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ARTIFICIAL INTELLIGENCE IN MANAGEMENT ACCOUNTING

The impacts and future expectations of AI in Finnish businesses'
operational process

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ABSTRACT

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Artificial intelligence is currently one of the most important aspects of the world's technological revolution, impacting all aspects of business processes. The developments of AI are heavily affecting and changing companies' approach in business management and operations.

Management accounting is one aspect of business management, where managers monitor and analyse financial and cost accounting activities, to provide helpful data for decision-making processes.

Qualitative researches were conducted in this thesis in the forms of interviews and secondary research to support the theoretical framework of this paper. The research result indicates that the AI revolution has significant impacts on Finland and its companies. Therefore, Finnish businesses must quickly embrace the technological evolution to prepare for the market-wide integration of AI.

Keywords	Artificial intelligence, management accounting, business management
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1 INTRODUCTION

The term artificial intelligence was first initiated by a professor named John McCarthy in 1955. (Rose 2020) The technology itself did not gain significant developments and popularity until the 2012. (Vance 2018) As of now, increasing number of businesses are embracing the new technology by digitalizing and automating many of their operational processes, including business management. AI technology can help companies in many business activities such as processing large data sets or assisting in managers' and executives' decision-making process. (Simons 2016) Entering the second decade of the century, we can expect even more advancement and evolution from AI and it is crucial that businesses are aware of such changes, along with its risks and rewards.

This thesis will discuss the current impacts and future influences that artificial intelligence has on business management processes, specifically in management accounting.

1.1 Research Objectives

The purpose of this thesis is to determine the current state of AI technology in business management and its influence on the accounting field. The paper will also provide insights on the level of AI integration in Finnish companies' daily operations. We will learn about their perspectives on the matter and what developments and changes they can anticipate from the industries. This will be achieved by building an adequate theoretical knowledge of the topics in the thesis. The research results will then be analysed, discussed and compared to the established theoretical background to provide a rounded, unbiased understanding of the subjects.

By the end of this thesis, these following questions should be answered:

- What is the impact and long-term vision of artificial intelligence technology in management accounting?
- How is artificial intelligence affecting Finnish business operations, and what are the future expectations?

1.2 Research Importance and Limitations

This thesis will provide its readers with essential knowledge on management accounting, artificial intelligence and discuss its current and future impacts on businesses.

The results of this research can be examined by both Finnish and international companies, who have interests in learning or implementing AI technology in their business processes. This thesis can equip them with information on the advantages and limitations of AI, help them to further understand the matter and prepare them for the application of AI in their businesses.

This research will also provide insights on Finnish businesses' current position on the international developments and competitiveness of digital technology. Actions and visions of the Finnish government will be included as well to give companies a realistic expectation on future changes and possibilities.

However, due to the nature of AI in management, new and still rapidly evolving, sourcing information and data on the topic can pose certain challenges. The criteria for data used in this research are: must come from a reliable source and must be relevant to the current developments of AI. As a result, information sources that are suitable for this paper is limited and scarce, which may impact the diversity and comprehensiveness of research results in the practical research segment.

In addition, this research also does not cover the technical aspects of AI, as its purpose is to understand the influences of the technology in business management rather than its creation processes. Which means, the thesis will not go into details on AI algorithms or software but only its abilities and how will they influence the industry.

1.3 Research Structure

The structure of the thesis is divided into 6 chapters. Chapter 1 is the introduction of the paper itself. Chapter 2 provides a brief definition and general overview of business management and accounting management. Chapter 3 explores artificial

intelligence technology, studies its current impacts and future influences in accounting processes. Theoretical study will be presented these chapters. This is used to provide the thesis with necessary background information. The readers will be equipped with an understanding of what management accounting is, current abilities and limitations of artificial intelligence technology, how the world is applying AI in their business management processes and experts' opinions on the future of AI. This section provides crucial information needed to analyze data collected through researches in the following chapters.

Chapter 4 explains the research process and methodologies. Chapter 5 presents the findings from the research process. The final chapter, chapter 6, discusses and concludes the research results of the thesis. These chapters contain practical research conducted by the writer. It will contain realistic information on current impacts and future influences of AI on Finnish companies and their business management processes. Data will be collected from interviews with local Finnish companies as well as secondary qualitative research on Finland's perspective on AI. The result is then analysed and discussed to answer the research questions provided earlier in sub-chapter 1.1 of this paper.

2 MANAGEMENT ACCOUNTING

2.1 Definition and Backgrounds

Management accounting is the act of collecting relevant data from different sources, including financial accounting, cost accounting and others, that concerns the production costs of a business. Said data is then analysed to calculate the products' possible future usage, its cost allocation, billing and auditing. The resulting information is then provided to the managers in order to assist them in the business's decision-making process. (Aboba, Arkko, Harrington 2000)

Management accounting is considered a relatively new discipline comparing to the history of business management. The term was first recorded to have appeared around the 1930s and 1940s in the US. Even then, a lot of its practices were (and still are) being considered to be under general business management and not until 1960 that researches on management accounting received more attention. Presently, the practice is still under research and is adopted and used differently around the world. (Chapman, Hopwood, Shields 2007, 3)

In addition, it is important to acknowledge the differences between management accounting, financial accounting and cost accounting. During a company's products' cost re-evaluating process, management accounting holds an essential role in determining the pricing adjustments. With financial accounting alone, managers cannot measure the changes in the costs of production, making it difficult for a business to determine the products' price. With cost accounting, it can provide information concerning the fluctuation of the production costs, making it a more effective tool for re-evaluating prices. However, cost accounting lacks the ability to provide additional data such as market changes, competition or customers' reaction to introducing a new price point. As a result, management accounting is needed as it is the most adequate system to use to collect and analyze data from different sources. (Madegowda 2006, 3-4)

In essence, management accounting benefits the future processes of planning, decision making and products launching by aiding management in decision-making

and operation-controlling activities. With management accounting, businesses are able to control their daily economical activities, costs and budgets as well as calculate risks in order to make the best decisions. They can prepare for the market's uncertainties, ensuring that the company reach their goal of earning profits with high efficiency. (Hlaciuc, Vultur, Cretu, Ailoaiei 2017)

2.2 Management Accounting Objectives, Functions and Scopes

2.2.1 Objectives

According to Proctor's (2002) explanation on the subject, management accounting primarily orientates towards the future. (Coombs, Jenkins, Hobbs 2005, 3) The main goal of management accounting is to aid management in making the appropriate decisions as well as to satisfyingly discharge their responsibility. (Madegowda 2006, 5)

"It is essentially a service function; a means to an end rather than the end itself."
– Proctor. (Coombs, Jenkins, Hobbs 2005, 4)

Even though the core objective of management accounting is to help managers in the decision-making process. It can also aid in organizing, planning and formulating future policies, controlling the performance of different activities, departments, products and services, etc. (Madegowda 2006, 9-10)

Essentially, management accounting provides executives and managers with information on operational and financial accounting, allowing them to make reasoned decisions. Management accountants achieve such objectives by performing the following main obligations: preparing financial statements, measuring performance, and producing decision related information. (Appelbaum, Kogan, Vasarhelyi, Yan 2017, 30)

2.2.2 Functions

To achieve its goals, management accounting may perform numerous functions. First one of which is to *providing relevant data*. Management accounting needs to be able to furnish managers with the most admissible facts and data as well as assist

them in making various decisions. It collects information from different sources and presents them to different levels of managements, where the information is relevant and required.

Secondly, management accounting has the function of *providing qualitative information*. Management cannot make appropriate decisions based on quantitative information alone as it is not a sufficient source of information. They demand different forms of information and should be provided if required.

The third function of management accounting is to *modify the data*. Since financial and cost accounting generate such large quantities of data, they are not applicable as directly extracted in most circumstances. Therefore, said data need to be classified and modified so it can be understood and put into use by managers. (Madegowda 2006, 5-6)

The next function management accounting needs to be able to perform is to *report to management*. The performances of different departments, products, etc. need to be reported to all levels of management wherever appropriate in order for the managers to be able to make decisions and initiate actions if necessary. (Madegowda 2006, 9)

The fifth function of management accounting is *analysis and interpretation*. Since financial data are only figures, they are not easily and immediately understood by managers from other departments. Therefore, management accountants' role is to use different tools to analyze, interpret and present the results in different forms (comments, conclusions, reports, etc). Translating technical data into non-technical language helps managers better understand the information and perform more effectively.

Following is *assisting in planning*. This function is considered to be one of the most important functions of management accounting, which is to aid management in the process of planning for the future, both short term and long term. To perform such tasks, management accounting has the responsibility to provide management

with diverse and appropriate information for them to be able to execute the planning process adequately.

Finally, the last function of management accounting is to *facilitate overall control*. Which means it is tasked with identifying different areas where management control is essential. By using tools such as standard costing, budgetary control and responsibility accounting, management accounting can compare the actual figures with the standards and budgets, identifying the differences. Correspondingly, it can determine the factors or people of which(whom) are to be held responsible for the poor performances so the managers can take corrective actions. (Madegowda 2006, 5-6)

2.2.3 Scopes

There are no exact definitions on which tools management accounting uses and which areas of work it includes. As management accounting is still changing and evolving, the areas and tools it currently covers and uses might be discarded in the future and new ones might emerge in replacement. Thus, it is difficult and complicated to list the definite scope of management accounting as experts are still studying and arguing over the subject. However, as of now, there are certain prominent activities which are considered to be under the scope of management accounting, of which will be presented in the table below. (Coombs, Jenkins, Hobbs 2005, 7)

Table 1 Some activities under the scope of management accounting

Budgeting, planning and forecasting
Calculate the products and/or services profitability
Measuring organizational, departmental and divisional performance
Comparing performance and results within and between organizations
Assisting in the effectiveness and efficiency enhancing process
Assessing the past, present and future capital investments performance
Advising on the decision-making process of product mix, market and selling prices
Advising on the decision-making process of whether to outsource
Advising on the decisions concerning the investment of funds between a range of possibilities
Assisting in the strategic decision-making process

In terms of tools, there are a variety that can be made available, the most common 5 tools which are being used by the majority of companies include: financial accounting, cost accounting, tools and technique of financial analysis, statistical and quantitative techniques and management reporting.

- ***Financial accounting:*** Annual financial reports provide an abundance of information and data. Those data are objectively historical, they can be useful as they act as a base and guideline for planning and controlling purposes. By using financial analysis tools, management accounting provides an insight to the company's performance.

- ***Cost accounting:*** Similar to financial accounting, cost accounting also generates a copious amount of data concerning the costs of producing and selling of products and services as well as their revenues. In addition, cost accounting also contributes different tools for management accounting such as: marginal costing, standard costing, budgetary control, etc.
- ***Tools and techniques of financial analysis:*** Using a variety of tools, including comparative financial statements, common-sized financial statements or ratio analysis, management accountants can analyze and interpret the company's financial statement.
- ***Statistical and quantitative techniques:*** As the problems faced by management accountants are very complex, statistical and mathematical tools and programs are used to analyze and present the reports with higher accuracy. Such tools are sampling techniques, probability, regression analysis and more.
- ***Management reporting:*** The act of collecting, analysing and classifying data and information are performed with the sole purpose of reporting to the management. The reports identify both achievements and failures of the company and are reviewed by managers in order to take appropriate actions and decisions. (Madegowda 2006, 7-8)

2.3 Recent Developments in Management Accounting

The core of management accounting is essentially financial measurements. A significant number of concepts being used now were established and developed in the early 20th century. The practices in use today do not differ much from its precedents. Contents of management accounting textbooks throughout history are relatively similar, of which can be divided into 3 groups: financial information for decision-making, financial performance analysis, and profitability measurements. The most recent notable development in management accounting is strategic cost analysis and its variances, which dated approximately 40 years ago. (Davila 2019, 2)

Nonetheless, management accounting is increasing its complexity of operations due to the 2 major forces: globalization and technology. With over a billion people and organizations joining the economy market in the last 20 years, most of which are from Asia, globalization allows new organizations to find different methods to explore and test the existing structures in business. (Davila 2019, 2)

The last 20 years have witnessed the astonishingly rapid developments in technologies. From machine learning (artificial intelligence) to blockchain, robotics and even the internet. Said forces can potentially be both opportunities and threats for organizations, depending on whether they can take advantages of the new changes in environment. (Davila 2019, 2)

The core nature of management accountants has also been evolving to correspond to the changes in management accounting itself. Traditionally, management accountants' responsibilities are to solely report and monitor historical data values. Presently, the scope has expanded to cover present and future reporting. Their tasks now include performance measurement and providing management with decision making information such as: long-term strategic cost management, measuring performance by implementing management and operational control, internal costs planning, and preparing financial report statements. (Appelbaum, Kogan, Vasarhelyi, Yan 2017, 29)

As tools and technologies for measurements improved, performance measurements in management accounting extended from purely financial to other business dimensions, reenforcing the connection between management accounting and other business functions. (Davila 2019, 3) Since management accounting is essentially a support system for decision-making and control within the business, it has significant links and potential to benefit from business intelligence technology. Hence, many enterprises have realized the opportunity and have been implementing intelligence technology into its reporting and decision-making process. (Rikhardsson, Yigitbasioglu 2018)

2.4 Management Accounting Limitations

As stated earlier, management accounting is a new concept. It is currently still being researched and developed upon and is yet to be perfect due to the lack of proper tools and system to perform the tasks efficiently. (Hlaciuc, Vultur, Cretu, Ailoiu (2017)) Some of the biggest limitations of management accounting are:

- **Lack of objectivity:** The reports from management accounting need to be able to predict the future based on the past and present data. Those reports include both facts and estimations, are heavily influenced by the management accountants' personal opinions and abilities. As a result, the reports are susceptible to bias and subjectivity.
- **Resistance:** Management accounting can only function properly and effectively if managements are willing to co-operate. However, many managers (even financial and cost accounting personnel) might consider management accounting as unnecessary and may not be willing to fully co-operate.
- **Intuitive decision-making:** As management gravitates towards resisting management accounting, they are more likely to prefer the easy short-cuts rather than the more scientific but complicated course of action suggested by management accounting, wasting the management accountants' efforts, resources and time.
- **High investment:** Management accounting system requires elaborate arrangements. Therefore, it can be highly expensive to install and operate, which means many SMEs may have difficulties affording.
- **Limitations from financial and cost accounting:** A substantial amount of data management accounting bases its reports on are acquired from financial and cost accounting. As such, if those data are flawed or inaccurate, the quality of management accounting reports will also be considerably impaired.
- **Wide scope:** because management accounting requires data and services from a variety of sources (financial and cost accounting, mathematical programming, production engineering, marketing aspects, etc.), it is highly

difficult to assemble a team of people who possess the full scope of knowledge and skills to form a management accounting department. (Madegowda 2006, 15)

Even though management accounting provides useful information for making decisions, it cannot however, replace the role of management personnel. Even though it aids in many aspects of business, management accounting is only a service function and cannot make decisions and cannot be the substitute for actual management. (Madegowda 2006, 15)

3 ARTIFICIAL INTELLIGENCE

3.1 Overviews

According to the Oxford Dictionary, the definition of artificial intelligence is: “The capacity of computers or other machines to exhibit or simulate intelligent behaviour; the field of study concerned with this”. (Artificial intelligence 2021)

The concept of artificial intelligence emerged in the 1940s, but not until the 1950s that the idea was further considered as a real possibility. (Vance 2018) In 1955, Professor John McCarthy introduced the term artificial intelligence in a conference in Dartmouth. At the time, the hard-ware technology was still primitive and could not achieve McCarthy’s goal of getting computers to behave “intelligently”. (Rose 2020) Over the next few decades, some developments were made in the field, but did not attract significant attention until very recently. In 2012, Geoff Hinton, a British-Canadian cognitive psychologist and computer scientist, and his 2 students made a breakthrough development in image recognition of AI, gaining interests from companies including Microsoft and Google as well as grasping the attention from the rest of the industry. (Vance 2018) In the span of less than a decade, AI has gone from recognizing faces to being commercially available as a virtual personal assistance, popularized by Apple’s Siri and Amazon’s Alexa. Advanced AI robots have also been created with the prime example of Sophia, the first ever robot to have received a citizenship (Saudi). (Retto 2017)

Artificial intelligence technology has been used in the banking and finance systems since its first initiation in the 1950. AI in business comprises a wide scope of technologies and applications, from rule-based technologies, fraud detecting probability-based methods to automatic stock and option trading or even primitive neural networks for optical recognition. Those technologies replaced manual labour processes, which were previously done by human beings, with automated processes. This led to improvements on the accuracy and efficiency of the processes and its results. (Chishti, Bartoletti, Leslie, Millie 2020, 6) However, even though AI is programmed to imitate and is similar to a human mind in a certain sense, it cannot actually replace humans. (Wang 2019). Nonetheless, with the rise of 5154

new AI start-ups establishments within the past 5 years, the global management consulting company McKinsey & Co. expects the technology to yield \$13 trillions in revenue over the next decade. (Chishti, Bartoletti, Leslie, Millie 2020, 10-20)

3.2 Current Capabilities of AI in Business

As stated earlier in this paper, the topic of management accounting is considered as a new aspect of business management, as does AI technology. Therefore, there has not been many research or academic papers on these topics together. In their paper published in 2018, Rikhardsson and Yigitbasioglu reviewed 60 papers on the literatures concerning the relationship between business intelligence and analytics (BI&A) and management accounting, which is considered a relatively low number of researches comparing to the abundant of literatures on general management accounting alone. (Rikhardsson, Yigitbasioglu 2018, 49) According to an older article by Granlund, the reasoning for the humble quantity of research on the joint topics is due to our limited knowledge on the developments of BI&A, despite its vast potential and benefits in the field of management accounting. (Granlund 2011, 3-4) Regardless, there are still many applications of AI in business management, this section will introduce a few current aspects of it and how it is being integrated into management accounting.

3.2.1 Machine Learning

Machine learning is one of the major branches of AI, and possibly the most important one. (García, Núñez-Valdez, García-Díaz, G- Bustelo, Lovelle 2018, 10) Machine learning can allow systems to “learn” and improve performance automatically through experience without needing to be specifically programmed for. It utilizes computational algorithms, which can learn patterns by recognizing an abundance of data to produce automatic decisions and recommendations. (Helm, Swiergosz, Haeberle 2020, 69-70)

Machine learning algorithms can be divided into four categories: supervised learning, unsupervised learning, semi-supervised and reinforcement learning. (Sarker 2021, 4-5)

Table 2 Machine learning categories

Category	Model building
Supervised learning	Models or algorithms learn from analysing labelled data sets (task-driven approach).
Unsupervised learning	Models or algorithms learn from analysing unlabelled data sets (data-driven approach).
Semi-supervised learning	Models or algorithms learn from both labelled and unlabelled data (hybrid approach).
Reinforcement learning	Models or algorithms learn from reward or penalty basis, can automatically evaluate the optimal behaviour or environment (environment-driven approach).

Machine learning also contains in itself multiple subfields, from deep learning to computer vision.

- ***Deep learning***

Deep learning is a sub-technique of machine learning. Deep learning is modelled after the human's brain structure. It mimics the brain by interconnecting multiple layers of software-based calculators, each of which functions as a neuron to form a neural network. The networks are then layered successively to be able to repetitively learn new data. (Nielsen 2020, 11-12)

- ***Artificial Neural Network***

A sub-branch of deep learning can also “think” and produce similar conclusion as a human would using its artificial neural network (ANN) structure of algorithms. The neural network is exceptional at identifying patterns and trends, deducting conclusions form complex data. Since ANN is more flexible than traditional

learning methodologies, it can learn more information and data and be even more sensitive and responsive to new problems when they occur. (Mirzaey, Jamshidi, Hojatpour 2017, 3523-3524)

- ***Computer Vision***

Computer vision is a computer program designed to “learn” to recognize images by analysing the characteristics of the images, allowing them to gain a certain level of understanding associated to the images provided. Computer vision aims to understand the world, the appearance of things by identifying elements in the image, understanding what they are and calculating their spatial position quickly and accurately. (García, Núñez-Valdez, García-Díaz, G- Bustelo, Lovelle 2018, 12)

- ***Enterprise Resource Planning System***

In today’s 4.0 industry, where data are digitalized and networked with Internet of Things (IoT), developers have incorporated machine learning in Enterprise Resource Planning (ERP) system. This allows the system to assign tasks to non-human intelligence. AI is now becoming a part of ERP and is used for optimizing the decision-making process by implementing machine learning, while syncing all data to a globally accessible network. (Majstorovic, Stojadinovic, Lalic, Marjanovic 2020, 291)

- ***Natural Language Processing***

Natural language processing (NLP) is a part of AI which serves as a communication bridge between human and computers. NLP addresses and solves the intercommunication problems since computer systems requires exact information to function while human language is imprecise and ambiguous. NLP is frequently used in accounting, financing and auditing. It has various capabilities including, but not limited to, processing the data input to subtract insights and make reasoned decisions. (Fisher, Garnsey, Hughes 2016, 157)

- ***Expert System***

Expert system is one of the earlier developments of artificial intelligence technology. It has the ability to self-explain and review its own reasoning and decisions. Expert system extracts knowledge and information from human experts and applies said knowledge in a program to process and manage quantitative and qualitative information. This system is more superior comparing to traditional systems and programs due to its capability to understand and handle imprecise reasoning and incomplete data input from human. (Tan, Wahidin, Khalil, Tamaldin, Hu, Rauterberg 2016, 2448)

- ***Fuzzy Logic***

Fuzzy logic is an advanced form of machine thinking, using the help of AI technology. Classical logic only understands when extensive knowledge of a system is provided, and still requires precise and exact data and equation to be able to process. Fuzzy logic, in contrary, allows unclear information input by using an alternative thinking method, which is capable of understanding more complex system with higher level of abstract. This ability of fuzzy logic, with in the past two decades, has been applied in various aspects of accounting including accounting research, detecting fraud and financial forecasting to name a few. (Čičak, Vašiček 2019, 91)

With extensive abilities and functions, machine learning can now benefit businesses in many different operational processes. For example, the process of classifying transactions, the source data of transactions in historical records can be used to forecast the classification of future transactions as they are recorded in real time by using machine learning inductive reasoning. Financial planning and analysis activities can also benefit from machine learning, specifically the analyzation of data used for forecasting. (Balakrishnan, Prakash, Ramesh 2020, 717-718)

3.2.2 Robotics

While robotics is a major sub-field of AI technology, it is mainly associated with manufacturing and assembly rather than management. However, with robotic process automation (RPA) and robotic desktop automation (RDA), robotics can

benefits managers in terms of increasing efficiency while reducing costs, with greater analytics performance. Both RPA and RDA are automation software that are capable of operating repetitive administration activities including processing transactions, entering and managing data or monitoring and reporting. By reducing the amount manual low-value tasks using robotics, managers as well as employees can focus more on advanced and complex activities. (Seasongood 2016, 32)

3.3 Advantages and Challenges of AI

3.3.1 Advantages

With the capabilities of AI mentioned previously, businesses can harvest great benefits from implementing AI technology into their daily operations. One of the most notable advantages is to *increase efficiency* while *saving time and resources*. The technology is substantially faster and with less errors comparing to human, while still being cheaper over the long-term. (Canhoto, Clear 2020, 187) AI currently handles most activities concerning accounts payable and receivable, for instance invoice categorization and payment, payroll, and audits with its data processing automation function. (Balakrishnan, Prakash, Ramesh 2020, 716) With automation technology, AI can process information in an instant with optimal precision while minimizing error margin, boosting effectiveness significantly for the organization. (Yarlagadda 2017, 385) AI software can also prepare taxes and assess risks with increasingly higher speed and accuracy by self-learning with machine learning using information from data observation and analysis. The technology increases workflows' speed and efficiency remarkably, allowing accountants to analyze financial trends faster with more precision. (Balakrishnan, Prakash, Ramesh 2020, 721)

Another benefit of AI is its ability to *increase data relevancy* and *enhance risk evaluation* in data analysis. Since data analysis relies heavily on accurate and relevant information, traditional management accounting faces challenges in backlog information as managers can only read historical financial data, reporting past statements and situations. By using AI analytical tools, management accountants can analyze against uncertain information, making decisions and

predictions which include uncertainty and risks into consideration. (Appelbaum, Kogan, Vasarhelyi, Yan 2017, 30)

As AI develops, algorithms have become increasingly reliable, flexible and advanced, allowing data to be recognized and processed automatically and reliably. In conjunction with the applications of machine learning, AI can learn from its own mistakes and over the course of time, excluding the need for human workforce for mundane tasks, *eliminating human risks* as a result. (Balakrishnan, Prakash, Ramesh 2020, 720)

In addition, AI technology can *detect fraud* and *prevent cyber-attack* since it can identify the deviant acts instantly, stop responding to said acts and notifying managers immediately as a response. (Yarlagadda 2017, 385) Moreover, its *cloud storage systems* grant global access to the same information data base, offering great beneficial values and technological enhancements, especially for international enterprises. (Balakrishnan, Prakash, Ramesh 2020, 721)

With all of its applications, AI technology contributes immensely to *boosting organizations' competitiveness*. By eliminating traditional manual tasks, the percentage of accounting errors can be significantly reduced, *lowering risks* in general. In addition, financial accounting flows artificial simulations is provided with more scientific and reasoned reference data, resulting in highly accurate *predictions for future financial trends* that are supported by concrete, data-based and reasoned logic. (Zhang 2020, 261)

A prime case of AI technology application in management accounting is the development of enterprise resource planning (ERP) systems. Bookkeeping is one of the first aspects of accounting to adopt AI in its operation processes. Bookkeeping tasks has been widely automated with AI technology. Processes of account payable and receivable such as initiating payments and matching orders are now automated via the use of ERP systems. Even though the human workforce is still largely responsible for approving transactions, a considerable portion of accounting activities such as payroll, tax remittance and auditing are now performed by or with the help of AI based ERP system. (Balakrishnan, Prakash,

Ramesh 2020, 716) The official term for said system is iERP. (Kenge 2020, 36) iERP can generate more simple workflows, minimizing human mistakes and risks, accelerating processing time for data. (Kenge 2020, 36) AI technology can also aid in categorizing data entries automatically, allowing accountants to analyse financial trends more effectively while being less time-consuming. (Balakrishnan, Prakash, Ramesh 2020, 716)

3.3.2 Challenges

The very first challenge companies encounter when implementing AI technology into their daily operations is the initial investment *cost*. Investing in AI is a complicated and difficult decision process for many organizations and requires a strong capital base and a high-risk tolerance from the companies. (Corea 2017, 27) While some of the cognitive programs can be a free open source, some of them can also be very expensive. In addition, even when the software itself might not be high cost, they still require high-level skills to operate properly. The consultants and data-scientist with the adequate skills set have a marginally higher wage standard. (Davenport 2018, 31) The full scope of function AI and machine learning is, in most cases, are too complex for investors to comprehend hence the need for “advisors” and “resident scientists”. Furthermore, the return on capital timeframe after implementing AI technology varies greatly between different companies, and it might take over a decade to see a real return on investment. (Corea 2017, 27)

Another important aspect of which businesses need to take into consideration before investing in AI systems is the *lack of knowledgeable personnel*. As stated previously in this paper, AI technology, especially AI concerning management accounting is a considerably new territory for businesses. As expert systems are operating data-based tasks, the labour needs in accounting employees deviate from data entry to management. (Zhang 2020, 260) However, there is high a demand for experts equipped with the right skills and knowledge to create, operate and maintain AI and its applications in management activities. These experts include data scientists, senior managers, top analysts and specialists. Recruiting said experts proved to be challenging since there has always been a shortage for data scientists, particularly for business-related science. As for managers and analysts, they need

to be exceptional at their field of work in order to be able to help “train” the machines. (Ross 2017)

Another obstacle concerning out-sourcing data-based tasks to AI is even though expert systems are superior in detecting fraud, they are also more susceptible to being hacked. Considering the data and information are all synced to a cloud-based system, allowing for easy access from managers and employees globally, the *risks for network security* are decidedly higher and require more attention and consideration. (Zhang 2020, 262)

3.4 Impacts of AI in Management Accounting

Artificial intelligence is, and will be, influencing the working methods of traditional accountants. As AI machines provides more accurate, quality analysis for faster processing time, they offer corporates with higher efficiency and lower long-term costs. Companies which implement AI to the process of handling complex, high volume data work can benefit from high quality results with lower risks while reducing internal labour costs as the systems and machines can replace the traditional staffs. All of which grants said companies with a competitive edge in the ever-evolving international market. (Zhang 2020, 261) However, the majority of small and medium enterprises do not have sufficient funds and resources to invest in computerizing their managing process as well as purchasing machineries needed for automation. Consequently, SMEs has a higher rate of failure comparing to larger businesses as they do not have adequate financial resources to survive in an exceedingly competitive market. (Sallem, Nasir, Nori, Kassim 2017, 47-49)

With the AI revolution and all its capabilities, it is inevitable that AI will be the future of management and start to replace human in data related tasks. Since traditional accountants’ abilities are becoming increasingly irrelevant comparing to AI, their roles will eventually shift from data-related to managing. Accountants will no longer have the need to process data and will be making decisions and build strategies based on the processed data instead. (Zhang 2020, 260-261) The critical concern most people have is: What role will humans have left? Professor Spyros Makridakis proposed four possible scenarios for said question: *The Optimists*,

robots will fully substitute humans, leaving them with free time for other work tasks or for leisure activities. *The Pessimists*, employees' motivation level will decrease as they allow computers to conduct all important decisions, resulting in robots fully replace people's roles and human's status will be reduced to second-rate. *The Pragmatists*, people will capitalize on the use of computer systems and adjust their skills accordingly while still reserving the rights of decision making to humans only. *The Doubters*, humans will have full control over the tasks which requires creativity. (Makridakis 2017, 50-52)

4 RESEARCH PROCESS

4.1 Research Methodology

Empirical research is the dominant type of research methodology in social sciences of present day. The term “empirical” refers to direct world experience or observation of information. Empirical research can be approached via quantitative or qualitative methodology. (Punch 2014, 2-3)

Quantitative method examines data of which can be expressed as numerical variables. The quantifiable data can be gathered through direct observation or through statistical analysis association. This method is most effective when its contents are controlled and free from any undefinable influence. Qualitative method is applied when the subjects are not suitable for statistical analysis and are unable to produce numerical variables. The research subjects for qualitative research can range from small groups to large organizations. This methodology is unstructured and is used to provide insights and understandings of the causations and interpretations for the research variables. (Lakshman, Sinha, Biswas, Charles, Arora 2000, 369-371)

Considering the research objective of this thesis, qualitative research method was chosen based on its sufficiency and suitability for the research. The methodology is applied in both primary research, in the form of individual interviews, and secondary research.

4.2 Primary Research

4.2.1 Research Objectives

The purpose of conducting primary research for this thesis is to study the level of integration of AI technology in Finnish case companies. Specifically, how an international company utilize AI differently comparing to a small scale business. In addition, this research will also explore the contrasting focus towards AI technology between a digital technology company versus a marine and energy technology company.

4.2.2 Target Companies

The target companies for this thesis's individual interviews are Gambit and Wärtsilä, two Finnish companies with different scales and business conducts. The research also includes informative presentation files from Siemens rather than personal interviews. The purpose of selecting oppositely sized companies is to provide a more varied information on the interview results which then can be compared and analysed against each other.

Gambit is a small size IT Services and Consulting company founded in 2011 by entrepreneurs Tim Wallin and Erik Nylund. The company offers a range of Digital services including system development, mobile and web apps, third party integrations, data analytics and UI/UX designs as well as Planning and resourcing services such as on-site resourcing, project management and DevOps and architecture. With over 300 projects delivered, Gambit is one of the few Finnish companies to hold the AAA credit rating for over 5 years consecutively. (Gambit, 2022) The interviewed representative for Gambit was Tim Wallin, Founder and Lead Strategist of the company.

Wärtsilä is an international organization specializing in technology and solutions for the marine and energy markets. With a wide range of businesses from renewable energy to marine systems and power with operations in 68 countries, Wärtsilä is one of Finland's largest companies and is listed on Nasdaq Helsinki. (Wärtsilä, 2022) The contacted person to be interviewed is Arda Özdemir, Solution Expert, AI and RPA. His main task is to develop software solutions for the treasury department in Wärtsilä.

Siemens is a global technology company with headquarter based in Germany. They are an automation machinery manufacturer focusing on industry, transport, infrastructure and healthcare. As a large-scale company, Siemens offers a variety of businesses and services ranging from digital industry, smart infrastructure, mobility to financial and business services and others. (Siemens, 2022)

4.2.3 Interview Process and Questionnaires

The interviews were conducted for research purposes and aimed to provide insights and details on if and how AI technology is incorporated in Finnish businesses. There were two interviews conducted and they were both hosted and recorded virtually via Zoom and Skype meetings. A semi-structured interview process was adopted to allow flexibility of information flow while still adhering to a focal point of interest, simplifying the analysis and comparison of data in later stages.

The interview questionnaires can be divided into two main categories: the applications of AI technology in the company's business process and the interviewee's opinions regarding the technology's future on both regional and international scale. The objective of the questionnaires is to discuss about the AI related technologies currently in use within the company, how or where they sourced the technology from as well as how is it applied to their daily process. The questions for each interviews varied slightly from one another due to the different nature between the companies as well as the interviewees' general knowledge on the topic and their company. Both the questionnaires can be found in the appendix below.

There were no interviews conducted with Siemens. Instead, the company provided 4 presentations files of their AI solutions as well as their current and future offerings.

4.2.4 Research Limitations

The biggest limitation of this primary research process is the low quantity of interviewed companies. This was due to multiple reasons, one of which is the criteria for choosing the interviewees. The person to be interviewed must have good knowledge of their company's management activities or in depth knowledge of the company's digital and AI aspects. The process of finding suitable companies was challenging with only two agreed for an interview and one provided their public presentations as research data. The lack of case studies may lead to the lack of diversity of data.

4.3 Secondary Research

4.3.1 Research Objectives

The intention of secondary research for this thesis is to extend on the limitations of its primary research. The aim for this research method is to examine in depth the relationship between AI technology and Finnish businesses, to what degree do general Finnish companies integrate AI into their processes, the country's view on the topic and what future is Finland heading for in terms of technological advancements.

4.3.2 Publications Used in the Research

Due to the nature of AI technology still being young and rapidly evolving, even though there are throughout studies done on the topic of AI and Finland, there has been fewer extensive research done specifically on AI technology and Finnish businesses. The research data used in this research was gathered from Finnish governments and EU's official sources. For the purposes of keeping the study relevant to current business trends, this thesis will only use data from reports published within the past five years prior to this paper. The publications used in this research is listed in the references at the end of the paper.

4.3.3 Research Limitations

As for research limitations, there were only 4 publications satisfied the criteria of reliability and relevancy suitable for this research. The scarcity of reliable data sources contributes to less than ideal information diversity and comprehensiveness. Moreover, since the sources were published by Finnish publications, the information on international matters were limited and simplified.

5 RESEARCH RESULTS

5.1 Primary Research Findings

5.1.1 AI in Business Operations

Both the interviewed participants stated their companies do incorporate different types of AI technology in different business processes. Gambit being a Digital technology focused business have their own daughter company for specializing in *data analytics* and *machine learning*. Their CEO, Tim Wallin disclosed that as of now all the company's AI algorithms are either being written by themselves or developed in partnership with another organization such as VTT Technical Research Centre of Finland. Potentially, Gambit might also consider purchasing premade AI Software in future if their projects required so or for the benefits of their partners and customers.

Wärtsilä have also been rapidly integrating AI technology in multiple stages of their daily operation processes. However, the interview with Wärtsilä's representative mainly focused on their applications of AI in accounting activities, which will be discussed in the following sub-chapter.

For Siemens, the company is proposing to implement artificial intelligence on an industrial grade. Currently, they are already focusing on a wide range of AI applications, from *blockchain applications*, *autonomous robotics* to *data analytics*, *cyber security*, *software systems and processes* and so forth. The company applies AI data analysis in many of their businesses, from Automotive to Electronics. Siemens predicts on customer values they can deliver with end-to-end AI offerings, including industrial AI applications, AI portfolio, AI life cycle services including operations and hardware/runtime. For instance, *image detection*, *automated robotics* and *deep learning* used in inspection and defect detection of the production processes can help increase worker's safety and increase product's quality. Siemens is also launching a new model of AI on *artificial neural network* called NPU (Neural Processing Unit). This solution can be easily adapted into *robotics* for new tasks on handling unknown shapes and objects detected by camera

since it requires no complex algorithm. The company is also piloting in applying ANN into *object and anomaly detection* for intelligent process monitoring via data based quality control, process anomaly detection and process optimization. Finally, they are currently having ANN *image classification* project under incubation, potentially integrating human's "expertise" on the perfect appearance of products and processes into applications.

5.1.2 AI in Accounting

In Wärtsilä, artificial intelligence solutions were used in various applications throughout their entire accounting operations. The technology was used in multiple procedures of *fraud detection* in the company's treasury department since their ledger monitoring program was implemented in 2019. It *monitors and detects suspicious actions* happened in their bank accounts or master data. The process oversees open invoices within the ledger, locates possible document errors and notifies the Account Payable department to verify said documents. *Image detection* was also utilized for the same purpose, scanning documents and emails for any suspicious activities. This process operates on an *API (Application Programming Interface)* basis, of which the company integrates received documents from other business operations into the same API service to get their images analysed for fraudulent activities. Finally, *flow analysis* supervises the paths of which data and documents take to travel within their system. The application monitors and identifies any issues which may occur in the system itself. According to the interviewee, the program was written by Wärtsilä's internal department themselves rather than being outsourced and purchased from an outside provider.

As for Gambit, since they operate on a smaller scale comparing to Wärtsilä, their accounting department is also considerably less complicated. They use Netvisor, an *ERP system* for bookkeeping activities and have all their bookkeeping data digitalized into it. It was revealed that Gambit does not have a separate management accounting department themselves. However, Tim Wallin, as the company's Lead Strategist does the internal evaluation and future strategic planning himself along with his partner, rather than having an AI software performing the task for them. Nonetheless, he stated that if given the opportunity and with the appropriate data

and resources, he would consider implementing AI further into their business and accounting operations.

5.1.3 Advantages and Challenges of AI in Businesses

- **Advantages**

Gambit, being the provider of AI solutions, have noticed considerable benefits for their customers from using the technology. According to Wallin, because AI is new and “hyped”, the consumers might be initially excited to consider purchasing the solution for its expected abilities. However, they are still wary of its expensive costs, in both the initial investment and if the investment can yield valuable results. Gambit can deliver those values to their partners by adopting AI technology into their service offerings since AI allows for more *effective problem solving* comparing to conventional methods, providing *higher productivity rate* and *better performances*.

Wärtsilä, on the other hand, although they are not a digital focused company, they have also been starting to structure themselves more around Software and Digital technology. The shift allows Wärtsilä to *optimize productions* on engines and parts, *deliver information and data* to their key partners and consumers. One of the first significant advantages that the Wärtsilä team noticed since implementing AI in their ledger monitoring process is the *decrease in human risks*. Since they monitor for outliers, the program allowed their team to identify mistakes made by human errors such as inaccurate data entries and enable them to correct such defects accordingly. Furthermore, as the program indicates document errors, it also helps people become more aware of their mistakes and certain risks involved with it, therefore they can be more attentive and careful with their work.

- **Challenges**

One of the challenges Wärtsilä’s representative has been experiencing with AI is that the program they developed for the accounting team appeared to be *difficult to be operated* by team members. He stated that although the program satisfied their expectations in terms of performance, it is still yet to be effective at communicating

with the end user, causing confusions such as: why were certain documents flagged and how could it be fixed. His team is working towards perfecting the solution by using people's feedbacks on how they can improve user experience, if the solution is operating efficiently and if the data are being detected correctly.

Gambit have also expressed some AI challenges they have encountered in their early business stages. Since writing AI algorithms is a complicated procedure, often consuming substantial resources, the result could be of *higher costs* and the customers might not have considered it to be worth investing into. However, over the years as the company increased their speed and efficiency in creating AI algorithms, they have noticeably reduced this limitation and be able to provide better values for their clients.

Another challenge proposed by both Gambit and Wärtsilä's people is since AI technology is still in its early stages of development, it *requires extensive data* to be able to perform efficiently enough to draw conclusions. In addition to the quantity of data required, the quality of data is also crucial, involving various procedures including data gathering, labelling, processing, analysing and so forth. This process *demand great resources* in terms of time, finance as well as human labour and intelligence. Due to this reason, Tim Wallin expressed it might still be some more time before the technology can be mass applied in different businesses.

An additional concern companies can face while integrating AI into their processes in these early stages is the people themselves, as stated by Arda Özdemir. People can have *unrealistic expectations* of what AI can achieve or, in contrary, they can be *skeptical towards the results* or solutions provided by the technology. He expressed it is important to thoroughly communicate with the consumers or users of AI on its target results to avoid misunderstandings or inaccurate perceptions and expectations of the solution's abilities.

5.1.4 Impacts and Expectations of AI in Businesses

Since Gambit works with various Finnish clients, their CEO believes that Finnish companies are in still in its early stages with integrating AI into their operations.

He anticipated that AI technology itself will mature over time and become more efficient and convenient to use. Therefore within 5 to 10 years, AI could be more widely used amongst companies both in Finland and the world for its evident benefits comparing to other conventional methods of operation.

Despite the clear possibilities of artificial intelligence, Wärtsilä's representative expressed his concerns towards implementing AI in businesses, with the reason being inadequate infrastructures of the companies. Apart from digital and technology oriented organisations, many businesses are underequipped to be able to perform and support data collection and creation of AI solution itself as well as the lack of sufficient talents. They need appropriate foundation as well as experts with adequate knowledge and technical skills to operate and monitor the solutions. The challenge being such changes can be costly and knowledgeable people are highly sought after, making it difficult for smaller size, non-software oriented companies to acquire. In contrary to this concern, Gambit expressed their recruiting priority is not in the level of expertise but is in the people themselves. Although they do take knowledge and experience with the technology into consideration, the company values individual passion, strength and their potential with the company rather than basing decisions on pure technical and statistical aspects.

As for accounting activities, especially Account Payables, Arda Özdemir expects the process to be more fully automated soon. Certain tasks involving data entry and data categorising can be automated, allowing people to focus more on intellectual work such as data analysis and decision making rather than repetitive laborious work. He however does not believe AI will perform any critical decision-making tasks in the foreseeable future, as it is still underdeveloped and lacks both the credibility and the ability to execute management responsibilities. Therefore, as of now, upper management tasks and decision-making processes are solely performed by human.

Another expectation proposed by Özdemir is while AI technology has achieved incredible accomplishments in different fields, for instance image and content generation, such developments have limited impact and adaptation usage for businesses. Therefore, AI applications in business still have more improvements to

be made in different aspects including decision making capability, such as applying reinforcement learning in more complicated areas.

5.2 Secondary Research Findings

5.2.1 Finland's International Position

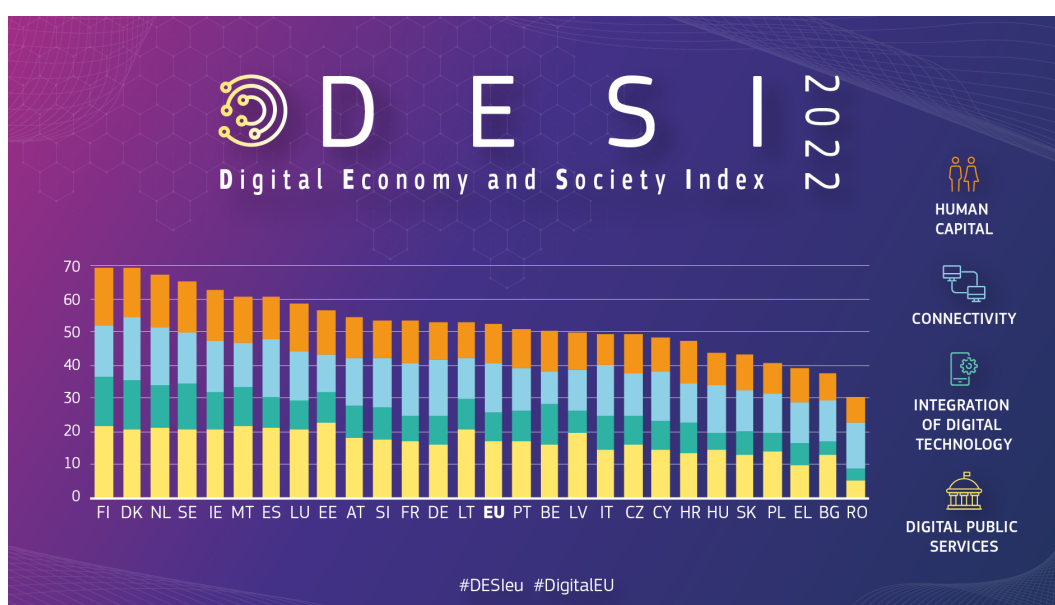
Artificial intelligence is currently one of the world's most significant and impactful technological revolution, with the United States and its companies being the current global leader of AI-based business and AI developments. However, China is aiming to surpass the US's ranking by 2030 by focusing their investments on AI even more comparing to other country, relatively speaking. China also has a major advantage edge in AI development, which is their resource of extensive amounts of accessible data. (Steering Group and Secretariat of the Artificial Intelligence Programme 2019, 37) Therefore, as of now, the European Union is still behind both China and the US in many aspects of AI technology, for instance: quantity, quality and diversity of accessible data, knowledge and investments. Rousku, Andersson, Stenfors, Lähteenmäki, Limnell, Mäkinen, Kopponen, Kuivalainen, Rissanen 2019, 28) The intensive competition between US and Chinese companies are forcing Europe, as well as Finland, to react early and adequately if they want to be one of the world's top talents. (Rousku, Andersson, Stenfors, Lähteenmäki, Limnell, Mäkinen, Kopponen, Kuivalainen, Rissanen 2019, 28)

Even though the EU is currently lagging behind in the AI fields, increasing number of developments are being made, especially from countries like France, Germany, the UK and the Nordic countries. (Steering Group of the Artificial Intelligence Programme 2017, 19) The European Union has also initiated numerous measures to support and boost research and development in AI, with Finland being one of the driving States. (Steering Group and Secretariat of the Artificial Intelligence Programme 2019, 38) With Europe being a union of multiple States, they have a different approach towards AI development strategy comparing to individual countries like the US and China. While companies are the driving factor for AI growth in America and the government takes full responsibility for leading AI developments in China, the EU has no uniform strategy but rather each of its

individual members has various measures in action. (Steering Group of the Artificial Intelligence Programme 2017, 20-21)

As of now, Finland is one of Europe's long-time leaders and pioneers in digital development. The country has been ranking first in the EU's Digital Economy and Society Index (DESI), which measures and track EU's countries' digital performance and their progress. (European Commission 2022)

Figure 1 European Union's Digital Economy and Society Index 2022



5.2.2 Impacts of AI on Finnish Businesses

Finland was accessed to be one of 11 developed countries, placing second after the United State, with great economic growth potential made possible by AI technology. The country has many favourable preconditions to gain great benefits from AI integration: business structure, investment product-driven industry, degree of digitalization and high level of education. With high growth potential from AI, Finland must quickly embrace the technology into its companies as well as public sector. Businesses which are driven by artificial intelligence benefits greatly from it, distinctly separate them from those who did not adopt it into their processes and are now left behind. (Steering Group of the Artificial Intelligence Programme 2017, 11-16)

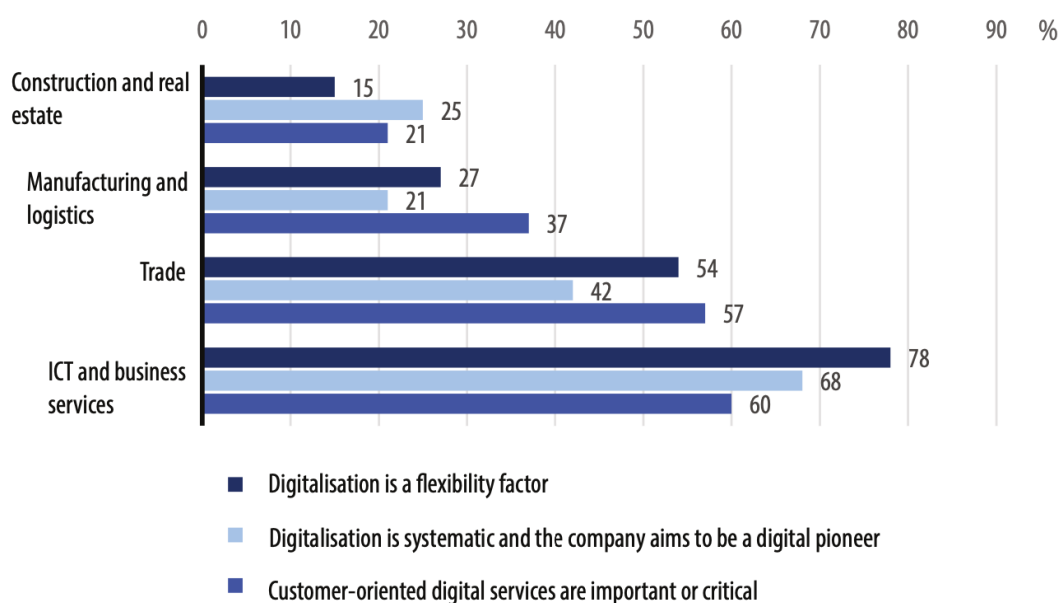
Finland has initiated their own measures to respond to the world's rapid transition into the age of artificial intelligence. The Finnish government (under Prime Minister Sipilä) launched a National Artificial Intelligence Programme. The goal of the programme is to turn AI into one of Finnish businesses' critical success factors as well as making Finland one of the world's leader in the implementation of AI. (Rousku, Andersson, Stenfors, Lähteenmäki, Limnell, Mäkinen, Kopponen, Kuivalainen, Rissanen 2019, 26) For the launch of the programme, Minister Lintilä, Finland's Minister of Economic Affairs, appointed a steering group on May 18th, 2017, consisting of both public and private sectors' representatives as well as research operators, to prepare an action proposal for the Finnish AI Programme. (Steering Group and Secretariat of the Artificial Intelligence Programme 2019, 43) This programme was one of the world's first AI programmes to be launched with the office term lasted until the end of Prime Minister Sipilä's electoral period. On November 13th, 2020, Minister Lintilä appointed another steering group to prepare the programme for expediting the deployment of AI. The new programme is called Artificial Intelligence 4.0. Their goal is to increase digital investment, diversify manufacturing industry's ecosystems and to strengthen Finland's position. This steering group's office term will continue to the end of this electoral period. (AI 4.0 Steering Group 2021, 7-10)

A survey was conducted by the Confederation of Finnish Industries addressing to companies on the topic of the challenges of digitalisation, specifically the needs for skills it created. The result indicates 90% of the companies agree that digitalisation affects their businesses however only 9% of which think that they are one of the pioneers in the matter. According to the survey, even though the proportion has increased slightly over the years of 2017-2019, companies still need adequate abilities for pioneering such as communication, RDI and marketing and sales. In 2020, 12% of Finnish companies, which have more than 10 employees, were reported to have utilized some form of AI in their business processes, comparable to EU's average rate of 7%. It is expected that the trend will continue with digital tools to be used heavily in Finland since most SMEs' current business investment plans involves at least some basic level of digitalisation. However, there are noticeable differences between different types of small and medium-sized

companies. Start-ups in digital sector typically become forerunners while SMEs associated with the conventional market tend to progress slower in the process of digitalisation. (AI 4.0 Steering Group 2021, 17-19)

In addition, there are also differences in the adoption of new digital technology between different business sectors. Information and Communication Technology (ICT) and services companies invest more in digital and utilize it more in their business processes while digitalisation investments are considerably less in the sectors such as manufacturing, logistics and construction. (AI 4.0 Steering Group 2021, 19-20)

Figure 2 Differences (% of respondents) between business sectors in digitalisation. Survey conducted by Priot Oy, Elisa and the Federation of Finnish Enterprises



In addition, comparing to large organisations, small medium-sized companies progressed significantly slower in the technology digitalisations and operating models. SMEs falter behind large companies in multiple aspects, particularly in data analytics, IoT and the use of professional personnel in ICT. (AI 4.0 Steering Group 2021, 18-19) Nonetheless, by benefiting from Finland's strengths and preconditions for the application of AI, start-ups who specialize in digital technologies especially in AI, have the opportunities to rapidly advance and grow in the field. (Steering Group of the Artificial Intelligence Programme 2017, 33)

The COVID-19 pandemic also played a critical role in the acceleration of digitalisation in companies, especially in the aspects of teleworking and online selling. Routine use of digital tools resulted in the improvement of data connections and infrastructures of companies, created a foundation for further digital technology advancement. This will presumably attract more investments into the matter and help improve general information security. However, there is still no distinct evidence on the degree of impact the pandemic made on companies, influencing their opinions and capabilities to digitize their businesses innovatively. (AI 4.0 Steering Group 2021, 18)

Businesses hold a critical role in boosting developments in AI. Rather than the government, it is the companies that promote AI application and investments, gaining important achievements and central impacts on the topic. (Steering Group of the Artificial Intelligence Programme 2017, 32) Introducing AI into business operations requires extensive investments into technical capability, experts' knowledge as well as changes in business models. However, in the majority of cases, one of the very first results of AI integration improved operational efficiency. New business models originated from AI not only benefit organisations individually, but also the entire business ecosystem as a whole. (Steering Group and Secretariat of the Artificial Intelligence Programme 2019, 34-35)

5.2.3 Finland's Strengths and Weaknesses for AI Developments

- ***Strengths***

One of Finland's greatest strengths lies in their agile business models, allowing for seamless cooperation between businesses, research institutes and the society. With high investments made by both companies and the public into researches, Finland holds an advantage in terms of developments and innovations. The country also has a limited and harmonized market, along with rich technological resources and legislation support. All of those factors combined offer a great platform for piloting, which is considered crucial element for successful application of artificial intelligence. Moreover, the promotion of experimentation culture along with broad-scope consensus on big and fast changes providing Finnish market with extra

business agility. (Steering Group of the Artificial Intelligence Programme 2017, 28-29)

In the recent years, Finnish start-ups have been growing rapidly in size and diversity, leading Finland as well as its existing companies towards various structural reformations, creating more opportunities for AI integration. In addition, Finland also has unique data resources, the availability of high quality data provides sufficient environment for companies and researchers to operate in. (Steering Group of the Artificial Intelligence Programme 2017, 29)

The revolution in technology will also inevitably result in major changes in workforce, requiring people with the ability to learn and adapt to AI. In Finland's case, there is a significant advantage in this regards due to the high level of education of Finnish citizens. Therefore, Finns can acclimate to the new technology faster and more efficiently comparing to other countries. (Steering Group of the Artificial Intelligence Programme 2017, 18)

- *Weaknesses*

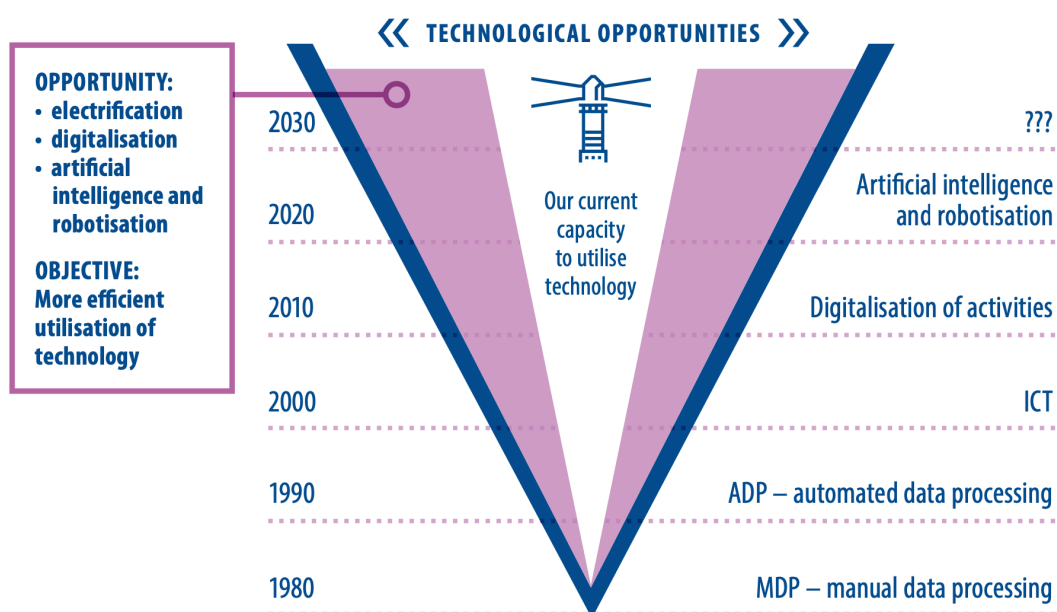
Finland's concentration on internal business activities led to evident lack in international relations. Even though the country has seen certain growth in foreign investments over the recent years, the number is still comparatively low amongst other countries. Another concern for Finland is its culture of avoiding risks as well as the lack of trust in their own ability and success threatens Finland to lose confidence. Finally, with their resources dispersed amongst many small projects with no focal point, causing unwanted underperformance. (Steering Group of the Artificial Intelligence Programme 2017, 29-30)

Table 3 Finland's Strengths and Weaknesses

<i>Strengths</i>	<i>Weaknesses</i>
<ul style="list-style-type: none"> - Agile business cooperation - Great platform for piloting - Experimentation culture - Consensus for changes - Increase of start-ups - Structural reformation - Unique data resources - High level of education 	<ul style="list-style-type: none"> - Lacking international relations - Culture of avoiding risks - Lack of trust - Dispersed resources

5.2.4 Future Vision of AI in Finland

In the 2020s, Finland is expected to be relying more on artificial intelligence and automation in both business and industrial sector as well as in their daily lives. (Rousku, Andersson, Stenfors, Lähteenmäki, Linnéll, Mäkinen, Kopponen, Kuivalainen, Rissanen 2019, 15)

Figure 3 What to expect in the 2020s?

The steering group of the AI Programme proposed a vision for Finland for 2025, a vision of which Finland is a competitive country and is attractive to talents. With AI used extensively, companies' competitiveness will be enhanced, business operations will become more effective and business models will have opportunities to shift and change. This will allow for the manufacturing industry to grow, the B2B market to change and involve and strong new B2C business ecosystems to rise. As a result, Finnish economy will benefit greatly and become a trusted digital economy pioneer with the possibility to export its model internationally. (Steering Group and Secretariat of the Artificial Intelligence Programme 2019, 119-120)

Further down the future, a study conducted by McKinsey on the future of work and AI and automation showed that if Finland focus on AI-based developments and growth, the country's GDP per person will increase by 3% and net employment rate will raise by 5% until 2030. In contrary, if Finland falter on its AI developments comparing to other countries, the country's GDP will only raise by 0.8% and net employment rate will decrease by 0.5%. (Steering Group of the Artificial Intelligence Programme 2017, 12)

Figure 4 McKinsey&Company, "Digitally-enabled automation and artificial intelligence: Shaping the future of work in Europe's digital front-runners", 2017. Finland-specific figures



According to a report published by the Ministry of Finance in 2021, Matti Pohjola mentioned that since the financial crisis of 2008, Finland's industrial productivity growth has been considerably weaker than other referencing countries such as Sweden, Germany and the USA. Digitalisation, especially the adoption of AI is

going to be one of the most critical tools to regenerate productivity growth. (AI 4.0 Steering Group 2021, 27-28) The economic growth of Finland can potentially double by 2030 if the possibilities of AI technology are taken full advantage of. This will require focusing investments on the developments and adaptations of AI in both public and private sectors, adequate scientific and legislative supports. (Steering Group of the Artificial Intelligence Programme 2017, 17)

As Finland become more prolific in AI developments, it will create a foundation for international competitive success. This will result in major gains in terms of important international networks, attracting investments, innovations and leading experts to Finland. (Steering Group of the Artificial Intelligence Programme 2017, 29)

6 DISCUSSION AND CONCLUSION

6.1 Research Validity and Reliability

Since the research methodology used in this thesis is qualitative research, its methods are more subjective comparing to quantitative research. With no definite statistical calculation and analysis, if the researcher's interpretation of the research is subjective, the validity and reliability of the research can become sceptical or even invalidated. (Brink 1993, 35)

Validity in a research represents the integrity and accuracy of the research findings. A valid research must be true to reality, unbiased and uninfluenced by forces including the researcher themselves or irrelevant data variables. Reliability of a research is its ability to be consistent, yielding the same results over repeated testing. The researcher must be able to obtain the same or comparable results while using similar or comparable research methods. (Brink 1993, 35)

Intensive efforts were put into establishing validity and reliability for this research. The author invested in building a sufficient understanding for the topics in this paper: collecting data from multiple sources using different methods, ensuring the data collected are accurate and relevant to the subjects of the research. Multiple safeguard actions were also practiced, minimizing risks of misinformation.

- *Primary research*

For the research interviews, there are high risks of misunderstanding between the interviewing parties, leading to misinformation. Actions were taken to ensure the integrity of the interviews. The questions must be delivered clearly and easy to understand, the interview answers must be verified and transcribed carefully for complete accuracy.

A questionnaire was prepared in advance to make sure that the questions were well drafted to avoid confusions for the interviewees. The interviewer would repeat the key points of the answers to the interviewees after each questions to eliminate potential risks of false data. In addition, all interviews were recorded with the

permission of both parties to later be used as reference. The author of the thesis also cross-verified all transcribed information with the recording multiple times, to assure that the data was correct before adding it to the thesis. By performing all safeguard actions, the risk of misinformation was minimized.

However, interviews with a small sample group did not yield enough evidence to apply the findings to a generalized population, lacking in reliability. For that reason, secondary research was conducted to supply additional data for the study.

- ***Secondary research***

For the secondary research segment, the validity the original data source difficult to secure due to the abundance amount of information that can be found on the internet with limited ways to verify its authentication. Without valid data, the validity of the research can be compromised.

Therefore, this study only utilized data published by official sources from the government and research institutes: publications of the Ministry of Economic Affairs and Employment, the Ministry of Finance of Finland and the European Commission. All the information and data were sourced from available electronic published reports from Valto (Institutional Repository for Finnish Government). Every document was double-checked to verify the validity of data as well as to confirm that the author(s) has adequate knowledge and experience on the topic before they are applied in this research paper, ensuring the accuracy and relevance of information.

By combining both secondary research and primary interview research, the author can ensure there are sufficient data to compare for consistency of results, ensuring the research's reliability.

6.2 Results Analysis

The research results have revealed that digitalisation, especially AI technology is well integrated into many aspects of Finnish business operations. Depending on the scale of the organizations and the business sectors of which they belong, this

number can vary significantly between companies. Nonetheless, all companies can expect to benefit from the applications of AI on different levels and in different ways. According to the research interviews, all participants agreed that AI improves business processes by increasing their productivity, enhancing operational performance and allowing higher problem-solving efficiency while reducing human errors and risks.

The aspect of AI that is utilized the most, based on the data collected in this research, is machine learning and its different applications, such as ERP systems, data analytics and deep learning. This was expected due to the popularity and the extensive resources invested into the research and developments of said applications. This allowed them the abilities to help businesses to improve their operational performance via many well developed programmes that are readily available and convenient to use.

Additionally, computer vision also appears to be gaining popularity amongst companies such as Wärtsilä or Siemens. This has been surprising to discover since computer vision was not a focal point of interest discussed in reports and articles about AI and its applications. The reasoning for this was provided by the case companies representatives themselves: by using image detection, companies like Siemens can provide automatic programs to detect defects in products or to scan documents for errors and frauds such as in Wärtsilä. Those applications of computer vision demonstrated its abilities to improve the company's productivity as well as reduce risks. For future researches, it is necessary to also invest attention to further explore other capabilities of computer vision, due to evidences suggesting that it is showing potential to be the next technological breakthrough in businesses.

In contrary, there are also certain capabilities of AI mentioned in in the theory segment that are not supported by the research findings. For instance, one of AI's proposed abilities is to predict future trends has no relevant data to support it from this research. One of the interviewed participants believes that AI is currently still underdeveloped and yet to have enough credibility for such decision-making applications like trends prediction. Regardless, both research results indicate that

AI technology is still in its early stages of development and still holds the potential to evolve and mature more in the future.

As for Finland, the country also considers AI to be an important factor in the race towards being the international pioneer in technological developments. The research revealed that Finland has the necessary foundations to harvest great benefits from the applications of AI. Evidently, following the government's AI programme, Finland has become one of Europe's long-time leaders in digital developments. Furthermore, data has shown that most Finnish companies also believe that the technological revolution affects their businesses in some manner, with the majority of SMEs incorporate some level digitalisation into their business plans.

Despite its potentials, the difficulties of applying AI into businesses have presented themselves to be more complicated than expected. Other than the anticipated high costs and shortage of personnel, the research uncovered more additional challenges businesses must overcome while adopting AI, including but not limited to: modifying their infrastructure to accommodate to the technologies, sourcing intensive resources in data, knowledge, time and investments.

According to the secondary research, one of the reasons why China is currently second in the lead of AI research is due to their access to an excessive amount of data. This puts Finnish and European organizations in a disadvantage as they do not have the same diversity, quantity and quality of accessible data. This requirement for data source was also mentioned by the interviewed participants, expressing concerns that this lack of data may prolong the wide-spread application of AI in the industries.

Infrastructure is another unexpected challenge for the implementation of AI in businesses. Both primary and secondary research results display the lack of adequate infrastructure support for AI in different business sectors, the level depending on the size of the organization or whether the business is digital-centric or not. Adequate equipment is crucial for supporting data collection for the creation

and operation of AI. This is a major investment and a difficulty businesses will encounter while starting the process of digitalisation.

Regardless, there are some challenges anticipated by the research theories that are unverified and unsupported by the research findings, such as risks in cyber security. However, this does not necessarily mean that this is not a concern for businesses. It is possible that due to the constant digital developments, many risks can be migrated with certain tools and programmes, such as image detection programme can migrate the risks of fraud. Furthermore, the research mainly focuses on the foremost difficulties of the implementation of AI. Comparing to cyber security, infrastructure and data sources are the more immediate matters since without them businesses cannot start to create and put AI in operation.

Another proposed concern for the large scale application of AI is the threat it has on the employments of human labour. This concern was contradicted by one of the interviewed representatives, stating their priority is in humans rather than statistics. There was also no evidence in the secondary research to support this matter. With Europe and Finland's human centric policies, it is unlikely that people will be replaced by technologies, but rather they will move to other managerial and decision making tasks rather than labour intensive tasks.

Overall, the research results correlate well with the theoretical information presented earlier in the thesis. Artificial intelligence, especially its machine learning branch, provides a multitude of benefits for organizations, from enhanced efficiency, fraud detection to risks reduction and more. There are also new findings such as the additional challenges of adopting AI, requiring more than just application costs but also data and infrastructure.

6.3 Conclusion

Management accounting is a business management process which contains aspects of both traditional financial accounting activities as well as management's decision-making activities. Management accounting is a valuable tool used by large-scale organizations' management executives, who consider it to be an important process

for decision-making. While it is not a requirement for SMEs, they can also be performing management accounting activities on a smaller scale without having to dedicate a team or significant resources for it. It can aid them in many business aspects such as monitoring financial and operational processes, evaluating risks, making business decisions and strategizing future plans. Nonetheless, both business management in general and management accounting in particular are being reformed rapidly due to the developments of advanced digital technologies, especially artificial intelligence.

AI is currently the most important and impactful technological revolution. It is reshaping every aspects of business operations and will continue to do so in the foreseeable future. With its ability of processing data faster and more accurate, AI can benefit companies in major ways such as enhancing their operational efficiency, saving resources and minimizing risks. The technology has many capabilities for business owners to exploit, from the more common such as machine learning and robotics to the more advanced including artificial neural network and expert system and more.

According to the results of this research, AI still holds the potential for even further advancements, becoming more intelligent and can accomplish even more complicated tasks including decision making. The rise of digital technology has created an environment where digital tools become more common and easy to use, resulting in increased level of AI integration across the markets. Companies who adopted AI has seen noticeable benefits, granting them advantage edge over their competitors. Those who fall behind on the adoption of AI, on the other hand, experience slower growth with less opportunities to develop in their business sector. However, businesses still need to consider certain challenges associating with the integration of AI, the intense resource demand for of time, data, investment and infrastructure while facing the lack of knowledgeable professionals.

With Finland being one of the world's leader in digital developments, Finnish companies having considerably higher rate of AI usage comparing to Europe's average. The Finnish governments are also encouraging investments for the research and development of the technology. Along with the country's favourable

markets and culture for cross-cooperation, the increasing number of start-ups and high level of national education, Finland holds great potentials to benefit and prosper from AI.

In essence, since Finland is expected to be relying more on artificial intelligence, businesses must embrace and prepare for the application of AI in their business operations. They need to prepare the infrastructure to be more compatible, sourcing knowledgeable experts on the topic and prioritizing their investments on new advanced technologies. This will allow businesses to be successful in their industry and drive Finland towards a successful pioneer in digital developments.

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APPENDICE

Appendix 1: Gambit's Questionnaire

1. AI in business processes:

- Does Gambit incorporate AI in any of your businesses? What type of AI?
- What are the challenges and advantages did you encounter while implementing AI in your operations?
- How does your company perform your accounting activities? Do you use any ERP Systems for bookkeeping?
- Does your company have a Management Accounting team?
- Does AI affect your company's hiring decisions? Does your company prioritize recruiting people with existing knowledge and experience for the technology?

2. AI's future expectations:

- Do you think AI is affecting the overall operation processes amongst Finnish companies?
- What do you expect to see from AI in 5-10 years' time?

Appendix 2: Wärtsilä's Questionnaire

1. Background information:

- What is your role in the company?

2. AI in business processes:

- Does your department incorporate AI in any of your processes? What type of AI?
- How long have you been implementing the AI solution in your operations? What are the challenges and advantages did you encounter since?
- Do you think that AI Technology is affecting Wärtsilä's overall operation processes?
- Does AI affect your company's hiring decisions? Does your company prioritize recruiting people with existing knowledge and experience for the technology?

3. AI's future expectations:

- Do you think Accounting activities will be fully automated in the near future?
- What challenges do you think businesses will encounter while integrating AI into their operations, apart from costs?
- What do you expect to see from AI in 5-10 years' time?