



# Artificial Intelligence as a Part of Financial Management Development

Automation of Accounts Payable Processes

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## **ABSTRACT**

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As a result of digitalization and the development of new innovations, job descriptions in financial management are also changing, as more efficient ways of working are sought. Artificial intelligence and software robotics are essential parts of this change. My thesis focuses on how artificial intelligence-based applications work as part of financial management, especially in the purchase invoice process. The thesis was not done in cooperation with a commissioner.

The study was conducted as quantitative research. An online survey was used as the data collection method, which was sent to 500 member companies of the Association of Finnish Accounting Firms. There were a total of 15 responses to the survey. The survey was conducted in January 2023.

The purpose of the research was to map the degree of automation in companies' financial management systems, how employees perceive the effects of artificial intelligence as part of financial management and their own job description, and most importantly, whether artificial intelligence adds value to the accounts payable process by making it more efficient.

Based on the results, the utilization of automation is high in financial management processes. The majority of the respondents believed that artificial intelligence and robotics have made the accounts payable process more efficient. The research results revealed an increase in work productivity since the application of artificial intelligence-based solutions, and the amount of manual work of employees has decreased, as the job description has become more consultative. Hence, it can be concluded that automation produce value and meet the given expectations in developing financial management processes.

Companies in the transition of digitalization are developing more advanced solutions in the field of artificial intelligence, and this technology is increasingly being utilized. Therefore, a suggestion for further research could be to repeat the study after a certain time, for example, after 3 years. Half of the respondents answered that they had implemented artificial intelligence-based solutions in the last couple of years. Therefore, it would be useful to research how the introduction of robotics has affected financial management processes and companies over a longer period.

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Key words: artificial intelligence, financial management, accounts payable

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# 1 INTRODUCTION

## 1.1 Research background

Robots, automation, algorithms, and artificial intelligence are today's hot buzzwords, representing different aspects of the same thing in practice, referring to information technology becoming more intelligent, and computers being able to perform tasks that previously required human intervention. Artificial intelligence is already a part of our lives, and in the future, it will be used more widely. These solutions are intended to make our everyday life and work tasks easier, and perhaps even perform them entirely for us. (Hiltunen 2017.) Kaplan and Haenlein (2019) define this digital transformation as the integration of digital technology into all areas of society and the changes that result from this integration. Simply put, "digital transformation represents the novel use of digital technology to solve traditional problems". (Kaplan & Haenlein 2019.)

In 2017, the Finnish Ministry of Economic Affairs formed a task force with the goal of making Finland one of the frontrunners in the global artificial intelligence-industry. The program was called Finland's Age of Artificial Intelligence. The aim of the program was to embrace the new technology to accelerate growth. The study reveals that several international surveys place Finland among the top countries in the world in terms of artificial intelligence readiness, and the strategy and efforts of the public administration are praised for their role in this achievement. (Finland's Artificial Intelligence Accelerator 2020.)

According to the State of AI in Finland report from Finland's Artificial Intelligence Accelerator (2020), the number of companies using artificial intelligence has more than tripled in the past three years. However, investments and knowledge are accumulating in a very small number of companies, which is cause for concern regarding whether companies that started slowly will be left behind in the competitive market of digitalization. (Finland's Artificial Intelligence Accelerator 2020.)

As we can notice, artificial intelligence is increasingly becoming more important for individuals, companies, and governments. The benefits brought by artificial

intelligence-based solutions have also been noticed in financial management, and they have been put into use.

The accounts payable process is one of the financial management processes including a lot of routine processing steps, which are time-consuming and prone to errors. Therefore, the accounts payable process is a suitable target for the introduction of artificial intelligence-based solutions to improve its functionality. In this research, the purpose of the researcher is to find out whether artificial intelligence-based applications produce added value for companies in their purchase invoicing process.

## **1.2 Thesis objective, purpose, and research questions**

The thesis focuses on artificial intelligence and software robotics in financial management, specifically in the purchase invoicing process. I believe that the topic is interesting, current, and constantly growing.

The thesis covers how the application of artificial intelligence and software robotics affects the development of financial management and the accounts payable process. It researches the benefits and possibilities, as well as the challenges posed by artificial intelligence.

The theoretical part of the thesis consists of artificial intelligence, financial management, and the effects of changes caused by technological development.

The purpose of the research is to survey whether artificial intelligence produces value in the purchase invoicing process and how professionals in the field of financial management perceive the effects of artificial intelligence and automation regarding their profession.

The intended outcome of the thesis is to gather information on how artificial intelligence affects the work of invoice handlers and whether automation enhances productivity in their basic work routines and in the analysis of purchase invoice data. Therefore, the objective of the research is to examine whether artificial intelligence adds value to the purchase invoice process theoretically. In

addition, the research also examines the current state of automation in financial management companies and the percentage of invoices processed completely by software robotics.

The main research problem:

- Does artificial intelligence add value to the purchase invoicing process?

The main research questions:

- Has automation made the purchase invoicing process more efficient?
- Have employees utilized the information from the automation software?
- Do they notice any possible threats regarding artificial intelligence in financial management?

### **1.3 Concepts and theory**

The main concepts of the thesis are the accounts payable process and artificial intelligence. Financial management will be described in more detail, with a particular focus on the accounts payable process. Artificial intelligence is also described as a concept, and the thesis examines its role as part of the development of financial management. The challenges and possible threats of artificial intelligence will also be covered.

#### **1.3.1 Innovation as a theory**

The intention of developing technological solutions to increase productivity and competitiveness, product development and innovation management are fundamental characteristics of artificial intelligence in the development of financial management processes.

According to Satell (2017, 3), the Innovation Matrix, as illustrated below in Figure 1 guides in identifying the right strategy to solve a problem by asking: "How well

can we define the problem?” and “How well can we define the skill domain(s) needed to solve it?”

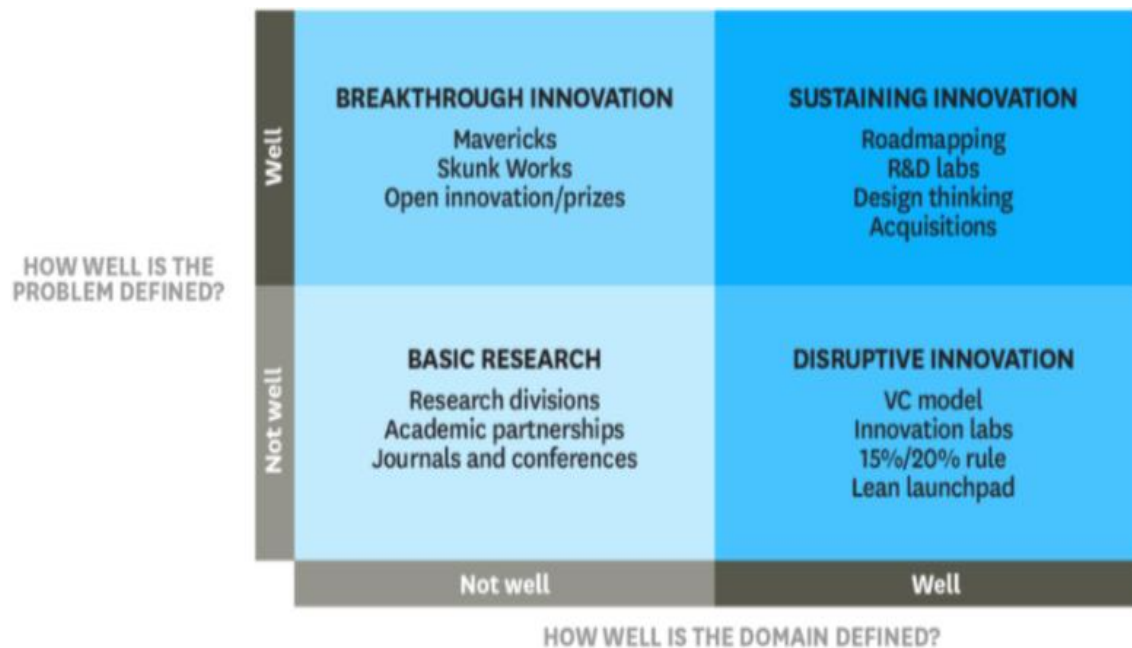


Figure 1. The Innovation Matrix for strategic planning (Satell 2017, 3).

Sustaining innovation, where most innovations emerge, is driven by the desire to improve whatever the initial purpose was. This means improving existing capabilities in existing markets, identifying the problems that need to be solved, and the skills required to solve them. Strategic roadmapping, research and development, acquisitions, and design thinking methods are ways to innovate something new if the problem and the necessary skills to solve it are well understood. (Satell 2017, 3-4.) As a part of financial management development, artificial intelligence could be considered to be in the phase of sustaining innovation, where there is a fairly clear understanding of what problems need to be solved and what areas of expertise are required to solve them. Strategic roadmapping, research and development laboratories, design thinking, and acquisitions are key drivers in the characteristics of artificial intelligence as a part of financial management development in this phase.

### 1.3.2 Value proposition as a theory

Value proposition for the user is performance delivered through quality, mass customization, differentiation, and innovation. Collaborative value creation has advantages in developing breakthrough innovations. (Seth 2019, 2-4.)

Artificial intelligence as an innovation without the added business value brought by the solution is not economically viable. Therefore, customers are not willing to pay for innovative technology without a value-producing factor. On the other hand, without innovation, no value is created, or the benefit is minimal. Artificial intelligence-based technologies make it possible to organize many functions in a new way, but the implementation of a new system often requires a change in operating models. The application of artificial intelligence can change the market and create situations where the competitive landscape can change quickly. With the help of artificial intelligence, it is possible to implement the so-called “Blue Ocean strategy” which refers to a situation where there is little competition, or it has been possible to create a completely new market. (Kim W.C, Mauborgne, R. 2015; Kananen & Puolitaival 2019, 16.)

#### **1.4 Working methods and data**

The empirical part of the research is planned to be conducted as quantitative research. The data collection method will involve sending an online survey via SurveyPal to the target group, which consists of 500 financial management companies from 54 different municipalities in Finland.

According to O’Dwyer and Bernauer (2014), the essential difference between qualitative and quantitative research is that qualitative research relies on inductive reasoning, while quantitative research relies on a deductive reasoning approach. As a result, qualitative methods tend to generate theories (inductive), while quantitative methods tend to test theories or hypotheses (deductive). However, every research, regardless of its type, involves stages that are both inductive and deductive. (O’Dwyer & Bernauer 2014, 45-46.)

As Vilkkä (2007) mentions, the quantitative research method usually answers the questions of how many, how much, and how often. In the context of this research, this kind of research method is generally the most suitable when considering the

survey questions. Characteristic features of quantitative research are also the large number of respondents, as well as the objectivity of the research, if the researcher does not have personal contact with the target group. (Vilkkä 2007, 14, 16-17.)

According to Vilkkä (2007), quantitative research is characterized by searching for causal relationships in the data and explaining them. Therefore, research assumes that some underlying factor leads to certain types of consequences in general, meaning that something is caused by something else. (Vilkkä 2007, 23.) The questions presented in the questionnaire aim to search for cause-and-effect relationships regarding the impact of robotics and artificial intelligence on the efficiency of the purchase ledger. In other words, the questions aim to determine whether these applications produce added value in the process by making it more efficient.

## 2 DEVELOPMENT OF FINANCIAL MANAGEMENT

Kaarlejärvi and Salminen (2018, 14) have acknowledged that the digitalization of financial management is progressing from digital financial management to the phase of intelligent financial management. Figure 2 below illustrates how the development of financial management has progressed from paperless accounting, followed by electronic financial management. Electronic financial management has further developed into digital financial management, which is constantly evolving into intelligent financial management. However, Lahti and Salminen (2014, 28) have also mentioned that the latest technological innovations are slightly delayed in financial management.

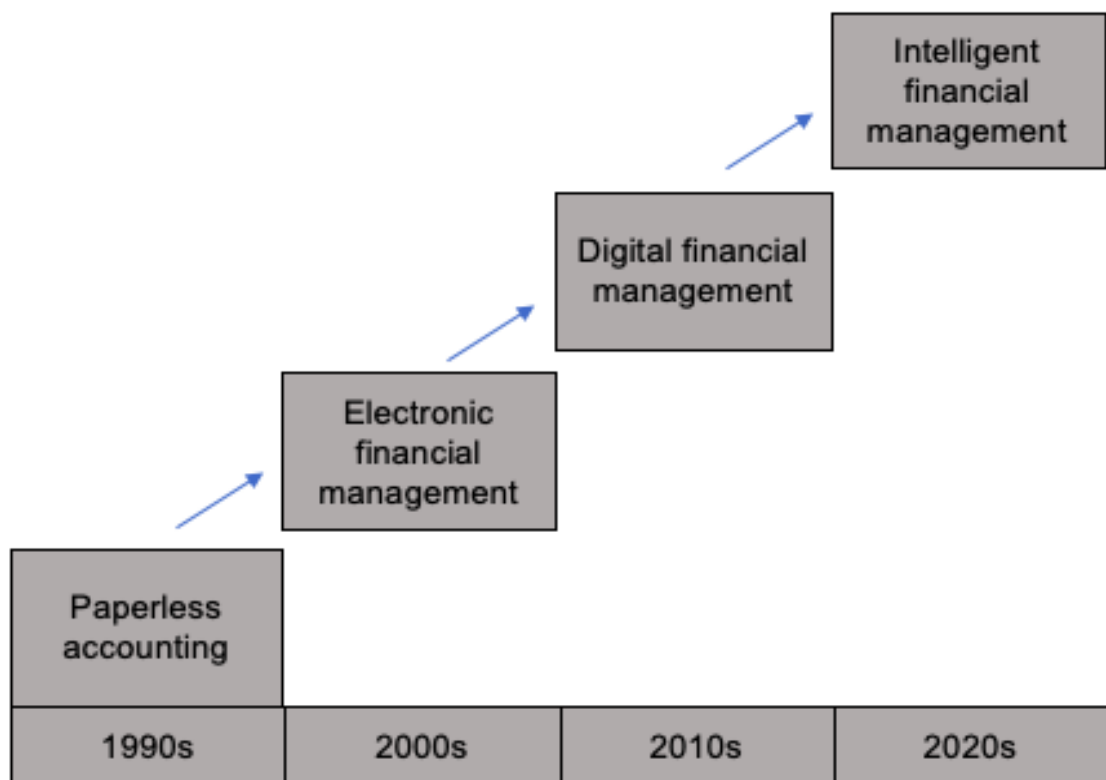


Figure 2. Development of electronic financial management in Finland (Kaarlejärvi & Salminen, 2018, 16).

Digital financial management refers to the automation and processing of all data flows and processing steps of financial management in digital form. In digital financial management, all transactions in accounting and its sub-processes are processed and generated as automatically as possible without paper. Digital

financial management can also be described by the definition of automatic financial management. (Kaarlejärvi & Salminen 2018, 14.)

Digital financial management is very different from paperless accounting. The term "paperless accounting" was commonly used in Finland at the end of the 1990s and the beginning of the 2000s when electronic systems became more common. In practice, paperless accounting meant the presentation of statutory accounting documents in electronic form. (Kaarlejärvi & Salminen 2018, 15.) In digital financial management, where most of the information is in digital form, the advantages of digitalization, i.e., the utilization of digital information in the automation of financial processes and reporting, have already been utilized. (Kaarlejärvi & Salminen 2018, 16.)

In the latest stage of development, intelligent financial management is characterized by the efficient reorganization of tasks between people and systems. In this phase, systems can autonomously perform routine tasks that previously required manual work and input from financial management staff. Additionally, systems and processes are designed to generate added value in tasks that require human reasoning and creative problem-solving. (Kaarlejärvi & Salminen 2018, 17.)

### **3 FINANCIAL MANAGEMENT**

#### **3.1 Financial management**

Financial management is a function that converts the organization's operations into financial form. Financial management consists of data, processes, people, and information systems. The processes manage the data entering financial management. Processing is done either by information systems automatically, by people manually, or by both together. The outcome of financial management is documentary and reporting. (Kaarlejärvi & Salminen, 2018, 93.)

The purpose of financial management is to report on the financial events of the business to the company's stakeholders. Financial management is divided into two different areas that produce different types of financial information. These separate areas of accounting are management accounting and financial accounting. (Lahti & Salminen 2014,16.) Management accounting measures, analyzes, and reports financial information, which is utilized, for example, in determining capital structure and funding. In addition, management accounting produces important non-financial information to assist managers in achieving organizational objectives, such as informing strategic decisions and formulating business strategy. (Bhimani, Horngren, Datar & Rajan 2018, 3.) Financial accounting focuses on external reporting, which is directed by authoritative guidelines (Bhimani et al. 2018, 4). This external financial information of the business is targeted for tax authorities and stakeholders outside the company, such as owners, customers, and other partners (Lahti & Salminen 2014, 16).

The role of the general ledger has changed to a process that gathers and verifies information. In modern financial management, there are only a few receipts that can be recorded directly into the general ledger. The majority of entries are created automatically through other sub-processes. Therefore, the role of the general ledger remains as a receiver of accounting records and entries, reconciliations of accounts, and period break measures and closing. (Kaarlejärvi & Salminen 2018, 95.)

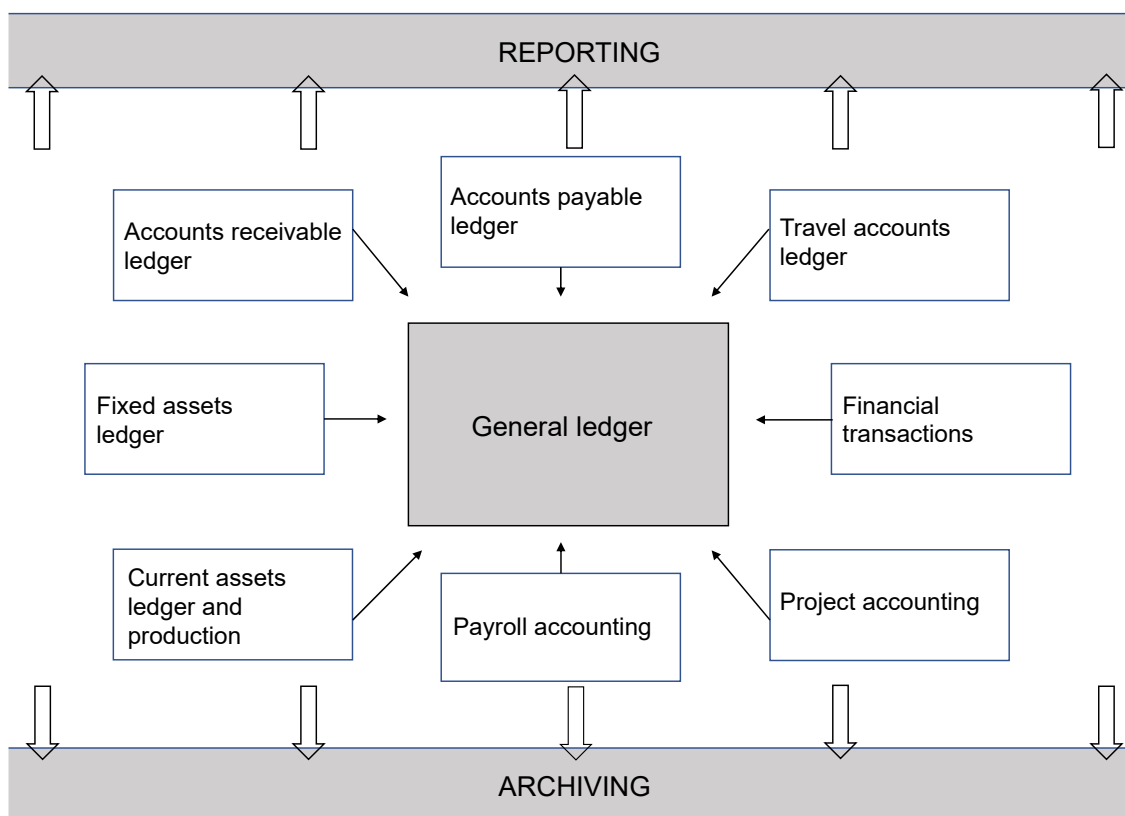


Figure 3. Financial management processes (Kaarlejärvi & Salminen 2018, 95).

In Figure 3 above, the most essential sub-processes are illustrated together with the general ledger. In financial management, the general ledger compiles events from other sub-processes, balances them, and creates reports based on the entries. Tasks of the general ledger include reconciling accounts, allocating, closing the period, processing taxes, and reporting. The overall process is called *Record to Report*. (Kaarlejärvi & Salminen 2018, 93-95.)

In Finland, the Accountancy Act guides the financial management processes of every company and community, and they are all obliged to keep records for taxation purposes. Additionally, the accounting, also called an *audit trail*, must be organized so that the connection of business transactions, receipts, and entries through possible sub-accounting to the main general ledger accounting, and from there to the financial statements, can be verified in both directions without difficulty. The same applies to periodic reporting of accounting to the authorities for taxation or other purposes. (Kirjanpitolaki, 1997, 1 chapter, 1a§, 2 chapter, 6§; Fredman 2015.)

Regardless of the size of the business, all companies have some kind of financial management system to automate and monitor their core business processes for optimal performance. Also, different processes require different kinds of systems and software. The systems can be roughly divided into two different groups: stand-alone systems and ERP (Enterprise Resource Planning) systems. An ERP system consists of various modules that can be implemented according to business needs. The advantage of an ERP system is that all functionalities can be found in the same system, hence there is no need to build integrations between systems. In turn, stand-alone systems are specialized in the functions of a certain area or field of business. However, for stand-alone systems, integrations with the ERP system must be created separately, but systems specialized for a certain function are often more beneficial for a specific purpose than an ERP module alone. (Kaarlejärvi & Salminen 2018, 32-33.)

### 3.2 Accounts payable process

The accounts payable process includes steps from the purchase proposal or purchase order to the payment of the purchase invoice. The overall purchasing process is often described by the term *purchase to payment*. As shown in figure 4 below, the process comprises several different processing stages, including the ordering and delivery process, receiving the invoice, posting, review and approval of the invoice, payment, balancing, and allocation. (Kaarlejärvi & Salminen 2018, 93, 96-98.)

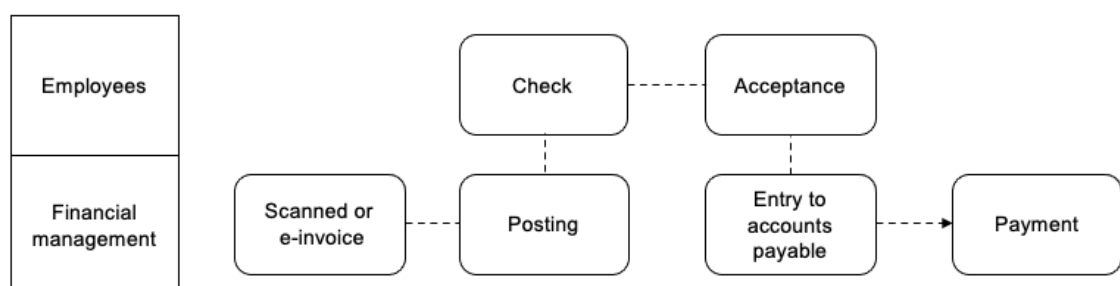


Figure 4. Electronic purchase invoice process (Lahti & Salminen 2014, 55).

From the perspective of financial management, the purchase invoice process starts when the purchase invoice is received by the company and ends when the invoice is paid, recorded in the accounts, and the document is archived (Lahti & Salminen 2014, 53).

The accounts payable ledger is balanced with the general ledger by comparing the accounts payable ledger's listing of open purchase invoices with the balance of the accounts payable. In the process, it is important to monitor the balance of the purchase payment interim account to ensure the correctness of the payments. Balancing of the accounts can be done either manually or with the help of automation, depending on the capabilities of the systems in use. (Kaarlejärvi & Salminen 2018, 110.)

### **3.2.1 Development of accounts payable process**

The processing of purchase invoices is usually the process that takes the most resources of the financial department, causing additional work in terms of invoice inspection, approval, and reconciliation of accounts. For this reason, the accounts payable process has development potential in terms of making operations more efficient, for example, through automation. (Kaarlejärvi & Salminen 2018, 96.)

Digitalization is a prerequisite for automation. Automation cannot be utilized in paper-based processes, for example, in the traditional accounts payable process, where the invoice must first be mailed and then forwarded to the invoice handler to be scanned and entered into the system. (Lahti & Salminen, 2014, 53; Kaarlejärvi & Salminen 2018, 184.)

The majority of Finnish companies send their invoices as electronic invoices, and in the largest companies, the share of e-invoicing is 80-100%, varying per company. Many organizations have also decided to only receive e-invoices due to the slower processing time of paper invoices and the ability to utilize e-invoice data by applying automation and reducing manual work. With the electronic invoice process, the basic invoice information does not have to be filled in manually, but is automatically read from an invoice or by using OCR (Optical Character Recognition) smart scanning to extract the necessary information from invoices still received as a paper version. (Kaarlejärvi & Salminen 2018, 97, 103.)

According to Lahti and Salminen (2014), the biggest development trends in the accounts payable process in the forthcoming years are increasing automation, transitioning from stand-alone systems towards invoice processing modules of ERP-systems, concentrating on principles, instructions and enhancing processes, optimizing organization and objectives, and metrics as executive functions (Lahti & Salminen 2014, 58-59).

Processes are made more efficient by unification and standardization. In development of processes, general objectives are increasing efficiency, faster lead times and improving the quality of transactions generated in the process. The more unified, standardized and centralized the processes are, the faster and more cost-effective automation is when building a smart financial management. The goal is to develop processes that are easy for both financial management and other organizations to use. (Kaarlejärvi & Salminen 2018, 55, 168.)

The importance of data governance, i.e., information management, has become more significant as data in digital form is a prerequisite for high automation and the use of artificial intelligence to increase operational efficiency (Kaarlejärvi & Salminen 2018, 49). In developing financial management and its processes, documentation is a major issue. The most important contents of financial management documentation are process descriptions, charts of accounts and related instructions, calculation manuals, to-do lists for the break of the season, and various work instructions. Careful documentation has a positive effect on the company's risk management by facilitating information and increasing transparency. (Kaarlejärvi & Salminen 2018, 169–172.)

## 4 TECHNOLOGIES IN FINANCIAL MANAGEMENT

Technological development and the proliferation of information systems in society have led to the point where the majority of services are provided as digital services. Robotic process automation has many advantages in terms of automating business processes. Increasing the performance of robotic process automation processes by combining artificial intelligence algorithms and techniques allows for the improvement of accuracy and execution in the extraction of information, as well as recognition, classification, forecasting, and optimization of processes. (Ribeiro, Lima, Eckhardt & Paiva 2020.)

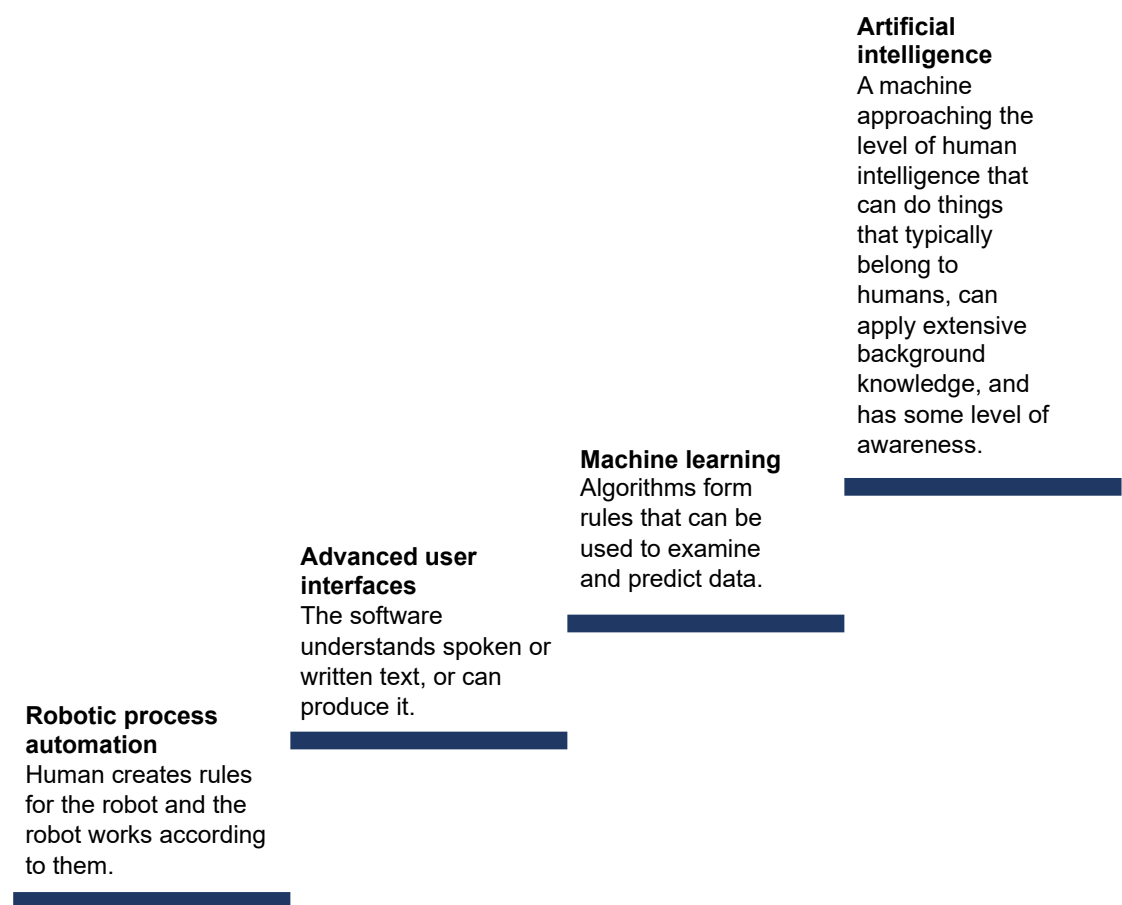


Figure 5. The applications of intelligent automation (Kaarlejärvi & Salminen, 2018, 52).

In figure 5 above, the applications of intelligent financial management are illustrated, ranging from software robotics to artificial intelligence. Robotic process automation is the most commonly utilized form of robotics in financial management. Additionally, there are several other technologies that can be

categorized as robotics and artificial intelligence. (Kaarlejärvi & Salminen 2018, 51.) Advanced user interfaces are able to identify, interpret, and process data from, for example, images or videos, such as text, sound, and speech in different languages (Kaarlejärvi & Salminen 2018, 56). The next stage of development is also one of the areas of artificial intelligence. Machine learning is based on the processing and classification of large masses of data by utilizing various mathematical models. The most advanced form of technology is artificial intelligence, which refers to a technological invention approaching the level of human intelligence. Artificial intelligence has the ability to perform tasks that typically belong to humans, can apply extensive background information, and has some level of awareness. (Kaarlejärvi & Salminen 2018, 59-61.)

Kaarlejärvi and Salminen (2018) agree that the application of software robotics and artificial intelligence is one of the most significant changes brought about by digitalization in increasing the degree of automation in financial management. The most advanced solutions already utilize machine learning and other artificial intelligence-based solutions. (Kaarlejärvi & Salminen 2018, 51.)

#### **4.1 What is robotic process automation?**

Robotic process automation is programmable software that performs routine business processes (Porter 2020). In robotic process automation, the word "robot" refers to software programs that mimic human actions (Tripathi 2018, 9). Software robots work like ordinary human workers and are a solution for tasks that cannot be automated using standard systems. The robots utilize other software, such as the ERP system, via the user interface. (Efima n.d.) Software robots are capable of complex calculations and decision making based on data and predefined rules. Automating tasks has become easier since the application of robotic process automation. In order for it to work functionally, the application only needs to know the steps taken by humans and make the robots mimic the actions on a computer screen using a mouse and keyboard. Robotic process automation distinguishes itself from more traditional automation by the method of learning. The software robot is trained using illustrative steps rather than instructions based on code, which facilitates the introduction of robotics. (Tripathi 2018, 10.) With the inclusion of artificial intelligence technologies, robotic process

automation has the capability to read from images or scanned documents and interpret unstructured data and formats as well (Tripathi 2018, 11).

Tripathi (2018) emphasizes that in the digital world, automation and software development are two different terms. If some portion of a workflow can be programmed to be done without human intervention, it can be called automation. For example, developing an inventory management software system is called software development, while programming a step so that no human intervention is required is called automation. (Tripathi 2018, 7.)

There are various techniques available to automate processes in an organization where software systems are being used to accomplish certain tasks. However, it is necessary to carefully consider which processes can be automated and what *should* be automated. (Tripathi 2018, 7.) Fantina, Storozhuk and Goyal (2021, 1) note that robotic process automation can be applied to a wide variety of processes by focusing on four key characteristics to determine if a process could be suitable for automation:

1. Is it repetitive?
2. Would the cost of automating the process be less than the cost of continuing to do it manually?
3. Is automation necessary for competitive advantage?
4. Would automating a process better enable the organization to comply with government regulations?

Cost reductions while delivering higher quality and scalable output makes robotic process automation appealing and value creating business case. Processes, which are labour- and transaction intensive, normally human performed recurring tasks that can be redesigned as rule-based activities executed by software robots. (Fantina et al. 2021, 1.) Tripathi (2018) emphasizes that logical, well defined repetitive rule-based steps can, and should be automated.

## **4.2 What is machine learning?**

Machine learning is a technology with rudimentary artificial intelligence features, and more developed automation than robotic process automation. The technology is capable of processing large amounts of data, and the more extensive the data available, the more the machine develops itself by learning and schematically becomes more reliable and better without separate programming. (Kaarlejärvi & Salminen, 2018, 59.) The application of machine learning methods to large databases is called data mining. In data mining, a large volume of data is processed to construct a simple model with valuable use, such as high predictive accuracy. (Alpaydin & Bach, 2014, 1.) However, humans still have to define the mathematical algorithms to be used and develop them along with learning. As stated, advanced machine learning becomes better and more reliable continuously when the amount of data increases and regularities and mutual relationships are found from the data. Therefore, machine learning does not need to be taught at every step, due to the technology's ability to learn during the process with the help of its rudimentary artificial intelligence. (Kaarlejärvi & Salminen, 2018, 60.)

One method of machine learning is deep learning, which refers to neural networks. It is inspired by the human cortex and biologically resembles the structure of the human brain. The recent rapid development of deep learning has increased interest in artificial intelligence, as it has made it possible to develop cognitive technologies, such as image and voice recognition and self-driving cars. Utilizing deep learning requires a large amount of data. Deep neural networks have made significant progress in the 2010s due to the availability of data, improved computing power, and the practical implementation of mathematical ideas in an efficient manner. (Kananen & Puolitaival 2019, 127.)

Machine learning is primarily used for data classification and prediction, which can include suggestions, recommendations, or automatic actions based on a prediction (Kaarlejärvi & Salminen, 2018, 60). Prediction models produced by machine learning fall into two categories: classification models, which predict probability, and quantity models, which predict magnitude (Kananen & Puolitaival 2019, 109).

The accounts payable process is the most suitable sub-process in financial management for the utilization of machine learning due to the vast amount of invoices that cannot be processed with standard automation. In the accounts payable process, machine learning can create solutions, for example, by suggesting posting rules and processing proposals. (Kaarlejärvi and Salminen, 2018, 60.)

### **4.3 What is artificial intelligence?**

The definition of artificial intelligence as a concept is ambiguous. According to McCarthy, Minsky, Rochester, and Shannon (1955), the Dartmouth Research Project defined artificial intelligence as the problem of "making a machine behave in ways that would be called intelligent if a human were so behaving". Similarly, cognitive scientist Marvin Minsky (1968) considered artificial intelligence as "the science of making machines do things that would require intelligence if done by men". (Kaplan & Haenlein 2019, 17.) Kaplan and Haenlein (2019) define artificial intelligence as "the system's ability to interpret external data correctly, to learn from such data, and to use those learnings to achieve specific goals and tasks through flexible adaptation".

The operational principles of artificial intelligence are programming, mathematics, and statistics. It is based on matrices, vectors, derivatives, and statistical probabilities. In principle, the basics of artificial intelligence are very simple and familiar mathematical concepts, but it becomes more complicated when applied in practice. Artificial intelligence can be programmed using open source-based development environments. The programming of artificial intelligence is based on rules according to which it learns to look for regularities in the data and produces more accurate predictions the more data it utilizes. (Kananen & Puolitaival 2019, 27–30.)

	Expert Systems	Analytical AI	Human-Inspired AI	Humanized AI	Human Beings
Cognitive Intelligence	x	✓	✓	✓	✓
Emotional Intelligence	x	x	✓	✓	✓
Social Intelligence	x	x	x	✓	✓
Artistic Creativity	x	x	x	x	✓
Supervised Learning, Unsupervised Learning, Reinforcement Learning					

Figure 6. Outlining the types of artificial intelligence systems (Kaplan and Haenlein 2019, 18).

Kaplan and Haenlein (2019) classify artificial intelligence into three types of competencies in figure 6 above:

*Analytical artificial intelligence*, which has only characteristics consistent with cognitive intelligence, generating a cognitive representation of the world and learning based on past experience to inform future decisions. Most of the artificial intelligence-based technologies fall into this category, such as applications used in financial management or self-driving cars.

*Human-inspired artificial intelligence*, which possesses features from cognitive as well as emotional intelligence. In addition to cognitive elements, this type of artificial intelligence also understands human emotions and considers them in their decision making.

*Humanized artificial intelligence*, which possesses characteristics of all types of competencies, i.e., cognitive, emotional, and social intelligence. A machine with the ability of being self-conscious and self-aware in its interaction with others is not available yet. Artificial intelligence-based machines that actually experience the world in a fundamental way are the project of the future. (Kaplan & Haenlein 2019, 18-19.)

A defining element of all artificial intelligence systems is their ability to learn from past data. For this, there are three types of learning processes: *supervised learning*, *unsupervised learning*, and *reinforcement learning*. (Kaplan & Haenlein 2019, 19.) Supervised and unsupervised learning utilize data in their operations, and data is used to teach artificial intelligence. Neural networks and machine learning methods are used in the operation of supervised learning, whereas unsupervised learning does not utilize neural networks. Unsupervised learning utilizes only machine learning methods, which can be combined with different

algorithms. Supervised and unsupervised learning methods require a large amount of data to train the artificial intelligence. Reinforcement learning, on the other hand, does not need large amounts of data to learn, but the operating environment of the artificial intelligence needs to be modeled. Unlike supervised and unsupervised learning types, it learns by experimenting. (Kananen & Puolitaival 2019, 43-44.)

Nowadays, as artificial intelligence becomes a part of society, it is impossible not to consider the development of technology in terms of its benefits and drawbacks. According to Verdegem (2021), as a counterweight to growth and efficiency, artificial intelligence has been found to be partly responsible for societal problems and harms. Borgesius (2018) further explains how artificial intelligence can intentionally be used for discrimination, while Asaro (2018) highlights the risks of autonomous weapons and the possibility of unattributable attacks (Asaro 2018; Borgesius 2018). Society needs critical perspectives on artificial intelligence: what it is, what type of artificial intelligence is needed, and what kind of visions arise from it. The main question is how to think and talk about artificial intelligence and its power to influence the actions, beliefs, or behavior of others. This is the most central aspect of it. Society should formulate critical perspectives on artificial intelligence to ensure that it benefits everyone. Therefore, it is important to consider who can influence what society looks like and who controls the means that allow such influence. (Fuchs 2017; Verdegem 2021.)

## 5 RESULTS AND ANALYSIS

In this chapter, the results of the survey are presented. A total of 15 responses were received. The recipients of the survey were asked to respond only if their company used artificial intelligence-based solutions in their financial management systems. The answers are examined in the order of the questions, and diagrams and tables were created from the survey data to illustrate the responses.

### 5.1 Respondent background

At the beginning of the survey, respondents were asked to provide background information, including their location, job position, and the number of employees in their company.

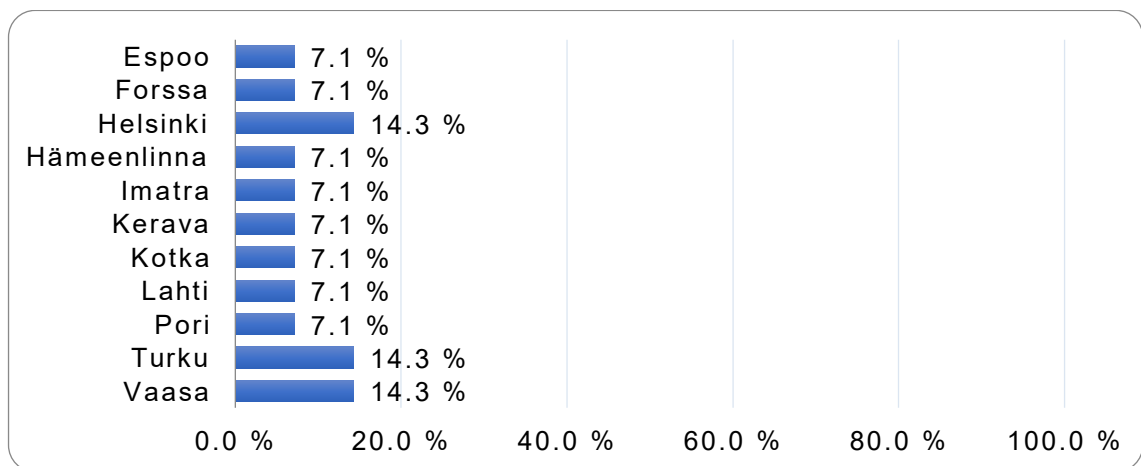


Figure 7. Respondents by location

Figure 7 above illustrates the distribution of respondents in Finland. Responses to the survey came from 11 different cities, with 2 responses from each of Helsinki, Turku, and Vaasa. The rest of the responses were from 8 different cities, as shown in Figure 7. 14 out of the 15 respondents answered to the question.

When asked about the job descriptions of the respondents, as seen in Figure 8 below, over half of the respondents (60%) were managing directors. 13,3% were financial managers, and the remaining respondents (each with a share of 6,7%)

answered their job titles as controller, accountant, payroll, and trainee. All respondents answered to the question.

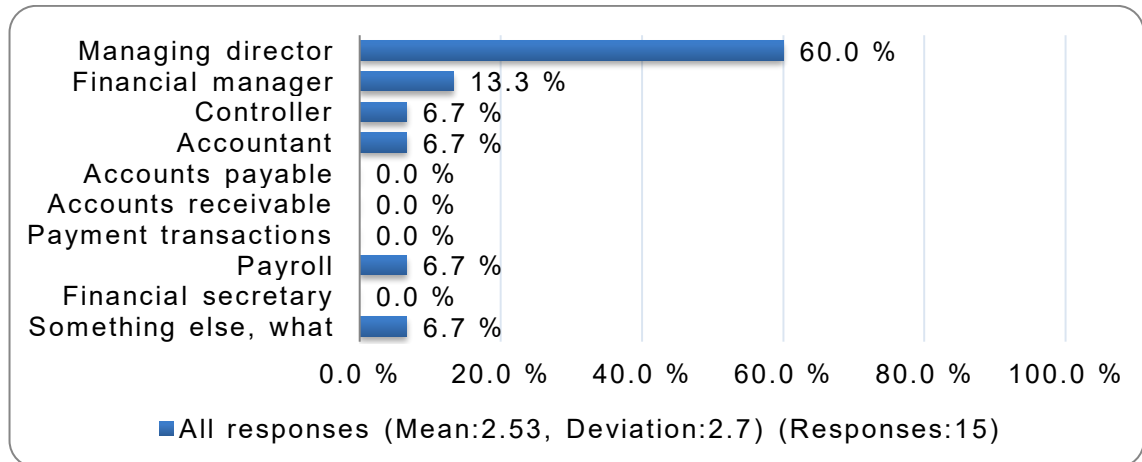


Figure 8. Respondents' professional title

The next question surveyed the number of employees in the respondents' workplaces. 14 out of the 15 respondents answered to this question. Figure 9 below illustrates the distribution of the respondents' answers. It can be noted that 50% of the respondents work in companies with 11-30 employees, 21,4% work in companies with 6-10 employees, and another 21,4% work in companies with 3-5 employees. Only 7,1% of the respondents work in companies with 31-50 employees. Only 7,1% of the respondents work in companies with 31-50 employees.

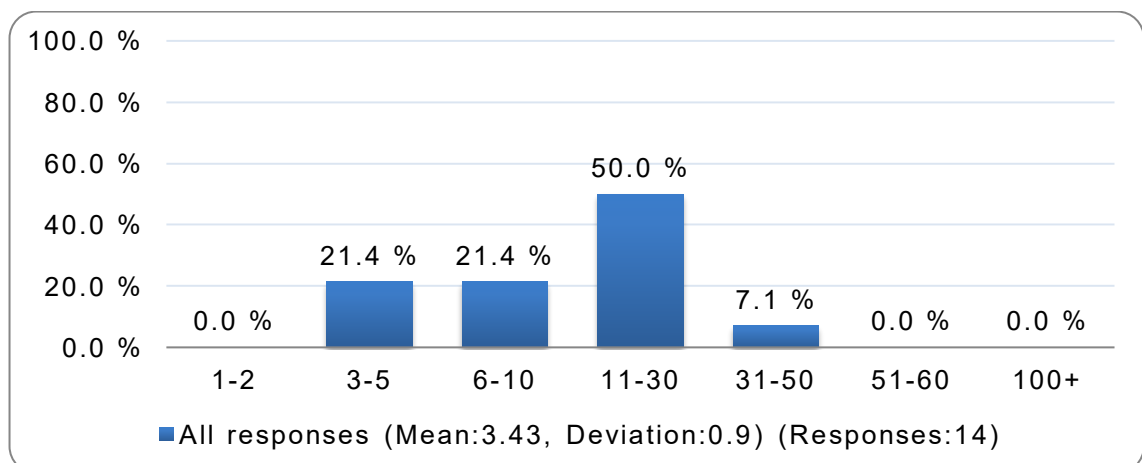


Figure 9. The amount of employees in respondent's company

## 5.2 Survey results

### **5.2.1 When did your company implement AI-based solutions in financial management processes?**

Next, the respondents answered open-ended questions. The purpose of the first question was to determine how much experience they had with artificial intelligence as a financial management tool. There were 15 answers to this question. Half of the respondents reported that they had implemented artificial intelligence-based solutions during 2021-2022. Two respondents stated that they had implemented such applications 15 years ago, and one respondent reported that they were not using artificial intelligence-based applications at all. The remaining respondents reported that they had adopted artificial intelligence-based applications during the 2010s.

### **5.2.2 What factors influenced to the decision of implementing these solutions in financial management systems?**

14 out of the 15 respondents answered to this question. The respondents were in agreement that time management and the reduction of manual repetitive tasks were the main reasons for introducing artificial intelligence and robotics into financial management systems. Automation increases operational efficiency, resulting in real-time accounting and improved customer satisfaction. The implementation of artificial intelligence has also been made easier by software providers. Lastly, one respondent mentioned that the world and financial markets are constantly changing, and not keeping up with technological development could lead to a disadvantage in competition with larger companies.

### **5.2.3 In which processes is the AI-based solutions used?**

The next step was to identify the processes in which the respondents used these applications. The multiple-choice question allowed the respondents to select more than one option. 14 out of the 15 respondents answered to this question. Figure 10 below illustrates that 92,9% of the respondents stated that they use artificial intelligence in the processing of purchase invoices. Accounting also appeared as a process where artificial intelligence was deemed a useful application, with 71,4% of the respondents reporting that they use artificial

intelligence in that specific process. 35,7% of the respondents stated that they also use artificial intelligence in sales invoices and payment transactions. Other processes, such as reporting and credit line determinations, were also mentioned as processes where artificial intelligence is utilized.

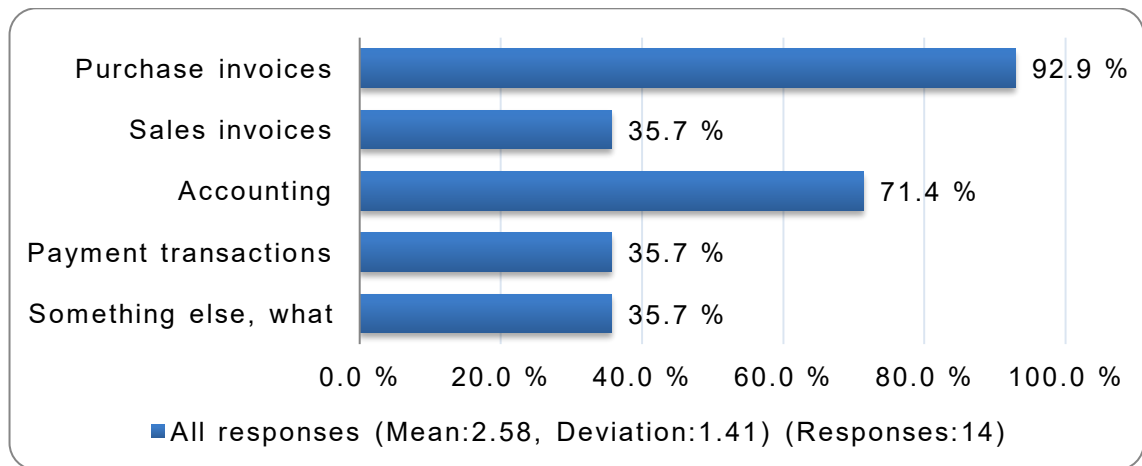


Figure 10. Processes where AI-based solutions are used

#### 5.2.4 To what extent is the statement true?

In this section, the respondents' task was to evaluate five different statements on a scale from 1 to 5 based on how they experienced the statement themselves. The respondents were given a guideline for the numerical evaluation of the statements, with 1 = Not at all, 2 = Not much, 3 = Neutral, 4 = Quite a lot, and 5 = Very much.

The respondents' first task was to assess whether robotic process automation has increased work productivity. Figure 11 below shows the distribution of the responses regarding the first statement. 13 out of the 15 respondents rated the statement, with an average of 3,62.

7,7% of the respondents answered that robotic process automation has not increased work productivity much, but 53,8% of the respondents answered that robotic process automation has increased it quite a lot, and 23,1% answered very much. 15,4% of the respondents answered that robotic process automation has not increased work productivity at all.

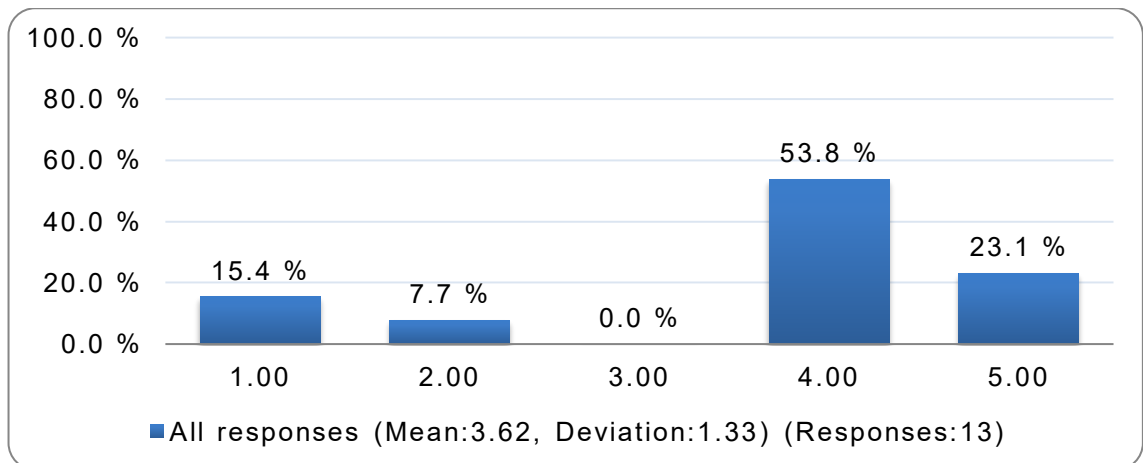


Figure 11. Statement 1: The robotic process automation has increased work productivity

The respondents' second task was to assess whether robotic process automation has reduced errors in the invoicing process. Figure 12 below shows the distribution of the respondents' answers regarding the second statement. 13 out of the 15 respondents rated the statement, with an average of 3,0.

15,4% of the respondents answered that robotic process automation has not reduced errors in the invoicing process much, but 30,8% of the respondents answered that robotic process automation has reduced errors quite a lot, and 15,4% answered very much. 15,4% of the respondents were neutral, and 23,1% of the respondents answered that robotic process automation has not reduced errors in the invoicing process at all.



Figure 12. Statement 2: The robotic process automation has reduced errors in the invoicing process

The respondents' third task was to assess whether the introduction of software robotics has freed up employees' working time for other tasks. Figure 13 below shows the distribution of the respondents' answers regarding the third statement. All 15 respondents rated the statement, with an average of 3,47.

6,7% of the respondents answered that the introduction of software robotics has not freed up employees' working time for other tasks much. However, 53,3% of the respondents answered that the introduction of software robotics has freed up employees' working time for other tasks quite a lot, and 20% answered very much. Another 20% of the respondents answered that the introduction of software robotics has not freed up employees' working time for other tasks at all.

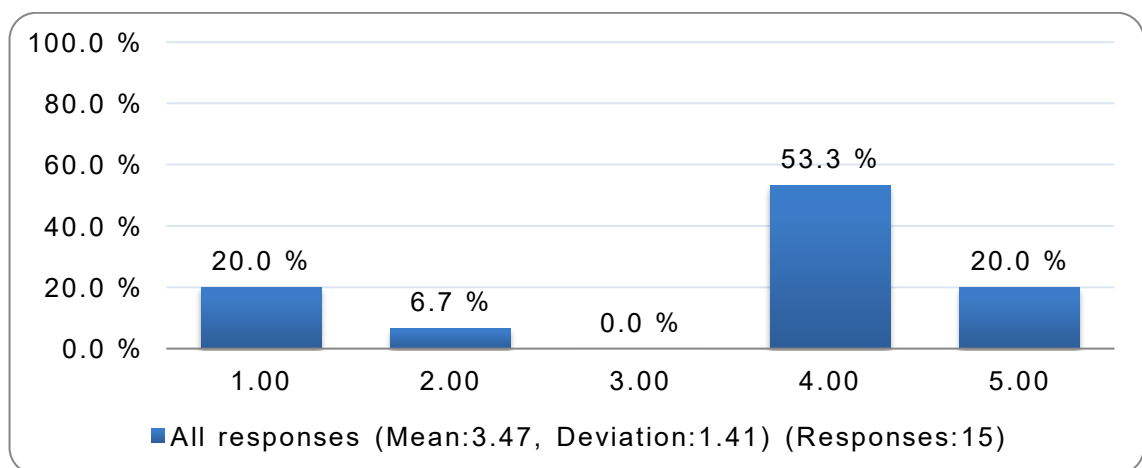


Figure 13. Statement 3: With the introduction of software robotics, employees' working time has been freed up for other tasks

The respondents' fourth task was to assess whether the purchase invoice process has become more efficient since the introduction of robotic process automation. Figure 14 below shows the distribution of the respondents' answers regarding the fourth statement. All 15 respondents rated the statement, with an average of 3,53.

6,7% of the respondents answered that the purchase invoice process has not become much more efficient since the introduction of robotic process automation, but 33,3% of the respondents answered that the process has become quite a lot more efficient, and another 33,3% answered that it has become much more efficient. 6,7% of the respondents were neutral, and 20% of the respondents

answered that the purchase invoice process has not become more efficient since the introduction of robotic process automation at all.

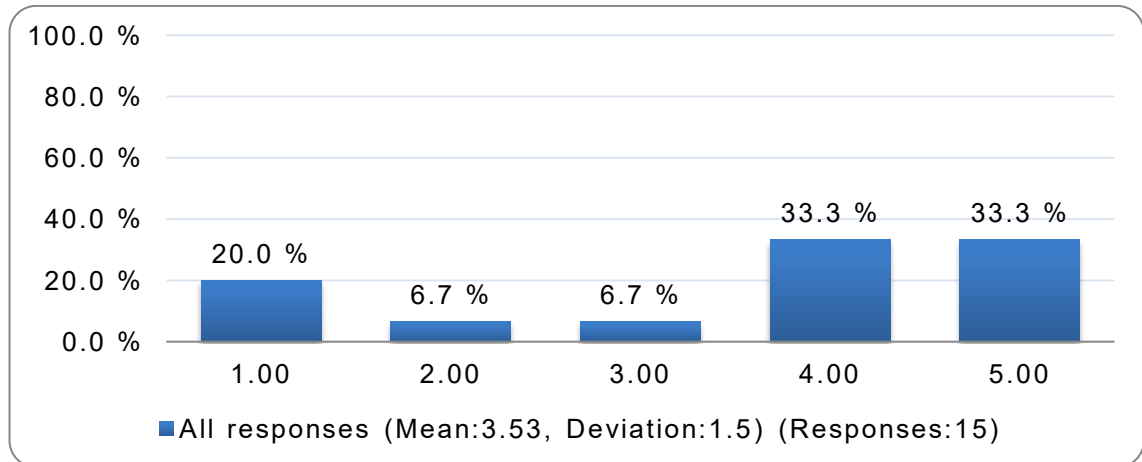


Figure 14. Statement 4: The purchase invoice process has become more efficient since the introduction of robotic process automation

The respondents' fifth task was to assess whether the total workload has increased since the introduction of software robotics. Figure 15 below shows the distribution of the respondents' answers regarding the fifth statement. 13 out of the 15 respondents rated the statement, with an average of 2,85.

30,8% of the respondents answered that their total workload has not increased much since the introduction of software robotics, yet another 30,8% of the respondents answered that their total workload has increased quite a lot since the introduction of software robotics, and 7,7% answered that their total workload has increased very much. 15,4% of the respondents were neutral, and another 15,4% of the respondents answered that their total workload has not increased since the introduction of software robotics at all.

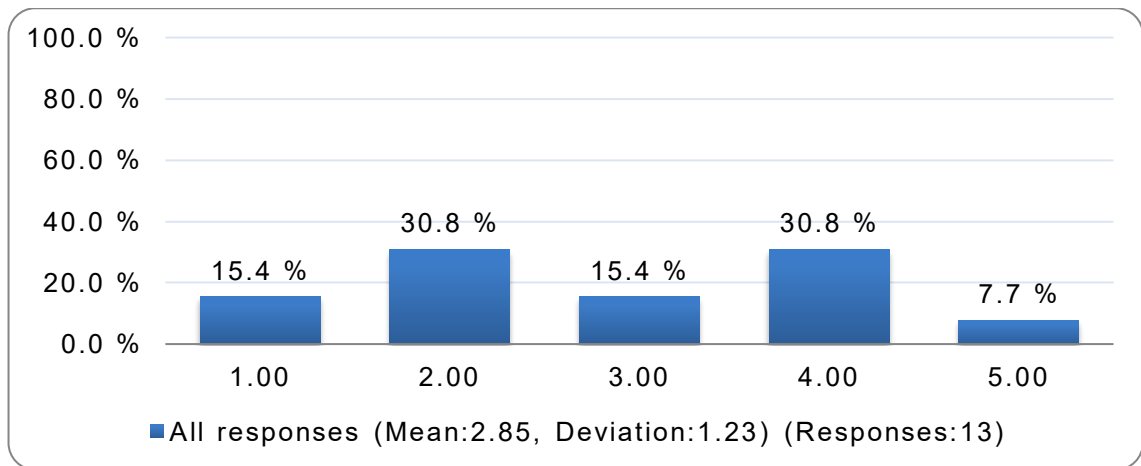


Figure 15. Statement 5: The total workload has increased since the introduction of software robotics

### 5.2.5 Estimation of the percentage of invoices processed completely by software robotics

Next it was surveyed, how many of the invoices were processed entirely by the software robotics in the employees' companies. The respondents were given a scale as a guideline for the numerical evaluation: 0=0% - 10=100%. 14 out of the 15 respondents rated the statement, with an average of 5,21.

As shown in Figure 16 below, the answers were evenly distributed. 7,1% of the respondents evaluated, that software robotics processed 20% of the company's invoices. 14,3% of the respondents estimated the share to be around 30%, 7,1% of the respondents 40%, 14,3% of the respondents 60%, 14,3% of the respondents 70%, 14,3% of the respondents 80%, 7,1% of the respondents 90%, and 7,1% of the respondents 100% of the invoices. 14,3% of respondents did not have a process where software robotics processed purchase invoices completely independently.

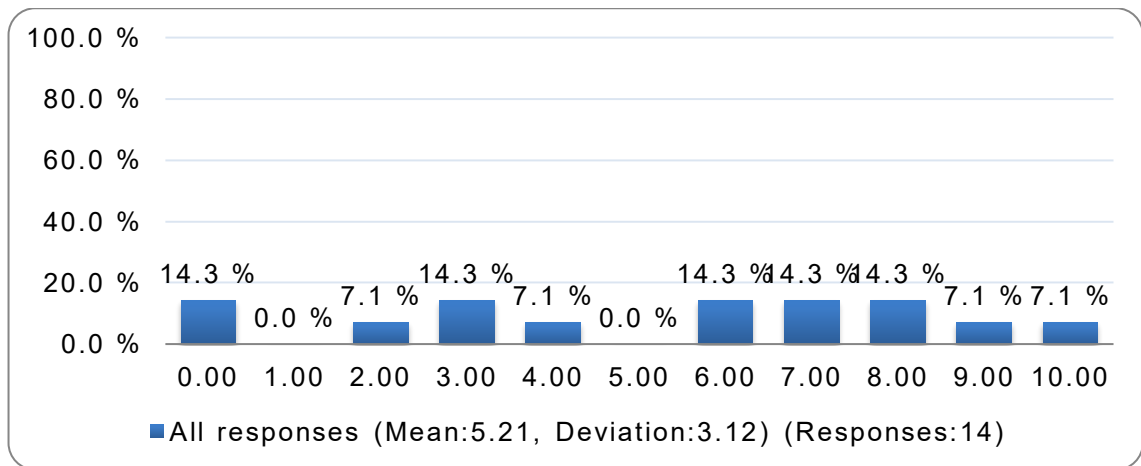


Figure 16. Estimation of the percentage of invoices processed completely by software robotics.

### 5.2.6 Have you utilized the data produced by invoicing automation in decision-making, for example in management accounting?

This was an open-ended question designed to survey whether the respondents utilized the data produced by invoicing automation in decision making. 11 out of the 15 respondents answered the question and unanimously reported that they have not utilized the data in their decision-making process.

### 5.2.7 How has the job description of employees changed in your field of expertise since the introduction of AI-based solutions?

The purpose of this open-ended question was to find out, how respondents' job description has changed in their area of expertise after the implementation of artificial intelligence-based solutions. 12 out of the 15 respondents answered to the question.

The respondents' answers to this question were very diverse, revealing their varying degrees of knowledge of artificial intelligence technology and its current level of usage in the company. Some of the respondents answered that their job description has not changed significantly yet. They mentioned that time is now used for other activities and reporting, which was previously used for making actual bookings. On the other hand, some respondents have completely automated their reporting processes. For example, one respondent mentioned

that they used to do monthly 7 reports for 250 companies manually, but now the process is handled by robotics.

Respondents also acknowledged that the implementation process of artificial intelligence applications is ongoing, and employees are learning to take advantage of the benefits brought by the applications. However, they also mentioned that they do not have full confidence in the work performed by artificial intelligence. It cannot be trusted too much on what the machine has done, and it needs to be monitored. Respondents also noted that there must be unlearning of the old way of working, and basic accounting knowledge will not be enough these days. They talked about the need for skilled workers due to the change in the role of an accountant caused by automation. The competence must be deeper, and the understanding must constantly develop in the background. The employees responsible for artificial intelligence must be highly skilled in their field of expertise. The work of an accountant has become more demanding, yet more efficient and faster, focusing more on consulting and the future than on recording.

#### **5.2.8 Do you see any possible threats on the implementation of AI in financial management?**

This open-ended question was designed for the respondents to assess the possible negative aspects of artificial intelligence and share their views on whether they see any potential threats to the implementation of artificial intelligence in financial management. 13 out of the 15 respondents answered the question. The answers strongly emphasized that artificial intelligence cannot be fully trusted as an independent employee. It must be controlled, and the output it produces must be checked by humans. A competent advisor should always be in charge of the process to ensure that everything goes according to the procedure, and potential errors are avoided.

However, respondents also mentioned people's own way of working as one of the threats. If people do not change their way of working even when artificial intelligence is introduced, there is a risk of duplicate work, which questions the reason for introducing artificial intelligence. Mistrust of artificial intelligence's reasoning ability raises questions about the cost of duplicate work.

### **5.2.9 Do you have anything to add to the topic?**

Five respondents answered to the last question. They emphasized artificial intelligence's ability to enhance the processes, because in business, customers also want things to be completed as quickly as possible. They also acknowledged how current it is, and the technology is still developing. Also, in order to succeed in the competition, it is necessary to keep up with technological change and developments.

### **5.3 Survey analysis**

The research material was collected using SurveyPal, from which the data was transferred to Microsoft PowerPoint to edit the data into an illustrative format. The results revealed positive resemblances regarding the effects of software robotics in the purchase invoicing process, but also disadvantages.

About half of the respondents reported that they have adopted artificial intelligence-based applications in the last two years. The respondents were unanimous about the reasons why artificial intelligence and software robotics have been introduced in financial administration. Automation is expected to make processes more efficient, enabling companies to concentrate effort from repetitive routine tasks to more demanding tasks. According to the question number 3, 92,9% of the respondents reported that they use artificial intelligence in the purchase invoice process, indicating a high degree of automation in the process. However, based on question number 5, artificial intelligence does not process all purchase invoices. Thus, it can be concluded that companies have implemented automation to make operations more efficient, but it does not process purchase invoices completely independently.

Examining more closely, the first statement of question number 4 for the respondents to assess whether software robotics has improved work productivity, the majority of respondents (76,9%) believed that robotics has improved work productivity quite a lot or very much. Also, regarding the fourth statement of question number 4, 66,6% of the respondents were of the opinion that the

accounts payable process has become somewhat or very much more efficient with the introduction of software robotics. These questions are very relevant considering the purpose of the thesis and the main problem of the research: does artificial intelligence add value to the purchase invoice process?

When responding to the third statement of question number 4, "with the introduction of software robotics, employees' working time has been freed up for other tasks", 73,3% of the respondents reported that the introduction of robotics has freed up working time for other tasks somewhat or very much. The results are consistent with other claims advocating the benefits of robotics in the accounts payable process.

One of the main questions of the thesis was whether the respondents have used the data produced by invoicing automation in decision-making. The answers were unanimously negative about the utilization of data in decision-making. I think the formatting of the question was relevant; however, it could have been made more specific.

The purpose of the study was also to map out whether the respondents see possible threats in the introduction of artificial intelligence in financial administration. The answers strongly emphasized that artificial intelligence cannot be fully trusted as an independent employee. Artificial intelligence tools are not faultless, and the threat is deterioration in the quality of information produced; incorrect purchase invoices get through the system and end up in accounting accounts where they are not noticed unless they are checked, and accounts reconciled.

The respondents were not worried about their own job description. However, it is also worth mentioning that 60% of the respondents were people in managerial positions. Nonetheless, the respondents collectively emphasized that routine work in processing invoices will decrease in the future as the job description becomes more consultative.

## **6 DISCUSSION**

This chapter contains the conclusions of the research and an overview of the thesis process. The chapter also includes the assessment of reliability of the research and reflection of the researcher's own learning during the thesis process.

### **6.1 Conclusion**

The purpose of the research was to survey whether artificial intelligence adds value to the purchase invoicing process and how professionals in the field of financial management perceive the effects of artificial intelligence and automation on their profession. In addition, the research aimed to examine the current state of automation in financial management companies and the percentage of invoices processed completely by software robotics. Based on the results, it can be concluded that the utilization of automation is high in financial management processes. 92,9% of respondents use artificial intelligence in the accounts payable process, 71,4% in accounting, and 35,7% in sales invoices and payment transactions. However, it cannot be directly concluded from the high utilization rate of automation whether it has made the process itself more efficient. Therefore, the survey also aimed to consider this matter and ask the respondents directly. The majority of the respondents (66,6%) reported that artificial intelligence and robotics have made the accounts payable process more efficient. Hence, it can be concluded that automation adds value and meets the expectations set for it in the development of financial management processes.

In the survey, the first and third statement of the fourth question were particularly important in determining whether artificial intelligence is useful for the accounts payable process and financial management as a whole. They also gave an indication of whether it would be worth investing in artificial intelligence in the future. The majority of respondents (76,9%) believed that robotics has improved work productivity, and 73,3% reported that since the introduction of robotics, their time has been freed up for other tasks somewhat or very much.

These questions were very relevant to the purpose and the main problem of the research.

The research also revealed that artificial intelligence cannot be fully trusted; hence, its operation must be monitored to ensure the correctness of the information produced. However, based on question number 5, automation also processes a relatively large proportion of invoices that end up directly in accounting accounts. Therefore, it can be interpreted that the reliability and ability to fully process purchase invoices is nevertheless sufficient.

Half of the respondents reported that they had adopted artificial intelligence-based applications in the last few years. Therefore, it is quite possible that not all the benefits of already existing applications have been exploited yet. The respondents themselves emphasized the significance of future investments in technology and raised thoughts about an increased need for competent and skilled professionals in the field of artificial intelligence and financial administration.

"Strategic long-term productivity" is a concept that becomes evident when considering the future role of artificial intelligence in financial management processes. Key drivers for this concept are the product development and value proposition theories. Product development, specifically innovation management, is essential for developing technological solutions that increase productivity and competitiveness.

In terms of the value proposition, users expect performance delivered through quality, mass customization, differentiation, and innovation. As stated before, it's important to note that innovations without added business value are not economically viable. The survey results showed that respondents generally agreed that artificial intelligence will be an essential part of the future of financial management, and that job descriptions will become more consultative in this change.

However, the results also showed slight dissatisfaction regarding the benefits of artificial intelligence, for example, in terms of reducing workload. Not every

respondent noticed a reduction in the amount of work after the introduction of artificial intelligence; rather, some noticed the opposite effect. Nevertheless, the respondents believed that artificial intelligence is an integral part of financial management today.

The survey results have provided an answer to the main research question. The value of artificial intelligence in financial management lies in its ability to make processes more efficient, freeing up time and resources for more demanding tasks. The survey results showed clear similarities, supporting the statement that artificial intelligence generates added value for companies by making their financial management processes more efficient. However, the small number of respondents must be taken into consideration when drawing larger conclusions.

## **6.2 Reliability and validity**

The reliability and validity of the research together form the overall reliability of the research (Vilkkä 2007, 152).

Reliability refers to the veracity of the research results. Research with high reliability could be repeated with the same end-result and can be found to be reliable and accurate, when the exact same result is obtained in a repeated measurement regardless of the researcher. The reliability of the survey can be evaluated with different quantities and measures, such as sample size and quality, response rate, and possible measurement errors in the research. (Vilkkä 2007, 149-150.) An attempt was made to improve the reliability of the research by sending the survey to a large group of people. However, the response rate to the survey was only 3%, which means that the results are not valid for larger conclusions.

Validity means that the research measures exactly what it was intended to measure. This requires the researcher to have precise specifications for the objectives of the research so that the results of the survey can be evaluated appropriately. In other words, achieving validity requires clear and understandable explanations of the theoretical concepts in the research, which will serve as a measure. The validity of the study can be assessed by considering

whether the interpretation of theoretical concepts has been successfully translated into everyday language, whether the questions have been formulated in such a way that the researcher and the respondent have a common understanding, the functionality of the chosen scale, and possible inaccuracies in a measure. (Vilkka 2007, 150.)

### **6.3 Assessment of own learning**

The topic of the thesis has been clear to the author for a long time; however, the thesis process has also taken longer than expected. In the beginning, the student became acquainted with the concept of artificial intelligence in financial management in connection with the additional task of accounting studies. It inevitably became clear to the researcher that artificial intelligence is part of the future of financial management, so the topic seemed interesting. The idea of the thesis was strengthened during the researcher's internship in a financial administration company, where the utilization of artificial intelligence and software robotics as a financial management tool became more familiar.

Creating a comprehensive and detailed theoretical frame of the topic from relevant sources for the reader was a time-consuming, yet educational process. The empirical part of the research was successful, although challenging, especially in preparing the survey so that the answers to the research problem could be analyzed as comprehensively as possible. Considering the number of questions, the questions were comprehensive enough to answer the research problem. The answers to the open-ended questions were comprehensive, and it was noticeable that those who responded to the survey had put effort into preparing their answers. The respondents' own viewpoints on the future of financial management were important for the research.

In the researcher's opinion, the thesis has been successful, even though scheduling has been challenging during the process.

As mentioned in section 1.1, the State of AI in Finland report, offering an outlook into the Finnish artificial intelligence market, gave insight into the importance of artificial intelligence in the international competitiveness of the business

economy. Survey respondents agreed with the report that they need to keep up with technological developments to stay competitive in business. Research on artificial intelligence as a part of financial management development is a current topic. The industry is growing and developing, and companies in the transition of digitalization are developing more advanced solutions in the field of artificial intelligence. Therefore, a suggestion for further research could be to repeat the study after a certain time, for example, after 3 years. It is also worth noting that half of the survey respondents had adopted applications based on artificial intelligence within a few years, so likely, new, different perspectives on the use of applications would arise if the survey were repeated.

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## APPENDICES

### Appendix 1. Survey

# Artificial Intelligence as a part of Financial Management Development - Automation of Accounts Payable Processes

#### Location

- Espoo
- Forssa
- Heinola
- Helsinki
- Hyvinkää
- Hämeenlinna
- Iisalmi
- Imatra

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- Joensuu
  - Jyväskylä
  - Jämsä
  - Järvenpää
  - Kaarina
  - Kajaani
  - Kangasala
  - Karkkila
  - Kemi
  - Kerava
  - Kirkkonummi
  - Kotka
  - Kouvola
  - Kuopio
  - Kuusamo
  - Lahti
  - Lappeenranta
  - Laukaa
  - Lempäälä
  - Lieto
  - Lohja
  - Mikkeli
  - Naantali
  - Nurmijärvi
  - Oulu
  - Pieksämäki

## Job position

- Managing director
- Financial manager
- Controller
- Accountant
- Accounts payable
- Accounts receivable
- Payment transactions
- Payroll
- Financial secretary
- Something else, what

## Amount of employees in your company?

- 1-2
- 3-5
- 6-10
- 11-30
- 31-50
- 51-60
- 100+

1. When did your company implemented AI-based solutions in financial management processes?

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2. What factors influenced to the decision of implementing these solutions in financial management systems?

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3. In which processes is the AI-based solutions used?

- Purchase invoices
- Sales invoices
- Accounting
- Payment transactions
- Something else, what

## 4. To what extent is the statement true?

The robotic process automation has increased work productivity	<input type="text"/>	(1 - 5)
The robotic process automation has reduced errors in the invoicing process	<input type="text"/>	(1 - 5)
With the introduction of software robotics, employees' working time has been freed up for other tasks	<input type="text"/>	(1 - 5)
The purchase invoice process has become more efficient since the introduction of robotic process automation	<input type="text"/>	(1 - 5)
The total workload has increased since the introduction of software robotics	<input type="text"/>	(1 - 5)

## 5. Estimation of the percentage of invoices processed completely by software robotics

Estimation of the percentage of invoices processed completely by software robotics	<input type="text"/>	(0 - 10)
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6. Have you utilized the data produced by invoicing automation in decision-making, for example in management accounting? How?

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7. Describe in your own words, how the job description of employees has changed in your field of expertise since the introduction of AI-based solutions?

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8. Do you see any possible threats on the implementation of artificial intelligence in financial management?

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9. Do you have anything to add to the topic?

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