill, D., 2021. Successful BPM Governance: Insights from Commonwealth Bank of Australia. *Business Process Management Cases Vol. 2* 195–206.
- Belanche, D., Casaló, L. v., Flavián, C., 2019. Artificial Intelligence in FinTech: understanding robo-advisors adoption among customers. *Industrial Management and Data Systems* 119, 1411–1430.
- Bernardo, R., Galina, S.V.R., de Pádua, S.I.D., 2017. The BPM lifecycle: How to incorporate a view external to the organization through dynamic capability. *Business Process Management Journal* 23, 155–175.
- Beverungen, D., Buijs, J.C.A.M., Becker, J., di Ciccio, C., van der Aalst, W.M.P., Bartelheimer, C., vom Brocke, J., Comuzzi, M., Kraume, K., Leopold, H., Matzner, M., Mendling, J., Ogonek, N., Post, T., Resinas, M., Revoredo, K., del-Río-Ortega, A., la Rosa, M., Santoro, F.M., Solti, A., Song, M., Stein, A., Stierle, M., Wolf, V.,

2021. Seven Paradoxes of Business Process Management in a Hyper-Connected World. *Business and Information Systems Engineering* 63, 145–156.
- Bock, A.C., Frank, U., 2021. Low-Code Platform. *Business and Information Systems Engineering* 63, 733–740.
- Brocke, J. vom, Zelt, S., Schmiedel, T., 2016. On the role of context in business process management. *International Journal of Information Management* 36, 486–495.
- Brown, L., 2022. How financial institutions can digitise and automate business processes with no/low code - Microsoft Industry Blogs - United Kingdom [WWW Document]. URL <https://cloudblogs.microsoft.com/industry-blog/en-gb/financial-services/2022/03/28/how-financial-institutions-can-digitise-and-automate-business-processes-with-no-low-code/> (accessed 5.22.22).
- Bucklin, R.E., Lehmann, D.R., Little, J.D.C., 1998. From decision support to decision automation: A 2020 vision. *Marketing Letters* 9, 235–246.
- Buijs, J.C.A.M., Bergmans, R.F.M., el Hasnaoui, R., 2021. Analysis of the Customer Journey at the Pension Provider APG Using Self-Service and Data Hub Concepts. *Business Process Management Cases Vol. 2* 111–124.
- Burke, B., 2020. Hyperautomation presentation. IT Symposium/Xpo in 2020.
- Calvo-Zaragoza, J., Castellanos, F.J., Vigliensoni, G., Fujinaga, I., 2018. Deep neural networks for document processing of music score images. *Applied Sciences (Switzerland)* 8.
- Chesbrough, H., 2017. The future of open innovation. *Research Technology Management* 60, 35–38.
- Coombs, C., Hislop, D., Taneva, S.K., Barnard, S., 2020. The strategic impacts of Intelligent Automation for knowledge and service work: An interdisciplinary review. *Journal of Strategic Information Systems* 29.
- Crick, C., Chew, E.K., Chew EngChew, E.K., 2017. Business processes in the agile organisation: a socio-technical perspective. *Software and Systems Modeling* 16, 631–648.
- Cunningham, R., 2017. New on PowerApps: easily create rules, configure forms and galleries, and get started building apps | Microsoft Power Apps [WWW Document]. URL <https://powerapps.microsoft.com/de-at/blog/powerapps-updates-700/> (accessed 5.23.22).

- Datamatics, n.d. RPA & AI in Insurance Case Study | Leading Insurance Company in India [WWW Document]. URL <https://www.datamatics.com/resources/case-studies/trubot-increases-productivity-for-a-leading-insurance-provider> (accessed 3.19.22a).
- Datamatics, n.d. Automation of Bank Account Opening Case Study for a Large Bank [WWW Document]. URL <https://www.datamatics.com/resources/case-studies/trubot-automates-tab-based-account-opening-for-a-large-bank> (accessed 3.19.22b).
- de Leoni, M., van der Aalst, W.M.P., Dees, M., 2016. A general process mining framework for correlating, predicting and clustering dynamic behavior based on event logs. *Information Systems* 56, 235–257.
- de Moraes, R.M., Kazan, S., de Pádua, S.I.D., Costa, A.L., 2014. An analysis of BPM lifecycles: From a literature review to a framework proposal. *Business Process Management Journal* 20, 412–432.
- de Weerd, J., Schupp, A., Vanderloock, A., Baesens, B., 2013. Process Mining for the multi-faceted analysis of business processes—A case study in a financial services organization. *Computers in Industry* 64, 57–67.
- Delgado, C., Ferreira, M., Branco, M.C., 2010. The implementation of lean Six Sigma in financial services organizations. *Journal of Manufacturing Technology Management* 21, 512–523.
- Díaz, J., López-Fernández, D., Pérez, J., González-Prieto, Á., 2021. Why are many businesses instilling a DevOps culture into their organization? *Empirical Software Engineering* 26.
- Ensslin, L., Ensslin, S.R., Dutra, A., Nunes, N.A., Reis, C., 2017. BPM governance: a literature analysis of performance evaluation. *Business Process Management Journal* 23, 71–86.
- Etemad-Sajadi, R., 2014. The influence of a virtual agent on web-users' desire to visit the company: The case of restaurant's web site. *International Journal of Quality and Reliability Management* 31, 419–434.
- Ezekiel, K., Vassilev, V., Ouazzane, K., Patel, Y., 2019. Adaptive business rules framework for workflow management. *Business Process Management Journal* 25, 1463–1514.
- Feng, D., Chen, H., 2021. A small samples training framework for deep Learning-based automatic information extraction: Case study of construction accident news reports analysis. *Advanced Engineering Informatics* 47, 101256.

- Fleischmann, A., Stary, C., 2012. Whom to talk to? A stakeholder perspective on business process development. *Universal Access in the Information Society* 11, 125–150.
- Gartner, 2021. Hyperautomation - Gartner Glossary [WWW Document].  
<https://www.gartner.com/en/information-technology/glossary/hyperautomation>.
- Gebhart, M., Giessler, P., Abeck, S., 2016. Challenges of the Digital Transformation in Software Engineering. *ISCEA 2016: The Eleventh International Conference on Software Engineering Advances* 136–141.
- Goedertier, S., Vanthienen, J., Caron, F., 2015. Declarative business process modelling: Principles and modelling languages. *Enterprise Information Systems* 9, 161–185.
- Gotthardt, M., Koivulaakso, D., Paksoy, O., Saramo, C., Martikainen, M., Lehner, O., 2020. ACRN Journal of Finance and Risk Perspectives Current State and Challenges in the Implementation of Smart Robotic Process Automation in Accounting and Auditing. *ACRN Journal of Finance and Risk Perspectives* 9, 90–102.
- Grisold, T., Mendling, J., Otto, M., vom Brocke, J., 2021. Adoption, use and management of process mining in practice. *Business Process Management Journal* 27, 369–387.
- Grisold, T., Wurm, B., Mendling, J., vom Brocke, J., 2020. Using process mining to support theorizing about change in organizations. *Proceedings of the Annual Hawaii International Conference on System Sciences 2020-January*, 5492–5501.
- Hemon, A., Lyonnet, B., Rowe, F., Fitzgerald, B., 2020. From Agile to DevOps: Smart Skills and Collaborations. *Information Systems Frontiers* 22, 927–945.
- Hofmann, P., Samp, C., Urbach, N., 2020. Robotic process automation. *Electronic Markets* 30, 99–106.
- Holz, F., Lantow, B., Fellmann, M., 2021. Towards a Content-Based Process Mining Approach in Personal Services. *Lecture Notes in Business Information Processing* 421, 62–77.
- Hyun, Y., Lee, D., Chae, U., Ko, J., Lee, J., 2021. Improvement of Business Productivity by Applying Robotic Process Automation. *Applied Sciences* 2021, Vol. 11, Page 10656 11, 10656.
- IBM, 2021a. A COO's Pocket Guide to Enterprisewide Intelligent Automation.
- IBM, 2021b. IBM Cloud Pak for Business Automation [WWW Document].  
<https://www.ibm.com/cloud/cloud-pak-for-business-automation>.
- Institute, P.M., 2021. Citizen Development : The Handbook for Creators and Change Makers 15–15.

- Javed, A., Sundrani, A., Malik, N., Prescott, S.M., 2021. Robotic Process Automation using UiPath StudioX. *Robotic Process Automation using UiPath StudioX*.
- Kahloun, F., Ayachi-Ghannouchi, S., 2020. A prototype for continuous improvement of processes and their results in the field of higher education. *Business Process Management Journal* 26, 168–190.
- Kang, S., Kim, S.K., 2021. Behavior analysis method for indoor environment based on app usage mining. *Journal of Supercomputing* 77, 7455–7475.
- Kedziora, D., Penttinen, E., 2020. Governance models for robotic process automation: The case of Nordea Bank. *Journal of Information Technology Teaching Cases* 11, 20–29.
- Kir, H., Erdogan, N., 2021. A knowledge-intensive adaptive business process management framework. *Information Systems* 95, 101639.
- Kotter, J.P., 2012. *Leading Change*. Harvard Business Review Press, Boston, Mass.
- Krämer, N.C., Lucas, G., Schmitt, L., Gratch, J., 2018. Social snacking with a virtual agent – On the interrelation of need to belong and effects of social responsiveness when interacting with artificial entities. *International Journal of Human-Computer Studies* 109, 112–121.
- Kratsch, W., Manderscheid, J., Röglinger, M., Seyfried, J., 2021. Machine Learning in Business Process Monitoring: A Comparison of Deep Learning and Classical Approaches Used for Outcome Prediction. *Business and Information Systems Engineering* 63, 261–276.
- Kuandykov, A., Kassymova, A., Uskenbayeva, R., Kalpeyeva, Z., Zhunissof, N., 2020. Model representation of business processes. *Proceedings - 2020 IEEE 22nd Conference on Business Informatics, CBI 2020* 2, 82–86.
- Langer, M., Landers, R.N., 2021. The future of artificial intelligence at work: A review on effects of decision automation and augmentation on workers targeted by algorithms and third-party observers. *Computers in Human Behavior* 123, 106878.
- Liermann, V., Stegmann, C., 2021. *The digital journey of banking and insurance. Volume II, Digitalization and machine learning*. Cham: Springer International Publishing AG.
- Lübke, D., Ahrens, M., Schneider, K., 2021. Influence of diagram layout and scrolling on understandability of BPMN processes: an eye tracking experiment with BPMN diagrams. *Information Technology and Management* 22, 99–131.
- Ludwig, S., Stegmann, C., Liermann, V., 2021. *Digitalization Strategy. The Digital Journey of Banking and Insurance, Volume I* 19–33.

- Marek, J., Blümlein, K., Wehking, C., 2021. Process Automation at Generali CEE Holding: A Journey to Digitalization. *Business Process Management Cases Vol. 2* 19–28.
- Mehbodniya, A., Alam, I., Pande, S., Neware, R., Rane, K.P., Shabaz, M., Madhavan, M.V., 2021. Financial Fraud Detection in Healthcare Using Machine Learning and Deep Learning Techniques. *Security and Communication Networks* 2021.
- Meroni, G., 2019. Artifact-Driven Business Process Monitoring. *Lecture Notes in Business Information Processing* 368.
- Mhlanga, D., 2020. Industry 4.0 in finance: the impact of artificial intelligence (ai) on digital financial inclusion. *International Journal of Financial Studies* 8, 1–14.
- Microsoft, 2021. Microsoft Power Platform [WWW Document].  
<https://powerplatform.microsoft.com/fi-fi/>.
- Mishra, K.N., Pandey, S.C., 2021. Fraud Prediction in Smart Societies Using Logistic Regression and k-fold Machine Learning Techniques. *Wireless Personal Communications* 119, 1341–1367.
- Mökander, J., Floridi, L., 2021. Ethics-Based Auditing to Develop Trustworthy AI. *Minds and Machines* 31, 323–327.
- Mökander, J., Morley, J., Taddeo, M., Floridi, L., 2021. Ethics-Based Auditing of Automated Decision-Making Systems: Nature, Scope, and Limitations. *Science and Engineering Ethics* 27.
- Mustansir, A., Shahzad, K., Malik, M.K., 2022. Towards automatic business process redesign: an NLP based approach to extract redesign suggestions. *Automated Software Engineering* 29.
- Ng, K.K.H., Chen, C.H., Lee, C.K.M., Jiao, J. (Roger), Yang, Z.X., 2021. A systematic literature review on intelligent automation: Aligning concepts from theory, practice, and future perspectives. *Advanced Engineering Informatics* 47, 101246.
- Overeem, M., Jansen, S., Mathijssen, M., 2021. API Management Maturity of Low-Code Development Platforms. *Lecture Notes in Business Information Processing* 421, 380–394.
- Panetta, K., 2020. Gartner Top Strategic Technology Trends for 2021 [WWW Document].  
<https://www.gartner.com/smarterwithgartner/gartner-top-strategic-technology-trends-for-2021>.

- Payraudeau, J.S., Marshall, A., Dencik, J., Ballou, S., 2021. The Virtual Enterprise: enterprise transformation enabled by strategic digital acceleration. *Strategy and Leadership* 49, 23–31.
- Polak, P., Nelischer, C., Guo, H., Robertson, D.C., 2020. “Intelligent” finance and treasury management: what we can expect. *AI and Society* 35, 715–726.
- Qafari, M.S., van der Aalst, W., 2020. Root Cause Analysis in Process Mining Using Structural Equation Models. *Lecture Notes in Business Information Processing* 397, 155–167.
- Quishpi, L., Carmona, J., Padró, L., 2021. Extracting Decision Models from Textual Descriptions of Processes. *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)* 12875 LNCS, 85–102.
- Ramel, D., 2015. “Citizen Developer” Movement Transforming in Enterprise, Report Says -- ADTmag [WWW Document]. URL <https://adtmag.com/articles/2015/09/29/citizen-developers-changing.aspx> (accessed 5.23.22).
- Reul, C., Christ, D., Hartelt, A., Balbach, N., Wehner, M., Springmann, U., Wick, C., Grundig, C., Büttner, A., Puppe, F., 2019. OCR4all-An open-source tool providing a (semi-)automatic OCR workflow for historical printings. *Applied Sciences (Switzerland)* 9.
- Riba, P., Goldmann, L., Terrades, O.R., Rusticus, D., Fornés, A., Lladós, J., 2022. Table detection in business document images by message passing networks. *Pattern Recognition* 127.
- Rimol, M., 2021. Gartner Forecasts Worldwide Hyperautomation-Enabling Software Market to Reach Nearly \$600 Billion by 2022 [WWW Document]. <https://www.gartner.com/en/newsroom/press-releases/2021-04-28-gartner-forecasts-worldwide-hyperautomation-enabling-software-market-to-reach-nearly-600-billion-by-2022>.
- Romão, M., Costa, J., Costa, C.J., 2019. Robotic Process Automation: A case study in the Banking Industry.
- Sallos, M.P., Yoruk, E., García-Pérez, A., 2017. A business process improvement framework for knowledge-intensive entrepreneurial ventures. *Journal of Technology Transfer* 42, 354–373.

- Santos, F., Pereira, R., Braga Vasconcelos, J., 2020. Toward robotic process automation implementation: an end-to-end perspective. *Business process management journal* 26, 405–420.
- Santoso, A., Felderer, M., 2020. Specification-driven predictive business process monitoring. *Software and Systems Modeling* 19, 1307–1343.
- Saunders, M., Lewis, P., Thornhill, A., 2016. *Research methods for business students: 7. ed.*, 7th ed. Pearson Education, Harlow.
- Shestakofsky, B., 2017. Working Algorithms: Software Automation and the Future of Work. *Work and Occupations* 44, 376–423.
- Sikdar, A., Payyazhi, J., 2014. A process model of managing organizational change during business process redesign. *Business Process Management Journal* 20, 971–978.
- Simm, J., Steiner, J., Truu, A., 2020. Verifiable Multi-Party Business Process Automation. *Lecture Notes in Business Information Processing* 397, 30–41.
- Smeets, Mario., Erhard, R., Kaussler, T., 2021. Robotic Process Automation (RPA) in the financial sector technology -- implementation -- success for decision makers and users.
- S.patil, N., Kamanavalli, S., Hiregoudar, S., Jadhav, S., Kanakraddi, S., Hiremath, N.D., 2021. Vehicle Insurance Fraud Detection System Using Robotic Process Automation and Machine Learning. 2021 International Conference on Intelligent Technologies, CONIT 2021.
- Urbach, N., Ahlemann, F., Böhmman, T., Drews, P., Brenner, W., Schaudel, F., Schü, R., 2019. The Impact of Digitalization on the IT Department. *Business & Information Systems Engineering* 61, 123–131.
- van der Aalst, W.M.P., Bichler, M., Heinzl, A., 2018. Robotic Process Automation. *Business and Information Systems Engineering* 60, 269–272.
- van der Aalst, W.M.P., van Hee, K.M., van der Werf, J.M., Verdonk, M., 2010. Auditing 2.0: Using process mining to support tomorrow's auditor. *Computer (Long Beach Calif)* 43, 90–93.
- van Dongen, B.F., de Smedt, J., di Ciccio, C., Mendling, J., 2021. Conformance checking of mixed-paradigm process models. *Information Systems* 102, 101685.
- vom Brocke, J., Baier, M.S., Schmiedel, T., Stelzl, K., Röglinger, M., Wehking, C., 2021. Context-Aware Business Process Management: Method Assessment and Selection. *Business and Information Systems Engineering* 63, 533–550.

- vom Brocke, J., Maaß, W., Buxmann, P., Maedche, A., Leimeister, J.M., Pecht, G., 2018. Future Work and Enterprise Systems. *Business and Information Systems Engineering* 60, 357–366.
- vom Brocke, J., Recker, J., Mendling, J., 2010. Value-oriented process modeling: Integrating financial perspectives into business process re-design. *Business Process Management Journal* 16, 333–356.
- vom Brocke, J., Schmiedel, T., Recker, J., Trkman, P., Mertens, W., Viaene, S., 2014. Ten principles of good business process management. *Business Process Management Journal* 20, 530–548.
- Wagner, D.N., 2020. Strategically managing the artificially intelligent firm. *Strategy and Leadership* 48, 19–25.
- Weir, L., 2019. *Enterprise API Management : Design and Deliver Valuable Business APIs*: EBSCOhost. Packt Publishing, Birmingham.
- Willcocks, L., Lacity, M., Craig, A., 2017. Robotic process automation: Strategic transformation lever for global business services? *Journal of Information Technology Teaching Cases* 7, 17–28.
- Yin, R.K., 1994. Introduction: The case study as a research strategy. *Case Study Research Design and Methods* 1–17.
- Zaman, R., Hassani, M., van Dongen, B.F., 2020. Data Minimisation as Privacy and Trust Instrument in Business Processes. *Lecture Notes in Business Information Processing* 397, 17–29.
- Zhang, N., Liu, B., 2019. Alignment of business in robotic process automation. *International Journal of Crowd Science* 3, 26–35.

## Appendix 1. Themes for interview with technological background

Overview of the participant, job role and relation to business process automation

### **Process Modelling**

The tools and ways of work related to process modelling and improvement

### **Process Mining**

Process Mining utilization and targets

Possible use cases and challenges from the organization where process mining would be useful

### **Process Monitoring**

The visibility and ways of utilization of Process Monitoring

Strengths, targets and challenges

Analysis based on monitoring, e.g. how automation has improved the process

The effect of monitoring regarding continuous development, current situation, challenges and targets

### **Co-Operation - IT and Business/ Citizen Development**

Co-Operation with Business, needs and role of CoE

Citizen Development

Daily Co-Operation for Continuous Business Process Automation Development

### **Automation Strategy**

Co-Operation and Alignment with Business

Future of Business Process Automation Technologies

## Appendix 2. Themes for interview with business background

Overview of the participant, job role and relation to business process automation

### **Business Process Automation – past and present**

Overview of the process automation journey in the business unit

Co-operation between process automation CoE and business

Visibility on possibilities of utilization and development of process automation and business' role in it

Business unit's processes and participation for process automation development and process enhancement

Process Monitoring's effect on continuous process automation development

Automation Strategy – alignment to business unit's needs and strategy

### **Future**

Needs for process automation – CoE and process automation strategy

Targets and near future of process automation in the business unit

IT and business Co-operation in the future

