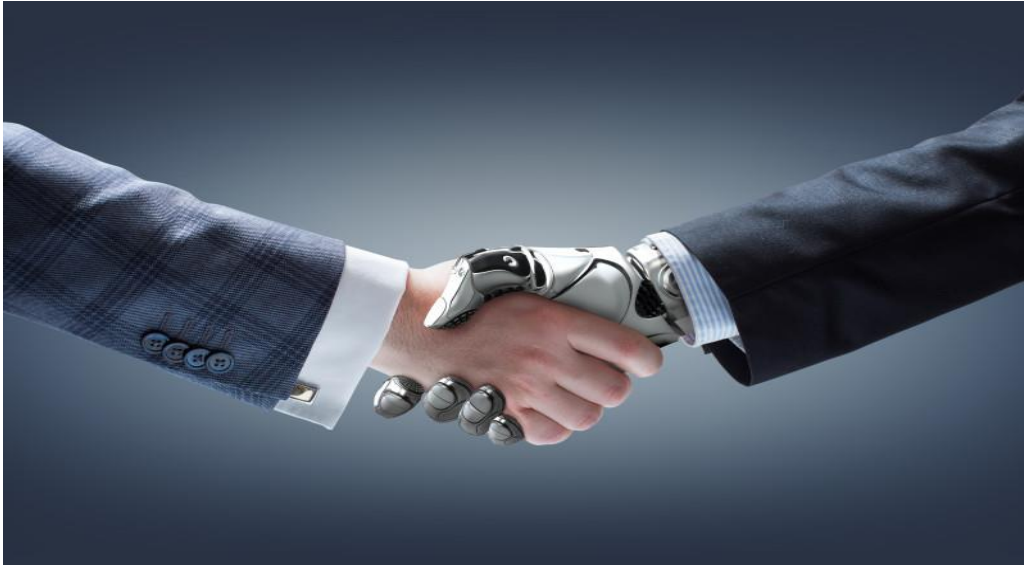**Master's Thesis**

Master of Science in Finance and Strategic Management

Implementation of intelligent automation in invoice processing: A strategic perspective of the impact on decision-making

- A case study of the Norwegian market

Supervisor: Steen Rasmussen

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Andreas Langørgen Solberg

116452

Martin Bach Olsen

116804

Preface

Choosing an academic direction is difficult in today's society, as the amount of possibilities are overwhelming. Like life in general, our choices regarding academic direction and geographical placement of these, has been object to coincidences. Our choice of topic for our master's degree and the following process are no exception. What started out as a fascination became an essential part of our everyday life for the last couple of months. The process has been both challenging and frustrating at times. However, it has also been interesting and educational way beyond what a syllabus offers.

As a chapter in our lives are coming to an end, some retrospective thoughts are difficult to avoid. Our studies have to a great extent expanded our knowledge not only academically, but also socially. It has been challenging, but in a good way. Our bachelor's course provided a general understanding of the world of economics, which has been useful in everyday life and as an academic foundation going into our master's course. Our master's course in Finance and Strategic Management provided a healthy mix of two important directions within the field of economics. Posteriori, neither of us regret the choice of applying.

Finally, there are a couple of people who deserves some extra recognition. Firstly, we want to thank lecturers and fellow students for making our studies such an unforgettable experience, both academically and socially. Secondly, our respondents deserve acknowledgment for using their valuable leisure time helping a couple of strangers. Their interesting and skilful insights represent a decisive contribution to this thesis. Thirdly, we would like to thank our supervisor, Steen Rasmussen. Through his availability he has shown a genuine interest in guiding our process. We appreciate this at least as much as the helpful advices. Lastly, and most importantly, we would like to thank our families for their support throughout the entirety of our studies. We have heard that it is not easy to see your child grow up, especially when this involves several residences across borders. However, your support has been as loyal as ever. For this we are forever grateful.

Abstract

The aim of this thesis is to look at how intelligent automation is affecting, and are likely to affect decision-making related to invoice processing in the Norwegian market. Thus, its purpose is to enlighten managers, primarily on the cost side, on aspects and challenges they are likely to face as a result of increased automation.

Our research question asks the following:

How is the trend of intelligent automation going to affect how decisions related to invoice processing are being made in the Norwegian market?

Through conducting five in-depth interviews of prominent players within the Norwegian market, and relating the findings to relevant theory, this thesis is able to identify key aspects of interest for future decision-making related to automation of invoice processing. Results show great promise toward technology being able to automate close to 100% of invoice processing. However, human's need for control alongside laws and regulations are likely to limit the development. As automation is evolving, the role of the accountant is likely to change, reshaping existing decision-making synergies. Time spent performing traditional tasks like invoice handling will decrease, while more time will be allocated toward control and decision support.

Keywords: Invoice processing, decision-making, RPA, artificial intelligence, intelligent agents.

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List of Abbreviations

AI = Artificial Intelligence

AP = Accounts Payable

AR = Artificial Reasoning

CA = Cognitive Automation

CEO = Chief Executive Officer

CFO = Chief Financial Officer

CIO = Chief Information Officer

COO = Chief Operating Officer

DL = Deep Learning

EDI = Electronic Data Interchange systems

EHF = Electronic Commerce Format (Norwegian expression)

ERP = Enterprise Resource Planning

IA = Intelligent Agent

KR = Knowledge Representation

ML = Machine Learning

NLP = Natural Language Processing

OCR = Optical Character Recognition

PSD2 = Revised Payment Service Directive

RPA = Robotic Process Automation

SMB = Small and Medium Businesses

1. Introduction

"I believe that at the end of the century the use of words and general educated opinion will have altered so much that one will be able to speak of machines thinking without expecting to be contradicted."

— **Alan Turing**

1.1 Background

Continuous development in technology creates an environment that is prone to rapid changes, and accounting and audit are by no means immune. In a study ordered by the department of knowledge in Norway aiming to map the possibilities of different professions getting replaced with computers and machines, professions linked to accounting tasks made up three of the five top spots. All of which were given a probability of above 95% of getting replaced (Pajarinen et al., 2015). The big four accounting firms refer to "intelligent automation" as the new trend. Robotic Process Automation (RPA), technology that is able to mimic human activity, is already taking part in automating the sector (Rozario and Vasarhelyi, 2018). At the same time, those working in the field of Artificial intelligence (AI) believe that AI is going to be the most disruptive technology of the next three to five years (EY, 2018a).

As scientists make major steps towards achieving intelligent automation, the future working environment changes with it. Imagine a world in which the meaning of work is totally redefined with a total focus on providing services instead of handling repetitive tasks and mundane processes. Automation is not only relevant for those into technology, it is highly relevant for managers and those working in the field of finance. Automation of certain processes will have implications for all stages of the value chain as changes in how things are done changes existing synergies. One of the most intriguing questions is how this is going to affect how decisions are being made, and furthermore the synergies between machines and humans. According to a study performed by Harvard Business Review Analytic Services on nearly 400 business leaders, both finance and decision support are among the business areas that is expected to benefit the most from intelligent automation (HBR, 2019). As new innovative solutions combining RPA and capabilities of AI is emerging, the thoughts of a changed workplace do not seem that far-fetched any more. While optical character recognition (OCR) gives RPA systems the ability to understand human language and extract information from unstructured data, machine learning (ML) and deep learning (DL) creates a foundation for system-self-learning that has not been experienced earlier. The institute of Robotic Process Automation

(2015) states that 2015 was to RPA what 1994 was to the internet. When looking at how revolutionary the internet proved to be for many sectors, who would not be fascinated by what implications extensions of RPA could have for the field of finance and management.

1.2 Scope of Thesis

Most research into the field of automation of the accounting and audit sector looks towards how automation changes the overall sector (KPMG, 2017; Rozario and Vasarhelyi, 2018; PWC, 2018). This thesis, however, will look directly into automation of invoice processing focusing on the part of the operation where the "intelligent automation" system must make decisions to become fully automated. Based on what level of automation is realistic, the thesis will have its focus on changes related to how decisions are being made in the financial department of a firm. By combining utilization of theory related to decision-making and valuable insights from interviews this thesis targets to give an understanding of how decision-making will look like after an implementation of automation in invoice processing. Research into the area is intriguing both from a "fresh out of school" point of view as well as from an "experienced accountant" point of view, as this might be the future of making financial decisions.

Invoice processing is relevant for all types of businesses. We have chosen to gather our data from development & innovation and accounting departments in prominent firms within the accounting sector. This because we believe it is reasonable to assume that this is where the development has come the furthest. Furthermore, all our research is focused on the Norwegian market. Accounting rules often differ between countries. Thus, concentrating the research towards one sole country seem reasonable. The choice of Norway was done on the basis of its standing as a highly developed country, as well as it being our home country.

1.3 Motivation

The field of study, that is the MSc in Finance and Strategic management, has its basis in a mix of quantitative and qualitative courses. To a large extent this master's course is tailored for a future within advisory services, as a key learning objective is to be able to provide support for internal decision-making and evaluate potential risks and outcomes of these decisions.

As a starting point for our thesis, we wanted to look at which trends consulting companies currently find interesting. Moreover, which topics that had a lack of research. We wanted to find a topic that could be both challenging and fascinating at the same time as the competence of our line of study was relevant and applicable. It was during the phase of applying for jobs that we initiated the search for topics. Intelligent automation related to the field of accounting and audit came up as one of the topics of most interest. This was confirmed by reading reports written by companies specializing on advisory-services (EY, 2018a; KPMG, 2017). What became clear was that smaller and more standardized processes were the first ones being automated. Hence, the choice of invoice processing.

Most of students enrolled in our study choose a quantitative approach for their master's thesis (Studentthesis.cbs.dk). However, we wanted to challenge ourselves doing something else. We had the lust to grasp the complexity of the topic using a qualitative approach. Thus, creating an environment where the strategical aspects of our study are in focus. Decision-making, rationality and change management have been a part of our studies. Hence, linking that theory to the chosen topic gave motivation for our final delimitation.

1.4 Research Question

Developing a research question represents the important final stage of topic delimitation. It provides direction in the research process and the following analysis. For us it was important to develop a research question that captured the essential parts of our thesis, namely intelligent automation, decision-making and invoice processing. At the same time, it was important to convey our position as business students. These thoughts resulted in the following research question:

How is the trend of intelligent automation going to affect how decisions related to invoice processing are being made in the Norwegian market?

In order to keep a fluent line of reasoning we developed sub questions supplementing our research question.

First, to be able to answer our research question it is important to get an understanding related to how much of the process can be automated. Thus, creating the basis for further discussion linked to decision-making. This resulted in sub question 1.

> **Sub question 1:** *To what extent is it possible for an artificial intelligent agent to make decisions related to invoice processing, thus maximizing the level of automation?*

Second, as the level of automation is mapped, the focus moves towards looking at how implementation of intelligent agents would take part in changing how decisions related to the process are being made. This resulted in sub question 2.

> **Sub question 2:** *What are the changes in decision-making synergies as a consequence of the level of automation?*

Third, a process in change can be affected by many factors that can possible limit the end result or the timeframe of a transformation. Thus, we found the need to include a sub question that lies within the topic of change management. This resulted in sub question 3.

> **Sub question 3:** *What challenges origins when automating, and to what extent will this impact the implementation of intelligent automation?*

1.5 Thesis Structure

Roughly speaking, this thesis consists of four main parts that creates the foundation for the final conclusion. The first part is methodology. In this section, our approach to data collection and how we analysed it are introduced. To a notable extent this is inspired by the work of Saunders et al. (2015), and their research onion.

The second part of the thesis concerns the literature review. Here, relevant literature from each of our main topics is presented. The majority of this chapter was developed early in the process

in order to inspire the delimitation needed for collecting relevant data. However, as the interviews were conducted, some adjustments were done due to new inputs and the need for aligning different sections of the thesis. Following this section is a section where proceedings from the interviews are presented. Rather than presenting it in whole, key quotes are presented alongside some personal comments. As these interviews represent our primary data we feel the need for a thorough presentation, hence the choice of devoting an own chapter. The choice is further backed up by our in depth focus. The final main section is the discussion of collected data. This is conducted with a focus on identifying theoretical connections.

Analysing qualitative data is not straightforward, and therefore it does not exist clear-cut rules on how it should be conducted (Bryman, 2012). As we felt that the lines between analysis and discussion were rather diffuse, we decided to not devote an own section to the analysis. Instead, this thesis analysed its data in two main steps. First, key focus areas and topics were identified through a thorough review of transcripts. This was done by looking at literature and discovering similarities and differences between interviews. The result is presented in section 4. Second, data presented was further analysed and discussed in relation to presented literature throughout the discussion.

1.6 Limitations

This thesis has some limitations that need to be addressed and reflected upon. The most evident limitation is its lack of quantitative data, which prevents the possibility of generalization. Instead it focuses more on the role of the human being, allowing for more in-depth phenomena to be explored. Thus, it captures aspects that a quantitative approach would not be able to do. An argument for why a qualitative approach is superior to a quantitative approach in our case is visualised through looking at the respondents' beliefs toward degree of automation of invoice processing. When first asked, several respondents expressed beliefs toward a fully automated process. However, when asked if that meant the need of control was not required, they all answered no. Thus, indicating that the process is likely to be in need of human interaction in foreseeable future. If this had been handled quantitatively, the need and desire for control and human interaction may not have been discovered, which in turn could have resulted in a different conclusion. Additionally, it is difficult to reach a better quality of quantitative data

than what the largest players in the market, having large amounts of resources, are able to. As a result, market indexes performed by large players are utilized.

Secondly, none of the interviews directly covers end-users, including CFOs, which could limit the ability of capturing overall thoughts in order to paint the big picture. However, as the thesis has a somewhat futuristic focus towards automation, it was more important with a focus toward players that drives automation. Furthermore, thoughts of end users were indirectly provided through interviews.

Thirdly, interviews with smaller players within the accounting sector were not conducted. In many ways this relates to both the limitations and reflections of not conducting interviews with end users. Smaller players are unlikely to have the power or influence to drive automation. Hence, the choice of not conducting interviews with such players.

One could argue that a case study of the entire Norwegian market is reaching to wide. However, as the process examined is highly standardized, we argue that it is appropriate. Furthermore, the amount of interviews might not seem sufficient for covering an entire market. This is a valid point. However, our intention is to discover developments in decision synergies as a result of automation. Therefore, we feel conducting interviews with the most prominent and influential players in the market, those who have come the furthest and are driving the development, paints a reasonable picture of the situation.

Lastly, it is needed to emphasize that predicting the future both in regards to level of automation and how this will affect decision-making in general involves uncertainty. However, as beliefs collected are from players that have expertise on the topic, one can argue that this is the best source of data available.

2. Methodology

Every science project has a goal of discovering something. In order to achieve this, you need to do research. Saunders et al. (2015) defines research as "a process that people undertake in a

systematic way in order to find out things, thereby increasing their knowledge". This definition introduces two important aspects with the research process. Firstly, it describes the need of finding out things. A project needs to find an exact purpose among the multiplicity of possible purposes (Saunders et al., 2015). Secondly, the phrase "systematic way" refers to the need for methodology when collecting data, analysing this data and realizing the limitations that follows. For our methodology section we will use Saunders et al. (2015) and their "research onion" as our main source. Thus, our structure of this chapter will resemble that of Saunders et al. The research onion is used as an analogy to showcase the different layers of methodology. Its standing as a reliable and useful tool during research processes for business students lead us to the conclusion of using this book and model.

The research question is a key part in a research process. According to Bryman (2012) a good research question is crucial, as it will guide the entire research process. In the process of developing a research question one would benefit from first finding a research topic. Saunders et al. (2015) presents two attributes of a good research topic, capability and appropriateness. The former raises questions concerned with feasibility. Writing a master thesis is a time-consuming process with extensive requirements what content is concerned. Thus, you should be certain that you will be able to complete your intended research in the timeframe given, and with a standard both your university and you can vouch for. Being personally fascinated by the topic is definitely advantageous. The latter raises questions of whether the output will be worthwhile the effort. It is important to ensure that the topic can provide enough theory and relevance to be able to fulfil the specifications and requirements set by the examining institution. Saunders et al. (2015) presses the importance of symmetrically findings. When you start a research process you do not know exactly where it will take you. Thus, choosing a topic where findings can provide value regardless of what direction it goes is advantageous.

Before focusing more on our methodological approach to this thesis, there are some aspects, or layers, of methodology that need to be introduced. This is done in order to provide a view of the big picture, which in turn justifies and clarifies our chosen approach.

2.1 Research philosophy - Layer 1

Business and management researchers do not agree what is the best research philosophy (Tsoukas and Knudsen, 2003). Thus, an overall knowledge seems necessary. When distinguishing between individual research philosophies one look at differences in the assumptions they make. Before looking closer at the five most important research philosophies from a business student's point of view, an introduction of these research assumptions seems relevant.

2.1.1 Ontology, Epistemology and Axiology

Ontology is concerned with assumptions regarding the nature of reality (Saunders et al., 2015). It describes an individual's subjective view of reality, which means factors such as culture and environment will be decisive. A business student will probably have a different view on the role of an auditor compared to a psychology student. From a master thesis point of view, these different views on reality result in different focus areas and assumptions, which in turn contributes to shaping the entire thesis.

Epistemology refers to assumptions about knowledge, what knowledge is acceptable, valid and legitimate and how knowledge can be communicated to others (Burrell and Morgan, 1979). Epistemology will naturally follow in the direction of ontology, as a person's view of reality will affect his knowledge regarding this very reality. The multidisciplinary nature of business and management results in a broad range of acceptable epistemologies (Saunders et al., 2015). On the one hand, this is advantageous as one is freer to choose desired and suited method. On the other hand, such freedom of choice demands knowledge of the different directions.

Axiology is concerned with the role of values and ethics within the research process (Saunders et al., 2015). In addition to asking questions regarding our own values, it also deals with those of our research participants. According to Heron (1996) researchers demonstrate axiological skill through being able to articulate their values as a basis for making decisions regarding what research they are conducting and how they do it. Values play an important role in achieving credible results (Saunders et al., 2015). Thus, awareness regarding one's own and other's values are essential.

2.1.2 Positivism

The research philosophy of positivism relates to the philosophical stand of natural science, which alongside social science can be viewed as the two main directions within modern science (Saunders et al., 2015; Nyeng, 2004). It can arguably be viewed as a traditional philosophy, as other philosophies have developed as a critique towards it. A positivist looks to use theory to explain measurable realities, as he believes that the world follows general rules. A typical positivistic research approach would be to go from hypotheses, through testing, and end up with a generalizable result. A main focus will be on quantifiable observations (Saunders et al., 2015).

2.1.3 Critical Realism

Critical realism focuses on explaining what we see based on the underlying structures of reality these observable events are shaped by (Saunders et al., 2015). According to Fleetwood (2005) reality is the most important philosophical consideration of a critical realist, and especially a structured and layered ontology. Their understanding of the world follows two steps. The first step is the actual events we experience. The second step is retroduction, which is a mental process of backward reasoning used to understand the reality that caused the event (Reed, 2005). Due to an overall desire to identify which deep social structures shape reality, most research is focused towards in depth historical analyses of social and organizational structures (Saunders et al., 2015).

2.1.4 Interpretivism

Interpretivism is a philosophy that lies closer to social science than the previous philosophies introduced. It developed as a critique towards positivism, and emphasise that humans are different from physical phenomena because they create meanings. Moreover, they claim that this difference result in a need for different kind of research compared to natural science (Saunders et al., 2015). As a result, the main focus of a researcher within the field of interpretivism is not to generalize, but simply to understand complex social structures. Such focus culminate in an explicitly subjectivism (Saunders et al., 2015).

2.1.5 Postmodernism

The main focus from a post modernistic point of view is language and power relations (Saunders et al., 2015). This philosophic direction also developed as a critique towards positivism. Unlike interpretivism it focuses more towards change, and claims that any sense of order is provisional and foundationless (Chia, 2003). With his focus on collectively accepted truths shaped by power relations, the post modernistic researcher's attention is towards challenging concepts and theories by looking at on-going processes (Saunders et al., 2015). Thus, in depth studies are more suited than quantitative studies.

2.1.6 Pragmatism

For a pragmatist, reality matters as practical effects of ideas, while knowledge is used in the process of enabling actions to be carried out successfully (Saunders et al., 2015). Research starts with a problem, and the ultimate goal is to contribute practical solutions that enlighten future practice. Research done by pragmatists vary in terms of how subjectivist or objectivist it is. Thus, most methods are acceptable. Moreover, as they recognize that there are different ways of interpreting the world, multiple methods are also normal (Saunders et al., 2015).

2.1.7 Our Philosophy

Identifying with one sole philosophy is difficult, especially when having a research question that focuses on both human behaviour and intelligent agents. Especially our focus on AI poses problems in defining exact methodological aspects. It is a relatively new phenomenon, which is difficult for a human being to fully grasp the entirety of. However, embracing one philosophy is not a requirement, neither is it necessarily a good idea. The research philosophies introduced represents extremities. Thus, identifying perfectly with only one is rare. At least this is our perception.

Our philosophy definitely has traces of a pragmatic philosophy as we aim to use knowledge in the process of identifying best practice. Furthermore, it also has traces of an interpretivistic philosophy and more precisely a phenomenologistic form of it. A phenomenologist focuses on existence and experience, which is in accordance with our line of focus (Saunders et al., 2015). One of our main challenges consists of understanding and defining differences between human beings and AI, thus such a philosophy seems reasonable. One could probably argue that our

philosophy also has traces to other philosophic directions. However, we feel that the pragmatic and interpretivistic directions lie closest to our world.

2.2 Approach to Theory Development - Layer 2

The second layer of the research onion describes different approaches to theory development. Saunders et al. (2015) introduces three different approaches.

Deduction is the dominant approach in natural science. The aim of the deductive approach is to discover causal relationships between variables through testing of theory (Saunders et al., 2015). A main goal from a deductive point of view is generalisation. In order to reach this goal, concepts need to be operationalized to an extent that enables it to be measured quantitatively. In order to ensure reliability, a deductive approach facilitates replication through using a structured method (Gill and Johnson, 2002). If one look at research philosophy the deductive approach, with its quantitative and natural scientific traits, has strong ties to a positivistic philosophy.

Induction in many ways represents a counterbalance to deduction. It lays closer to social science, and instead of testing theory it develops it. Induction, however, does not give the same possibilities of generalizing results. Small rather than large samples and a qualitative rather than a quantitative focus is the reason for this. Moreover, an inductive approach is more concerned with understanding a phenomenon rather than identifying causal relationships. Thus, it has ties to an interpretivistic philosophy (Saunders et al., 2015).

Abduction is the final approach introduced. It starts with an observation of what Saunders et al. (2015) defines as a 'surprising fact'. From there the goal is to develop a plausible theory of the reasons for this fact. Unlike deduction and induction, abduction is not as rigid. It moves back and forth combining the two other approaches (Suddaby, 2006).

2.2.1 Our Approach

As with the research philosophy, the approaches to theory development are not mutually exclusive. The emergence of the abductive approach is a good example of this. An interpretivistic philosophy indicates that an inductive approach would be a natural choice. In our case, this is only partly true. Although we aim to understand some kind of phenomena or process through in depth interviews with respondents in these processes, we also use prior literature and theories in order to try to identify the most likely future. The latter resembles a deductive approach.

2.3 Methodological Choice - Layer 3

When making a methodological choice there are a couple of concerns that need to be taken into account. Perhaps the most important one is what type of data you want. The main choice in this regard is the one between qualitative and quantitative data. As one peel of the layers of the onion, the inner layers to a great extent depends on what the outer layers looked like. As pointed out, a quantitative method would be suitable for a positivistic philosophy, while a qualitative approach would be better suited for an interpretivistic approach. One also has the choice of using multiple methods, both within the same categorization and a mix of the two (Saunders et al., 2015).

Furthermore, it is important to consider the relationship between primary and secondary data. For a master thesis one should include some sort of primary data. However, basing a master thesis solely on primary data is arguably somewhat farfetched. Although one has gained experience through a long educational period, there are still mountains of existing quality literature. Neglecting this would be ignorant.

2.3.1 Our Choice

When identifying most with an interpretivistic philosophy and applying a mixed approach to our theory development, the methodological choice might not seem crystal clear. However, as we try to capture something that is not directly measurable, somewhat abstract and difficult to understand, a qualitative approach feels like the correct way to go. We believe that a quantitative approach simply will not be able to cope with a problem this complex. Besides, finding enough respondents for a quantitative approach, with the required knowledge, could

have proven difficult. Thus, our choice of method is towards a mono qualitative direction. What secondary sources are concerned we will mainly be using documentary data.

2.4 Our Approach - Layer 4-6

As we have peeled of the three outer layers and defined our approach so far, we do no longer see the need for introducing every alternative approach to every layer. Choices made at an early stage to a great extent exclude certain directions. The following will therefore have a more applied approach towards structure.

For our research strategy we have chosen the case study. Denzin and Lincoln (2011) define a research strategy as "the methodological link between your philosophy and subsequent choice of methods to collect and analyse data". Thus, it is important to make the choice on the basis of one's research philosophy. Our purpose of research is to both explore and describe a process of change that is occurring. A case study can be described as an in-depth research into a phenomenon or topic within their real life settings (Yin, 2014). A classic misunderstanding with case studies is that they are only relevant for describing persons and organizations. However, as Saunders et al. (2015) says, they are also relevant for processes, and change processes in particular. The most important aspect with case studies is to understand the context of the study, as this is what separates it from other lines of study (Saunders et al., 2015). Thus, understanding invoice processing and the market maturity related to new technology is an essential part of this thesis.

For our data collection we have chosen the personal interview. The reason for this is that it is the strategy we feel match our philosophy, approach to theory development and methodological choice the best. Interview is the dominating method within qualitative research, and is well suited to get insight to a person's experience, thoughts and emotions (Thagaard, 2013). Saunders et al. (2015) introduces three types of personal interviews: in-depth interview, semi-structured interview and structured interview. Furthermore, Saunders et al. (2015) points out that an interview can provide inspiration towards finalizing one's research question. In our case this was helpful knowledge, as the process of locating the final delimitation within our topic was challenging.

When choosing amongst different types of personal interviews one need to consider what type of information one is looking for. In our case we were looking to discover existing synergies, at the same time as we wanted qualified predictions regarding likely future developments. The latter involves speculation, which makes a rigid structure difficult. Thus, our choice of interview was the semi-structured.

2.4.1 Our Semi-structured Interviews

The semi-structured interview gave us the room for the variation that we felt was necessary when conducting our interviews. According to Saunders et al. (2015) it is beneficial with such an interview when your study involves some kind of exploratory element. Furthermore, it is suitable when questions are complex or open ended. As our research question involves some extent of speculation, we felt this was a suited method for collecting data. In the following we will give a detailed description of how we conducted the entire interview process.

2.4.2 Respondents

The first step in an interview process, given that your topic is already decided, is finding respondents. Thagaard (2013) uses the definition of 'strategic selection' for describing the choice of respondents that is made as a result of strategic considerations with one's research question and theoretical perspectives. Furthermore, Thagaard (2013) presses the need for the number of respondents to be sufficient in order for the research question to be fully explored, at the same time as it needs to be feasible. In this respect, both the number of respondents and the time spent with each need to be considered. On the basis of these thoughts, we have strategically chosen to have five respondents. This is a feasible amount of respondents, which allows for a thorough analysis of each interview.

Our respondents consist of people with different backgrounds and positions, but with a common denominator of working for a prominent organization in Norway that are focused towards automation of the accounting sector. Insights from different angles allows for a more complete understanding. As our research involves some degree of speculation it was important for us to interview people with the best prerequisites to answer such questions, hence the choice of not interviewing end users. End users are less likely to play a decisive role in the development of automating invoice processing, as they to a great extent rely on advice from

consultants and accountants. Thus, we found it relevant to focus on interviewing consultants, accounting houses and developers. Consultants provide an objective view of the entire market, as they need to have knowledge about every aspect in order to provide helpful guidance to customers. Developers are the ones driving the technical development and provide innovative insights toward level of automation and future possibilities. An accounting house provides insights toward current practice and how changes are interpreted in the market, as they work closely with end users. Finally, the choice of interviewing a head of accounting is done to get insight related to how the management of an accountant department positions towards automation.

The respondents were contacted by e-mail where they were given an introduction of our studies alongside an overview of our thoughts for the thesis. Our selection of respondents was done on the basis of personal network, recommendations and research. This resulted in a total of 5 respondents, where 2 were from our own network and 3 as a result of research.

2.4.3 Before the Interview

There are several concerns to consider before conducting a personal interview. It is of utmost importance to be prepared, both mentally and academically. Our preparation consisted of two main steps. The first step was to read up on theory on how to conduct personal interviews. Main takeaways for us included types of questions and possible behavioural biases of both parties. In regard to the former, insights from Bryman (2012) lead to an increased focus towards open questions due to their exploratory and genuine nature. To avoid the latter, we focused on keeping a relatively neutral line of engagement, and avoiding leading and proposing questions (Saunders et al., 2015). However, as a human being, being completely objective is impossible. Furthermore, we also looked at Kvales's (1996) ten criteria of a successful interviewer. Despite every criterion being relevant, we found three criteria of special interest. The focus towards structuring, having a gentle approach which allows for complete answers and being critical.

The second part of our preparation involved creating questions and rehearsing the overall interview. The questions were developed through reading up on our respondents, getting some inspiration from our literature review and some underlying curiosity regarding our research question. Moreover, all respondents were provided with a list of topics for the interview, in

order for them to be able to prepare. The choice of providing the respondents with topics rather than specific questions was made on the basis of our interview method. We did not feel that a strictly structural approach would fully be able to capture the essence of our research question.

2.4.4 Topics for Questions

Drawing from our literature review, there were some topics of special interest toward exploring decision-making synergies. The literature on the technical aspects of this thesis shows a complicated environment with several sub technologies. Thus, it was important to get the respondents' thoughts on developments and present practice alongside their thoughts of the future and possible limitations. This in order to better understand and define what technology is used for invoice processing. Furthermore, this would prove helpful toward discussing the degree of rationality in relation to level of automation. Secondly, the literature regarding change management raised awareness regarding inertia. As this could have implications for technological developments, which would potentially affect roles and decision synergies, it was important to map how new systems are received in the market. Lastly, literature proved that human decision-making is complex, which lead to some curiosity regarding the ethical aspects involved with having systems make potentially decisive decisions.

2.4.5 Execution

The interviews were conducted using Skype, and each interview lasted between 45-60 minutes. All interviews were recorded using a tape-recorder. This allows for better focus from an interviewer's point of view, as all focus can be concentrated towards the interviewee. Furthermore, it allows for better information processing. The reason for using an internet-mediated form of interview was mainly due to geographical challenges. Using this form of interview could result in biases. However, as all interviews used video and there were no technical difficulties, we believe that they represent an acceptable form of data collection. Both of the researchers were present during the interviews. However, one researcher was appointed to lead, which prevents interruptions and secures a more fluent line of questioning.

Roughly speaking, all interviews followed the same procedure. In order to "warm up" they started rather softly with an introduction from both parties. From there they followed a chronological approach, starting with some historical thoughts, before describing current

trends, focus areas and limitations. Lastly, more speculative topics, like thoughts concerning the future, were discussed.

2.4.6 Information Processing

In-depth interviews produce a lot of information that often are unstructured. In order to structure the data we chose to transcribe each interview. This was done in Norwegian, as all our interviews also were done in Norwegian. After transcribing we filtered out and translated what we believe was key information from each interview, based on collected literature and relevance for further discussion. This information is introduced in section 4. Notable is that despite our best efforts of being completely objective, there is a chance that data presented could be affected by personal beliefs. This because complete objectivity is not possible for a human being.

2.5 Assessing the Quality of Our Research
2.5.1 Validity

Validity is concerned with how the actual analysis is conducted. Important questions include appropriateness with measures used, accuracy of the analysis of results and generalizability (Saunders et al., 2015). Internal validity is problematic when conducting research of a qualitative nature, as it is associated with quantitative research (Saunders et al., 2015). Proving causal relationships are much more difficult in qualitative research, neither should it necessarily be an objective. In order to understand the complexity of phenomena in qualitative research one often has to dig beyond the level of what is quantifiable. Thus, validity becomes more difficult to prove, which demands increased focus towards information processing and a thorough analysis. This is why we have chosen to be so circumstantial in our presentation of the data collected, and in defining the market and future solutions. External validity is concerned with the question of generalizability/transferability, and will be discussed below (Saunders et al., 2015).

2.5.2 Transferability

Transferability are concerned with to what extent one can generalize one's findings (Saunders et al., 2015). In terms of transferability our approach does not give us the same ability to generalize as other approaches like for instance a more deductive positivistic approach would.

Our number of respondents simply does not give us that opportunity. This lacking ability towards generalizing has traditionally been one of the main criticisms towards case studies. However, case studies as research strategy has gotten more acknowledgment in recent years (Saunders et al., 2015). Although there are limitations toward generalization, a qualitative line of research provides a valuable and deep understanding of a phenomenon or topic that a more quantitative approach would not be able to. However, working with fewer respondents demands an extra focus towards understanding the context and environment within which they exist.

We focused on finding respondents in prominent firms within our chosen industry and country. Therefore, more answers would probably have been collected had we gone beyond these limitations. However, we do not feel that these would add any value to our research. Prominent players within an industry are the ones that have the most knowledge and experience. Thus, we feel our approach toward number of respondents is justifiable.

2.5.3 Reliability

Reliability refers to consistency and the act of replicating previous work (Saunders et al., 2015). This is challenging for qualitative and unstructured research. Neither should it necessarily be a goal. Qualitative research aim to understand complex phenomena, hence focusing too much on replicating previous work could hurt this process. Consequently, our research does not rely on any previous specific study. However, numerous studies in different fields have been used as inspiration and references in our research process.

2.5.4 Research Ethics

Research ethics have been an important focus area during our research. All respondents were asked twice if recording the interview was okay, first during e-mail exchange and later at the beginning of the interview. Furthermore, they were reassured that all recordings will be deleted when the oral defence of our thesis is done. In addition, respondents were offered the possibility of validating and approving their specific parts. As we are using direct quotes from the interviews we have chosen to keep the respondents' names anonymous. This is done more as a precaution than as a requirement, as we were given clear guidelines from the respondents

concerning what information was confidential. However, we do not feel that this choice has any influence on our research process or the final result.

2.6 Summary

As a conclusion to the methodology section we have summarized some of our key choices, and included them in a customized version of Saunders et al. (2015)'s research onion. The model can be found below.
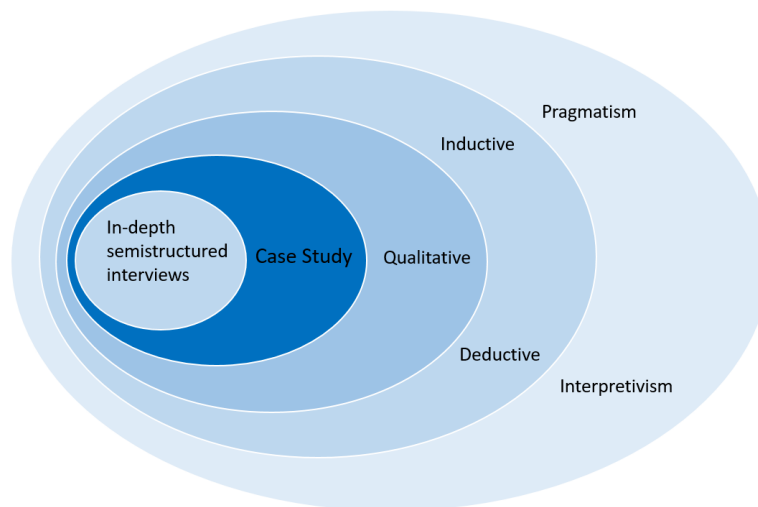
Figure 1. Modified research onion.
Based on the model of Saunders et al. (2015)

3. Literature Review

In the following we will introduce relevant theories for our thesis. There will be five main parts, which reflects the focus areas of the thesis. Firstly, an introduction of AI and its development, especially within the accounting sector, will be provided. AI represents an important part of intelligent automation. Thus, a thorough understanding of it is essential. Furthermore, we have chosen to look at invoice processing related to accounts payable. An introduction of this process will therefore be provided. Thirdly, we feel the need for including some theory regarding rationality, as this has proven to play a central part in our thesis. As our research question ultimately deals with decisions, an introduction of this is also essential. Both traditional decision theories and literature on decision making in the age of automation alongside ethical considerations, will be introduced. Introducing some aspects within change management will complete the literature review as implementing intelligent automation represents a possible change.

There are a vast number of relevant theories and thoughts in existing literature. We have to the best of our ability tried to find the most relevant theories for our thesis. In the process of finding literature we have focused on credibility and relevance. The former is achieved through finding highly cited literature from respected journals or textbooks used at universities, and cross-referencing these with other literature. In terms of relevance the focus has been toward making sure that the literature we use is up to date, especially concerning technological aspects and their advances, and that it enriches our thesis. Not all theories can be said to be directly relevant. However, we believe that an overall understanding of some topics is beneficial, and even necessary for understanding the big picture.

3.1 Artificial Intelligence

The field known as Artificial Intelligence (AI) was introduced in 1950 by the English mathematician Alan Turing. In his paper entitled "Computing Machinery and Intelligence" he asks the following question "Can machines think?" (Turing, 1950). However, the term AI was first coined by Prof. John McCarthy at the Dartmouth Conference in 1956. He defines the topic as "the science and engineering of making intelligent machines" (McCarthy, 2007).

The intelligence of humans is existentially important and trying to understand the paradigm of *how we think* has been on the agenda for thousands of years. The field of AI goes even further than trying to understand how we think, as it attempts to actually build intelligent entities (Russel and Norvig, 2010). AI researcher Ray Kurzweil (2000) defines intelligence as "the ability to use optimally limited resources – including time – to achieve goals".

As one of the youngest fields in science and engineering, AI encompasses a huge variety of subfields. As a result, there are several ways to define what it actually is. Russel and Norvig (2010) operate with four different approaches to AI. These will be introduced in the following.

3.1.1 Acting Humanly: The Turing Test Approach

"The art of creating machines that perform functions that require intelligence when performed by people." (Kurzweil, 1990)

The approach is based on the Turing Test, proposed by Alan Turing (1950). The test was designed to provide a satisfactory operational definition of intelligence. A computer passes the test if a human interrogator, after posing some written questions, cannot tell whether the written responses come from a person or from a computer (Russel and Norvig, 2010). Furthermore, to pass the test a computer would need to possess the following capabilities:

3.1.1.1 Natural Language Processing

Natural language processing (NLP) is concerned with enabling computers to understand and process human languages. NLP is one of the earliest non-numerical applications of computing and can be traced back to the post-WWII interest and research in machine translation of natural languages (Nirenburg and McShane, 2017). Initially, computers do not have the same intuition as humans do when it comes to natural language. However, language-processing applications differ from other processing systems by application of *Knowledge of language.* This is exemplified by programs with implementation of *knowledge about what it means to be a word* (Jurafsky and James, 2008).

3.1.1.2 Knowledge Representation and Automated Reasoning

Knowledge representation (KR) concerns how knowledge can be represented symbolically and thereby be a storage of information that can be manipulated in an automated way by reasoning programs later on (Brachman and Levesque, 2003). The important question is what information is needed for an agent in order to act intelligently and which computational mechanisms that are needed to make this knowledge available to the agent. As a result, instead of trying to build brains from bottom-up, AI researchers tries to build intelligent behavior from the top-down (Brachman and Levesque, 2003). Bordini et al. (2007) considers agents as systems that are situated in some environment. Agents are capable of both sensing their environment and have a repertoire of possible actions they can perform to modify their environment. This subfield of AI is heavily connected to automated reasoning (AR). Reasoning is the ability to make inferences, and AR is concerned with the building of computing systems that automate this process (Portoraro, 2001). As KR is the storage of what the computer knows or hears, AR is the part of the computer that utilizes this brain to answer questions and draw new conclusions (Russel and Norvig, 2010).

3.1.1.3 Machine Learning

To be able to solve a problem using a computer, an algorithm is needed. An algorithm is "a sequence of instructions that should be carried out to transform the input to output" (Alpaydin, 2014). For some tasks, however, there is no exact algorithm solving the problem. ML is the focus on building computing systems that autonomously improve through experience (Mitchell, 2006). ML makes the computer able to adapt to new circumstances and to detect and extrapolate patterns (Russel and Norvig, 2010). By using example data or past experience the computer is able to "learn" and can thereby solve problems that cannot be directly coded into a program. Theory of statistics is used to build mathematical models as the core task is making inference from a given data sample (Alpaydin, 2014).

A subset of ML is DL. While ML uses algorithms, DL structures multiple algorithms in layers to create an "artificial neural network" similar to the neural network of the human brain. Terrence J. Sejnowski, a pioneer in the field of DL, draws comparisons between how deep networks learn from data to how babies experience the world. They start with fresh eyes and gradually acquires the skills needed to navigate novel environments (Sejnowski, 2018). By extracting information from raw data, learning algorithms are able to create knowledge, which leads to an underlying understanding and eventually that understanding becomes wisdom. (Sejnowski, 2018)

3.1.1.4 Computer Vision

To achieve an intelligent artificial agent, it is important for the computer to have the capability of dealing with sensory inputs. "Computer vision is the construction of explicit meaningful descriptions of physical objects from images" (Ballard and Brown, 1982). The human visual system is able to create order out of chaotic visual input. The same capability is needed to become an artificial intelligent agent (IA). In other words, computer vision is the automation and integration of a wide range of processes and representations to achieve vision perception (Ballard and Brown, 1982).

3.1.1.5 Robotics

The term "robot" is often tied to artificial creatures that have a human-like appearance. However, when operating in the field of AI the term intelligent robot is often used. The American computer scientist Murphy (2000) defines an intelligent robot as "a mechanical

creature, which can function autonomously". The term "function autonomously" implies that the robot can operate, self-contained, under all reasonable conditions without requiring recourse to a human operator (Murphy, 2000).

These capabilities are at the center of the field of AI, and the Turing Test remains relevant. However, there are few researchers trying to pass the Turing Test, as there is a common belief that it is more important to study the underlying principles of intelligence rather than duplicating an exemplar (Russel and Norvig, 2010).

3.1.2 Thinking Humanly: The Cognitive Modeling Approach
"The exciting new effort to make computers think . . . machines with minds, in the full and literal sense." (Haugeland, 1985)

In 1978 Richard Bellman tried to address the question "can computers think?" (Bellman, 1978). Firstly, it is important to address the actual meaning of the word "think". Without trying to define what is meant by human thinking Bellman expressed "think" as "… a performance of activities that we associate with human thinking, activities such as decision making, problem solving, learning, creating, game playing and so on." (Bellman, 1978). As a result, AI is present in the field of cognitive science. AI-based computer models and experimental techniques from psychology are brought together to construct precise and testable theories of the human mind (Russel and Norvig, 2010).

3.1.3 Thinking Rationally: The "Laws of Thought" Approach
"The study of the computations that make it possible to perceive, reason, and act."
(Winston, 1992)

This approach has its basis in the laws of thought introduced by Aristoteles as an attempt to codify "right thinking". That is, irrefutable reasoning processes (Russel and Norvig, 2010). Aristotle's theories of syllogism, an argument of a special form in which the conclusion results of necessity from the premises given (Smith, 2000), laid the foundation for the field called logic. A syllogism is exemplified by Russel and Norvig (2010) as "Socrates is a man; all men are mortal; therefore, Socrates is mortal". During the 19th century, logicians developed a precise

notation for statements about all kinds of objects in the world and the relations among them. By 1965, this culminated in programs that could, in principle solve any solvable problem described in logical notation (Russel and Norvig, 2010). However, if no solution exists, the program would create an infinite loop. Using the thoughts of logics, the hope of scientists is to create intelligent systems by inserting the right arguments. Yet, Russel and Norvig (2010) pinpoint two main drawbacks to the approach. First, informal knowledge and knowledge that is not 100 % certain is difficult to characterize in logical notation. Second, problem solving is quite different in theory and practice. If for example a couple of hundred arguments is implemented and the computer has no starting point to reason, the computer's computational resources would be weakened and in worst case cause a shut down.

3.1.4 Acting Rationally: The Rational Agent Approach
"Computational Intelligence is the study of the design of intelligent agents."
(Poole et al., 1998)

Those who follow this approach looks directly towards the rationality of the agent involved. All computer programs have a function. However, intelligent computer agents are expected to do more. The expectation is that they can operate autonomously, perceive their environment, persist over a prolonged time period, adapt to change and create and pursue goals (Russel and Norvig, 2010). Russel and Norvig (2010) defines a rational agent as "one that act so as to achieve the best outcome or, when there is uncertainty, the best expected outcome".
The capabilities needed to pass the Turing Test is the foundation to make an agent act rationally. Moreover, the focus on making correct inferences as in the "laws of thought" approach is sometimes a part of acting rationally. Altogether, this approach goes further than the other approaches. Firstly, as correct inference is just one of several possible mechanisms for achieving rationality, this approach is more general than the thought of *thinking rationally*. Secondly, approaches based on human behavior or human thought is not as responsive to scientific development. Rationality is mathematically generalized and easier to replicate and test in the design of an IA than what human behavior and human thought is (Russel and Norvig, 2010).

3.1.5 Our Approach

Different people approach AI with different goals in mind. Russell and Norvig (2010) highlight two important questions to ask: *Are you concerned with thinking or behavior? Do you want to model humans or work from an ideal standard?*

Our approach to AI cannot be categorized by giving just one simple answer, which is the basis for including all the above-mentioned approaches. An IA supposed to fully automate invoice processing would need attributes that converge with more than one of these approaches. Nevertheless, the most general of the approaches is the *rational agent* approach, which partly includes attributes introduced in other approaches. Thus, it will be the basis for the discussion. The section of *acting humanly* explains in a more thorough way the capabilities needed to be categorized as an AI, and some of the capabilities mentioned are highly relevant for the process examined. Moreover, the process includes rule-based, repetitive tasks that will be operated by what is defined as RPAs, which combined with AI often is referred to as IAs. RPA has its basis in computational logics and comparisons can be drawn towards the *acting rationally* approach. As invoice processing proceeds to the phase of an approval, the IA would be in the need of *thinking humanly* to be able to reach the same decisions as a human accountant or CFO would have. In addition, invoice processing handles different types of tasks related to both ideal standards, the work of humans and thinking and behavior, different types of intelligence are required.

3.2 Invoice Processing

A typical corporation has an organizational structure where the board of directors led by the chairman of the board is at the top (Brigham and Houston, 2006) Furthermore, the management team does regularly consist of a chief executive officer (CEO), a chief operating officer (COO) and a chief financial officer (CFO). The CFO is the head of the finance function, the part of the organization that manages its money, and among other things has the main responsibility for the accounting system. The accounting system is crucial in order to make good decisions, as management need knowledge about true costs (Brigham and Houston, 2006). Moreover, accounting is a data-processing system that can be described as the "language of business" (Mariott, Edwards and Mellett, 2002). The accounting system records and report financial transactions done by a business to keep control, be a part of decision-making and be the basis for performance assessment (Mariott, Edwards and Mellett, 2002). Within accounting there are different departments. One of these is the accounts payable (AP) department. Within the AP

department one has an important process, the process of handling invoices. This process is what this thesis is concerned with.
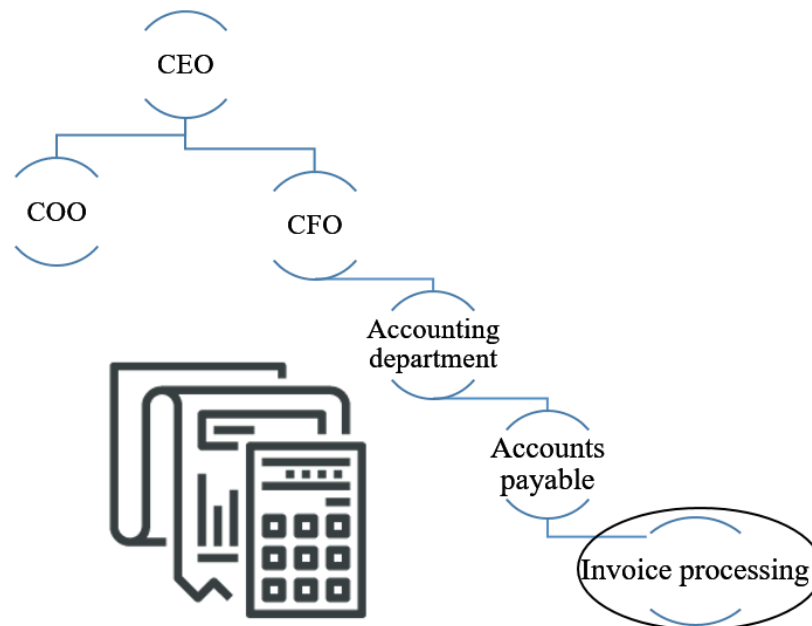
Figure 2. Chart pinpointing invoice processing.
(Self-made)

3.2.1 Invoice Handling

Normally there are three documents that govern a corporate payment: the invoice, the purchase order, and the receiving documents (Schaeffer, 2002). Invoice processing is the complete process from receiving the invoice to the payment is made. Theory on the topic will be based on the book *Essentials of Accounts Payable* (Schaeffer, 2002).

Three-way matching

Before the payment of the invoice can be sent for approval the three documents need to be compared and found a match. While the *invoice* is the actual bill, the *purchase order is* the list of goods or services ordered. The last document that must match is the *receiving document,* which states what goods that actually are received.

Approving the invoice

Businesses do typically have a system for internal control to avoid payments being executed without any approval. This can be viewed as a checklist that AP must go through before

allowing completion of the payment of goods purchased. At most companies, only certain people with the right authority can approve invoices for payment.

3.2.2 The Development of Invoice Processing

Historically, invoices were sent and received in paper format. This could be challenging as the AP clerk had to manually collect the invoice, check if it actually was an invoice and send it to the responsible person. All these tasks where tasks that had to be done before the main processing of the invoice had even started. Furthermore, the three-way match had to be done manually, and document sharing across departments was a source of inefficiency. Only when no variances were found, it could be manually typed into the accounting system. The introduction of electronic invoices was therefore a revolution for AP. Instead of receiving invoices in paper format, the normality became receiving invoices as PDF's. Furthermore, an increase in implementation of Electronic Data Interchange systems (EDI) changed how invoices were handled. In short, EDI can be described as "computer-to-computer transmission of standard business data" (Emmelhainz, 1988). These new systems allowed organizations to have a more seamless inter-connection within and across organizational boundaries (Swatman and Swatman, 1991). This led to huge easements regarding three-way matching.

3.2.2.1 Automating the process

Automation is not a completely new term regarding invoice processing. For a period of time automation has been executed by usage of different tools. This is exemplified by usage of macros in Excel. By utilizing templates and other preprogrammed functions the process became more efficient. However, the most dramatic and disruptive change in the industry has been observed during the last few years as a result of the wide exploration into the field of RPA. The IEEE (Institute of Electrical and Electronics Engineers) Standards Association defines RPA as: ''A preconfigured software instance that uses business rules and predefined activity choreography to complete the autonomous execution of a combination of processes, activities, transactions, and tasks in one or more unrelated software systems to deliver a result or service with human exception management'' (Corporate Advisory Group, 2017). In other words, RPA robots mimic and automate human tasks (Moffitt et al., 2018). RPA robots is comparable to recorded macros in excel that automate specific tasks. The main difference is that an RPA robot is able to work with any existing desktop or server software (Moffitt et al., 2018). An RPA robot work in the same way as humans do and can be configured to read emails,

open PDFs, identify salient information, enter data into Enterprise resource planning (ERP) systems and alert specific supervisors when ambiguity or errors are encountered (Moffitt et al., 2018).

Big players that are concerned with the automation of the accounting and audit sector distinguish between three types of intelligent automation, using RPA as the one with highest simplicity. KPMG labels the extension of RPA as enhanced process automation (KPMG, 2018) while EY give it the term RPA+ (EY, 2018b). The most complex solutions of the spectrum are referred to as cognitive automation (CA) (KPMG, 2018) and "Big AI" (EY, 2018b).

Enhanced Process automation/RPA+

Mid spectrum are technologies that process unstructured data, build and use repositories of knowledge and learn from experience (KPMG, 2018). In other words, RPA with some elements of AI capabilities implemented. ML and NLP are in some way combined with the abilities of RPA to mimic standardized task. OCR is able to identify and converse scanned images into recognizable data, which can be utilized by information retrieval systems for locating or editing (Gross, Neely and Sidgman, 2015). This combination allows for automation of more complex processes that are less structured, more specialized and require some human judgment (KPMG, 2018).

CA/" Big AI"

RPA deals with tasks that do not have the need for knowledge, understanding or insight - tasks that can be done by codifying rules and instructing the computer or the software to act. CA handles all the human attributes that go beyond the physical ability to do something, such as the attribute of human knowledge (McKinsey, 2016). What is defined as CA or "Big AI" is at the far end of the spectrum and includes the capabilities elaborated upon in section 3.1.1.

*"RPA and AI are highly complementary
solutions — for example, RPA can be
thought of as the oxygen that feeds
data into AI, and enacts the decisions
or insights that AI delivers."* (EY, 2018b)
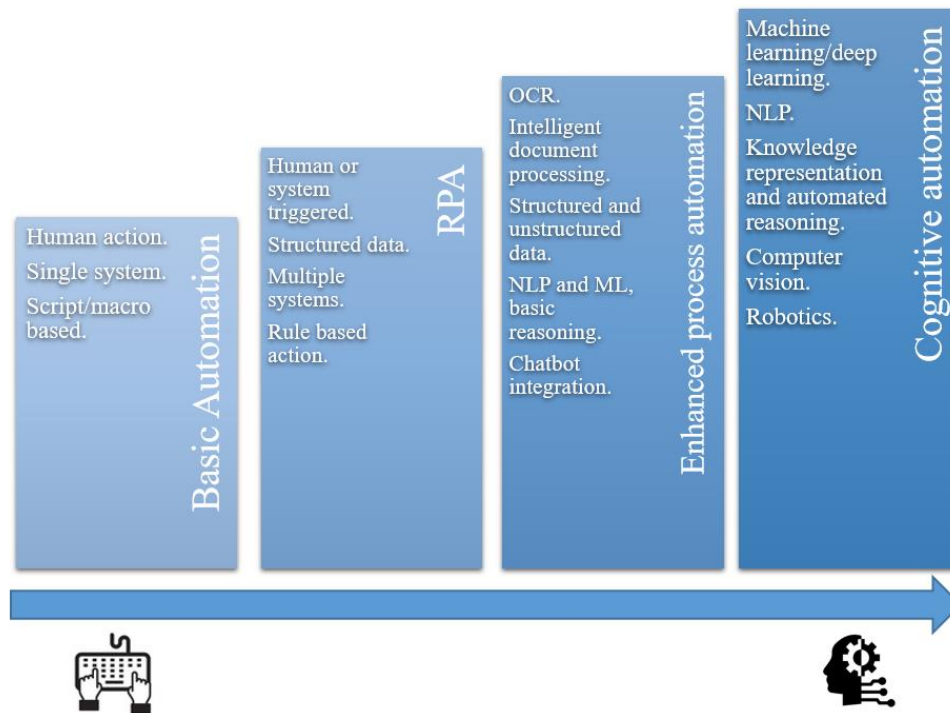
Figure 3. Development of Intelligent Automation.
Self-made model inspired by (KPMG, 2018) and (EY, 2018b)

3.3 Rationality

The question of, or degree of rationality is often used as part of the assumptions to theories and models. The degree of it varies, and it could have different meaning within different fields. We have already touched upon the field of rationality. However, given its prominent position in our thesis, we feel the need for an elaboration and focus towards our field of research.

3.3.1 Degrees of Rationality

Hendrikse (2003) operates with three degrees of rationality. Heiner (1983) defines degree of rationality as "the ratio between the cognitive capacities of the decision-maker and the complexity of the problem he or she faces". Decreasing the complexity of a problem or increasing the cognitive capacities of the decision-maker would increase the ratio (Hendrikse, 2003). When the ratio is 1, there is complete rationality. This is often used as a starting-point for the development of theories, as it is easy to understand and work with. When there is

complete rationality the decision-maker understands and solves a problem immediately without any problems or second thoughts. It is only possible for simple problems in situations where adjustments are quick (Hendrikse, 2003). Although it is often used as a starting-point for theories, complete rationality is dubious when used for describing human beings.

A more likely degree of rationality in this respect is bounded rationality. Hendrikse (2003) says this is relevant for a decision-maker when his cognitive capacities are insufficient in terms of grasping the entire complexity of a problem. In this case the ratio is somewhere between 0 and 1. When there is bounded rationality, the decision-maker cannot take all aspects of a problem into account. Limited time and means are examples of typical constraints, which cause such a lack of information.

The last degree of rationality that Hendrikse (2003) presents is procedural rationality. This is relevant when the complexity of a problem goes way beyond the cognitive capacities of the decision-maker. Thus, when the ratio is close to 0. In many ways this represents a counterpoint to complete rationality. Opposite to the environment of its counterpoint, the speed of adjustment is low. The complexity of the environment alongside the lacking cognitive capacities often result in a behaviour characterized by rule of thumb (Hendrikse, 2003).

3.3.2 Normative and Descriptive Rationality

As mentioned, the way in which rationality is defined depends on the field in which it is used. When categorizing rationality, it is normal to distinguish between normative and descriptive notions. In social sciences the notions of rationality are normative, as the main focus is towards prescribing how humans should reason (Besold and Uckelman). The field of AI has used notions of rationality as guides for developing intelligent systems and machines. These have also been given a normative function (Besold and Uckelman, 2018). Besold and Uckelman (2018) argue that this is problematic. The normative notions used in the field of AI are based on notions of human rationality. They argue that in a human context this would be descriptive, as the aim is to imitate human reasoning.

3.4 Decision Theory

With the current development in automation within the accounting sector, decision-making is likely to change in some way or another. Thus, we find it relevant to introduce some theory on the matter. The amount of literature on the subject is deterrent. Hence, our job is to identify the parts relevant for our thesis. In order to enlighten our knowledge towards the research question we will include both some general theory to secure an overall understanding, and some more specific theories that are directly tied to our topic.

Most definitions of decisions focus on the technical aspect of the actual decision. Takemura (1996; 2014) defines a decision as "the act of selecting an alternative from a group of alternatives" or simply as "a choice of action". However, Nygaard (2006) points out that decisions can be a result of routines. The latter is an interesting aspect, as accounting robots to a great extent has been used for what can be defined as routine tasks. Nygaard (2006) also says that decisions can be analysed on four different levels: individual, social group, organization and system. Furthermore, he adds the fact that a group or an organization in reality is not able to make a decision. At the end of the day only individuals are able to do so.

3.4.1 Normative and Descriptive Theories

There are two main types of theories within the field of decision-making, normative theories and descriptive theories (Takemura, 2014). Normative decision theory to a great extent uses a mathematical approach in its quest for the ultimate decisions. Through gathering all available information and using optimization it tries to rationalize the decision. Rationality is an important factor for differentiating between decision-makers (Hendrikse, 2003). Normative decision theories operate with complete rationality, which in theory means that the decision-maker possesses all relevant information of both alternatives and possible choices. In economics this is often referred to as the Economic Man.

While the normative decision theory focuses on rationality and desirable forms of decision-making, descriptive decision theories focus on describing actual decision-making (Takemura, 2014). Thus, it has an inductive attitude towards the problem at hand, unlike its rational cousin, which has a more deductive approach. Descriptive decision theory developed, to some extent, as a criticism towards rational normative decision theory. It operates with bounded rationality,

which Nygaard (2006) points out as clarifying and more realistic for human beings in contrast to complete rationality. Furthermore, it emphasises the decision process to a greater extent than the normative direction, which has its main focus on the outcome. The main theory within this direction is the bounded rational decision theory.

3.4.2 Decision-making Processes and Models:

Like decision theory in general, the amount of literature on decision-making processes and models are extensive. However, Khalil (1993) claims that most theories, in one form or another, include the same steps. According to Khalil (1993) these steps are (chronologically): setting objectives, searching for alternatives, evaluating alternatives, choosing an alternative, implementing the decision and controlling the result. According to Bommer et al. (1987) a person has to acquire and process a myriad of information at each step, thus indicating the complexity of human decision-making.
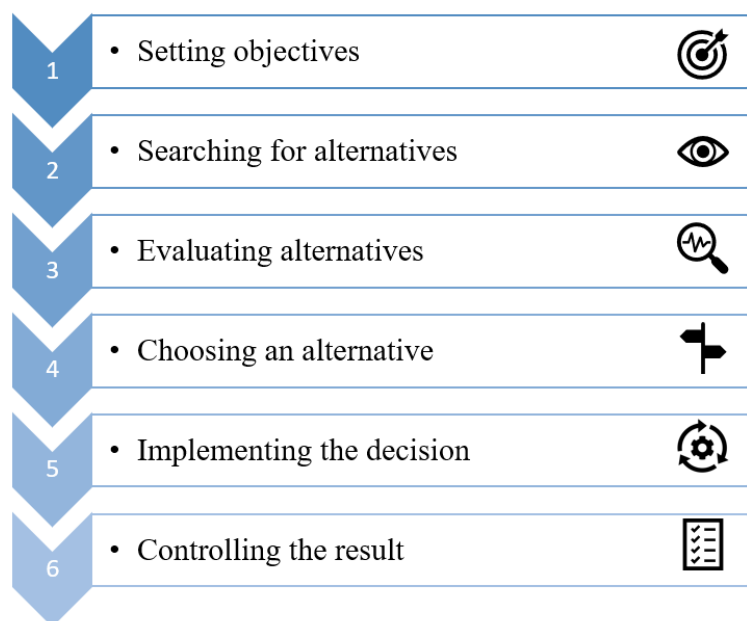
Figure 4. Steps of the decision-making process.
(Khalil, 1993)

3.4.3 Decision-making Environment

The environment in which a decision is made may influence the decision-maker. Especially the condition of the decision will play an important role. Decision theory operates with three conditions: certainty, uncertainty and risk (Merigó, 2011). A decision made under certainty is a straightforward one, which have links toward complete rationality. The decision-maker is

aware of the alternatives, what consequences each alternative involve and what their outcomes will look like. When there is uncertainty, the story is different. Here, the decision-maker is not aware of all alternatives, risks, probabilities and possible outcomes. Moreover, the information available might not always be reliable. Most decisions made on a daily basis are made in an uncertain environment. The same arguments regarding human beings' limited cognitive capacities discussed earlier are valid in this context. The last condition concerns decisions that involve risk. What separates this condition from that of uncertainty, is the reasonable knowledge regarding probabilities of outcomes that are present (Merigó, 2011).

In addition to these conditions, factors such as culture, norms and beliefs play a role in shaping the environment in which a decision is made. We will not elaborate more what this is concerned, simply state the fact that human beings, as not completely rational agents, will develop biases through merely existing in such environments.

3.4.4 Decision-making in the Age of Automation

A challenge that was highlighted during the 80's was that most expert systems were designed to provide help within a single domain of knowledge (Sheil, 1987). An expert system is a term used for knowledge-based information systems that are supposed to possess human attributes, which it uses in ethical decision-making (Khalil, 1993). This challenge, which demonstrates the limited usability of expert systems in decision-making due to inadequacy of human intelligence, is still relevant. Khalil (1993) highlighted three limitations with expert systems in his work. Firstly, the need for flexibility and human values in decision-making is a necessity, but not particularly easy to incorporate. Secondly, the lacking ability of deep reasoning gave rise to challenges. Lastly, the systems were unable to learn from their mistakes. Significant progress has been made since then, considering the introduction of self- learning IA's with basis in ML. However, as a result of the complex nature of human decision-making, most computational models on the matter are still rather simplistic (Sun, 2007). Decision-making, even for standardized tasks, is not homogenous (Khalil, 1993). Thus, the technology needed for developing artificial decision-making systems of a desired complexity is immense.

The way in which systems historically made decisions was highly mathematical. In short, the principles behind how computers make decisions are based on optimizing an equation given.

When given a puzzle, a computer would use iteration over a recursive algorithm to check all possible solutions, and thereby reach a solution (Bellman, 1978).

As for the decision-making structure, Klatzky (1970) found that early theories on the matter proposed that automation leads to increased centralization of decision-making authority because automation speeds up and simplifies processing of information. Such shift in decision-making structure results in increased responsibility for decision-makers, as decisions made will be of increased importance and magnitude.

3.4.5 Ethical Decision-making

Making decisions are often accompanied by ethical considerations. Taylor (1975) viewed ethics as "inquiry into the nature and grounds of morality where the term morality is taken to mean moral judgements, standards and rules of conduct". Making ethical decisions can be relatively easy as long as all relevant facts are known and the choices are black and white (Khalil, 1993). However, this is often not the case. The increasing use of automation gives rise to new ethical considerations. Are robots really suited to make decisions that will affect human beings?

Khalil (1993) presented four attributes that AI need to possess in order to make a valid moral judgement:

Knowledge of all relevant facts

In-biasedness

Freedom from disturbing passion

Ability to vividly imagine the feelings and circumstances of the parties involved
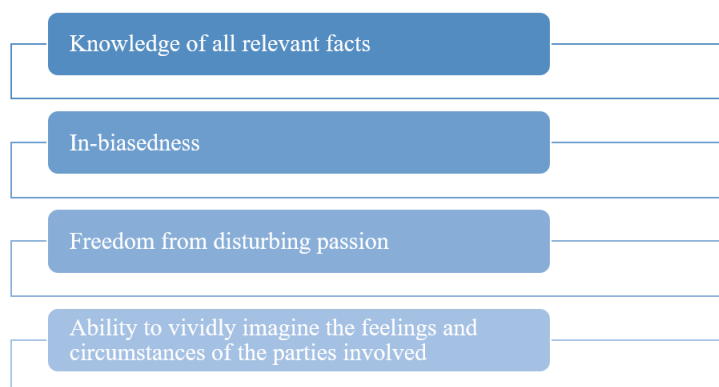
Figure 5. Attributes needed to make a valid moral judgement.
(Khalil, 1993)

According to the study AI is fulfilling the three first conditions, but not the last. Due to the lacking ability of understanding emotions the study concludes that AI should only be used in an advising capacity. Furthermore, managers should not relieve themselves of legal and ethical responsibility when using such systems for decision-making (Khalil, 1993).

Millar (2016) also presses the need for ethical considerations, as automation is progressing continuously. He introduces his concern that "automating ethical decision-making can pose a threat to a user's moral autonomy" (Millar, 2015). As a result of his concern, he introduces five general ethical considerations, which he believes should be taken into account when developing automated forms of ethical decision-making. Firstly, it should be proportional in its approach, meaning that it has a suitable balance between the needs of users and those of designers. Secondly, it should be user-centred. That is, a sufficient weight should be given to the user's perspective. Thirdly, it should acknowledge and accept the psychology of user-robot relationships. It is in human nature to attribute emotional or cognitive states to a robot in order to rationalize its existence and behaviour (Millar, 2016). Thus, such concerns should be made when developing automated forms of ethical decision-making. Fourthly, Millar (2016) believes that such a tool should help designers satisfy the principles of the human-robotics interaction (HRI) code of ethics. Such codes concerns rules for interaction between robots and humans, and often include rules such as "the emotional needs of humans are always to be respected" (Riek and Howard, 2014). Lastly, Millar (2016) believes that this tool should help designers distinguish between unacceptable and acceptable design features.

3.5 Change Management

Technology raises the need for change, which demands action from organizations. These changes often involve changes in decision-making structures. Motivation for change can vary, but a common denominator is often money. Thus, from a resource perspective it is easier for well-established organizations to adapt to technological changes. On the other side, well-established organizations could have bigger difficulties restructuring and adapting to change, as they often have more complex structures. Independent of organization size, it is important to identify what type of technological change one faces. Some types are more challenging than others.

3.5.1 Types of Technological Change

According to Grant (2016) there are three types of technological change that are especially challenging for an organization. Firstly, Grant (2016) distinguishes between competence enhancing and competence destroying technological change. Tushman and Anderson (1986) differentiate the two by looking at how technological change affects an organization's resources and capabilities. While the former preserves, and even strengthens existing resources and capabilities, the latter undermines it (Tushman and Anderson, 1986).

The second distinction Grant (2016) makes is between architectural innovation and component innovation, and deals with at what level change is required. Change at an architectural level demands substantial alteration to the overall architecture of a product. Thus, it could be extremely challenging, as such change requires reconfigurations to strategy and systems (Henderson and Clark, 1990). Change at a component level on the other hand, does not require the same extensive changes.

Finally, Grant (2016) distinguishes between disruptive technologies and sustaining technologies. Bower and Christensen (1995) distinguish between the two by looking at how they affect performance attributes. When it augments existing performance attributes new technology is sustaining, and when it incorporates other performance attributes than the existing technology it is disruptive (Bower and Christensen, 1995).

3.5.2 Strategy and the Decision to Change

Having a strategy that is open for change is important both in regard to implementation and for creating awareness regarding the need to change, which could make change run more fluent. Furthermore, strategy is an important factor in decision-making. Grant (2016) describes strategy as "a pattern or theme that gives coherence to decisions of an individual or organizations". In other words, it works as a kind of support to decision-making, which will be decisive in regard to the decision to change. Grant (2016) argues for his stand through introducing three factors for how strategy improves decision-making. First, it simplifies decision-making by reducing the range of alternatives and acts as heuristic. Second, the making of strategy takes knowledge from different individuals into account. Thus, allowing for

cooperation and optimization. Last, it facilitates the use of different analytical tools (Grant, 2016).

3.5.3 Inertia

Changing and adapting are one of the most challenging actions for both an individual and an organization due to our built-in inertia. It is traditionally defined as "the inability to enact internal change in the face of significant external change" (van der Steen, 2009). A useful distinction when discussing inertia is the one between resource rigidity and routine rigidity (Gilbert, 2005). The former is related to path-dependency and technological rigidities. It is often a result of external resource providers or that the choice of technology automatically excludes other technology (van der Steen, 2009). The latter is concerned with routines and their effect on organizational thinking. Tripsas and Gavetti (2009) argue that routines are not suitable for dealing with discontinuities as they represent such a significant part of organizational thinking. Moreover, routines are found to be inert (Nelson and Winter, 1982; Becker, 2005). Accounting tasks, including invoice handling, is generally viewed as routine tasks. Thus, it is subject to risks toward inertia.

Grant (2016) introduces five barriers related to change for organizations. Firstly, he points at challenges regarding well-incorporated organizational routines. These can be a result of continuous repetition through many years. Thus, trying to change them could face resistance. Some of the same arguments are used to explain the second challenge. An organization is both a social and political system with its own unique pattern of interaction. Changing this, especially if it affects persons that have obtained positions of authority, will be stressful and disruptive (Hannan et al., 2002). Thirdly, Grant (2016) addresses the challenge related to conformity. Organizations tend to imitate each other's structures, resulting in common structures that are difficult to change. The fourth challenge relates to limited search when conducting a process of change. The Carnegie School of Organizational theory views *search* as the most important driver for organizational change (Grant, 2016). In this respect, the bounded rationality of humans represents challenges. Limited information and the capacity to process this, result in an incomplete set of possible choices. In turn, this results in sub optimal outcomes and decisions. Lastly, Grant (2016) emphasises the need for aligning structures and systems to strategy. It should all be connected. Thus, implementing new technological

capabilities raises the need for evaluating current structures, including decision-making structures.

There are several measures possible for reducing the effects of inertia. Awareness is important as a starting point. Furthermore, one needs to shift the attention of employees from the on-going changes to something else. This could be toward special initiatives or specific targets, or by creating perceptions of crisis (Grant, 2016). More structural measures like reorganization and new leadership could also be a solution (Grant, 2016).

3.6 Literature Summary

The literature review has provided an overview of topics of relevance when looking at decision synergies related to automation of invoice processing. At first glance it may seem like some theory is excess. However, as were stated in the introduction, we feel that an overall understanding is advantageous toward understanding the big picture.

Establishing our approach to AI was difficult due to the complex nature of the new emerging technology. However, as was argued for in section 3.1.5, the rational agent approach is found to be the most fitting for our research. Hence, this approach is emphasized throughout the entirety of the thesis. Furthermore, the literature review continued by introducing invoice processing and some of the focus areas towards including AI in it. Figure 3 provides useful insight toward understanding the connection between AI and automation in invoice processing.

The next two topics introduced in the literature review are rationality and decision theory. These topics are somewhat complementary, but for the sake of simplicity they are divided into individual sections. Main focus in terms of rationality is put on different degrees of rationality, which in turn affects decision-making. As decision-making represents the core of this thesis, the theory introduced on the matter reaches broader than other topics. In addition to general theory this section also include both ethical and environmental aspects of decision-making.

The final section of the literature review is devoted to an introduction of change management. As it is pretty evident that changes will be needed, we felt this was necessary. Main focus is put on introducing different aspects of technological change, as this is what drives automation of invoice handling. Establishing what type of technological change one is facing will be a key factor in the discussion.

Theory introduced is to a notable extent used as a point of reference when analysing data from interviews. The way this thesis is structured relies on discovering connections or differences between theory and primary data collected from in depth semi-structured interviews. The latter is processed and introduced in section 4. Finally, it is these findings that will be used to draw the final conclusions.

3.7 Structure of Analysis

Throughout the development of the literature review and the gathering of data through interviews, a deeper understanding of the situation is made. A tool to be able to give the best possible analysis of data collected is needed. As a result, a framework for analyses related to implementation of automation to a process is developed. It reflects what we, through the working process, believe to be the most efficient way to analyse the situation. This framework will be the basis for the discussion in section 5. As there are no data related to the framework it is needed to emphasize that the framework is not generalizable. However, a proposal is that it would work for other similar situations.
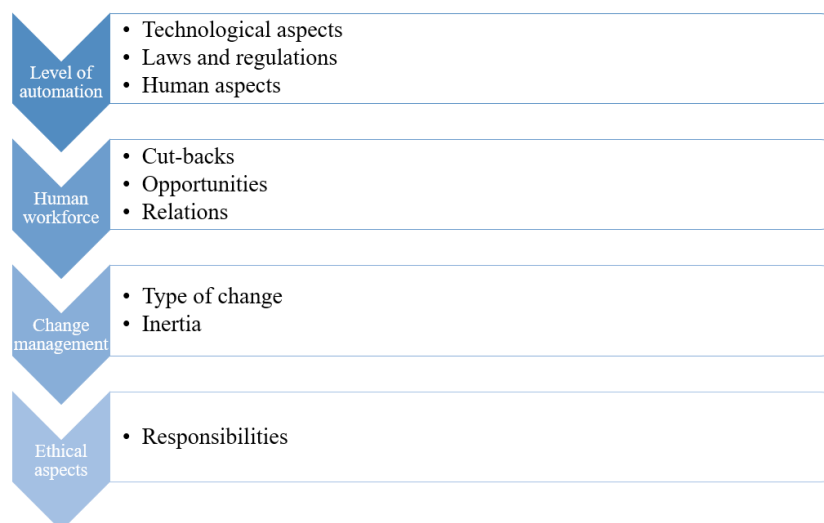

Figure 6. Self-made framework for analysis

There are many different angles of approaching a research question. What has become clear is the need for establishing a differentiation of rationality between humans and IAs before we can look at other aspects that will follow as a result of automation. The degree of rationality is a crucial factor in understanding decision-making, both in regard to cognitive capacities and environment. Thus, this will work as a starting point for the discussion in section 5.

Notable is that despite the interview-section being a part of the analysis it is organized in a different way. The reason for this is mainly because of a desire to secure a fluent and logical flow throughout interviews. We do not believe this affects the overall outcome, as this layout still covers the same topics.

4. Data Collection

4.1 Interviews

Since interviews are the main source of knowledge of this master thesis, each interview has been devoted a separate section. The insights presented are what we believe to be key data for our discussion. Strategically, we have chosen interview objects with different relation to the process we examine. This is done in order to get valuable insights from different points of view. Respondents were given information regarding some intended topics and questions beforehand. However, as our intention was to capture personal beliefs as well as company beliefs, some information was intentionally held back in order to avoid predetermined answers. The following presents the interviews and what we believe to be key takeaways from them. Additionally, main take-aways from each interview are presented in figure 7 utilizing the framework for analysis. Figure 7 gives an overview related to findings, and support the following discussion.

For the sake of simplicity, each interview is divided into four main parts, which reflects key themes during the interviews. These are: Present, Future, Limitations and Ethical aspects.

4.1.1 Interview 1 – Supplier of an Accounting Robot

Respondent number one is the sales director of Bilagos, a supplier of an accounting robot. Their new technology is among the most innovative technologies in the market. A supplier could

give us insight on how far the technology has come, what is expected and the perception of their product from the market.

Present situation

The respondent could tell us that there by all means is a market under huge growth:

> *We experience huge growth. When I entered the company in October 2017, approximately 1.5 years ago we had around 30 employees in Kristiansand, Oslo and India. Now we are around 70.*

Their robot is one of the most innovative solutions within the field of invoice processing and can be used as a standard for how far the automation has come:

> *Semine is a platform that consists of several technologies. It consists of rule-based validation, advanced OCR interpretation and different kinds of AI motors… What we automate is in great part all the steps that have to be done until it is ready in the accounting system.*

As the field of AI has proven to include a vast number of sub fields it was interesting to hear the respondent's thoughts on the matter. When asked if it is the AI part that differs their solution from other RPA solutions that have been offered earlier on, the respondent gives insight on the importance of good data:

> *What we do, as others can't, is securing correct data extraction… correct data is the most important foundation for further automation. If one has a bad data foundation, no matter if one use rules or AI, it is difficult to make it work… If AI learns from bad input, the output becomes bad. Shit in, shit out.*

The interview object underlines that AI at this point of time is dependent on humans:

> *AI is in a phase where it can do a lot, but humans must still give the AI input in form of a direction. When given a direction the AI can validate from that data and after a while do more… AI does not get better than the input it gets. The*

> *human intervention will in great parts be about giving the system good input so that the system gets good at the right things.*

If good data is the case, the respondent elaborate upon the benefits of using automation related to decision-making:

> *A machine works 24/7, which is one of the benefits of using technology. All data and everything that is being processed become available at an earlier point of time and decisions based on that data can be made faster. In the same way, errors etc. are discovered in an early phase. Everything becomes available almost instantaneously, unlike what might have taken 1-2 weeks to process earlier... When talking about decision-making, the decision regarding how the invoice should be posted into the system is not the only focus. Data availability is a source of information and could have implications for how other decisions are being made. Additionally, if one has the same available data regarding the income side of the business, a more detailed picture could be painted. Data can be used rationally and could result in quicker actions and furthermore lead to a better cost management etc.*

To collect data on how relevant automation is in the market, the respondent is asked how the market has responded to their product. This is interesting both in terms of maturity of the market and willingness to change:

> *Very good. It is repetitive work, boring work. No one finds this kind of tasks interesting. Every solution that can eliminate this part of their workload so that they can focus on other stuff is top notch. We know that they like the product and a lot of them want to be a part of it. They have waited for this for a long time, as one has spoken about this in the last 5-10 years, and finally one can see it being implemented. One is beginning to see some effects. I definitively believe that the market is mature, that is our perception at least. However, we are aware that they still want to have quality checks and controls.*

In order to set the scene for answering the research question, it is important to map to what extent invoice processing can be automated. Thus, a developers thoughts on whether it is possible to automate the step of human approval if input is structured in a sufficient way is interesting:

> *In an organization they usually have their own way of doing accounting and any deviations from company accounting principles have to be approved by the top management or board of directors. However, it is possible that a lot of the incoming invoices can be fully automated. For example, payment of rent for housing... As long as there are no deviations to important terms, one can approve without the involvement of humans. It is fully automated, and it is possible to do that.*

Moreover, the respondent confirms that interaction between their solution and the process of the actual payment is possible indicating that a fully automated end-to-end process is realistic:

> *Our system is responsible for the accounting, we check everything against the ERP system and post it into the accounting system, but accounting has its own process regarding payment. The payment process is situated in the ERP system, not in the front system. In theory, integrations using a trigger solution between the two systems can be made.*

Future predictions

When talking about the future the respondent has thoughts, both about the future related to how the system can evolve and how the finance function, including decision-making synergies, will change as a result of further automation. This is useful information in terms of predicting future roles for the accountant that could affect decision-making synergies.

Related to the system

The respondent explains that systems can be connected to external registers and other supporting data sources. Invoices should be posted according to accounting principles and contents of the invoice. Furthermore, a cooperating portal between supplier and receiver to secure correct data input given on the invoice is a possibility:

> *It is all about trusting the system… I believe that if we see 5-6 years into the future a lot would be changed. I believe that maybe 20% of all invoices still will have some principal controls, but that the rest of them will go directly through the system.*

Changes in the finance function

The overall finance function:

> *The future finance function will be a lot smaller, no doubt. And the employees will be much more analytical and strategic. There would be a need for persons that can understand accounting in combination with data and furthermore how it affects other parts of the organization. Moreover, people needed are people that are able to see how data can be used actively to continuously improve both financial and other aspects.*

The traditional accountant:

> *The traditional accountant will not look alike. There is going to be an accountant present in some form. However, they are going to have different tasks, and more in the direction of looking at how finance, technology and accounting interacts to create value instead of having a sole focus on posting transactional data as they are currently doing.*

An observed trend:

> *Companies have already started to hire differently to the finance function than what they did earlier. Controllers have suddenly gotten much more to do. The task is no longer only about being a control function, it is an important part of doing analyses. It can be viewed as strategic controlling and a part of the business' cost management.*

Limitations for automation

Although being quite positive regarding the future of automation, the respondent sees some limitations. The respondent gives an example related to the Norwegian market. The market is characterized by a lot of small firms, and some of them are not using modern systems related

to their receipts. Invoices in form of a handwritten note given by hand would create problems related to automation. Moreover, an IA would need training based on historical data before being able to handle an invoice:

> *I believe that it is far into the future that the first invoice one gets from a new supplier is getting fully automated…it will always be a need for some sort of deviation handling. You would never reach 100% automation. I do not believe so.*

Ethical aspects of future AI solutions

To get an understanding of how a supplier handles the responsibility of allowing a robot with some AI characteristics to make decisions that could affect the customer, the respondent is confronted with the ethical aspects of the case:

> *We deliver a system that tries as best as possible to calculate different probabilities. However, our system never states that something is 100% secure, no system does that. Speaking about technology, a bulletproof technology does not exist… High quality is strength. What we can see is that the quality is higher when technology does the task than when humans does the task…as long as the system outperforms the alternative it is acceptable with some minor mistakes.*

Lastly, the respondent was further challenged on reflecting upon who should be responsible for decisions made by systems:

> *An accountant has a responsibility toward punching correct numbers as he has always had. Nothing changes in that respect. It is management who decides whether or not there shall be conducted quality checks or guidelines related to AI. Thus, I feel a greater proportion of the responsibility rests upon management rather than accountants.*

Summary interview 1

The interview gave insight on how far technology has come, what is believed to be possible and some future predictions. Key takeaways are that it is realistic from a technological point of view that invoice processing can be fully automated. However, it should be mentioned that

a 100% automated process requires a perfect system, which is hard to accomplish. The respondent believes that the need for some deviation handling always would be the case. Furthermore, automation will have impact on decision-making by giving real time suggestions and analytics, which will have implications for the future role of the accountant. A smaller finance function with more strategic and analytical employees is predicted.

4.1.2 Interview 2 – Accounting Firm

The person interviewed is a director of innovation & market for one of the largest accounting companies in Norway, Sparebank1 Regnskapshuset SMN. They represent the "traditional" player in the market and can give insight on how they approach automation and changes that comes with it. Furthermore, they work closely with end-users, which means that they could provide valuable insight into their perception of the ongoing changes.

Present situation

As an introduction the respondent provides some thoughts regarding what solutions exists in the market, the development and how that is connected to an automated function:

> *What is new in the accounting field is the cloud-based solutions available online similar to Dropbox etc. These solutions are easy to get, and software developers have been good at making it easy for the end-user.*

> *…Cloud systems where the accounting system can suggest posting of vouchers automatically based on what has been done earlier in addition to performing other analyses… A lot of it is related to consent from the end-user. As long as one get large amounts of data, which one get in the cloud solutions, one can do a lot of statistical analyses. This is the foundation for automation. A lot of people call it Artificial intelligence, but basically it is statistics leading to a suggestion of action. It is a positive trend, but it is a challenge for us in the field of accounting concerning our business has its basis in "punching" this. It challenges our bread of living, resulting in the need of thinking differently.*

The respondent could tell that they have grown in size as a result of acquisitions, mostly by acquiring SMBs. When asked what attitude those companies have to the increasing digitalization and automation the respondent could tell that:

> *They fear the future and see that they cannot make it on their own. They want to be a part of a company that still wants to focus on local shops, so that their workplace is kept. At the same time, it is an opportunity to think future together.*

Future predictions

The respondent has already noticed some shifts related to new solutions entering the market that could have implications for decision-making structure:

> *I believe that the end-user to a larger degree wants to be a part of the accounting process, which challenges our role in the market… I see a clear trend that more customers want to have live insights into their accounts, resulting in more control of their own economy than what they have had earlier.*

However, the respondent states that these changes do not happen overnight and that a lot of their customers still are very "traditional". In other words, satisfied with the old school accountant service. Moreover, current systems do often require an understanding of how accounting works in order for them to be useful:

> *What we challenge software suppliers on is related to thinking about the accountant's role. A lot of end-user systems experience high churn, mostly because people actually need the insights of an accountant. I hope and believe systems that make the accountant good is something that we will see in the future… The practice of accounting will not change. However, I believe that the content will be more in the direction of a controller-role where one must contribute with understanding and insight into the numbers rather than posting vouchers as traditionally done.*

The respondent gives some general thoughts regarding what implications automation would have for the traditional player in the Norwegian market, which is interesting in terms of changing roles:

> *I believe that we definitely must be able to produce more financial statements per employee than what we do today. This is because the customers react to prices. Available systems so cheap and easy that you can almost do it yourself push the*

> *price down. This is one of our biggest challenges… After the transition from traditional T-accounts to the use of computer-based systems we had to adapt by producing more financial statements per employee. The same will happen now because of automation, but to a larger degree.*

The respondent underlines that even though automation is going to be a larger part of the business they will still have use for as many employees. They would rather look towards new ways of doing business:

> *Given the trends (above), we need to look towards new ways of doing business… We look towards ways of expanding the business given that it relates to our core business. The focus is on financial management and working as a consultant to the customers' administrative functions.*

When asked about who makes decisions related to the process examined, the respondent gives insight on what is typically seen in the Norwegian market:

> *I think it depends on what type of company one talks about. In the SMB market, the market we work the most with, one can often see that the CEO is both the CFO and the controller. We are hired to cover the role that is directly underneath the CFO. The expectation is that we should come up with advice in forms of suggestions. However, I think that the founders, there are a lot of family companies in Norway, I think they will resist giving up the authority of decision making to someone else when it is going to affect their wallet. I believe that the need for control related to decisions is a part of the Norwegian culture. On the basis of how decisions are being made at the moment, I believe that if you create the trust needed in the system some decision-making authority can be given to systems. However, I think that most people would want to make decisions that would have the biggest impact on the business themselves.*

Moreover, the respondent explains that the bigger a company grows, the harder it is for the top management to keep control. Good analyses and a well-functioning control function are crucial to reach the right decisions.

To be able to fully automate invoice processing the IA would need to have some sort of human judgement including decision-making capabilities, which according to literature has proven to be complex. The respondent elaborates upon the possibilities of an IA achieving the capabilities of human judgement needed of an accountant:

> *I believe so. It is a question of time. If one take a look at the Watson examples in the field of medicine it seems reasonable to believe that it is possible to develop a form of human judgement. These examples shows that a robot can teach itself to walk by only having the input that one must put one foot in front of the other. The robot must itself figure out the point of balance and that sort of things. Looking at that I believe that someone in the future could be able to create human understanding. What I believe is the most difficult related to this is the accessibility of data.*

One of the effects of automation could be lost control, but also high rewards related to efficiency and cost savings. The respondent gives his thoughts about the market and how they approach the implementation of new solutions:

> *The market works in such a way that it is better for us to milk the industry. A lot of the traditional accounting firms are doing that right now. An on-premise solution where the customers buy hour for hour is definitely the best model for us. The transition towards cloud-based solutions where the customers can do more by themselves is less profit for us. This is one of the drivers for not implementing new solutions early on. It is challenging for us, so what we do is letting the responsibility for the transformation be on the customers premise.*

Limitations for automation

Even if the belief is that AI can develop some sort of human judgement this is mentioned as one of the main limitations of the current and future of automation:

> *It has been shown at seminars and other types of conferences that invoices should have been posted on other accounts than what have been suggested by some of the newest solutions… Accounting contains a lot of human judgment. This implicates that AI sometime along the road must make a decision, because it cannot only look at historical data. Someone must train the AI by giving it the right input. It is going to be quite a demanding journey.*

Ethical aspects of future AI solutions

The respondent relates the aspects of this case to the case of self-driving cars. However, he underlines that the consequences of this process are not as brutal:

> *I find it interesting. One can see examples where statistics are making mistakes. For the smallest firms this could have large consequences… I think a lot of company owners have a hard time letting a system do the accounting without supervision. I cannot really see that yet. I believe that humans want to have some sort of control, and have the need to verify that the computer systems are doing things correctly.*

Lastly, the respondent is asked to reflect upon responsibility related to systems making decisions rather than humans:

> *At the end of the day my impression is that managers feel most responsibility. However, they still expect us to feel some responsibility as well. This is challenging for us from a cultural perspective. Several employees experience too much of this responsibility, which results in them picking the customer's side. This is a problem as our job is to be objective.*

Summary interview 2

Key takeaways from the accountant's point of view are that they focus on solutions making the accountant better rather than solutions replacing them. They are totally aware that automation can challenge their bread of living and do constantly have a focus on finding new business related to their core business. Thus, affecting present decision-making synergies of finance departments. SMBs do more often look towards being acquired by larger companies as a result of the fear against modern systems making them redundant. However, the market is still moving in a slow pace and the traditional accounting firms are not going to be the ones initiating automation, as their present business model is the most profitable. Moreover, insight into how Norwegian culture could affect how far automation of processes related to decisions can reach is given.

4.1.3 Interview 3 – Digital Consultant

The respondent is a director at PriceWaterhouseCoopers (PwC) with many years of experience within the field of ERP-systems and invoice optimization. It is crucial for consultants to be updated on current trends and possibilities and their ripple effects. Thus, insights from a consultants' perspective provide valuable insights for our research.

Present situation

When asked about the historical development of invoice processing, the respondent emphasises an important development:

> *About 10 years ago, large companies started automating the approval of invoices below a certain amount. If it were below that amount it would go through automatically without any human witnessing it.*

When focusing on more present focus areas, the respondent gave some thoughts regarding RPA:

> *What they do additionally (RPA), now we are talking about the long tail, is that they are able to increase automation in the moment of approval. That is the next bottleneck.*

> *What is becoming more normal is approval at the time of need. If you are in need of something you make a request in the system and get a request from a leader. Then when the order arrives someone needs to receive it. A secretary etc. does this. If the invoice matches the order and are within given restrictions it will go directly through. There are great opportunities of saving money by doing this… The purchasing manager increases his power.*

The principle of four eyes was mentioned. In this regard, the respondent had extra focus towards public sector, as the discussion involved examples from a real-life case for implementing a new ERP system in public sector:

> *One of the things we saw was that where you some places have automatic approval of an invoice, one is not able to have the same in public sector due to the principle of four eyes. First it needs an approval from the person that made the order, and then you need an additional approval from a leader.*

However, for certain standardized transactions, one is able to link the transaction to a membership and thereby isolate the order to a series of orders, which allows for more automation. This is what the respondent worked with on the abovementioned case in public sector. According to the respondent there were clear benefits associated with this:

> *… the transaction processing step becomes much shorter, which allows for more time towards decision-making support and other tasks in financial management.*

As for changes in the decision-making structure due to developments and efficiency improvements, the respondent expressed thoughts in line with what Klatzky (1970) described:

> *I would say it gets more centralized. However, I believe that this effect has already been harvested. We are currently experiencing the latest stages of this development in efficiency for invoice processing. It has been a long journey of digitalization and efficiency improvement, so I believe that this effect is already harvested... What is more evident with the implementation of RPA is toward*

quality controls, random checks and approvals. I believe RPA will be used for such tasks in the years to come.

Unlike the respondent working with supplying accounting robots, this respondent felt the market was not mature what AI and RPA is concerned:

There is not much AI or RPA in the market as of now, it is primarily used for increasing efficiency. When you use RPA it is to increase control, remove tasks that are done manually. If you add the AI dimension, it is not many examples of that in the market. It is very immature as of now. This has to do with the amount of unstructured data and the difficulties of finding enough common data… I believe it will take some time until we use a lot of AI.

As the section regarding present effects of automation came to an end the respondent had some thoughts on how the users and management have received new RPA and AI technologies. Some inertia were present:

Users: *There are resistance, but they are often overworked so they are happy about efficiency improvements. The challenge is that there is a fear of robotics. Therefore, it is easier to recommend automation within existing systems, which they are experts of. Then the fear of automation is much less evident because they understand that no one completely external will take over.*

Management: *Management are happy to be relieved of some of the controlling duties, it is boring work. However, they are too afraid of disloyal service to let everything slip right through… Furthermore, as new systems are being put into use, the need for employees might not be as high due to automation. However, some managers do not have the heart to do necessary cut downs.*

Future predictions

Like previous respondents this respondent had predictions toward a considerably shorter invoice processing. In fact the respondent took it even further:

> *I believe we will skip the entire invoice processing in a couple of years… I think we will see other forms of payments… However, you will still need an approval of the transaction.*

Some respondents mentioned an accountant's understanding and ability to make intuitive choices as important traits. It was therefore interesting to hear some personal beliefs regarding whether AI could be able to learn this:

> *Theoretically I believe it is possible because as long as you have a volume of teaching material, like previous decisions, it should be able to. However, how we are going to find data of this magnitude I am not sure. In Norway we have limitations regarding our law. For instance, we do not necessarily want data to be available on foreign servers. This is due to both legislative and security reasons.*

Limitations for automation

In terms of limitations of future AI solutions within RPA that could be able to make decisions regarding approval, the respondent expressed some concern regarding the involvement of auditors:

> *… I believe it is possible, but auditors will probably have objections. Auditors will be able to make quality checks and say that here are the rules, all invoices are going this way, and this is completely black and white. However, if you add AI there will be an opportunity for AI to depart from these rules, so how are you going to audit the AI if it should be able to learn and improvise? It is able to learn and make suggestions, but then someone else should approve. So if you say that it learns, suggests and approves it will have implications for the rules.*

Ethical aspects of future AI solutions

When asked about ethical aspects related to AI making decisions, also this respondent drew comparisons to self-driving cars and the decision of whom to kill. The respondent also had some thoughts on control and responsibility:

> *In general, I would say that everyone working within the fields of accounting and finance are responsible people. I believe that the leaders of accounting and finance departments will feel the most responsibility, but not more than the people actually doing the work. In my experience business managers will not care as much, as they have delegated the responsibility to a financial officer and trusts his and the auditor's work.*

Summary interview 3

Key takeaways from a consultants' point of view is that they are more pessimistic than developers what future AI involvement is concerned, at least the timeframe of its development. Whether this is because of realism or simply a result of lacking technical knowledge is difficult to say. Moreover, the respondent believes RPA will be mostly used for quality checks and approvals in the years to come, while invoice processing is believed to disappear.

4.1.4 Interview 4 – Supplier of Accounting Systems

Respondent number four is working as a manager for Visma, the most prominent supplier of automated accounting systems in Norway. One of the respondent's main tasks is to keep in touch with their business partners, mainly accounting houses, and make sure they are up to date with the latest systems. Thus, the respondent should be well informed on the subject and be a highly relevant source of data for this thesis.

Present situation

When addressing the question of recent developments the respondent provides several developments of interest. First, the trend regarding digitalization is introduced alongside some thoughts concerning inertia:

> *An exciting development is the trend of fully digitalized accounting houses… An employee at a normal accounting house typically has a customer base of 20-30 customers. At the fully digitalized accounting houses an employee could have*

> *around 60. In our experience this does not lead to inferior work, it is simply a result of more automated processes...*

> *In terms of inertia there are some resistance from both customers and accounting houses. There is no one that wants to work in another way, digitalize or make changes to their everyday life... However, the present situation demands change from an accounting house point of interest. If they do not become a cloud-based accounting house they will be gone within two years.*

Second, implications for decision-making synergies as a result of the abovementioned changes were discussed:

> *Historically one had to go to an accounting house in order to have them post invoices into the accounting system, even though it most of the times already was paid. Today an invoice goes directly into the system. The accounting house often sees an invoice before the customer. In our system one checks if things are in order from an accountant point of view and then it is sent for approval. Thus, the line of decision has changed. Where a customer previously had to approve and pay before seeing an accountant, one now has an accountant deal with the invoice so that the customer only approves at the end of the process.*

Lastly, the trend of implementing AI in accounting systems were introduced:

> *I would say that we have included much more AI in our system during the past two years. It is something we are working extremely hard with, however I would not say we have gotten very far yet.*

Future predictions

Speculating in the future is a difficult sport, which the respondent emphasized several times. However, he had a clear opinion regarding the future role of the accountant:

> *We believe that the accountant will persevere. You need someone who performs controls and makes sure things are done correctly. We are not in a place where systems can be automated to an extent that everything is done without human*

> *interaction... There are simply too many rules and laws to be able to standardize such processes... Future role of an accountant would probably shift towards more controlling and reporting tasks.*

The respondent also had some thoughts regarding the future of AI for accounting systems:

> *I believe we would reach a point where processes are 100% automated using AI. However, the use of AI would mainly be towards production of the financial statement.*

Limitations for automation

The respondent has a clear opinion regarding limitations for further automation and implementation of AI in such processes:

> *The authorities play an important role in automating Norway. However, they have not gotten very far. We had expected that there for instance was going to be made a requirement to use EHF invoices many years ago, also believed this would happen, but there is still no requirement to use this. If you are going to automate processes you need to standardize tasks. If one does not, it is difficult to make systems for automation.*

The respondent believes that the authorities are not the sole source of limitation. However, it seems like it is the most decisive source:

> *The limitations are probably divided between two factors, where the development in itself makes up the second part. We would love to develop faster. However, we are so dependent on the authorities in doing so, which results in very long testing periods. But yes, we do have limitations toward development.*

Ethical aspects of future AI solutions

The respondent expresses his company's responsibility toward assisting customers and accounting houses in the on-going era of digitalization and automation. In addition to this he has some thoughts regarding ethical aspects with implementing more AI in systems:

> *We have to be very careful with releasing new technology in the market without sufficient testing. In the process of releasing new AI technology we go through several steps of testing, both within our own systems and at accounting houses. This is done so we can guarantee it is something that will work in the market. We definitely do not want something we develop causing errors in invoices. Testing is incredibly important and probably part of the explanation of why the development is somewhat slow.*

Summary interview 4

The respondent to a great extent focuses on the same aspects as the previous respondents. He too has doubts regarding completely removing human interaction in invoice processing. Furthermore, their company believe the role of the accountant will persevere and that his/her tasks would shift in the direction of controlling and reporting. Where this respondent differs slightly from previous respondents, is in his strong beliefs regarding the role of the authorities and the rigid rules in Norway.

4.1.5 Interview 5 – Head of Accounting

Respondent five is partner and head of accounting at KPMG. Some of their main focus areas include digitalization, efficiency improvements of finance functions and implementation of new systems. The respondent has more than 20 years of experience with improving economic processes and will therefore be a valuable source of information regarding both historical development and future opportunities.

Present situation

The respondent is initially asked to give his thoughts regarding current focus areas and important developments:

> *If one look at automation of accounting processes, what Xledger did with integrating the bank within ERP solutions is probably the most important development in recent history. Xledger is a cloud-based system that automates payments, bookkeeping and bank reconciliation 100%... However, it is not done without any form of approval or control.*

He too exemplifies rent as one of the areas where systems has come the furthest in terms of automation:

> *Some of the systems start getting purchasing orders. That means that if an order is standardized, a supplier can deliver in relation to it. Then you have the opportunity to set requirements, and if these are fulfilled it will go through automatically. This is typical in the case of rent.*

Like several other respondents, respondent five also has an opinion on the role of the government in automating invoice processing:

> *My assertion is that we have lost five years of development as a result of the government and public sector failing to follow up on the demands of EHF, and continuing to accept paper formats. There is a long way to go related to the use of EHF, but the goal has to be 100%. That will eliminate the need for interpretation, which is a weakness of present systems.*

The respondent has directly contact with end users and therefore has valuable insight toward possible inertia connected to new systems:

> *A few years ago people were terrified of systems becoming cloud-based. This is not the case today… People are not yet at a stage where they accept invoices going directly through without control. They need to see this work over time in order to accept it.*

<u>Future predictions</u>

Like other respondents, he has strong beliefs regarding a fully automated invoice processing in the future:

> *In some years I believe that everything will be done automatically. However, it is important that accountants stop accepting manual formats.*

Mapping whether the accountant will persevere or change is important toward identifying possible changes in decision synergies. Like other respondents, the respondent does not fear that the accountant will disappear:

> *Everything will be automated more and more, but the competency of the accountant will still be important. One of the reasons for this is the increasing complexity regarding regulatory aspects.*

Furthermore, the respondent elaborates on the future role of the accountant:

> *It will be more consulting-based… As elderly accountants that perform tasks manually are naturally phased out through retirement, focus will shift from traditional bookkeeping to control, setting limits, exploiting technology and implementing new functionalities in existing systems.*

Additionally, the respondent tells that a 100 % automated process leads to the accountant not looking at the process any more.

> *I do not believe that the accountant will do services related to analyses for the end user. What is different from us and the other accountant firms is that we have our own departments for analyses in our advisory department. We are looking towards both working with analysis of data, the combination of different data sources and how they can work together.*

This can be interpreted in different ways. The accountant is predicted to not be the one doing analyses. However, analyses are stated as one of their competitive advantages because they have in-house analysts.

Limitations for automation

The respondent did not see any clear limitations for automation of invoice processing. However, he indirectly indicated one challenging aspect regarding systems:

> *In case of a new invoice, systems might not have a suggestion for how to handle it. We as accountants must handle it. The next time a similar invoice is received the system will recognise it, and handle it automatically.*

Ethical aspects of future AI solutions

When faced with the task of reflecting on ethical aspects of future AI solutions the respondent presented beliefs regarding a misunderstanding of the AI term, which demonstrates some of the complexity of this term:

> *AI is something completely different than machine learning. Systems are currently using machine learning. Thus, in this context it is a misuse of the term AI.*

The respondent had a consistent focus towards the need for approval and control during the interview. Related to this, thoughts regarding responsibility were offered:

> *In theory it is possible to let invoices from existing customers go directly through. However, it must be approved. End users and accountants should determine whether or not it should go directly through, or if there for instance should be any limits toward amount or type of invoice. They have the responsibility.*

Summary interview 5

Like other respondents, respondent five has a positive attitude toward future automation. The importance of accountants aligning with automated practice is emphasised as a decisive factor for future development. The respondent has a positive view towards the future of automation, which is substantiated by not seeing any clear limitations. Where respondent five differs the most from other respondents is in his opinions regarding AI. Respondent five believes that the use of the term AI is completely wrong when talking of invoice processing. The belief is that implementation of intelligent automation into the process is primarily on the basis of machine learning.
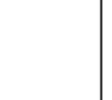
4.1.6 Summary Interviews

Topic/Respondent	Level of automation	Human workforce	Change management	Ethical
Supplier of Accounting Robot (SEMINE)	- Close to 100% automated. - Requires a "perfect" system. - Need good data input and control checks.	- Real time data. - More strategical and analytical. - Smaller finance function. - Controller.	- Mature market. - Happy to get rid of repetitive work.	- Responsibility lies upon management rather than accountants.
Accounting Firm (SpareBank 1 REGNSKAPSHUSET)	- Still traditional customers. - Control is a part of Norwegian culture. - Limitation: Data availability.	- Towards being a consultant/advisor. - Controller-role including insight into numbers.	- Fear of the future from smaller actors. - More acquisitions of smaller firms.	- Statistics makes mistakes. Need for control. - Managers feel the most responsibility.
Digital Consultant (pwc)	- Close to 100 % automated. - Need of control/approval. - Limitation: Data availability.	- More centralized. - More time towards decision-making support. - Control.	- Fear of robotics. - Happy to be relieved of some repetitive work.	- Management and accountants share the responsibility.
Supplier of Accounting Systems (VISMA)	- Will be 100 % automated, but need controlling. - Limitations: Laws and regulations. EHF maturity.	- The accountant will persevere. - Controlling/reporting.	- Resistance from both customers and accounting houses. - Inertia towards change.	- Sufficient testing to avoid errors related to invoices.
Head of Accounting (KPMG)	- Will be 100 % automated, but need controlling. - Integrations. - EHF maturity.	- The competency of the accountant will be important. - Consulting-based. - Control.	- People need time and persistent results in order to trust and accept new solutions.	- In this context, the term AI is misused. - End-users and accountants have responsibility for what goes through.

Figure 7. Table summarizing interview findings.

4.2 Digital Maturity of the Market

To be able to analyze the automation of invoice processing in the Norwegian market, some additional information specific to the digital maturity of the Norwegian market is provided. The section is divided into four parts. First, information related to the digital maturity of the public sector is provided. Second, there might be differences between the private and public sector when it comes to digital maturity. Hence, a section is devoted to the private sector. Third, based on both insights from interviews as well as information related to the digital maturity, a model pinpointing the degree of market maturity is presented. Last, since new systems are cloud based, a brief mapping of the cloud maturity in the market is conducted.

4.2.1 Public sector

In cooperation with Difi, the agency for Public Management and eGovernment in Norway, PwC performed a survey on public digitalization related to procurement and related processes in the Norwegian market (PwC, 2017). Having collected answers from 217 respondents, whereas most of respondents from businesses with more than 1000 employees, they conclude with a high digital maturity related to administrative processes, especially minding invoice processing. One can see a positive development related to receiving invoices electronically (in EHF-format), as there have been requirements made related to EHF handling by the Norwegian government (Difi, 2019). The largest improvement in the period 2013 to 2017 is seen in business related to municipalities. The conclusion is that 90% of the businesses that participated in the survey have digitalized their reception of invoices (PwC, 2017).

4.2.2 Private sector

Visma's digital index (2018) survey, purposed to map the digital maturity of the Norwegian market, shows that Norwegian companies still are doing a lot of work related to accounting processes manually. Only 44% of the companies sent and received electronic invoices, and only 41% of them posted travel expenses and other expenses through a digital solution (Visma, 2018). Furthermore, their research shows that 46% of all invoices are being paid automatically from the system without manual interaction. The survey completed by Visma has 1500 respondents and can therefore be seen as a reliable source describing the private sector of the Norwegian market. However, there are a couple of aspects that need to be mentioned with this survey. Firstly, it is primarily performed on the SMB market. Thus, it does not include insights from larger companies. Secondly, the survey's respondents consist of Visma customers only.

Nevertheless, since Visma by far is the largest actor of digital solutions in the Norwegian market, one could use their research as a benchmark for the private SMB market. Another survey executed by PwC (PwC, 2018) on companies in different industries tells that 8 out of 10 are using electronic invoices. This indicates that larger firms might have a higher degree of digital maturity than SMBs. From a logical point of view, it makes sense, as larger firms have more resources available. More resources make it easier to implement new digital solutions at a faster pace.

4.2.3 Degree of maturity

To explain the maturity of automation in the market one can use a 3-step model operating in the range from traditional- to a fully automated- invoice processing. The perception of the market is that different businesses are at different stages regarding automation. However, through interviews and other collected data one can safely say that most companies have included some sort of digitalization into their invoice processing, and could relate to step two of the model. Mentionable is that still only 3% have implemented AI or RPA for improving process efficiency (PwC, 2018).
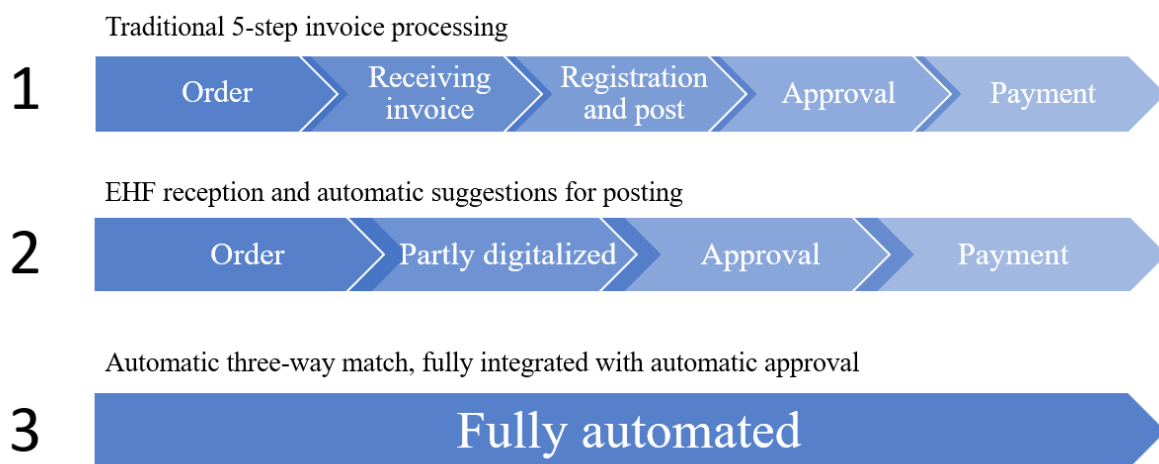
Figure 8. Overview of degree of maturity.
(PwC, 2018)

4.2.4 Cloud maturity

Through the interviews one has gotten an understanding of the importance of data related to further automation of processes. EY conducted a survey to map the cloud maturity in the Norwegian market. With response from CIOs in the 126 largest Norwegian businesses, EY concludes with a low maturity related to the use of cloud systems (EY, 2018c). However, more

than 40% of their respondents are planning on developing a cloud strategy in 2018, implying increased cloud maturity. Complexity in migrating legacy applications together with security concerns and compliance and/or regulations are listed as the major challenges for moving to the cloud (EY, 2018c).

5. Discussion

5.1 Level of Automation

Seeking to answer our research question, it is important to get an understanding of how far invoice processing can be automated. This gave rise for our first sub question: *To what extent is it possible for an artificial intelligent agent to make decisions related to invoice processing, thus maximizing the level of automation?* This section will try to answer this question utilizing theory and findings in the data collection, creating a basis for further discussion.

When trying to map to what extent invoice processing can be automated, an important aspect to look at is the IA's degree of rationality. As elaborated upon in section 3.1.4 one has expectations to IA's related to achieving the ability to act rational. Hence, how rational an IA could become related to the process examined is of importance.

The execution of repetitive routine-based tasks is performed by the part of the IA that is represented by RPA. Related to invoice processing a large share of the process is driven by rules. For example, there are a given set of laws given by the Norwegian government that are to be followed when registering and posting invoices into the system. Thus, there is no need for human attributes such as knowledge, understanding or insight. In other words, it can be interpreted as pretty straightforward. A decrease in the complexity of a problem can be a source of increasing the ratio of rationality. If an IA is rightly coded and given the correct instructions it will be able to follow instructions, bringing characteristics of a complete rational agent to the table. The condition of the decisions being made can be linked to a situation of certainty and normative decision-making theory, drawing comparisons to Aristotle's syllogisms and computational logics.

A human decision-maker will be exposed to a different decision-making environment than an IA would. Whereas a human would be affected by culture, norms and beliefs, an IA has no other intentions than being an objective agent, making the best decision based on the instructions given. Hence, directly related to routine processes IA's could be viewed as superior to humans because of the simple fact that IA's are not victims to biases.

An accountant's human judgment has impact related to how invoice processing is done. Whereas some regulations are straightforward, others have room for interpretation. Moreover, the payment phase of the process has traditionally been in need of an approval. A fully automated process involves that the IA makes these decisions. Thus, a discussion regarding whether AI can replicate the human judgement needed linked to the degree of complexity of the abovementioned tasks becomes relevant. As mentioned in section 3.4.5, AI possesses most of the attributes needed to make a valid moral judgement. However, AI lack the ability to vividly imagine the feelings and circumstances of the parties involved. One could argue that a standardized process like invoice handling does not involve these factors. To some degree this is also true, hence the reason for automating it to a great extent. However, human beings, not being completely rational, are incapable of not feeling or not being affected by circumstances regardless of how standardized the process and the following decision is. Insights from interviews tells a story where Norwegian business owners have a need for control, and often want to have a say when it comes to decisions that have a substantial impact on their business. This paints a picture of an emotional attachment that AI is currently unable to experience.

The complexity of the task depends on subject opinions, as accounting includes norms in addition to the given laws. A clear consensus in the interviews is that regular transactions, for example payment of rent, is going to be or already is fully automated from incoming bill to completed payment. When it comes to more unregular invoices there are different opinions to how that is going to be handled. Moneywise, mistakes by an IA related to the step of payment can have huge consequences, and there might be a need for control in situations of unregular deals concerning large amounts. From a theoretical or technological point of view there are no difference between small payments and big payments. In practice however, due to the desire for control, there are differences.

Nevertheless, beliefs presented by respondents in interviews are that the process will be close to, or 100% automated. However, there is no clear consensus in the interviews when it comes to AIs ability to become able to replicate the accountant's human judgment. There is a consensus linked to the need for control. This indicates that the accountant's human judgement might not be as essential as initially believed, as well as the need of control could limit how automated the process can become. Additionally, an argument for why the process cannot be 100% automated is presented by one of the respondents. The respondent underlines that 100% automation requires a "perfect" system where every player one cooperates with must use an electronically based system. As the Norwegian marketplace is crowded with smaller less automated companies, this might seem difficult to achieve. This is also directly linked to the facts presented in the section of market maturity. Both the degree of invoices sent by EHF and the maturity of the cloud have implications for how well-functioning an IA system works.

Data in section 4.2 shows that the degree of digitalization when it comes to reception of invoices are much higher in the public sector than in the private SMB market. As the public sector is subject to common regulations given by the government, an investment towards automation from the government could have the results of public sector transforming faster than the private market. However, public sector and private sector trade services regularly and regulations related to electronic invoices from one side would lead to changes at the other side. As a respondent pinpoints, smaller players doing small services would most likely be the last ones to adapt. Thus, being a source of still having the need to do manual deviation handling. This is relevant at least short term, as requirements related to businesses being obligated to handle their invoices electronically are not being enforced.

The new rules that came with the revised payment services directive (PSD2) had to be implemented into national law by 13. January 2018. One of the objectives of PSD2 was to contribute to a more integrated and efficient European payments market. Hence, creating the prerequisites for the digitalization of the payments industry (EY, 2018d). In interviews, integrations are highlighted as an important part of making the examined process fully automated. Current solutions and future AI solutions can be integrated with payment solutions that are directly linked to bank accounts. Having that integration, no approval is needed. One system triggers an action in the other system.

Insight provided tells that a three-way match done by an IA would secure that payments can be made correctly, without need for human approval. AI capabilities of the IA would be responsible for making a decision if there for example are deviations between receiving document and invoice. However, this would require consent from the management. Trust is a key aspect when talking about digitalization and automation, especially when examining processes that involves financial assets. Trust is necessary when there is an element of risk arising from the possibility that the trustee will fail to complete the task (Hardin, 2006). AI is based on statistics, and interviews have given an understanding that IAs using AI are not 100% correct. This leaves room for some uncertainty and potential failures. Nevertheless, in the situation of a three-way match the IA have a high degree of rationality concerning the fact that the task is pretty straightforward until deviations between the documents are the case. Insight given tells that current IA solutions alarm personnel if anomalies are found so that it can be fixed. Thus, indicating that current level of IAs are not able to find solutions on how to handle deviations themselves or given the trust to make those decisions.

In the current market, the most innovative solutions have similarities to enhanced process automation illustrated in figure 3. As RPA and AI is brought together, these solutions allow for automation of processes that are less structured and of higher complexity. In interviews one respondent tells that talking about AI is a misuse of the term in the case of invoice processing, others speak a lot about AI and some focus on the term machine learning. The lack of a universal understanding of the term could be the basis for confusion and difficulties related to interpreting the data. However, the terms used by different respondents consolidate with literature of section 3.1. Literature on the topic makes it easier to extract what is meant by each respondent and draw the right conclusions even though different terms are used. In the end, AI is a wide term, and the emphasis is that related to invoice processing only capabilities of AI introduced in section 3.1.1 is the case.

By utilizing OCR technology, a variant of NLP in combination with computer vision, the IA is able to read and understand data given in an invoice. However, the IA is dependent on receiving invoices in electronic format and in a familiar format. Insight from interviews and theory states that the IA must have sufficient "training" to work optimally. This is also applicable when talking about the IAs ability to learn and reason. What "training" means is giving the IA enough

historical data so that it, by using statistics, can reach the right conclusions based on previous practice. Insight from respondents is related to limitations linked to the first time the IA handles a new type of invoice. Usage of ML and DL makes the IA able to learn, but it has to have some sort of point of reference to be able to draw conclusions. This indicates that humans must be the provider of initial knowledge in form of data input.

Respondents have their doubts regarding data availability, especially short term, as they tell a story of restrictions related to keeping data in the cloud. This is supported by the low cloud maturity of the market. Having data available is crucial to utilize IAs potential and low cloud maturity can be a deal breaker related to achieving full automation. Additionally, both insight from interviews as well as data related to market maturity confirms that there is a low implementation of IA solutions. The supplier of the accounting robot is positive related to the market's reception of their product. Nonetheless, it is difficult to state how fast companies will adapt to this new trend. Other respondents believe that it might take some time before it is being widely used.

Auditors are mentioned as an actor that could have objections against implementation of AI. The argument that AI will learn and improvise is used to paint a picture of how AI in some way could be able to change the rules of the game. Mentioning that, one is skimming the surface of one of the biggest fears related to an increase in the use of AI. As ML and especially DL networks are very advanced, there is a lack of transparency related to how AI makes decisions. AI might reach conclusions that may be based on patterns that we as humans cannot perceive, and the AI is not able to communicate reasons for reaching those conclusions. This is referred to as AI being a black box (Bathaee, 2018). The black box problem is in a larger degree relevant when talking about complex decision-making where the AI does not have a clear set of rules, and it is easy to deviate from methods used by humans. The discussion done above regarding the accountant's human judgement and interpretation of given laws and regulations remains highly relevant.

The lack of trust in IAs is not the only factor putting some restrictions on the degree of automation or the timeline of implementation. Insight proves that management is happy to be relieved of boring repetitive work. However, fear of disloyal service stands in the way of letting

everything slip right through, not only related to automation, but in general. The term "control" is again at the center of the discussion. Market specific information given in interviews indicates a high need for control in the Norwegian market. The principles of four eyes, that decisions must be made by at least two persons, is present both in the private and the public sector. This principle is used as an instrument to reduce the risk of inconsiderate fraudulent or suboptimal decisions in organizations (Sutter, 2007; Feldbauer-Durstmüller et al., 2012; Six et al., 2012; Bátiz-Lazo and Noguchi, 2013). Furthermore, it also ensures the rationality of decisions as well as reciprocal control of decisions (Schickora, 2010). A fully automated process implies that organizations are willing to let go of this kind of control, which can be difficult minding that decisions related to the process includes putting a certain amount of capital at risk. Insight provided describe the Norwegian private market as crowded by a lot of family businesses with a clear wish for control. Moreover, the public sector follows rigid rules when it comes to control checks. Removal of such principles could therefore be seen as difficult both in the private and public sector.

The fear related to IAs making decisions only based on historical data is an additional source for having control checks. However, one can argue that past experience are what influences the choices of humans as well. Theoretically, creation of IAs with optimal use of the capabilities presented in section 3.1.1 would eliminate this kind of fear. If that is practically possible is another question, which is far beyond what a business master thesis is able to give a correct answer to.

What can be answered is how automated the process is believed to be. In a short-term perspective, it seems that low digital maturity of the market and the fear of trusting automation is going to be factors limiting a fully automated process. The term control, the last step of decision-making according to the model presented in section 3.4.2, is key in the Norwegian market and will be performed until sufficient trust in IAs are established. If sufficient trust is achieved, theory have proven that the process examined is a process that could be close to fully automated if given the right data input. The long-term perspective will therefore be affected by the degree of trust in IAs and the availability of data. However, IAs need data as foundation for learning and in some way humans must provide this. At this point of time, a process without human interaction seems farfetched even in a long-term perspective.
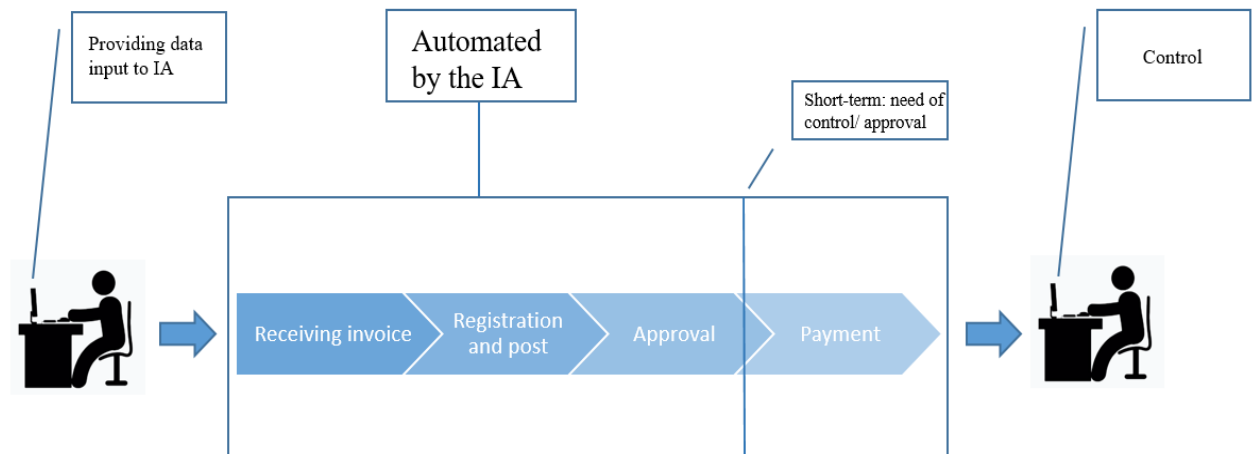
Figure 9. Level of Automation
(Self-made)

5.2 Human Workforce

On the basis of the level of automation mapped above, this section will seek to map how this will affect the human workforce. First, a section related to what effects new amounts of real time data could have related to decision-making is provided. Second, there will be a section related to changes linked to the role of the accountant and a look at how decision-making synergies could possibly change.

5.2.1 Real Time Data

Implementation of intelligent automation does not only affect decisions directly linked to the process examined. It has more to it. Data availability create opportunities for better support to decision-making at a higher level. As confirmed in interviews, solutions that have its basis in robots with AI capabilities gives possibilities of 24/7 action. On the basis of ML and DL one open doors to new types of analytics that have not been executed earlier. ML and DL represents the part of the IA that creates opportunities for learning based on experience. As explained in section 3.1.1.3, ML makes a computer able to adapt to new circumstances and detect and extrapolate patterns. By having full insight into numbers that is related to the cost side of the business, the IA could detect trends and anomalies that humans may never catch. The IA can be viewed as an advisor to the financial department, giving predictions related to the cost side

of the business. Better predictions and faster discovery of anomalies would create opportunities to be proactive. Quicker decisions could be made, resulting in a better cost-management.

As elaborated upon in the section of rationality, bounded rationality is relevant for a decision-maker when his/her cognitive capacities are insufficient in terms of grasping the entire complexity of a problem. Bounded rationality could be directly linked to decision-making of human beings, as complete rationality could be seen as unachievable. However, the introduction of real time data could be the basis for a higher degree of rationality. Better insight in form of extensive data analyses would make it easier to grasp larger parts of the complexity of problems. Hence, when dealing with complex problems, supporting information improving the decision-makers cognitive capacities could be decisive. Limited time and means are mentioned constraints related to a lack of information, resulting in a lower degree of rationality. An increase in use of intelligent automation related to invoice processing would in many ways eliminate some of these constraints. An IA would be able to provide analyses based on real time data in a much faster pace than what humans are able to. Confirmed in interviews is that a robot can do analyses almost instantaneously in contrast to what would take a human 1-2 weeks to process. Hence, confirming that IAs is a source of greater efficiency and can lead to a faster flow of information.

In section 3.4.2, steps related to the decision-making process are explained. Better analyses, which lead to a higher level of information, are directly linked to both searching for alternatives and the evaluation of those alternatives. Better prognoses and expectations related to costs gives a better picture of the business' economy, exemplified with new information linked to what degree of liquidity is needed in the future. This also makes it easier to evaluate what are the correct decisions to make. The decision-making environment will still include uncertainty. However, reliable real time data in combination with better ML and DL networks leads to more certain predictions. This creates an environment that has a higher degree of certainty than what have been observed historically. Better information creates better awareness of alternatives and a better understanding of consequences of choosing each alternative, resulting in a better overall cost management.

IAs operating in the cloud makes it easier for the regular customer to get an overview of their financial cost status. Greater insight and transparency give a greater feeling of control. By

having real time control the decision-maker can easily do follow ups related to strategic choices made, affecting the last of Khalil's (1993) steps related to the decision-making process. Additionally, it makes it easy to quickly make contradictory actions if wrong decisions are made. The interviews confirm that control is something that is highly appreciated at all levels of a business, and is a backbone in the human mindset.

The question if bigger data leads to better decisions has been addressed by many scholars, from decision scientists to organizational theorists (Evgeniou et al., 2013). For most complex questions the answer is "it depends" (Evgeniou et al., 2013). As touched upon, humans are victims of bounded rationality in contrast to IAs that potentially can act as fully rational agents. The introduction of ML and DL is a game changer related to the interpretation and analyses of large data sets. However, data predictions are not 100% correct. It should therefore not be suppressed that prognoses and analyses should be used as advice and not be viewed as the truth. As the foundation for AI is statistics, the level of the analyses depends on how good the datasets analysed are. Furthermore, the importance of how humans interpret prognoses given by the IA is crucial in relation to whether or not more extensive forecasting and trend analyses will lead to better decisions made by the cost management team.

5.2.2 Change of Roles

As elaborated upon in section 5.1, invoice processing is going to be near fully automated. However, there is a clear consensus among respondents that human interaction is needed at some point. The largest supplier of accounting systems in Norway believes that the role of the accountant will persevere, indicating that solutions, at least in the nearest future, are made with this in mind. With the new systems one expects the role of the accountant to shift from the traditional role of posting vouchers to controlling and reporting tasks.

Capabilities needed from an accountant have gradually changed during the last years, but larger changes are predicted. Insights from interviews shows that this is something some companies already are aware of, as an observed trend is that companies hire differently. In addition to having a responsibility for controlling and reporting as stated above, the accountant would have to be more analytical and strategical than before. This is needed in order for the accountant to understand what the numbers mean so that he is able to give advice to the top management.

Moreover, future accountants have to possess some sort of technological understanding, as one has to operate side by side with IAs. This thesis operates with four different roles that the accountant must fulfil in the future that have implications for decision-making. These are introduced in the following.
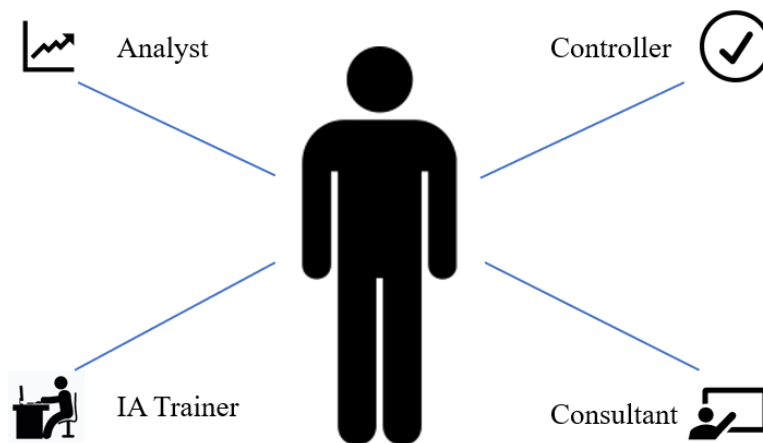
Figure 10. Future roles of the Accountant
(Self-made)

IA Trainer

As discussed earlier it is emphasized that IAs cannot learn without being given the right direction. Furthermore, it is underlined that bad data foundation would create an environment where the IA easily can make future mistakes. This is directly linked to future decision-making. The accountant's role would be to give the best possible basis for correct learning, as the IA uses data on how previous decisions are made both related to posting in the accounting system and decisions linked to whether to trigger payment or not. Although this is just a task that is relevant to get the IA started, the importance of that task should not be undermined as it can affect the correctness of future decisions. Using figure 4 as a starting point, one could say that this task is a part of the first step of the decision-making process, setting objectives. Showing the IA how the job is initially done is not directly a change related to the traditional role of the accountant. It can be viewed as the only role that looks like the old part of their work in relation to invoice processing. In the future, both short term and long term, this would no longer be the accountant's primary task, as shown by figure 10. It is just going to be one of many different competences that is needed in the job.

Analyst

Earlier on, how new amounts of available data would affect decision-making was discussed. More information could be a source of a higher degree of rationality for the cost management team. In this regard, the importance of having a workforce that is able to understand data extracted by the IA should not be neglected. The IA would be able to give trend prognoses and do forecasting based on invoices received. What is needed from the accountant is to give the right interpretation of the data given. Moreover, the extra data availability gives room for additional analyses that can be performed by the accountant. Better analyses are directly linked to information collection and are a part of the decision-making process. Using figure 4 one can relate this task to improvement of information at the steps of searching for alternatives and evaluating alternatives.

One important aspect to discuss is whether the role as an analyst will be the accountant's responsibility or the end-user's responsibility. One of the respondents has thoughts on this topic. First, he presents a belief towards end-users having this responsibility. However, additional value added such as doing analyses, is mentioned as one of their competitive advantages. This indicates that larger players could move in the direction of providing extra value through analyses. Second, important to mention is that larger companies also have in-house accountants. In the case of in-house accounting, the accountant and the end-user are acting as the same player. The responsibility of providing analyses will then lie upon the accountant.

Consultant

New solutions that ease the work needed from the end-user creates an environment where more end-users want to do their accounting in-house. This creates challenges for the traditional accounting firms, as they need to adapt to stay in business. Insights from respondents imply that this is the foundation for some changes related to the role of the accountant. The responsibility of providing insight into the numbers and present them to the top management would be key.

New amounts of available data would result in multiple cost analyses being done. However, not all of them are important for cost management. The role of filtrating information will therefore be necessary. As the accountant have the role of picking out the right data, the

accountant will have increased influence related to decisions being made. Using figure 4, this role of the accountant influence the part of the decision-making process of evaluating alternatives.

In the Norwegian market, both internal and external accountants are used. External accountants fit the role of an external consultant. Regularly appointed meetings with management will be held to give updates regarding the cost side of the business. Internal accountants, on the other hand, would contribute as decision-making support when needed, or when important findings crucial for the business are discovered. Thus, aligning with a role of a management-advisor. The most important transformation of the accountant in the AP department would be a more prominent focus on strategically evaluating posts and analyses linked to costs. This to be able to provide advice to management.

Controller

Interpreting respondents' answers, it seems that a lack of trust in IAs from the top management is prominent. As discussed earlier, low trust result in the necessity of a well-functioning control function. Moreover, throughout the whole discussion related to the degree of automation, control is emphasized as one of the factors having most implication for how automated the process is going to be. Top management is willing to give the IA more responsibility, but as figure 9 shows there is still someone having to perform control checks. This would be the accountant's responsibility as they have the core competence related to the job performed by the IA. Primary knowledge makes them able to easily discover if mistakes are made. Controlling the result is the last step of the decision-making process as seen from figure 4.

Decision-making synergies

Respondents' beliefs related to the human interaction needed when making decisions is in line with what is visualized in RPA research done on the audit sector by Moffitt et al. (2018) related to the effect of replacement of devices into human-based workflows. Robots have the opportunity to replace low-level jobs to a greater extent than high-level jobs. Related to this thesis findings, comparisons can be drawn towards the fact that repetitive work can be replaced. However, current IA solutions are not yet at a level where company owners trust them to make decisions that could result in large consequences related to liquidity.
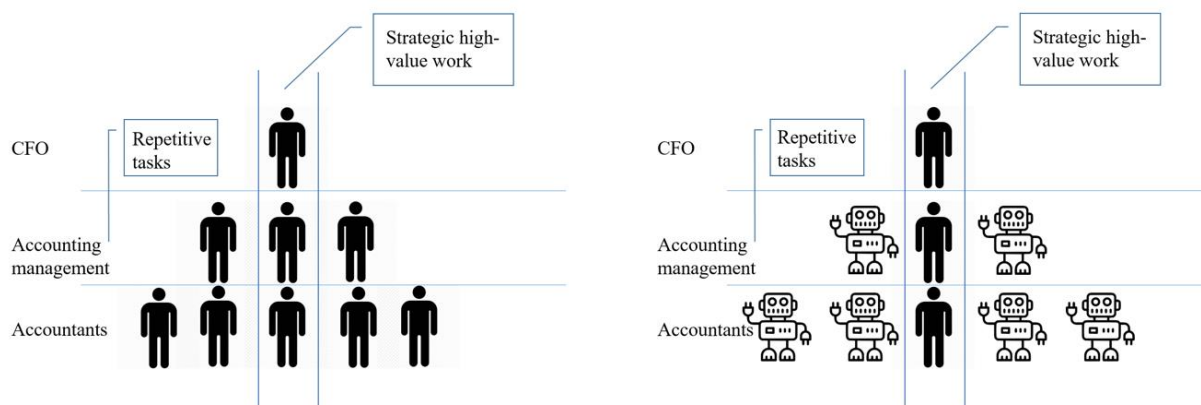
Figure 11. Decision-making synergies
Self-made figure based on the thoughts of Moffitt et al. (2018)

An implementation of IAs would, as discussed above, change the role of the accountant towards more strategic responsibility. As this role changes, decision making synergies of the financial department changes accordingly. Emphasizable is that this thesis' focus is on the cost side of the business. Hence, ripple effects will only be discussed in that manner.

Firstly, IAs will be responsible for most assignments that can be viewed as repetitive and standardized. Thus, freeing time for both accountants and management to focus on other assignments. There is indications among respondents that an increase in the use of automation would be the basis for a more centralized finance function. This is visualized by figure 11. Secondly, not relying on IAs to make critical decisions aligns with what Klatzky (1970) described related to decision-making structure. Automation speeds up and simplifies processing of information, which leads to increased centralization of decision-making authority. Despite thoughts towards a more centralized finance function, one respondent pinpoints that some of this effect might already have been harvested and that implementation of IAs can be seen as the latest stage of development related to the efficiency of the process.

The main target of figure 11 is visualizing the shift of focus from repetitive routine tasks towards high-value work linked to the core business. However, the figure can be interpreted in the direction of IAs replacing humans, which will lead to cutbacks. A discussion related to the size of the finance department is relevant, as this could affect decision-making synergies.

An increase in implementation of IAs into invoice processing would result in several tasks currently done by humans being replaced by IAs. The immediate thought is that cutbacks are the only solution. As the discussion above has proven, this is not the only case. This change also brings opportunities for the role of the accountant. However, as beliefs in interviews are towards a smaller finance department, one could argue that sum of opportunities is smaller than sum of cutbacks in relation to the need of people. Less people could mean more responsibility for those who is left, and the new role of the accountant will have increased influence linked to decision-making. Thus, changing existing synergies. Questions related to the size of the finance function are important, but as it is not the main focus of this thesis it will not be discussed further.

In figure 11, three layers of the finance function is used. The accountant, accounting management and the CFO. In the Norwegian market, many companies operate with fewer layers than three and the model is therefore not completely applicable for all situations. Nonetheless, the same thoughts are just as relevant.

By looking at the predicted changes linked to the role of the accountant, one can see that the accountant is taking part in more steps of the decision-making process. This implies an increase in influence related to decisions made. The degree of influence could differ on the basis of the size of the company. In smaller companies the accountant could have the role directly linked to the CFO or CEO as an advisor, and the information provided from the accountant would be decisive for decisions made. An increase in decision-making influence for the accountant is also the case in larger companies, but as the company includes more layers the accountant would not be in direct contact with the decision-maker. The Norwegian market is, as mentioned, crowded by a lot of smaller companies implying that the accountant could have a prominent role in relation to decision-making in the time to come.
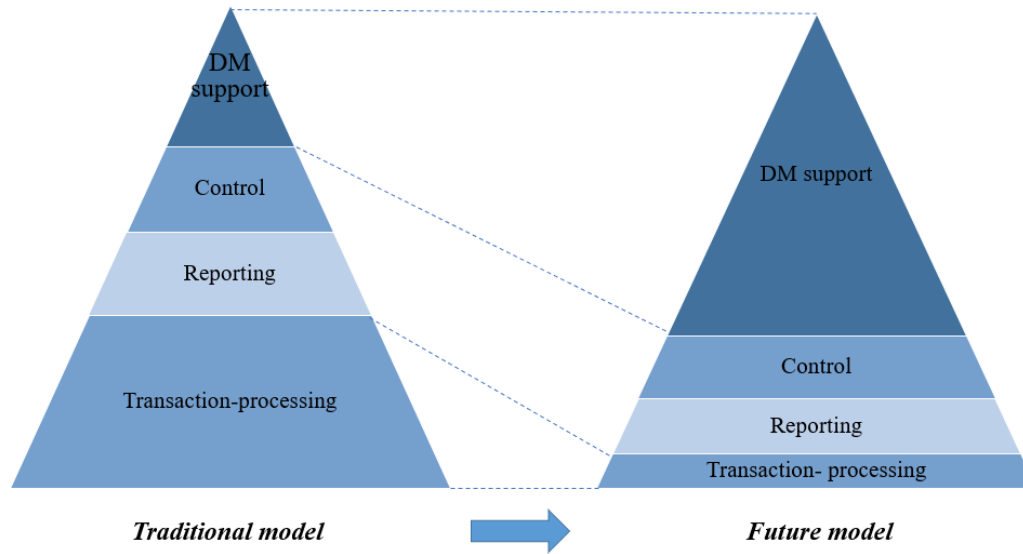
Figure 12. Development in allocation of the accountant's resources.
Self-made model based on the model of PwC (2016).

In a benchmark report on efficiency and productivity in Norwegian businesses finance departments done by PwC (2016), a model related to allocation of resources were developed. A lot of similarities from that model can be drawn towards allocation of resources related to the accountants' workload. On the basis of the discussion done above, this thesis predicts changes visualized by figure 12. Figure 12 is inspired by the model made by PwC (2016) related to the overall finance function. However, adjustments are made on the basis of insights and what have been discussed above. Additionally, as we use the model for allocation of the accountant's resources, some differences to the original model are present. This thesis is purely qualitative and presenting allocation per percent would be ignorant. The model is therefore to be used as an indication for how the accountant are going to allocate his/hers resources in the future compared to what have been done historically.

5.3 Change Management

There is no doubt that there is a continuous process of change needed in the accounting sector as a result of technological progress. Before one can discuss or analyse aspects of change management one need to define what type of change one faces. Chapter 3.5.1 introduced three distinctions regarding technological change, which will be used to define this technological change. These distinctions were competence destroying vs competence enhancing,

architectural innovation vs component innovation and disruptive technologies vs sustaining technologies.

Moving from paper format invoices to EHF, thus automating the process, definitely represent a substantial change. New systems are required, which means change is architectural rather than component. Moreover, as were indicated by respondents, the change is also competence destroying. New systems require new competence at the same time as they eliminate and change some of the old tasks. Finally, the change involves disruptive rather than sustaining technology. Judging from the respondents there seem to be an increased focus on new performance attributes like strategic knowledge. Developments of the above-mentioned nature require more extensive changes and it could, and probably will, lead to a change of accounting roles (Grant, 2016).

An increased focus on implementing AI in new systems will lead to another wave of change. EY (2018a) describes intelligent automation as "the fastest growing technology with the greatest power for disruption", which indicates some of the possibilities and challenges with such technology. However, as respondents confirmed, current work is focusing on implementing AI into existing systems. Thus, indicating that this wave of change might not be as existential as previous automation. That said, predicting the future is an impossible sport.

Klatzky (1970) presented that automation leads to centralization of decision-making authority. Judging from the respondents' perception of changes it seems that this, at least to some extent, is relatable to the automation of invoice processing. Not all respondents directly state that decision-making authority has become more centralised. However, there seem to be a consensus regarding more efficient solutions, which is the main argument for reaching the conclusion regarding centralization of decision-making authority (Klatzky, 1970). On the other hand, as automation in this case also challenges the very role of the accountant, a discussion of decision-making authority related to the beliefs of Klatzky (1970) is problematic. If a role disappears or is severely altered it is not as relevant discussing structures. This may very well be the case.

What speaks against what Klatzky (1970) presented is the increased ability and desire from end users toward taking part in the process, which were highlighted by some of the respondents. Such a development implies a decentralisation of decision-making authority rather than a centralisation.

Nygaard (2006) stated that decisions could be made as a result of routines, which is reasonable to believe in a standardized process like invoice processing. At the same time, both Nelson and Winter (1982) and Becker (2005) found routines to be inert, while Grant (2016) mentioned well-incorporated routines as a barrier to change. This paints a picture of some of the challenges related to automating this process.

Judging from respondents it seems that a higher degree of standardization is preferable toward being able to automate tasks, at least on a short-term basis. Rent was highlighted as such a standardized aspect. The reason for this is the need for matching of inputs, limits and orders. If an invoice matches an order or is identical each period and within certain predetermined limits, it is possible to handle it automatically. Thus, the need for decision-making or control is decreasing. However, the human desire of control limits this progress.

As introduced in section 3.5.3, people have a built-in inertia towards change (van der Steen, 2009). Thus, there is likely to be some resistance toward implementing new systems and changing the way one work. The respondents are all providing services toward the end-user. Their perception of how the changes are being received in the market is consistent. Every respondent expressed thoughts regarding some resistance toward new systems, which is in line with expectations drawn from theory. The main reason for the resistance was worries regarding the unknown. People fear what they do not understand, and especially when it could have implications for their everyday life. Robots represent a classic example of the unknown. Thus, raising awareness will be a key in implementing new systems.

On the other side, there have not only been negative receptions related to automation of invoice processing. The respondents emphasized that most customers, as they got to know the systems

through training, had a positive attitude towards automation. Invoice handling is a pretty straightforward and boring process. Thus, customers are happy to be relieved of some responsibility regarding conducting such processes. Such a positive attitude from customers could result in changes linked to decision-making authority. Due to the boring and standardized nature of invoice processing and the general trust in the market regarding accountants, many customers are happy to delegate substantial parts of the process. However, there is still strong doubt toward authorizing systems to make approvals. There is still a desire to conduct controls and quality checks. None of the respondents see this changing in foreseeable future.

End customers are by no means the only ones affected by changes in invoice handling. Employees of accounting firms are also facing changes. In a study ordered by the department of knowledge in Norway aiming to map the possibilities of different professions getting replaced with computers and machines, professions linked to accounting tasks made up three of the five top spots. All of which were given a probability of above 95% of getting replaced (Pajarinen et al., 2015). Thus, some resistance could be expected from employees as well. Judging from interviews, elderly employees will, and are struggling with adapting to the new electronic standards. The longer one has been in an industry, the harder it is to adapt to new ways of practice. Problems regarding decision synergies may therefore occur if persons with authority, which often will be elderly people, are not fond of the suggested changes. However, as several respondents pointed out, there is simply no choice regarding change. Either you do it or you are gone within few years.

On the other hand, resistance amongst employees are not immense. There are two main reasons for this. First, it is difficult to fully grasp the seriousness of the changes. Respondents representing consulting firms experience some degree of unawareness amongst customers. At the same time, focus on tailoring systems to companies and teaching employees are making the process of change less scary. Second, as made evident by the respondents, there is a lot of focus towards including accounting houses in the process of change. The goal is to find new ways of earning money, which is what all business ultimately boils down to. Respondents see decision-making, consulting and controlling as likely future focus areas for accountants.

Judging from the respondents, the rigid laws in Norway are a defining factor for developments regarding implementation of AI in invoice processing. Chapter 3.5.3 introduced political structures as a challenge and possible barrier for change. There are two main reasons why such a rigid set of rules could be decisive in the development and implementation of AI, which in turn would affect decision-making synergies. Firstly, developing AI requires it to have huge data sets in order to learn and improve. A rigid set of rules may hinder obtaining data sets of the required magnitude. Norway currently has rules for sharing data for both security and legislative reasons, which may hinder, or at least slow down, the required ML. An example of such a law is the law of national security.

The second concern with having a rigid set of rules when developing and implementing AI technology is tied to existing rules. New technology often leads to new ways of handling different processes. However, these processes may, directly or indirectly, be hindered by existing rules. The most evident hindrance when dealing with invoice processing is that authorities in Norway are yet to enforce requirements regarding EHF. As a result, many companies, mainly of small size, still do not use this. This has implications for the development of AI, as available data through cloud platforms are limited. Furthermore, the rigid set of rules in Norway makes it more challenging to develop systems of a required standard, which in turn results in a need for extensive testing. This is time consuming and frustrating from a developers point of view, and leads to slower technological development.

5.4 Ethical Aspects

There has always been an ethical aspect involved in accounting. Controlling someone's economy and future comes with great responsibility. The introduction of systems and AI do not eliminate these aspects, it merely alters the line of thinking. Furthermore, it represents an important area of focus regarding future opportunities of AI. Is it ethically responsible to have machines make decisions that could potentially be the difference between survival and bankruptcy for some firms? And does the responsibility in terms of responsible development of systems and potential defaults lay with end user, accounting houses or suppliers?

Khalil (1993) stated that ethical decisions are relatively easy to make when all facts are on the table. One could argue that accounting and invoice handling involves standardized tasks. Invoice processing is subject to a framework of rules. Hence, there are apparently not much room for other inputs than standardized routines and processes. However, a couple of respondents addressed the need for an accountant's discretion. That is, his personal believes based on experiences, which includes decision-making capacities. A natural question in this regard is therefore whether AI will be able to replace or replicate this. Khalil (1993) found AI to be unable to make a valid moral judgement because of its lacking ability of understanding emotions and circumstances. Arguably these emotions and circumstances translate into an accountant's discretion, thus adding substance to the respondents' thoughts. However, this line of thinking involves some degree of speculation. Ethical considerations are difficult to discuss in terms of reaching solid answers. Adding speculative aspects regarding future predictions does not make it easier. A final important note in this discussion is that these statements regarding an accountant's discretion may be motivated by the fear of being replaced by machines. Thus, it may to some degree be biased.

Machines are more efficient than humans and in many cases also more accurate and flawless. Respondents working with developing accounting systems ensured that the margin of error is much less with machines than humans. Thus, a completely rational line of reasoning would implicate giving more responsibility to machines. However, there is still a desire of some human interaction towards decision-making and control. One of the reasons might be that the level of technology and the knowledge towards it not yet is at a comfortable level compared to the complex nature of human decision-making. The latter was demonstrated by Millar (2015; 2016) through his five ethical considerations. A more likely explanation though is human being's lacking ability of letting go of control. In some cases this could be a positive trait, other times it may represent a hindrance.

Responsibility is an important aspect when discussing issues of an ethical nature. When addressing respondents with this issue, their responses were rather congruent toward feeling some kind of responsibility. Suppliers felt responsibility toward developing as flawless systems as possible. Being highly reliant on previous data for future learning, there is a great responsibility resting on the ability of using appropriate data in such systems. Unfaithful

servants are always a risk. Following the trend of automation and AI, one does not only have the risk of such servants during the process. In theory, developers could program defaults from the beginning for personal benefit. That is why systems are developed with certain safety features that will alert in a case of default. However, despite of having a new layer of possible unfaithful servants, it is still one's trust in an agent that decides whether or not one will go through with the service.

Accountant firms felt responsibility toward their customers. In some cases, this responsibility was even said to be too strong, as it could challenge the customer-accountant relationship. Furthermore, suppliers, consultants and accounting houses had an impression that the end customer felt a desire to keep some sort of control, hence implying some degree of responsibility. Once again this indicates the unlikelihood of completely excluding human interaction in invoice processing.

As introduced, all respondents had some feelings toward responsibility. When faced with the question of who had most responsibility regarding decisions related to automation, a majority expressed thoughts in the direction of management feeling most responsible. At the end of the day it is management that sets restrictions and makes decisions regarding implementation of new systems. In other words, the level of trust in systems. This is in line with the thoughts of Nygaard (2006) regarding that a decision ultimately has to be made by an individual.

A more centralised decision-making structure, as has been discussed earlier, results in increased responsibility for those actually making decisions or conducting controls. With more implementation of AI this responsibility will increase even more. Developing healthy guidelines are therefore important. This is an area of great focus amongst authorities. The latest addition is the development of seven essentials for achieving trustworthy AI made by an EU commission. During the summer of 2019 these will be tested in a pilot phase (EU, 2019). Such guidelines will have an impact on the Norwegian market despite the fact that Norway currently is not a part of EU.

6. Conclusion

The purpose of this master thesis was to look at how the introduction of intelligent automation in invoice processing is affecting, and will affect, decision-making synergies of companies in the Norwegian market. By performing in-depth interviews with people of different prominent positions related to the process in the Norwegian market, the thesis have gained knowledge about invoice processing from different angles. Thus, securing that the data collected to a great extent reflects the total market perception, and not only is relatable to one group of people. By utilization of relevant theory and collected data, the thesis has answered the research question through the use of a self- made framework that includes answers to all the initial sub questions.

Throughout the first part of the discussion the thesis tried to map the level of automation. Insights prove that intelligent automation would be able to automate close to 100% of invoice processing. However, low trust in IAs from management resulting in a need for control alongside laws and regulations will probably set limitations related to a fully automated process, at least in the short term perspective. Additionally, the need of initial input data from humans is emphasized as a reason for not being able to fully automate. This answered the first sub question and was used as a foundation for the following discussion.

As a consequence of the level of automation, humans could experience the feeling of being replaced. Nonetheless, automation of the process will also be a provider of opportunities for the existing human workforce. This thesis has shed light on likely future roles of the accountant, and how their role is linked to decision-making. Roles as an IA trainer, analyst, consultant and controller are predicted. Supplementary, the role is predicted to involve more strategic and analytical aspects, resulting in more direct influence towards decisions. Moreover, implementation of IAs is believed to lead the way for a smaller and more centralised decision-making structure.

When dealing with change, challenges that origins can limit how fast the transformation is. Insights shows that there are mixed feelings toward implementation of automation. On one hand, the human workforce is happy to be relieved of some of the responsibility regarding

conducting such a process, as it is said to be boring and repetitive. On the other hand, inertia towards change is existent. The main reason for resistance is worries regarding the unknown.

The thesis does also give insight into the ethical aspects of implementing IAs. The most prominent finding is the perception that the main responsibility lies in the hands of the management, as they are the ones ultimately making the decision related to which systems should be used or not. Furthermore, managers decide the level of trust linked to analyses and are therefore responsible for outcomes of decisions made.

As mentioned, uncertainty regarding the future alongside an in depth focus toward data collection results in this thesis not being able to generalize findings or state something with absolute certainty. As a result, this thesis merely works as a qualified suggestion of a possible scenario, which could enlighten management in the Norwegian market in terms of preparing for intelligent automation.

7. Perspectives and Further Research

This thesis has to its best ability tried to grasp the entirety of the topic by completing a case study of the Norwegian market. Additional case studies are proposed to give the best possible perspective of how automation of invoice processing will affect decision-making. Moreover, as this thesis has chosen a purely qualitative approach, future research focusing on quantitative data would be complementary. Additionally, research related to other processes linked to the role of the accountant could take part in painting a more complete picture of the situation. Lastly, as this thesis strategically has made choices related to respondents, some points of view have been excluded. Research strictly focusing on the role of the CFO or the end-user is a possibility.

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9. Appendix

Request to participate in an interview for our master thesis.

Hi,

We are two business students that are currently completing our masters' degree within "Finance and Strategic Management" at Copenhagen Business School. In that occasion we have decided to write a master thesis where we are in need of interview objects within the accounting sector in Norway.

The theme of our thesis is automation of invoice processing. Our focus is towards Robotic Process Automation and future possibilities within Artificial Intelligence. This will be discussed in light of decision theory. Our main focus is to examine the possibility of fully automating invoice processing.

In order to present a representable overview of the situation, we wish to interview 4-5 persons with different professional backgrounds and current occupations. Our view is that your profile is a perfect match. The interview will last no longer than an hour, and your participation would be of great use for our research. If this sounds interesting, we will provide more extensive information regarding the contents of the interview, as well as more practical information. Due to factors of feasibility we wish to carry out the interview as quickly as possible with 10/04 as a latest opportunity. We are currently living in Copenhagen. However, we are flexible when it comes to location (Skype is an alternative) and timing of a possible interview.

If you got any questions, we are available at:
Tel: +4795926947, +4797043264
Mail: anso17aj@student.cbs.dk

Kind regards,

Martin Bach Olsen and Andreas Langørgen Solberg