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THE IMPACT OF ARTIFICIAL INTELLIGENCE ON FINANCE

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List of Abbreviations

AI: Artificial intelligence

ML: Machine learning

FX: Foreign exchange

NLG: Natural Language Generation

DLT: Distributed ledger technologies

AML: Anti-money laundering

KYC: Know-your-customer

PCI: Payment Card Industry

DSS: Industry Data Security Standard

IPO: Initial Public Offering

B2B SaaS: Business-to-business Software as a Service

SA: Sentiment analysis

HFT: High-frequency trading

CFT: Combating the Financing of Terrorism

AP: Accounts payable

PO: Purchase order

NPO: Non-purchase order

OCR: Character recognition

RPA: Robotic Process Automation

PSPs: Payment service providers

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ABSTRACT

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Artificial intelligence (AI), or differently called machine intelligence, is a simulation of human intelligence in machines. It is the intellect exhibited by machines, in contrast to the natural knowledge demonstrated by humans. Artificial intelligence consists of generally two fundamental ideas. First it involved studying human brains like how their thought process works and secondly it helps representing those processes through machine learning.

Artificial intelligence has taken over numerous sectors including the accounting industry. There is a significant research gap in the context of AI-driven workplace on the particular skill that are required for the success of finance professionals. The fundamental goal of this thesis is to comprehend the effects of AI on the financial sector. The main goal is to gain a complete understanding of how AI works in financial services. The research objective also includes an investigation into the current AI skill gap in the finance sector.

Using a qualitative methodology featuring theoretical sampling and interviews with professionals in finance and AI, this research reveals diverse insights. The key findings highlight an overall positive reception of AI in finance, with professionals emphasizing its supportive role.

Nonetheless, challenges in the implementation of robotic process automation (RPA) are acknowledged, pointing towards areas that demand careful consideration. This study emphasizes the significance of addressing these challenges and to foster a more seamless integration of AI technologies in the financial sector.
Given that the artificial intelligence is experiencing noteworthy changes at a quick pace, this thesis is a preview of the current application of artificial intelligence in the financial industry and how it is changing.

Keywords Impact of AI, Finance, AI.

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1 INTRODUCTION

In a world that is continuously evolving, the integration of Artificial Intelligence (AI) has become one of the biggest game-changing tools offering extradentary opportunities for automation and strategic decision making (Rajan Nagina, 2023). AI is the process of making machines intelligent by mimicking how people think. It enables machines to perform human duties in an intelligent manner. (Xu et al., 2021). AI functions similarly to the human brain, thinking and deciding more accurately by processing relevant data. (David Winter, 2018; Xu et al., 2021).

Artificial intelligence is now becoming more widespread in the current market (Du & Xie, 2021). It is used in various sectors, financial advisory services, trading, and banking is one among them (Deloitte., 2023.; Kaur et al., 2020). Various sectors are using AI in a very innovative way which saves plenty of time and money (Deloitte., 2023.; Kaur et al., 2020). Various industries rely on algorithms to produce reliable outcomes, contributing to improved customer service and increased sales for better profits. AI incorporates machine learning, which minimizes mistakes influenced by emotions and psychology. A crucial role of AI involves sifting through diverse data to extract essential information and reach conclusions (Kaur et al., 2020).

In a 2023 study, it was found that 67% of companies operating in the finance sector have already adopted automation tools to enhance the efficiency of their day-to-day operations by automating repetitive tasks (Alan Hester, 2023). Furthermore, 31% of these companies have successfully achieved full automation for at least one of their primary functions. Notably, 24% of organizations have incorporated low-code process automation into their workflows, and an additional 29% are currently in the process of implementing it, with plans to do so in the near future. Researchers have shown that 80% of organizations will adopt intelligent automation by 2025. Indeed, this change will increase their investments (Alan Hester, 2023).

The purpose of this thesis is to focus on artificial intelligence in the financial industry. Focus on how AI can help humans in their daily tasks, lowering the workload and focusing on more important topics in their job. What interests me is, how can

we foster a more AI-enhanced environment within an industry while simultaneously ensuring job security in the workforce, for this matter I conduct an examination of ethical considerations and provide an in-depth analysis of AI's role within the financial industry.

1.1 Background of the study

The concept of artificially intelligent robots may seem like a recent innovation, but its roots can be traced back to early 20th-century literature and the pioneering work of individuals like Karel Čapek, Arthur Samuel, and Alan Turing (Miu, 2023). This chapter explores the fascinating history of artificial intelligence, from its conceptual origins to its contemporary rise in popularity, all against the backdrop of advancing technology and the wealth of data available in the modern age (Rockwell Anyoha, 2017). The idea of "artificial people" brought to life by machines was first introduced by Czech playwright Karel Čapek in 1921 through his science fiction play, "Rossum's Universal Robots" (Tableau, 2023.). In this groundbreaking work, he coined the term "robots," which would go on to become synonymous with artificially intelligent beings (Tableau, 2023.). Čapek's visionary storytelling laid the initial foundation for the concept of artificial intelligence (Tableau, 2023.). Fast forward to 1952, when computer scientist Arthur Samuel made history by developing a program to play checkers (Giorgio Barilla, 2023). This program was a trailblazer, as it marked the first instance of a computer learning to play a game independently (Giorgio Barilla, 2023). Samuel's work exemplified the early steps in the journey toward artificial intelligence, where machines began to exhibit the ability to learn and adapt (Giorgio Barilla, 2023). The study of machine learning truly took shape with the contributions of Alan Turing. In his influential paper, "Computer Machinery and Intelligence," Turing introduced the concept of the "Imitation Game." In this game, he proposed to test machine learning and pondered the fundamental question, "Can Machine Think?" Turing's hypothesis was based on the idea that if humans could process information, reason, and make decisions, machines should also have the potential to do the same (Stephen Cave & Kanta

Dihal, 2023). This groundbreaking work laid the theoretical groundwork for artificial intelligence, marking a pivotal moment in its history (Tableau, 2023.). In recent times, artificial intelligence has experienced a resurgence, capturing the imagination of a broader audience (AI-Mastermind, 2023). This resurgence can be attributed, in part, to the explosion of data and the remarkable improvement in computing power (Haroon Sheikh et al., 2023). The widespread use of the internet and the proliferation of connected devices have led to a constant flow of information (Rockwell Anyoha, 2017; Tableau, 2023.). This data includes our interests, preferences, and behaviour, meticulously tracked through our online interactions (Rockwell Anyoha, 2017). Simultaneously, the declining costs associated with manufacturing sensors, cameras, storage capacity, powerful processors, and cloud computing infrastructure have paved the way for AI to thrive. The journey of artificial intelligence, from its inception in the imaginative world of Karel Čapek to the theoretical musings of Alan Turing, has been marked by remarkable milestones (Rockwell Anyoha, 2017; Tableau, 2023.). While the idea of artificial intelligence has been around for nearly a century, recent years have seen an unprecedented surge in interest and development (Xu et al., 2021). The abundance of data, coupled with enhanced computing capabilities, has propelled AI into the forefront of technological innovation (Xu et al., 2021). As we stand on the point of a new era, the future of artificial intelligence is filled with limitless possibilities, promising even greater advancements and a deeper integration into our daily lives (Xu et al., 2021).

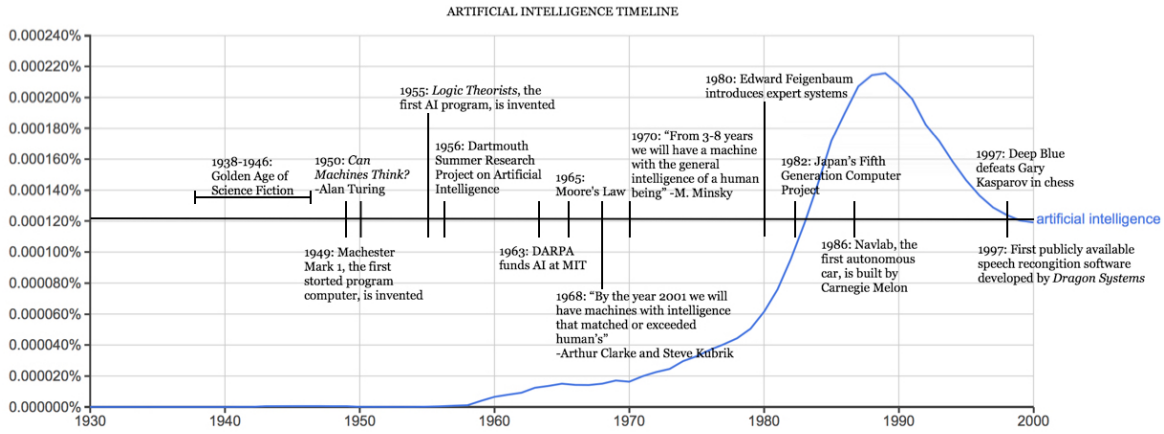

Figure 1. Artificial Intelligence Timeline (Rockwell Anyoha, 2017)

1.2 Research Gap

While extensive research has been conducted on the impact of artificial intelligence (AI) on the financial industry, there is a notable research gap in understanding the specific skills and competencies that finance professionals need to thrive in an increasingly AI-driven environment (Nikolaos-Alexandros Perifanis & Fotis Kitsios, 2023). This gap exists because most studies primarily emphasize the overall impact of AI on finance without delving into the coarse details of how AI will reshape the skill set and career paths of finance professionals (Nikolaos-Alexandros Perifanis & Fotis Kitsios, 2023).

1.3 Research objective and research question

This study aims to fill a knowledge gap by studying the specific skills essential for finance professionals to thrive in an AI-driven future. This study aims to expand insights into the shifting demands within this AI-infused context by evaluating the subtle influence of AI in finance. Furthermore, the research helps to gain a comprehensive understanding of AI's functioning within financial service as well as to investigate and comprehend the existing AI skill gap in the financial sector. The following research questions will be answered:

- Why AI in the finance industry?

- How does the AI skill gap affect financial professionals, and how can their AI expertise be improved?

1.4 Scope and limitations of the study

The scope of this research is narrowed to AI in Finance to set a limit and to focus on the topic. It covers AI applications in finance, the required skills for finance professionals in an AI-driven environment, benefits, challenges, ethical considerations, and implementation strategies. This study relies on publicly available data and existing literature as its primary sources. While this approach provides a comprehensive overview, it can be constrained by the availability and accessibility of relevant data. In some cases, organizations may not publicly disclose their AI strategies or experiences, leading to potential gaps in the research. Additionally, the quality and depth of publicly available information may vary, impacting the depth and accuracy of the analysis.

For example, a financial institution may have implemented AI but not publicly shared detailed information about its strategies, challenges, or outcomes. As a result, the study may not capture practical, real-world insights from specific organizations due to the limitations in data source availability. This constraint can restrict the study's ability to provide a detailed and up-to-date account of AI integration in the financial industry. To address this limitation and enhance the study's comprehensiveness, an interview with a knowledgeable individual in the field is planned. This interview aims to provide practical, firsthand insights into the realities of AI adoption within Finnish financial organizations.

1.5 Thesis Layout

In the First chapter, the thesis and the topic of research are introduced. In the ensuing part of the first chapter the research gap as well as thesis statement, research questions and background of the study are presented. The second chapter contains the literature review Here, the focus is exploring the spectrum of its various types. A significant portion of this chapter is dedicated to understanding the intricate workings of automation, particularly within the domain of finance, while also discussing how can we automate certain processes with AI for example asset

management, credit intermediation, algorithmic trading, possible risks of AI in trading. Addressing the non-purchase orders where explored the challenges of handling invoices without a formal PO, emphasizing the need for efficient processes. Understanding the mechanisms that enhance efficiency and accuracy, examining the invoicing process, highlighting the significance of effective vendor data management, capturing essential data from invoices, investigating the complexities of accounting entries. Presenting the benefits of AI automation, which brings precision and efficiency, enhancing data validation, swiftly navigates vast datasets, workflow management by automating repetitive tasks. In payment processing, AI reduces errors and increases security. In the following chapter the methodology, the reason for choosing the qualitative method is presented, demonstrating how it allows to answer the research questions through insightful interviews. The fourth chapter discusses interview findings provided by a summarized overview, incorporating direct quotations to capture key insights without repletion of statement. A comprehensive analysis into the interview outcomes. Concluding the research, the final chapter synthesized findings, offering conclusive insights into the addresses research questions.

2 LITERATURE REVIEW

2.1 Evolution of AI

> *"The whole idea is to do something no other human—and no other machine—is doing.*(Traders Magazine, 2019)*"*

The world of artificial intelligence may seem like a recent phenomenon, but its roots trace back to the mid-20th century (Rockwell Anyoha, 2017). This research explores the historical timeline of AI, from its early conceptualization by Alan Turing to its contemporary applications by tech giants (Rockwell Anyoha, 2017). The journey of AI takes us through decades of development, punctuated by significant advancements that have reshaped our understanding of machine intelligence (Yogesh K. Dwivedi et al., 2023). In the 1950s, the concept of AI was first formalized when British mathematician and computer scientist Alan Turing released a groundbreaking paper (A. M. TURING, 1950). In this paper, Turing contemplated the potential of machines possessing genuine intelligence (A. M. TURING, 1950). Although the term "artificial intelligence" came into existence during this period, practical applications of AI or an AI approach remained in the realm of theory (Haroon Sheikh et al., 2023). Despite the early conceptualization of AI, its practical implementation remained elusive for several decades (Patrick Mikalef & Manjul Gupta, 2021). Theoretical discussions and hypotheses abounded, but tangible progress was limited (A. M. TURING, 1950). It was not until the late 1990s that AI's potential began to materialize in real-world applications (A. M. TURING, 1950). The true acceleration of artificial intelligence occurred in the 21st century, notably gaining momentum after 2011 (Xu et al., 2021). This pivotal moment saw major tech companies, including Facebook, IBM, Microsoft, and Google, embracing AI and machine learning for various business applications (Alex Hern, 2016). Their adoption of AI marked a turning point in the history of artificial intelligence, with these corporate giants leading the charge in integrating AI into everyday operations (H. James Wilson & Paul Daugherty, 2018). the journey of artificial intelligence is a testament to human ingenuity and persistence (H. James Wilson & Paul Daugherty, 2018). From its theoretical inception in the 1950s by Alan Turing to its practical applications in the late 1990s and the subsequent explosion of AI in the business world after 2011, AI's history is a tale of continuous development and

evolution. As we stand on the threshold of a new era, the future of artificial intelligence holds the promise of further innovations and transformative applications, which will continue to shape our world and redefine the boundaries of what machines can achieve (A. M. TURING, 1950; Rockwell Anyoha, 2017).

2.2 Adoption of AI

Artificial intelligence (AI) has permeated various facets of our lives, revolutionizing the way we interact with technology and opening up new possibilities in countless domains (Chugh, 2023). This into the myriad implementations of AI, including data mining and an array of methods such as algorithm monitoring, facial detection, and optical character recognition (Sabyasachi Dash et al., 2019). These applications have transcended traditional boundaries and found their place in diverse commercial fields, ranging from advertising and marketing to accountancy, insurance, the Internet, transportation, aerospace, and agriculture (OECD, 2023.). This part will also explore how the 1990s ushered in a new era of AI technologies, enabling breakthroughs in natural language analysis, image identification, deep learning, voice recognition, and emotion recognition. The versatility of AI is evident through its diverse implementations (Chugh, 2023). Data mining, one of AI's notable applications, involves the extraction of valuable insights and patterns from large datasets (Ibm, 2023.). This process not only aids businesses in understanding their customers and markets but also enhances decision-making (Abid Haleem et al., 2022). Algorithm monitoring is another essential use of AI, ensuring that complex algorithms operate effectively and meet their intended objectives. In the dynamic world of technology, constant monitoring and adjustment are crucial. Facial detection, a remarkable AI application, has transformed the realm of security, personalization, and entertainment (Abid Haleem et al., 2022). It enables devices and systems to recognize and respond to human faces, offering a range of innovative possibilities. Optical character recognition (OCR) is a boon for businesses and individuals dealing with vast amounts of printed or handwritten text. AI-driven OCR technology can quickly and accurately convert text into digital formats, saving time and effort (Appen, 2021). AI has not confined itself to any one industry but has

made inroads into various commercial sectors (Appen, 2021). In the realm of advertising and marketing, AI-driven algorithms analyse consumer behaviour and preferences, facilitating personalized advertisements and marketing strategies (Joshua Almeria, 2023). Accountancy and insurance industries benefit from AI's data analysis capabilities, streamlining financial transactions, risk assessment, and fraud detection (Deloitte, 2021). The Internet, a vast ecosystem, relies on AI for search engines, chatbots, and content recommendation systems, enriching user experiences and making information readily accessible. Transportation, with the emergence of autonomous vehicles, has AI at its core, enabling safer and more efficient travel (mckinsey, 2017). Aerospace utilizes AI for navigation, maintenance, and advanced flight systems. In agriculture, AI assists in crop monitoring, yield prediction, and pest control, enhancing productivity and sustainability.

The 1990s witnessed a paradigm shift in AI technologies. It marked the emergence of natural language analysis, enabling machines to understand and respond to human language. Image identification, a subset of computer vision, allowed machines to recognize and interpret visual content. Deep learning, a subfield of AI, revolutionized neural networks, enabling them to process vast amounts of data, detect patterns, and make accurate predictions. Voice recognition technology made voice-activated devices and virtual assistants a reality. Emotion recognition, a captivating development, allows AI systems to gauge human emotions through facial expressions and vocal cues, enhancing human-computer interactions.

2.3 AI in Financial Services

> *Humans and machines can enhance each other's strengths. by H. James Wilson and Paul R. Daugherty (H. James Wilson & Paul Daugherty, 2018)*

The financial sector has undergone a profound transformation in recent years, largely fuelled by advancements in technology (*Digital Disruption in Banking and its Impact on Competition*, 2020). In this chapter, we will search into the notable changes in communication, customer service, recruitment, and asset management within the financial industry (KPMG, 2017). The increasing impact of sentiment analysis, crowd-sourced data, and algorithms on how money is managed in

this sector. As financial institutions embrace these innovations, they are fundamentally altering the financial and investment landscape (KPMG, 2019a).

2.3.1 Communication

Communication is a cornerstone of the financial sector, and in recent years, it has undergone a remarkable evolution (OECD, 2021). This research investigates into the fascinating developments in financial sector communication, exploring the transition from laborious paperwork to swift digital interactions. We discuss how online platforms, mobile apps, and instant messaging have revolutionized the way financial institutions interact with their clients. This transformation not only enhances accessibility to financial services but also empowers customers to manage their finances conveniently (Bruhati, 2023). The financial sector has bid farewell to the era of endless paperwork and cumbersome processes. In its place, a digital revolution has unfolded. The era of extensive form-filling and the protracted wait for postal responses has become obsolete. Today, financial institutions have transitioned to online platforms and mobile apps, enabling clients to access services and information at their fingertips (Jim Marous, 2023). This shift from paper to pixels has not only saved time but also contributed to environmental sustainability by reducing paper waste (Alison Moodie, 2014). The advent of instant messaging has brought a new level of convenience to financial interactions. Clients can now communicate with their financial institutions in real time, seeking assistance or clarifications without the need for lengthy phone calls or face-to-face meetings (Brosix, 2023). This seamless connectivity has bridged the gap between clients and their financial advisors, making financial services more accessible and responsive. Perhaps one of the most significant outcomes of this communication evolution is the empowerment of clients (Brosix, 2023). In the digital age, clients have unprecedented access to their financial data, account information, and transaction history. They can monitor investments, transfer funds, and pay bills with ease. This level of control fosters financial literacy and independence, as clients can actively manage their finances without being reliant on intermediaries (Ceyla Pazarbasioglu et al., 2020). Financial institutions have embraced digital communication to

ensure their services are accessible to a wider audience (Brosix, 2023). Mobile apps and online platforms cater to a broad demographic, from tech-savvy millennials to individuals who may have limited access to traditional banking services (BiggBrains, 2023). This redefined accessibility ensures that financial services are inclusive and available to a diverse range of clients (BiggBrains, 2023).

2.3.2 Enhanced Customer Service

Customer service is a critical aspect of the financial sector, and in recent years, it has experienced a remarkable transformation (Swetha Amaresan, 2023). In this chapter examines into the fascinating developments in customer service, focusing on the emergence of chatbots and AI-driven virtual assistants that are available around the clock to address customer queries and provide assistance. Addressing how these technological innovations not only ensure a faster response but also enhance the overall customer experience. While the human touch remains essential, technology has become a valuable ally in delivering prompt and effective customer service (Oji Udezue, 2023). Chatbots have become a ubiquitous presence in the world of customer service (Usman Aslam, 2022). These automated assistants are designed to interact with customers in a conversational manner, providing real-time support and responses (Usman Aslam, 2022). Whether it's answering frequently asked questions or guiding clients through specific processes, chatbots offer immediate assistance, eliminating the need for customers to wait on hold or navigate through complicated phone menus (Usman Aslam, 2022). In addition to chatbots, AI-driven virtual assistants have further elevated customer service in the financial sector (Usman Aslam, 2022). These intelligent systems can handle a wider range of tasks, often with a high degree of accuracy (Usman Aslam, 2022). They can process complex inquiries, assist with account management, and even execute transactions on behalf of clients. The continuous availability of these virtual assistants ensures that customers can receive support at any time, accommodating their schedules and needs (Usman Aslam, 2022). The integration of chatbots and AI-driven virtual assistants has a profound impact on the overall customer experience (Usman Aslam, 2022). Clients no longer need to adhere to traditional business hours for assistance. They can seek help at their convenience, which is particularly advantageous for international clients across different time zones (Usman

Aslam, 2022). The efficiency and responsiveness of these technologies contribute to a more positive and seamless customer experience (Usman Aslam, 2022). While technology plays a pivotal role in modern customer service, the human touch remains indispensable. Complex issues or emotionally sensitive matters may necessitate human intervention (Usman Aslam, 2022). Financial institutions understand the importance of striking a balance between technology and human interaction to provide the best possible service. This synergy ensures that customers receive both the efficiency of automation and the empathy of human assistance when needed (Bankingly, 2019).

2.3.3 Modernizing Recruitment

Recruitment is a vital component of the financial industry, and in recent years, it has adapted to the digital age (Phyllis Messalina Gilch & Jost Sieweke, 2021). This part of research explores the significant changes in financial industry recruitment, highlighting the prevalence of online job platforms, video interviews, and data-driven hiring processes. These advancements not only expedite the hiring process but also enable financial institutions to efficiently identify the most suitable candidates (Phyllis Messalina Gilch & Jost Sieweke, 2021). The integration of technology in recruitment reflects the sector's commitment to staying competitive in the job market (Phyllis Messalina Gilch & Jost Sieweke, 2021). The times when job seekers predominantly depended on newspaper classifieds or dispatched physical resumes are now a thing of the past. The financial industry has embraced online job platforms as a means of connecting with potential candidates (Phyllis Messalina Gilch & Jost Sieweke, 2021). These platforms offer an extensive pool of talent and provide financial institutions with the ability to reach a diverse array of candidates (Phyllis Messalina Gilch & Jost Sieweke, 2021). Job postings can now be accessed by candidates from around the world, eliminating geographical limitations (Phyllis Messalina Gilch & Jost Sieweke, 2021). Video interviews have become a standard in financial industry recruitment. Instead of the traditional in-person interviews, candidates and hiring managers now connect through screens (Phyllis Messalina Gilch & Jost Sieweke, 2021). This approach not only saves time but also

enables financial institutions to assess a candidate's communication skills, presence, and suitability for the role. Video interviews have streamlined the interview process, allowing candidates to participate from the comfort of their own homes (Phyllis Messalina Gilch & Jost Sieweke, 2021). Data-driven hiring processes have transformed the way candidates are evaluated and selected. Technology allows financial institutions to collect and analyse a wealth of data on candidates, including their qualifications, work history, and even their social media presence (Phyllis Messalina Gilch & Jost Sieweke, 2021). This data-driven approach ensures that candidates are matched with positions that align with their skills and experience (Phyllis Messalina Gilch & Jost Sieweke, 2021). It also minimizes biases and enhances the objectivity of the recruitment process. The integration of technology in recruitment not only expedites the hiring process but also makes it more competitive (Jinisha Ghodasara, 2023.; Phyllis Messalina Gilch & Jost Sieweke, 2021). Financial institutions can quickly identify and secure the most suitable candidates, ensuring that they are not left behind in the race for top talent. This efficiency benefits both employers and job seekers, as positions are filled more rapidly, and candidates find suitable opportunities sooner (Jinisha Ghodasara, 2023.; Phyllis Messalina Gilch & Jost Sieweke, 2021).

2.4 Revolution in Asset Management

Asset management, a fundamental pillar of the financial industry, has embarked on a new era marked by the emergence of robo-advisors and AI-driven investment strategies (Skillfloor, 2023). This part of the thesis explores the profound changes in asset management, shedding light on how these innovative tools utilize algorithms and data analysis to make investment decisions. They offer a range of benefits, including lower fees, automated portfolio rebalancing, and personalized investment strategies. This revolution is making investment services more affordable and accessible to a broader audience (Si Katara Forbes, 2023). Robo-advisors have become prominent players in the world of asset management. These automated platforms utilize algorithms to create and manage investment portfolios for clients Frankenfield, 2023). They leverage technology to assess clients' risk tolerance, financial goals, and investment preferences, all while maintaining a diversi-

fied portfolio (Frankenfield, 2023). The convenience and affordability of robo-advisors have made them an attractive option for individuals seeking professional investment management without the high costs associated with traditional financial advisors (Frankenfield, 2023). The infusion of artificial intelligence into asset management has paved the way for more sophisticated investment strategies. AI-driven systems can process vast amounts of data in real-time, enabling them to identify trends, assess market conditions, and make rapid investment decisions (VARTEQ Inc., 2023). This level of data analysis goes beyond what human advisors can achieve, offering the potential for higher returns and more informed investment choices. One of the most significant advantages of robo-advisors and AI-driven investment strategies is the reduction in fees (VARTEQ Inc., 2023). Traditional financial advisors often charge substantial fees for their services, making professional asset management inaccessible to many. Robo-advisors typically charge lower fees, ensuring that a more extensive segment of the population can access professional investment advice (Michael Bromberg, 2023). This democratization of asset management is a welcome development, as it empowers individuals to grow their wealth without the burden of exorbitant costs (Michael Bromberg, 2023). Robo-advisors and AI-driven systems excel in providing personalized investment strategies. They take into account a client's unique financial situation, goals, and risk tolerance to create tailored portfolios. This level of personalization ensures that clients' investments align with their objectives, making the path to financial success more attainable (Michael Bromberg, 2023).

2.5 The Rise of Sentiment Analysis and Crowd-Sourced Data

The financial sector has witnessed a notable transformation with the growing importance of sentiment analysis and crowd-sourced data (OECD, 2021). The analysis of social media, news, and online discussions has become a valuable tool for understanding market sentiment and trends. When combined with advanced algorithms, this data aids in making informed investment decisions (Comparables, 2023). It serves as a clear example of how technology is reshaping the decision-making process in finance (Comparables, 2023). Sentiment analysis (SA), also

known as opinion mining, involves the use of natural language processing and text analysis to assess and interpret sentiment in text data (Saidah Saad & Bilal Saberi, 2017). In the financial sector, this technique is applied to a wide range of textual sources, including social media posts, news articles, and online forums (Saidah Saad & Bilal Saberi, 2017). By analysing the language and tone used in these texts, financial professionals can gain valuable insights into market sentiment (Saidah Saad & Bilal Saberi, 2017). The analysis of social media, news, and online discussions provides a wealth of information on market trends (Comparables, 2023; Saidah Saad & Bilal Saberi, 2017). Investors and financial experts can identify patterns and trends by studying the sentiment expressed in these sources. Positive sentiments may indicate growing interest in a particular asset, while negative sentiments might signal concerns or potential risks (Francesco Audrino et al., 2020). This data helps investors stay ahead of market developments and make informed decisions. Crowd-sourced data refers to information that is collected from a diverse group of individuals, often via online platforms (Francesco Audrino et al., 2020). This data can be a valuable source of insights for financial decision-making. In the context of finance, crowd-sourced data may include ratings, reviews, and opinions from individuals who have experienced a product or service (Francesco Audrino et al., 2020). This data can be especially useful when evaluating the potential of a particular investment or financial product. Advanced algorithms play a crucial role in making sense of sentiment analysis and crowd-sourced data (Francesco Audrino et al., 2020). These algorithms can process and analyse vast amounts of text data quickly and efficiently. By identifying patterns, sentiment shifts, and emerging trends, algorithms assist financial professionals in making well-informed investment decisions. This fusion of human insights and machine capabilities is at the forefront of modern financial analysis (Francesco Audrino et al., 2020).

2.6 Examples of finance processes that can be automated with AI

Many financial companies are adopting AI, ML, and big data tools with the prospect of obtaining a competitive edge (OECD, 2021). This utilization aims to enhance effectiveness by cost reduction and elevate the quality of financial services products in demand by customers, as indicated by the US Treasury in 2020 (OECD,

2021; U.S. Department Of The Treasury, 2018). Corresponding to the Organization for Economic Co-operation and Development (OECD), AI, machine learning (ML), and Big Data can be applied in many areas of finance (Tuomas Haapsaari, 2018.-a). In various financial activities, such as managing assets and working with block-chain-based finance, AI can be a valuable tool for automation. The OECD has pin-pointed four specific financial market activities where AI can be effectively put to use (OECD, 2021):

2.6.1 Asset Management

BlackRock's literature on artificial intelligence and machine learning in asset management explains its importance of the usage of artificial intelligence and machine learning in the asset management. By using effectively, the machine learning and artificial intelligence in asset management there is an increase and precision of workflows, strengthen risk management, improve customer experience, and enhance performance (BlackRock, 2019; OECD, 2021; Tuomas Haapsaari, 2018.-a). A valuable tool that can be served to the financial advisors in humanizing and streamlining the process of data analysis and reporting to their clients, it is the "Natural Language Generation (NLG)", which falls under the umbrella of artificial intelligence (Ivy Wigmore, 2023). Machine learning can improve the management of risks for hedge fund managers and other major institutional investors since it can identify risk variables daily and test the performance of each scenario presented. An example of BlackRock's literature is that "a model might be able to take known inputs such as the average price of a stock to determine if the latest price received from a vendor is erroneous" (BlackRock, 2019). Which in turn it reduces from the back-office by automating tasks, reducing costs, and increasing the speed.

Depending on the sort of artificial intelligence technique used, providing machine learning (ML) algorithms with large data might give asset managers recommendations that influence portfolio allocation (OECD, 2021). Big data has largely supplanted traditional datasets, which are now regarded as a commodity accessible

to all investors and is being used by asset managers to get insights into their investment process. Information has always been important to the financial world, and data has formed the foundation of numerous investment strategies, ranging from fundamental research to systematic trading and quantitative strategies (OECD, 2021). Deploying artificial intelligence for the comprehensive analysis of raw data from numerous channels provides organizations with the capability to rapidly discover valuable insights, facilitating the formulation of informed strategies within exceptionally tight time constraints.

However, by deploying artificial intelligence and machine learning (AI/ML) is being served as a competitive advantage over the rivals. Since smaller companies are unable to use the AI/ML techniques, which comes to the limitations of participation among the smaller companies where is likely to endure until such time as the industry reaches a juncture wherein these tools become ubiquitous or accessible through third-party vendors. Relying on third-party vendors, many financial experts will start using similar AI tools for their work, they might end up making similar decisions in the financial markets. This can create a situation where everyone seems to be following the crowd. If this happens, it can make the financial system unstable, especially when there's already a lot of uncertainty. For example, if a lot of people start buying or selling all at the same time, it can make prices go up and down rapidly, and this can lead to unexpected problems.

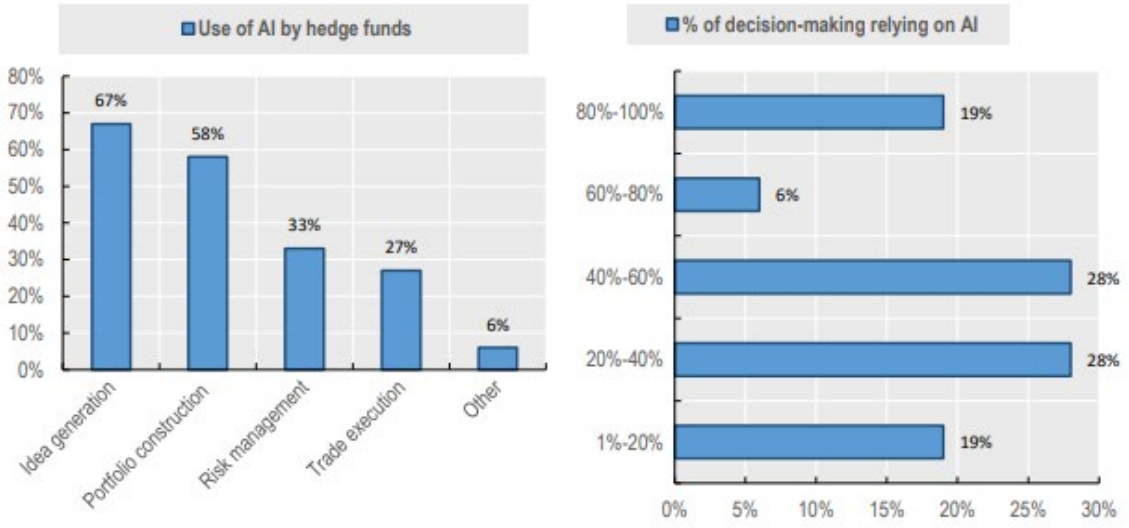

Figure 2. Use of AI by hedge funds (OECD, 2021)

2.6.2 Credit Intermediation

Artificial intelligence can be used in credit intermediation and has been increasingly getting popular among banks and fintech, which helps to evaluate the creditworthiness of potential debtors and then create an underwriting decision. In credit scoring, we can utilize machine learning models as a smart tool that help us guess if a person have trouble paying back loans (OECD, 2021). Machine learning can forecast the information since a company might not have much information about the borrowers (OECD, 2021). AI built technology are able to catch fraud detection, who try to trick them and to see how different borrowers are connected. This helps them manage their loans better (OECD, 2021).

Having lots of data and artificial intelligence has changed how we figure out if someone can pay back a loan. These AI-based tools use both regular information like for example your credit history and also in the unconventional or non-traditional data sources that may not seems directly related to a person's creditworthiness which can include digital footprints, open banking data, and social media data (OECD, 2021). Consequently, they can see if someone is a reliable person in order to loan their money and expect to be paid back (OECD, 2021). This helps banks to make better decisions about who they should lend money to.

Using AI models to make decisions about who gets loans can help save money and make it easier for people who do not have a long history of borrowing money (thin files) to get loans (OECD, 2021). This can be very beneficial for a small business that can't prove they're good at paying back loans based on their past record or by putting up valuable stuff as a guarantee (OECD, 2021).

The idea is that AI can help make it possible for these businesses to get loans, which can help the economy grow by making it easier for them to get the money they need (OECD, 2021). Some studies even say that we might not need to put up valuable stuff as collateral to get loans if we use AI. Businesses who haven't always had an easy access to loans, while they had an average credit or who didn't use banks a lot, might be able to get loans more easily if we use different ways of deciding who can get a loan (OECD, 2021). This could help more people be a part of the financial system. Even though we have machine learning technology, we can still be uncertain about in the long run how these machines be operating (OECD, 2021). Some research indicates that using AI for deciding who gets loans might only make it cheaper for certain groups of people, while others say it can help reduce unfair treatment based on things like race when giving out loans (Chirag Shah, 2023).

2.6.3 Algorithmic Trading

In the early '70s and until now, artificial intelligence has been used as a tool to automate trading systems that make forecasts, make decisions, and execute transactions (Cade Metz, 2016; Neelima Jauhari, 2023a; OECD, 2021). AI-driven systems in the financial markets can identify and execute trades without direct human involvement autonomously. These systems leverage advanced AI technologies, including evolutionary computation, deep learning, and probabilistic logic, to make independent trading decisions and execute orders (Cade Metz, 2016; OECD, 2021). Artificial intelligence-powered systems can assist in formulating methodical trade approaches by implementing a structured "if/then" decision-making approach for upcoming trades (Traders Magazine, 2019). In today's complex financial landscape where different types of assets and regions are closely linked, artificial intelligence (AI) provides a predictive capability that surpasses the effectiveness of traditional

algorithms used in finance and trading. In the world of trading, AI-driven systems also play a role in helping traders manage their risks and control how they control their arrangements. For instance, AI applications can monitor the level of risk involved and make automatic adjustments or exit positions as required, all without the need for manual reprogramming. These AI systems learn and adapt to shifting market conditions on their own, with little to no human involvement (OECD, 2021). AI-powered technologies can help traders manage the distribution of their orders across various stockbrokers. They aid in the management of predetermined transactions, allowing for more control over the distribution of transaction costs and liquidity to various components of the trading strategy. This improves a trader's capacity to manage trading activity efficiently, optimize expenses, and guarantee liquidity is allocated properly (OECD, 2021).

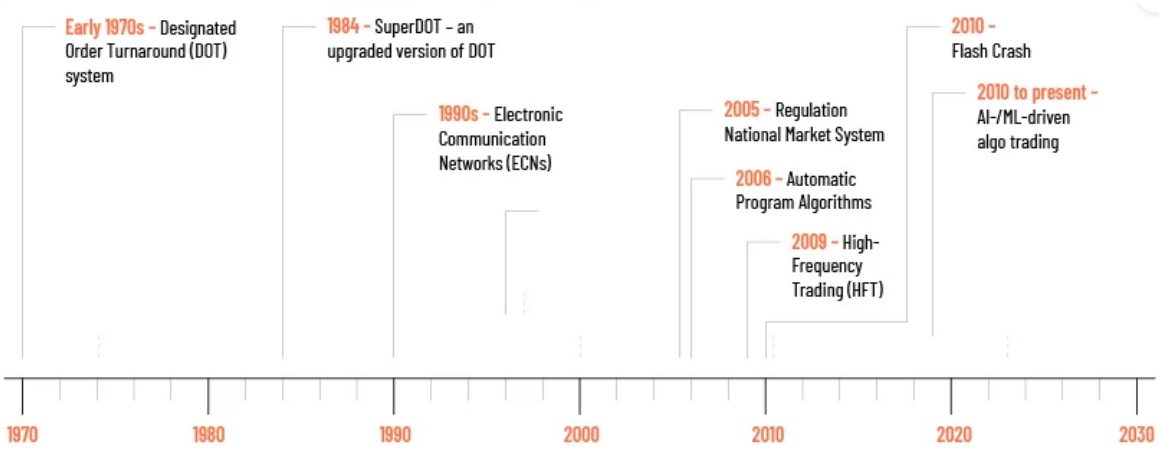

Figure 3. Developments in algo trading. (Neelima Jauhari, 2023b)

In the context of thoroughly digitized financial markets, particularly in the equities and foreign exchange (FX) products, trading algorithms based on artificial intelligence play a critical role as they improve the management of liquidity and the successful execution of substantial orders with limited trading effect. They accomplish this by constantly modifying order size, time frame, and implementation size according to the market's circumstances (OECD, 2021).

As of OECD literature about algorithmic trading discusses how the integration of AI and big data in sentiment analysis is revolutionizing a practice that has been in

use for decades (OECD, 2021). Traditionally, traders have relied on mining news reports and management statements to gauge the impact of non-financial information on stock prices (OECD, 2021). Nowadays, advanced technologies, such as natural language processing (NLP) algorithms, enable the automated analysis of social media, tweets, and even satellite data. This automation allows for the identification of persistent patterns and behaviours on a scale beyond human capability (OECD, 2021).

What sets AI-managed trading apart from systematic trading is its ability to learn and adapt to changing market conditions using reinforcement learning (OECD, 2021). Unlike traditional systematic strategies that involve more human intervention and take longer to adjust parameters, AI models can quickly adapt (OECD, 2021). Conventional back-testing approaches based on historical data may falter when previously identified trends no longer hold (OECD, 2021). Machine learning models shift the focus to real-time trend prediction and analysis, employing "walk forward" tests instead of back testing (OECD, 2021). These tests predict and adjust to real-time trends to reduce issues like over-fitting in historical data-based back tests (OECD, 2021).

2.6.4 Historical evolution of trading

The evolving role of artificial intelligence (AI) in financial trading, particularly in highly digitized markets like equities and foreign exchange (FX) (OECD, 2021). AI solutions offer the potential to improve various aspects of trading, including competitive pricing, liquidity management, and order execution (OECD, 2021). Notably, AI algorithms can enhance liquidity management and minimize market impact when handling large orders by dynamically optimizing factors like order size, duration, and execution based on current market conditions (OECD, 2021).

The use of AI and big data for sentiment analysis is described as an augmentation of a longstanding practice (OECD, 2021). Traders have traditionally relied on mining news reports and management communications to understand how non-financial information impacts stock prices (OECD, 2021). Today, AI-driven text min-

ing and analysis of social media and satellite data, utilizing natural language processing (NLP) algorithms, provide the capability to automate data gathering and identify patterns on a scale beyond human capacity (OECD, 2021).

The key differentiator between AI-managed trading and traditional systematic trading is reinforcement learning, enabling AI models to adapt to changing market conditions more swiftly than human-dependent systematic strategies (OECD, 2021). Conventional back-testing strategies based on historical data may not perform well in real time when previously identified trends break down (OECD, 2021). Machine learning (ML) models shift the focus toward real-time trend prediction and analysis, reducing issues like overfitting in back tests (OECD, 2021).

AI in trading has evolved from simple buy/sell orders to dynamic pricing, execution algorithms, and current deep neural network strategies that aim to minimize market impact. Deep neural networks, resembling the human brain, rely less on human intervention and can enhance inventory management and reduce balance sheet costs for market makers (OECD, 2021).

Advanced AI models today are primarily used to identify signals from less obvious events in flow-based trading, where the goal is to extract valuable information from a noisy dataset (OECD, 2021). They are not typically used for high-frequency trading (HFT) to profit from speed but instead focus on improving algorithm parameters and decision logic (OECD, 2021).

In the future, as AI technology advances, it is expected to play a more significant role in trade execution, offering automated, dynamic adjustments to decision logic throughout the trading process (OECD, 2021). As AI becomes more integrated into execution phases, it will necessitate extending risk management measures to AI-driven algorithmic trading, similar to safeguards applied to traditional algorithmic trading (OECD, 2021). This shift holds implications for financial markets as AI's capabilities continue to expand and influence various aspects of trading (Lucas Liew, 2020; OECD, 2021).

2.6.5 Possible risks of AI in trading

The widespread use of similar AI models among traders can reduce arbitrage opportunities, potentially lowering trading costs but also leading to market behaviours like herding and one-way movements, impacting market stability. The risk of self-reinforcing feedback loops emerges, causing rapid and unpredictable price change s(OECD, 2021).

The convergence of AI models can raise cybersecurity concerns, making it easier for cybercriminals to manipulate trading systems. Additionally, AI can be employed for autonomous cyberattacks, introducing security risks (OECD, 2021).

A lack of transparency in AI models used by traders can complicate supervision and understanding. Collusive outcomes may become more sustainable, posing challenges for regulatory identification of illegal trading practices (OECD, 2021).

AI's application in trading, especially in high-frequency trading, can increase market volatility, potentially reducing liquidity and causing flash crashes. Safeguards and circuit breakers are essential.

The interconnectedness of financial markets may rise due to AI, leading to unexpected correlations and dependencies among variables. As a result, it is crucial to implement safeguards, transparency, and cybersecurity measures to manage risks effectively and ensure the resilience and integrity of financial markets (OECD, 2021).

2.6.6 Reduced Arbitrage Opportunities

Widespread use of similar AI models in financial markets has consequences for traders. On one hand, it can decrease arbitrage opportunities, meaning there are fewer chances to profit from price differences. While this may ultimately benefit consumers by reducing the costs associated with trading, it also comes with risks (BIS Markets Committee, 2023.; OECD, 2021).

For instance, when many traders employ similar AI models, it can lead to market actions such as convergence and herding. This means that market participants

tend to follow the same strategies, potentially resulting in one-way market movements. This can have implications for market stability, especially during times of stress or crisis (BIS Markets Committee, 2023.).

2.6.7 Risk of Self-Reinforcing Feedback Loops:

The risk of self-reinforcing feedback loops is a critical concern when AI models are widely adopted. Such feedback loops can trigger rapid and sometimes unpredictable price changes. This means that the behaviour of AI-driven systems can amplify market movements, which could lead to heightened market volatility (BIS Markets Committee, 2023.; OECD, 2021).

2.6.8 Cybersecurity Implications:

The convergence of AI models raises cybersecurity issues. With more AI systems operating in similar ways, it becomes easier for cybercriminals to exploit vulnerabilities in these systems (DXC, 2023; GOV.UK, 2022.; OECD, 2021). This could pose a significant threat to the security and integrity of financial markets.

Furthermore, AI can be leveraged for autonomous cyberattacks (DXC, 2023; GOV.UK, 2022.; OECD, 2021). In this scenario, AI systems conduct attacks on vulnerable trading systems without human intervention. This added layer of complexity in cybersecurity underscores the need for robust protective measures (DXC, 2023; GOV.UK, 2022.; OECD, 2021).

2.6.9 Lack of Transparency:

The lack of transparency in AI models used by traders is a significant concern. Traders often keep their AI model workings secretive to maintain a competitive edge. However, this secrecy complicates regulatory supervision and understanding of how these model’s function. This lack of transparency can be problematic in ensuring that AI-driven trading remains fair, secure, and compliant with regulations (OECD, 2021).

2.6.10 Collusive Outcomes

AI-driven trading can facilitate collusive outcomes, making it more challenging for regulators to identify illegal trading practices. For instance, practices like "spoofing," which involve creating a false impression of market activity, may be harder to detect when AI-driven systems are involved. This poses a regulatory challenge in maintaining market integrity (Financial Stability Board, 2017; OECD, 2021).

2.6.11 Market Volatility

The adoption of AI in trading can lead to increased market volatility. This is especially noticeable in high-frequency trading (HFT), where AI-driven systems can execute large trades simultaneously (Financial Stability Board, 2017; OECD, 2021; U.S. Department Of The Treasury, 2018). The result is a potentially more volatile market environment. This heightened volatility could reduce liquidity, making it more challenging for the market to absorb large trades, and may contribute to flash crashes (Financial Stability Board, 2017; OECD, 2021; U.S. Department Of The Treasury, 2018).

In response to this, safeguards and circuit breakers are being considered. These mechanisms aim to prevent excessive market volatility and protect against system malfunctions or market manipulation (OECD, 2021).

Interconnectedness of Markets:

The broader use of AI models in trading has the potential to increase the interconnectedness of financial markets. As AI becomes more ubiquitous, unexpected correlations and dependencies among variables may arise. This interconnectedness could have implications for systemic risk and market stability (OECD, 2021).

2.6.12 Blockchain-Based Finance

The increasing utilization of distributed ledger technologies (DLT), particularly blockchain, in various industries, with a primary focus on finance (Marcus Reeves et al., 2023; OECD, 2021). The growth of blockchain-based applications is driven by the promised advantages of speed, efficiency, and transparency, achieved through automation and disintermediation (Marcus Reeves et al., 2023; OECD,

2021). This adoption of DLTs in finance aims to enhance operational efficiency, especially in areas like securities markets, payments, and tokenization of assets, potentially leading to a reconfiguration of financial operators' roles and business models (OECD, 2020; Roy Choudhury et al., 2023).

The OECD report also emphasizes the potential convergence of artificial intelligence (AI) and distributed ledger technologies (DLT) in blockchain-based finance to enhance the competence of the system, while actual AI application in blockchain projects looks limited. (OECD, 2021; Toshihide Endo, 2019; Xiaofei Wang et al., 2022). Instead of convergence, there's a trend of implementing AI in specific blockchain systems for use cases like risk management and leveraging DLT to enhance data management in AI mechanisms (OECD, 2020, 2021).

The most significant contribution of artificial intelligence in DLT-based finance is observed in augmenting smart contract automation, particularly in compliance, risk management, and data inference (OECD, 2021). AI can aid in identifying irregular activities, enhancing onboarding processes, and assisting with anti-money laundering (AML) and counter-terrorist financing (CFT) checks (OECD, 2021). However, the elimination of financial intermediaries in transactions may challenge existing regulatory approaches (OECD, 2020, 2021).

The incorporation of artificial intelligence at the protocol level in distributed ledger technology (DLT) offers potential benefits for regulators by enabling real-time data sharing and automated compliance (Marcus Reeves et al., 2023; OECD, 2020, 2021; Toshihide Endo, 2019; Xiaofei Wang et al., 2022). To address supervision issues in decentralized platforms, regulators have been considered as network nodes (OECD, 2021).

In terms of data quality, AI has the ability to improve data inputs by automating organizing data and potentially improving the robustness of information recording and dissemination. It may also lessen reliance on third-party data providers such

as Oracles, enhancing network trust (OECD, 2020, 2021; Ryan Boder, 2022). However, it may not completely eliminate the challenge of poor data quality, as this issue is also observed in AI-based systems (OECD, 2021).

2.7 Accounts Payable invoicing

In today's rapidly evolving business landscape, technology is playing an increasingly pivotal role in revolutionizing traditional business processes (Cevinio, 2023). One such area where automation has the potential to make a significant impact is accounts payable (AP) invoicing (Cevinio, 2023). This research paper examines into the application of artificial intelligence (AI) to automate AP invoicing, focusing on the handling of non-purchase order (PO) invoices (Cevinio, 2023). Realistically, a substantial portion of non-PO invoices is still processed manually, presenting a stark example of the untapped potential for automation in streamlining financial operations (Cevinio, 2023).

2.7.1 The Manual Challenge: Non-PO Invoicing

Non-PO invoices, which include invoices not associated with a formal purchase order, have historically demanded substantial human intervention for processing (Basware, 2023). This labour-intensive process is not only time-consuming but also susceptible to human errors. According to industry statistics, up to 90% of non-PO invoices are processed manually (Basware, 2023). This glaring statistic underscores the immense opportunity for automation to alleviate the burden on human employees and enhance operational efficiency (Basware, 2023).

2.7.2 Leveraging AI for AP Invoicing Automation and Managing Vendor Data

AI technologies, particularly machine learning and natural language processing, can be harnessed to automate various aspects of accounts payable invoicing. Companies can leverage AI to streamline the following critical functions (Cevinio, 2023).

AI systems can be trained to recognize and classify incoming invoices, ensuring that they are directed to the appropriate department for processing (Cevinio, 2023; Tuomas Haapsaari, 2018.-b). This reduces the need for manual sorting and

routing of invoices, minimizing the risk of misplacement or delays (Cevinio, 2023; Tuomas Haapsaari, 2018.-b).

By integrating AI, organizations can maintain and update vendor information more efficiently (Basware 2023). AI systems can automatically validate and update vendor details, reducing the likelihood of errors in the AP process (Basware, 2023).

2.7.3 Capturing Data and validating the Invoice

AI-driven optical character recognition (OCR) technology can be employed to extract relevant data from invoices, such as invoice number, date, and line items (Abbyy, 2023). This not only expedites data entry but also minimizes the risk of manual transcription errors (Abbyy, 2023).

AI can be used to cross-reference invoice data with internal records and business rules, flagging discrepancies and anomalies for further review (Abbyy, 2023; Brianna Blaney, 2023.). This ensures that only accurate and compliant invoices are processed (Abbyy, 2023; Brianna Blaney, 2023.).

2.7.4 Creating Multiple Accounting Entries Making Payments on Time

AI can automate the creation of accounting entries, distributing costs to the relevant expense accounts, and updating the general ledger (Basware, n.d.-a; Brianna Blaney, 2023.). This reduces the potential for errors and accelerates the financial reporting process (Brianna Blaney, 2023.).

Timely payment is crucial for maintaining positive vendor relationships and avoiding delayed payment consequences (Derrick McMahon, 2023). AI systems can be programmed to schedule and execute payments in accordance with predefined terms, ensuring that payments are consistently made on time (Derrick McMahon, 2023).

2.8 The Benefits of AI Automation

The implementation of AI in accounts payable invoicing offers a multitude of benefits for organizations (Brianna Blaney, 2023.). Firstly, it significantly reduces the

risk of errors that may occur during manual data entry and validation, leading to more accurate financial records (Brianna Blaney, 2023.). Secondly, automation minimizes the processing time, allowing companies to make informed decisions faster (Brianna Blaney, 2023.). Additionally, the reduction in manual labour required for AP invoicing enables employees to focus on more strategic and value-added tasks, enhancing overall productivity (Brianna Blaney, 2023.).

The automation of accounts payable invoicing through AI represents a crucial step in modernizing financial operations (Cevinio, 2023; Matt Osborn, 2023; Tuomas Haapsaari, 2018.-b). By embracing AI-driven solutions for processing non-PO invoices, organizations can realize substantial efficiency gains, minimize errors, and ensure timely payments to vendors (Cevinio, 2023; Matt Osborn, 2023; Tuomas Haapsaari, 2018.-b). While the adoption of AI in AP invoicing may present initial challenges, the long-term benefits far outweigh the initial investment, ultimately leading to enhanced financial stability and competitive advantage in today's business landscape (Matt Osborn, 2023). As companies continue to explore the untapped potential of AI automation in this domain, it is evident that the future of accounts payable invoicing lies in the hands of intelligent technology (Matt Osborn, 2023).

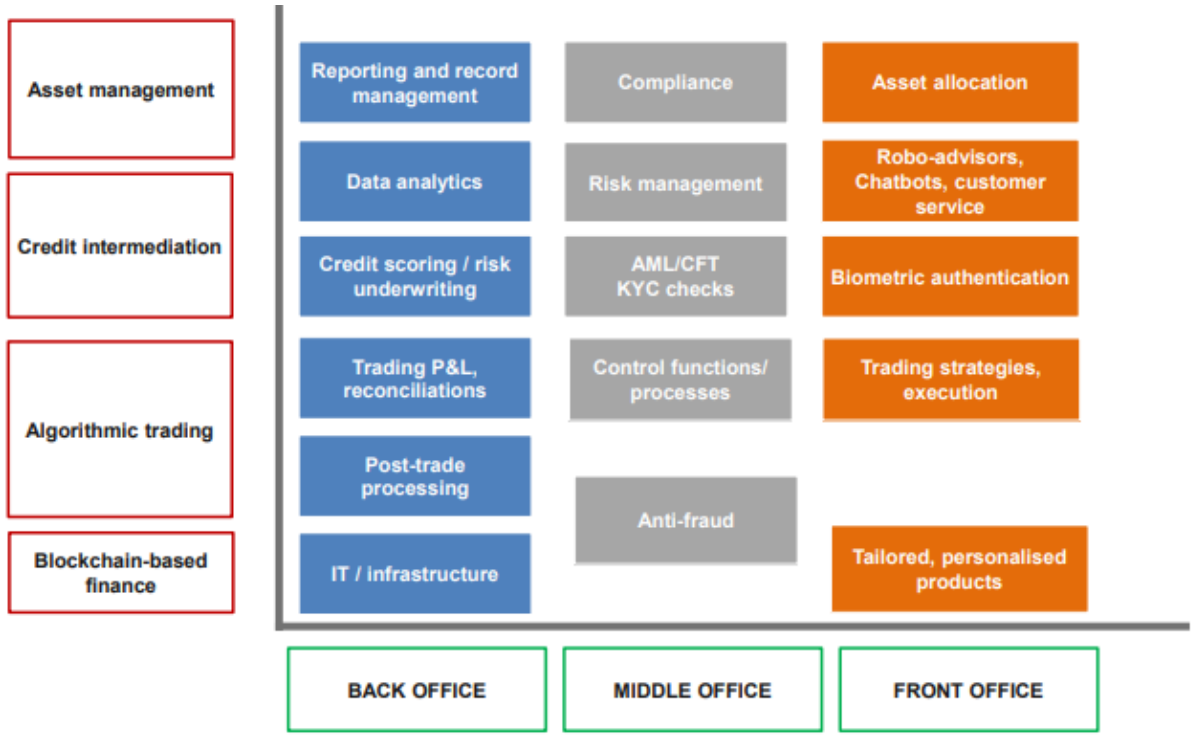

Figure 4. Examples of AI applications in some financial market activities. (OECD, 2021)

2.9 How invoice automation works

Invoice automation is a fundamental component of modernizing financial processes within organizations (Tuomas Haapsaari et al., 2020). This research paper examines the intricacies of how invoice automation works, shedding light on the various stages involved. The journey from receiving an invoice to processing it efficiently involves multiple key steps that are integral to optimizing financial operations (Olav Maas, 2021; Tuomas Haapsaari et al., 2020). This paper explores these steps in detail: Scanning and Data Extraction, Data Validation, Matching and Verification, Exception Handling, Workflow Management, and Payment (Olav Maas, 2021; Tuomas Haapsaari et al., 2020).

2.9.1 Scanning and Data Extraction:

The initial step in invoice automation involves the digitization of paper invoices or the extraction of data from electronic invoices (Klippa, 2022; Tuomas Haapsaari Et

Al., 2020). This process usually employs Optical Character Recognition (OCR) technology, which is a form of artificial intelligence (Klippa, 2022; Olav Maas, 2021; Tuomas Haapsaari Et Al., 2020). OCR technology reads and interprets text on invoices, capturing crucial information such as invoice number, date, vendor details, and line-item descriptions (Klippa, 2022; Tuomas Haapsaari Et Al., 2020). It plays a pivotal role in eliminating manual data entry and transcription errors, significantly expediting the invoice processing workflow (Klippa, 2022; Tuomas Haapsaari Et Al., 2020).

2.9.2 Data Validation:

Data validation is the next crucial stage in invoice automation. It entails a systematic verification of the extracted information against predefined business rules and internal records (Abbyy, 2023; Tuomas Haapsaari Et Al., 2020). During this phase, the system checks for discrepancies, ensuring that the data adheres to established standards (Abbyy, 2023; Tuomas Haapsaari Et Al., 2020). For example, it may verify that the invoice amount matches the purchase order or contract terms. If any inconsistencies are identified, they are flagged for further review (Abbyy, 2023; Tuomas Haapsaari Et Al., 2020).

2.9.3 Matching and Verification

Matching and verification is a pivotal step to ensure the accuracy and authenticity of invoices (Sathya Jameson, 2023). In this stage, the system compares the invoice against supporting documents, such as purchase orders and delivery receipts (Sathya Jameson, 2023; Tuomas Haapsaari, 2018.-b). This process helps confirm that the goods or services have been received and are in accordance with the contractual terms (Sathya Jameson, 2023; Tuomas Haapsaari, 2018.-b). By automating this verification process, organizations can prevent erroneous payments and discrepancies, promoting financial accuracy (Sathya Jameson, 2023).

2.9.4 Exception Handling

Not all invoices fit perfectly within established parameters, and this is where exception handling comes into play (Basware, 2023). Exception handling allows organizations to address invoices that do not conform to standard processes, such

as those with discrepancies or missing information (Basware, 2023). Automation allows for predefined protocols to manage exceptions, directing them to designated personnel for resolution. This ensures that non-standard invoices do not disrupt the entire invoicing workflow (Basware, 2023).

2.9.5 Workflow Management

Workflow management is the orchestration of tasks within the invoice processing system (Per Holmlund, 2023). Automation streamlines and accelerates the routing of invoices through predefined workflows (Per Holmlund, 2023). It assigns tasks to appropriate personnel, establishes approval hierarchies, and tracks the progress of each invoice as it moves through the system (Per Holmlund, 2023). Workflow management enhances transparency, accountability, and collaboration within the organization, facilitating efficient invoice processing (Per Holmlund, 2023).

2.9.6 Payment

The final stage of invoice automation is payment. Once an invoice successfully completes the preceding steps, the system triggers the payment process (Abbyy, 2023). Automation ensures that payments are made in a timely and consistent manner, based on predefined payment terms and schedules (Abbyy, 2023). By automating payments, organizations not only prevent late payment penalties but also maintain positive vendor relationships, as vendors receive their funds promptly (Abbyy, 2023).

Invoice automation has revolutionized the way organizations handle their financial processes, offering numerous advantages, including improved accuracy, efficiency, and cost savings (Artsyl, 2023.; Tuomas Haapsaari Et Al., 2020). Understanding the inner workings of this automation process, from scanning and data extraction to payment, is essential for organizations seeking to optimize their financial operations (Artsyl, 2023.).

By embracing technology-driven solutions, businesses can unlock the potential of invoice automation and redirect their human resources toward more strategic and

value-added tasks (Graip.AI, 2022). The systematic approach to invoice processing presented in this research paper demonstrates how automation is transforming financial workflows, streamlining processes, and ensuring the timely and accurate management of invoices (Graip.AI, 2022). In the ever-evolving landscape of financial technology, invoice automation stands as a testament to the power of innovation and efficiency in the modern business world (Graip.AI, 2022).

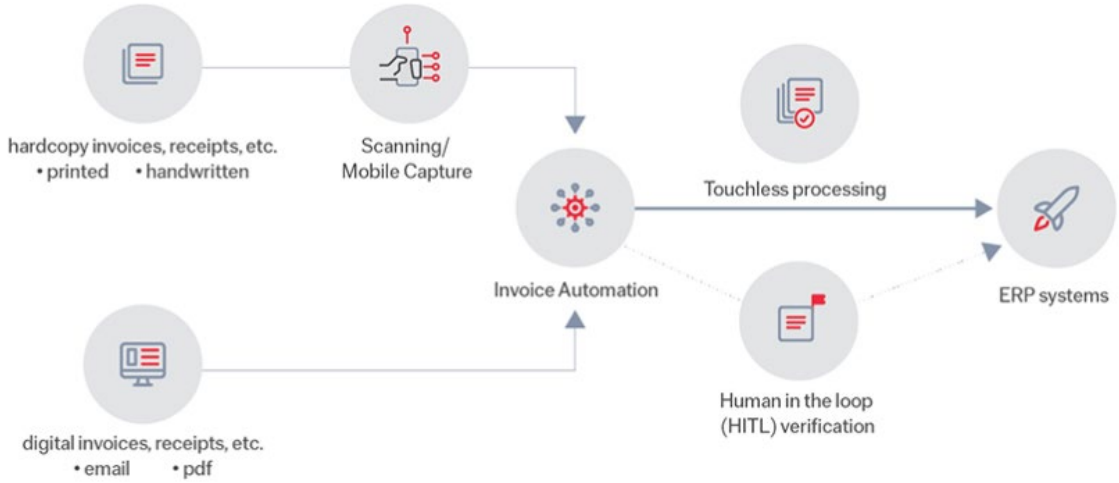

Figure 5. How invoice automation works (Abbyy, 2023)

2.10 AI in payment processing, deposits and account management

The world of digital payments is undergoing a profound transformation, driven by the relentless expansion of eCommerce and the relentless evolution of technology (FM Contributors, 2023). With global digital payments revenue projected to soar to $14.79 trillion by 2027, it is clear that the ability to craft an effective payment strategy and establish a robust technical stack is paramount for eCommerce and digital merchants (Dilara Bereket, 2023.; FM Contributors, 2023). In the words of Richie Serna, CEO of payments startup Finix, many merchants lack the necessary tools, data, and knowledge to create and execute an effective payment strategy (Finix, 2021). Even when they do, considerable opportunities often remain untapped. Artificial intelligence (AI) is the next frontier in payment innovation since it is data-driven and incorporates both advanced orchestration and intelligence (Dilara Bereket, 2023.).

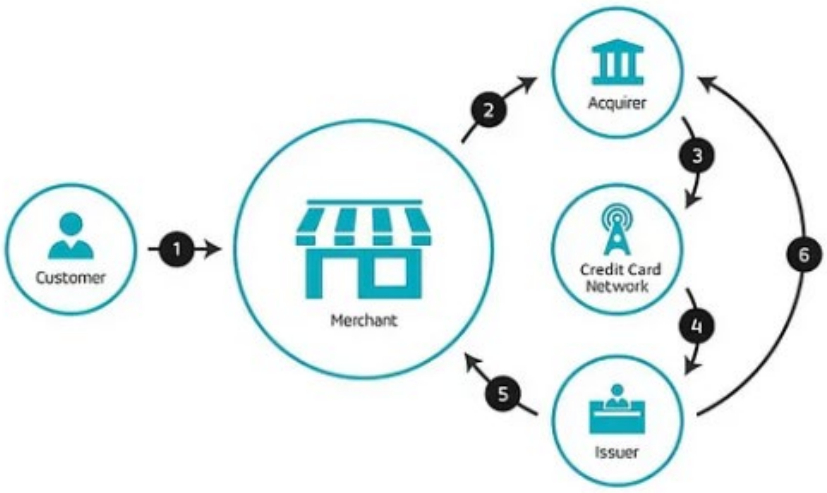

Figure 6. Payment Processing (Dilara Bereket, 2023.)

The journey of a payment transaction is a multi-step process, involving various parties, from the customer to the merchant, acquirer, network, and issuer (Knowyourpayments, 2023.). It's a complex web that, in its traditional four-party model, facilitates transactions between these key players (Marketing Skaleet, 2022). However, this model becomes more intricate when merchants deal with multiple bank accounts and payment providers, leading to challenges such as slow processing, high costs, inflexible payment methods, and integration limitations (*Digital Disruption in Banking and its Impact on Competition*, 2020).

To address these pain points, payment orchestration has emerged as a transformative solution. It offers an end-to-end payment process that automates and optimizes the routing and processing of payment transactions (Dilara Bereket, 2023.). These platforms empower merchants to dynamically route transactions based on a range of factors, including cost, availability, performance, and customer preferences (Dilara Bereket, 2023.). This dynamic routing enhances payment processing, improves authorization rates, and reduces the incidence of transaction failures, thereby revolutionizing the payment experience (Dilara Bereket, 2023.).

A powerful rules engine is at the core of payment management. Here's how AI plays a key part in this novel approach:

Sophisticated Rules Engine: AI-powered rules engines are the core of payment orchestration platforms. These engines leverage AI's analytical capabilities to make intelligent decisions regarding transaction routing (Dilara Bereket, 2023.; McKinsey & Company, 2021). By constantly analysing data and considering a multitude of variables, they ensure that each transaction is optimally processed, providing cost savings, improving customer experiences, and enhancing authorization rates (Dilara Bereket, 2023.; McKinsey & Company, 2021).

The amalgamation of AI and payment orchestration holds the promise of not just streamlining payment processes but also transforming the way businesses interact with customers (Nikolaos-Alexandros Perifanis & Fotis Kitsios, 2023). It is the embodiment of a data-driven approach to payment strategy that can adapt in real-time, ensuring that businesses harness every opportunity for growth and profitability (Svitla Team, 2023).

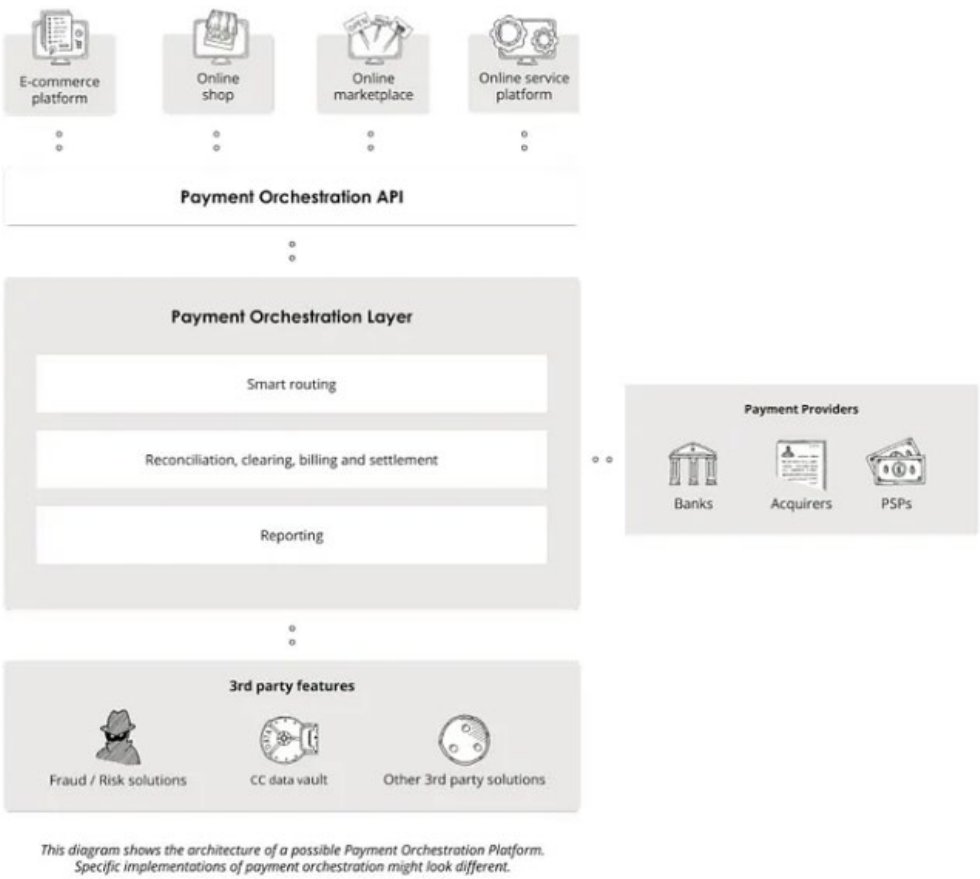

Figure 7. What's the difference between Payment Gateway and Payment Orchestration? (Dilara Bereket, 2023.)

The world of trade is witnessing a dramatic transition in today's digital age. As we enter the digital payment era, the incorporation of a modern payment strategy is more important than ever (Anne O. Krueger, 2006). According to 451 Research's Voice of the Enterprise surveys, 61% of merchants feel that contemporary payment infrastructure will have a profoundly transformative impact on their operations within the next three years (Jordan McKee, 2023a). The year 2023 is predicted to see a boom in merchants implementing payments optimization solutions in order to fulfil their growth, improve customer experience, and strengthen operational goals (Jordan McKee, 2023a).

Payment orchestration: Payment orchestration is a cornerstone of this modern payment strategy (Jordan McKee, 2023a). It operates as the brain behind transactions, determining the optimal routing while the gateway acts as the technology

collecting the customer's payment details (checkout, 2023). The advantages of payment orchestration are numerous and include a boost in revenue, reduction in payment processing costs, simplified integration, access to diverse payment methods, and increased acceptance rates (checkout, 2023; *Digital Disruption in Banking and its Impact on Competition*, 2020). This modern approach streamlines the payment process, enhances customer experiences, and ensures merchants can seize every opportunity for growth (worldline, 2023).

Complementing payment orchestration is payments intelligence. It involves the meticulous analysis of various data points related to payment transactions (checkout, 2023). This data ranges from transaction history to customer behaviour, device information, location data, and more (Avi Yaeli et al., 2014). The aim is to glean valuable insights, identify patterns, and spot anomalies that may indicate fraud, risk, or other payment-related issues. Traditional payment gateways, however, often fall short in providing this crucial data reporting and visualization that informs a merchant's payment strategy (Boaz Gam, 2023).

Together, payment orchestration and intelligence constitute a modern payment strategy that empowers merchants with insights, automation, and optimization capabilities (Jordan McKee, 2023b). This dynamic duo streamlines payment processes, enhances operational efficiency, improves customer experiences, and mitigates the risks associated with digital payments (Stripe, 2023). By harnessing data and technology, these components help merchants make informed decisions and ultimately achieve better business outcomes in the ever-evolving world of digital payments (Yogesh K. Dwivedi et al., 2021).

Further enhancing the modern payment strategy is artificial intelligence (AI) (Emily Johnson, 2023). AI has the potential to revolutionize operations, provide real-time insights, and fortify anti-fraud efforts. This technology's role is far-reaching, as AI in payment technology can (Emily Johnson, 2023):

1. Prevent Fraud: By analysing transaction data in real-time, AI can help merchants identify and prevent fraudulent transactions (Signifyd, 2023). It detects unusual patterns and anomalies that may signify fraud, safeguarding

merchants from financial losses due to chargebacks and fraudulent activities (Signifyd, 2023).

2. Manage Risk: AI assists merchants in assessing and managing risk associated with payment methods, geographies, and customer segments (OECD, 2021). It enables informed decisions about which payment methods to accept and which customers to approve, thereby minimizing potential losses and optimizing payment acceptance strategies (OECD, 2021).
3. Provide Business Intelligence: AI provides valuable insights into customer behaviour and preferences, aiding merchants in tailoring their offerings, pricing, and marketing campaigns (Abid Haleem et al., 2022). This knowledge enhances customer retention and profitability (Abid Haleem et al., 2022).
4. Optimize Payments: AI analyses transaction data to identify inefficiencies in payment flows, streamlining processes and reducing costs (OECD, 2021). This results in enhanced customer experiences and cost savings (OECD, 2021).

In addition to streamlining operations and combating fraud, AI assists merchants in complying with various regulations and compliance processes (Pratibha Kumari J., 2023). By analysing transaction data in real-time, AI helps in identifying and reporting suspicious transactions and ensures compliance with anti-money laundering (AML), know-your-customer (KYC), Payment Card Industry Data Security Standard (PCI DSS), Customer Protection Regulations, and International Money Transfer Regulations, avoiding legal liabilities and penalties associated with non-compliance (Canecom, 2023.). In the ever-evolving landscape of digital payments, the integration of a modern payment strategy backed by AI is indispensable (Alexis Damen, 2023). Payment orchestration and intelligence are the guiding lights that empower merchants to navigate this landscape efficiently, make informed decisions, and stay ahead in the game (checkout, 2023; Dilara Bereket, 2023.). As digital transactions continue to proliferate, the synergy of these components ensures that merchants can provide a seamless, secure, and efficient payment experience while safeguarding their financial interests (Dilara Bereket, 2023; Finix, 2021). The

future of digital payments lies in harnessing technology and data to drive innovation, efficiency, and profitability (KPMG, 2019b).

Among the innovative startups harnessing the power of AI in their payment intelligence and payment orchestration business models are:

Company	Stats	Description	Focus
Pagos	$34MM Series A, led by Arbor Ventures	Pagos offers connections to payment, as well as data ingestion APIs so that businesses can stream payments data and custom metadata into the platform.	Payment Intelligence: Tracking, analytics, monitoring across markets, channels, and vendors
Spade	$5MM Seed, led by Andreessen Horowitz	Transaction enrichment API that brings clarity and context to transactional data to help customers underwrite, detect fraud, build better banking infrastructure and get a unique understanding of their users' spending habits	Payment Intelligence: Data visualization and insights
Apexx Global	$25MM Series B, led by MMC Ventures, Forward Partners, Alliance	Payment orchestration provider that lets merchants connect via a sample API integration to enable global payments	Payment orchestration: global partner for local payments
Paytrix	$18.3MM Series A, led by Unusual Ventures, Motive Partners, and Bain Capital Ventures	A single platform — and single contract — that lets its customers manage all of the different payment options from payment acceptance to payouts, in one place.	Payment orchestration: one-stop shop for payments
Gr4vy:	$15MM Series A, led by March Capital	Gr4vy helps merchants reduce fraud and chargebacks, optimize processing fees, reduce transaction costs, restrict the sale of prohibited goods, and more.	Payment orchestration: cloud payment orchestration

Figure 8. AI for payment intelligence and/or payment orchestration business models (Dilara Bereket, 2023.)

The dynamic landscape of FinTech is a hotbed of innovation, where startups and established players continually shape the industry through exits and acquisitions. This research explores the world of payment orchestration and intelligence, delving into two prominent case studies - Adyen and Braintree - that have left a significant mark in the FinTech ecosystem (Dilara Bereket, 2023.). Furthermore, it illuminates the enthusiastic investors who are consistently on the lookout for the next big opportunity.

One compelling success story within the payment orchestration and intelligence realm is Adyen, a Dutch payment processing company (similarweb, 2023.). In 2018, Adyen made waves by going public in a remarkable Initial Public Offering (IPO) that not only marked a pivotal moment for the company but also became one of Europe's largest IPOs (Arjun Kharpal, 2018). The IPO placed an impressive

valuation of $8.3 billion on the company, underscoring its rapid growth and significance in the FinTech ecosystem (Arjun Kharpal, 2018). Another noteworthy case study is Braintree, a Chicago-based company specializing in mobile and web payment systems for e-Commerce companies (CBC News, 2013). In 2013, the company made headlines by being acquired by the renowned digital payments giant, PayPal (CBC News, 2013). This acquisition, valued at a staggering $800 million, solidified Braintree's position in the industry and demonstrated the strategic moves made by established players to expand their capabilities in the rapidly evolving digital payments landscape (CBC News, 2013). The world of FinTech is an abundant ground for investors seeking the next game-changing opportunity (World Economic Forum, 2015). Among these enthusiastic investors are some of the most active players in the ecosystem, individuals, and entities with a keen eye for identifying potential winners. These investors are constantly on the lookout for startups and ventures that have the potential to disrupt and reshape the financial technology landscape (AIContentfy team, 2023a).

In the ever-evolving landscape of FinTech, exits and acquisitions are common occurrences that shape the industry's trajectory (Accenture, 2021). The success stories of Adyen and Braintree serve as inspiring examples of startups making a significant impact in the payment orchestration and intelligence arena (Peter Renton, 2023). Furthermore, the relentless quest of investors to discover the next big opportunity highlights the dynamic and promising nature of the FinTech ecosystem (Stfalcon, 2023). As we move forward, these stories and the active players in the field will continue to shape the future of financial technology, pushing the boundaries of innovation and progress (Stfalcon, 2023).

Name	Sector	Stage	Fund	Notable Investments
Andereessen Horowitz	FinTech, Bio + Healthcare, Consumer, Crypto, Enterprise, Gaming	Stage agnostic	$9B	Affirm, Carta, Robinhood, Plaid
Ribbit Capital	Financial Services, FinTech, Software, Web3	Series A, Series B, Seed, Series C, Growth	$2.4B	Affirm, Brex, Coinbase, Credit Karma
Greycroft	FinTech, Consumer, Enterprise Software, Healthtech	Pre-Seed, Seed, Series A, Series B, Growth	$2B	Venmo, Braintree, Acorns
Soma Capital	Sector Agnostic	Seed	$412MM	Ramp, Clara, Axle
Better Tomorrow Ventures	FinTech	Pre-Seed, Seed	$225MM	Unit, Patrix, Monnai, FreightPay

Figure 9. AI for payment intelligence and/or payment orchestration business models (Dilara Bereket, 2023.)

In today's fast-evolving financial technology landscape, payment orchestration and intelligence platforms are becoming key players (Tranzzo, 2023). These platforms serve as a one-stop shop for merchants, simplifying the complex world of payments by aggregating and integrating with various Payment Service Providers (PSPs), acquirers, issuing banks, and third-party service providers (Tranzzo, 2023). This thesis explores the pricing strategies adopted by these platforms and the opportunities they present to startups in a rapidly expanding digital payments landscape.

Payment orchestration and intelligence platforms operate under a variety of pricing models. A common approach is the hybrid pricing model, combining a percentage fee with a fixed fee per transaction (Aashish Krishna Kumar, 2023). Some platforms may follow a traditional business-to-business Software as a Service (B2B SaaS) pricing model, while others opt for a transaction-based approach (Aashish Krishna Kumar, 2023). Customized pricing models tailored to specific merchant needs are also prevalent, allowing flexibility in meeting diverse requirements(Paddle, 2023.). White-labelling models, where the platform can be branded and resold by merchants, and value-added services models are other pricing options(Kyle Ferreira, 2022).

During the pandemic and shifting consumer behaviours have propelled the growth of e-Commerce payments (Othman Zidane, 2021). Over the past three years, the digital payments landscape has witnessed rapid expansion, creating ample opportunities for startups to innovate and cater to both merchant and customer payment needs (Deloitte, 2019). As more businesses embrace artificial intelligence to enhance secure and safe payments, it is becoming increasingly clear that AI can be the game-changer for these startups (AIContentfy team, 2023b). AI's potential in areas like fraud prevention, risk management, business intelligence, and payment optimization are promising (Pratibha Kumari J., 2023). Despite fluctuations in fintech funding due to factors like inflation and interest rates, the payment sector has displayed resilience (KPMG Pulse of Fintech, 2023). In 2022, total investment dollars and deals in the payments sector remained robust. This demonstrates the unwavering demand for enhanced payment systems (Gerardo Uña et al., 2023). As the world of digital payments continues to expand, the need for innovative solutions that optimize the payment experience remains strong, driving investment and innovation in the fintech sector (Sukhpreet Singh, 2023).

Payment orchestration and intelligence platforms are transforming the way merchants handle payments (Jordan McKee, 2023b). The diverse pricing models they employ offer flexibility and cater to a wide array of business needs (Aashish Krishna Kumar, 2023). The accelerated growth of digital payments, amplified by the pandemic, presents startups with a unique opportunity to innovate and address the evolving demands of merchants and customers alike (Gerardo Uña et al., 2023). In this dynamic landscape, artificial intelligence emerges as a promising tool for startups to enhance payment security and efficiency (Alexis Damen, 2023). The steady demand for better payment systems underscores the resilience of the payments sector, paving the way for continued growth and innovation in the world of fintech (Tobias Adrian, 2019).

2.11 Privacy and sensitive information

In the era of Artificial Intelligence (AI) and Machine Learning (ML), the landscape of privacy concerns has undergone a profound transformation (Venny Turner,

2023). While concerns about big data and privacy are not new, the incorporation of AI/ML into mainstream applications has created new and distinct issues (El Bachir Boukherouaa et al., 2021; OECD, 2021). Privacy precautions for big data have long been a priority, even before the mainstream usage of AI/ML (OECD, 2021). Several techniques have been developed to ensure data anonymity and the privacy of individuals whose data is involved. Furthermore, global legislative frameworks addressing data laws have been formed to address these problems, highlighting the global significance of the issue (OECD, 2019).

The addition of AI/ML to the privacy question adds a new element. The robustness of AI/ML models is challenging traditional methods of maintaining anonymity. The prospect of Artificial Intelligence/Machine Learning (AI/ML) disclosing de-identification datasets through sophisticated inferences, thereby deducing identities based on intricate behavioral patterns, constitutes a significant and worrisome issue (El Bachir Boukherouaa et al., 2021). The retention of information by AI/ML models after training complicates privacy even further. There is a risk that the AI/ML system recall details about individuals from the training set, or that its results mistakenly reveal sensitive data, either directly or indirectly (El Bachir Boukherouaa et al., 2021). This necessitates a reevaluation of existing privacy technologies in order to strengthen the robustness of AI/ML models and successfully address these subtle difficulties (El Bachir Boukherouaa et al., 2021).

Efforts are being made to create solutions that are expressly designed to address the privacy concerns connected with AI/ML. These solutions aim to increase the ability of AI/ML models to protect sensitive data and ensure that information is not unintentionally leaked or misused (El Bachir Boukherouaa et al., 2021). However, because these issues are dynamic, such technologies must be modified on a regular basis (El Bachir Boukherouaa et al., 2021).

In parallel with technical advancements, there is a growing consensus that an update to the legal and regulatory framework is necessary (OECD, 2019). The current legal provisions, designed to address traditional privacy concerns, might be insufficient in encompassing the intricacies introduced by AI/ML. An enhanced legal and regulatory framework should mandate that AI/ML systems and associated

data sources adhere to elevated privacy standards (El Bachir Boukherouaa et al., 2021). This updated framework should also take into account issues related to preventing illegal financial activities (El Bachir Boukherouaa et al., 2021). The interconnectedness of AI/ML with sensitive financial data necessitates a comprehensive approach that not only prioritizes privacy but also aligns with broader regulatory requirements (El Bachir Boukherouaa et al., 2021).

2.12 AI skill gap

AI is undeniably affecting organizations at an unprecedented rate, suggesting more than just a trend it is a seismic shift across industries. The implications for university graduates navigating this new terrain are considerable, since the number of professions requiring AI competencies has surged 4.5-fold in the last decade (Patrick Brothers, 2018). AI's impact extends beyond the technology sector to include healthcare, banking, manufacturing, and other areas (Xiaomin Mou, 2019). According to the World Economic Forum's Future of Jobs Report 2020, AI will replace 85 million jobs while creating 97 million new ones by 2025 (World Economic Forum, 2020). This underlines the significance of graduates possessing the skills necessary by today's technologically driven workplace (World Economic Forum, 2020).

The rise in AI-driven job openings signals a fundamental shift in skill needs. Employers now place an emphasis on soft skills such as critical thinking and adaptability above technical proficiency (Michaela Poláková et al., 2023; Virtual Internships, 2020). Job descriptions are being revised to emphasize the importance of a hybrid skill set that combines technical expertise with creativity and teamwork (Michaela Poláková et al., 2023; Virtual Internships, 2020). While the promise of AI-powered opportunities is obvious, graduates face challenges. The skill gap is compounded by the World Economic Forum's estimate that more than 60% of workers will need retraining by 2027, with limited access to such opportunities (Coursera, 2023).

Universities are crucial in bridging the education-industry gap (Jane Southworth et al., 2023). AI-focused courses, as well as transdisciplinary learning, must be included in curricula (Jane Southworth et al., 2023). Hands-on projects and industry partnerships provide practical experience, allowing graduates to excel in an AI-powered workforce (Steven Gause, 2023). Real-world applications train people to navigate the complexities of AI-centric roles (Steven Gause, 2023). Graduates must cultivate a growth mindset in a rapidly changing work environment, remaining open to learning and evolving (Lisa B. Limeri et al., 2020). Faculty experts can help students cultivate this mindset by encouraging them to keep studying throughout their careers (Lisa B. Limeri et al., 2020). The ability to pivot and adapt has become the hallmark of success in the AI era. Collaboration between academia and industry is critical (S N. Ankrah & Omar Al-Tabbaa, 2015). Collaborations guarantee that courses meet industry demands, providing students with a competitive advantage (S N. Ankrah & Omar Al-Tabbaa, 2015). Experiential learning, whether on-site or remote, correlates with higher academic accomplishment, resulting in a mutually beneficial situation in which students are better prepared for the job, and employers can find skilled employees (Yangtao Kong, 2021).

Classroom technologies for future accountants	Brief description
SAP (ERP- enterprise resource planning)	SAP FICO (FI – SAP Finance and CO – SAP Control) is a core module in the SAP ERP Central Component. It describes cost elements, cost centers, profit centers (handles cost data related to line of business), profitability analysis, product costing and internal orders.
IBM Cloud	IBM provides educators with software and courseware using its cloud infrastructure. This includes data gathering, sharing, computation, processing and simulation. Students can experiment with what-if analysis and virtual simulations.
Bloomberg	Bloomberg (supported by Classroom Inc.) is a non-profit online educational service. Bloomberg includes simulations and technology tools for banking, economics, finance and accounting.
Microsoft Dynamics 365	Microsoft Dynamics is a combination of ERP and CRM.
XBRL (Extensible Business Reporting Language)	XBRL is based on XML (Extensible Markup Language) which is a standard protocol for Internet communication. It is designed to allow financial and non-financial data to be exchanged for business reporting.
Idaciti	Idaciti makes global financial data usable, accessible and shareable. It can also be used for XBRL financial datasets.
Aura and e-audit	Aura and e-audit specifically support competencies for the area of audit in the digital age.
DMS – document management system	In the area of taxation competencies for the digital age, DMS is highly recommended.
Accounting information systems (AIS)	The AIS module includes six major components: personnel, hardware, software, procedure, stored data, procedures and internal controls.
Cyber security and trusted computing	One very key area that institutions must prepare their students for is the area of trusted computing and cyber security.
Cryptocurrencies and electronic payment systems (CEPS)	Another area that has heavily impacted movement of funds and cash flow is electronic payment methods.

Figure 10. Classroom technologies for future accountants (PMC8753577, 2021)

2.13 Lack of emotional exhibition

In the fast-evolving landscape of AI, a fascinating conundrum persists the realm of emotions remains a terrain largely uncharted by artificial intelligence. In specific domains like asset management and algorithm trading, the innate ability of human employees and relationship managers to forge emotional connections with investors remains incomparable. AI, despite its strides, is yet to navigate the elaborate scope of human emotions. This comparison underscores the importance of human employees in handling intricate aspects of client interactions, such as providing empathetic support during major life events like for example career achievements (Dennis Hillemann, 2023).

In these emotional moments, the human touch becomes irreplaceable. It is the empathetic response, the understanding of delicate emotions, and the ability to provide comfort that define the indispensable role of human professionals (Dennis Hillemann, 2023). AI, with its computational might, excels in various analytical tasks, yet it falls short in comprehending the intricacies of human emotions, especially during essential life events.

Thus, a harmonious solution emerges a workplace model that seamlessly integrates the computational prowess of AI with the emotional intelligence inherent in human interactions. This hybrid approach envisions a synergy where AI optimizes efficiency in routine tasks and data processing, while human employees bring forth the empathetic understanding crucial for emotionally charged scenarios. In essence, it's not a question of AI versus humans it's about harnessing the unique strengths of both to create a holistic and successful workplace that accommodates to the multifaceted needs of clients in an ever-changing world.

2.14 Biased training data

As Forrester's research suggests, the widespread adoption of AI is anticipated across companies by 2025. While the benefits of AI are undeniable, it is crucial to acknowledge its drawbacks, particularly the issue of bias (Rowan Curran, 2022).

AI bias manifests in three key areas: input data, development, and post-training. In cases where biases are present in input data, such as gender, race, or ideology, AI's objectivity is compromised due to incomplete or unrepresentative datasets (ethics-of-ai.mooc.fi, 2023). Additionally, discrimination may occur when certain AI training methods obscure how data influences decisions (ethics-of-ai.mooc.fi, 2023).

To address the risks associated with bias and discrimination, banks and financial institutions have strengthened their governance. They have established internal multidisciplinary teams or enlisted third-party auditors to scrutinize AI models and assess data. Transparent policies for algorithm development and metrics to measure bias have been implemented, ensuring compliance with regulations and best practices (Atte Ojanen et al., 2022). Regular monitoring of AI and machine learning models for data and concept drift is another proactive measure. This involves scanning training and testing data to identify underrepresented characteristics or attributes, leading to model retraining when necessary (Atte Ojanen et al., 2022).

In response to the evolving landscape of AI, humans play a crucial role in checking for bias as models progress. While complete elimination of bias remains challenging, this approach has proven effective in reducing bias and enhancing the overall performance of AI models (Chirag Shah, 2023).

Banks and financial institutions have recognized the importance of addressing AI bias and have consequently established multidisciplinary teams to spearhead AI initiatives (Chirag Shah, 2023). These teams encompass a diverse range of professionals, including developers, business managers, human resources experts, and legal professionals. This collaborative effort aims to ensure that AI technologies are developed, implemented, and monitored with ethical considerations at the forefront (Chirag Shah, 2023).

2.15 Ethical problems

In the ever-advancing landscape of technology, the rise of Artificial Intelligence (AI) brings forth a profound transformation, with machines exhibiting capabilities that not only match but often surpass human ability, particularly in sectors like financial services. This paradigm shift, commonly referred to as the fourth industrial revolution, has implications not only for workers but also for larger economies and civilizations (McKinsey & Company, 2022). The current technological wave raises ethical challenges similar to those seen in previous industrial revolutions, including considerations about labour rights and social inequality (MinHwa Lee et al., 2018).

Unlike its predecessors, where the impact was predominantly on unskilled labour, the ongoing revolution questions and revises a spectrum of job types for enhanced performance. The assessment of the immediacy and likelihood of automation in a profession hinge on three critical variables: the degree of routine involved, the skill set required, and the level of social interaction inherent in the job (Scott A. Wright & Ainslie E. Schultz, 2018). As automation gains momentum, concerns about its societal consequences intensify.

Ethical concerns come to the forefront, predicting a potential shift in the social fabric. Studies conducted in 2017 even suggested that automation might replace nearly half of the existing occupations within a decade (Carl Benedikt Frey & Michael A. Osborne, 2017). During this transformation, the importance of human interaction in certain scenarios becomes evident. Instances where AI lacks an adequate response to customer inquiries or where AI recommendations mistakeably impact customers' lives highlight the irreplaceable role of human employees (H. James Wilson & Paul Daugherty, 2018).

A crucial aspect of this transformation revolves around accountability. As machines evolve, the question of how to hold them responsible for their actions emerges larger. Even as AI is yet to reach its full potential, errors will occur, raising questions about who bears the responsibility for programming deficiencies or erroneous decisions made by AI.

In this dynamic landscape, financial services should reevaluate their communication methods. Consider a scenario where AI is responsible for generating personalized investment advice based on intricate data patterns. Effectively conveying these recommendations to clients in a comprehensible and transparent manner becomes essential. This underscores the significance of adapting communication strategies to facilitate a clear understanding of AI-generated insights and decisions in various financial contexts. This highlights the imperative for transparent and understandable communication to bridge the gap between complex AI-driven decisions and the comprehension of customers and the broader public (Patrick Mikalef & Manjul Gupta, 2021). In navigating this technological surge, it becomes evident that the integration of AI prompts not just economic shifts but necessitates ethical considerations, re-evaluation of job landscapes, and a reassessment of accountability structures within the evolving social framework.

3 METHODOLOGY

The primary aim of this thesis is to explore the factors contributing to the AI integration in finance companies and how it will affect the future. To answer the research questions, qualitative methodologies will be used in this thesis. Relevant publications which were written by scholars and subject matter experts for the integration of AI in the financial companies in this current year. To enhance comprehension and address gaps due to limited secondary data, interviews will be conducted with financial experts specializing in artificial intelligence.

3.1 Qualitative Method

The thesis focuses on literature and research reports. The qualitative method aligns well with this thesis, as it prioritizes words over quantification in both data collection and analysis (Alan Bryman, 1984) (Martyn Hammerslay, 2012). The qualitative method mainly highlights an inductive approach to connecting theory and research, with a focus on generating theories and understanding how individuals interpret their social world. It also reflects a perspective that sees social reality as an ever-changing emergent property shaped by individual creation (Alan Bryman, 1984; Martyn Hammerslay, 2012).

Qualitative method is favoured by AI researchers due to its ability to explore the complexity of AI's impact on society and its ethical considerations. It enables a deep understanding of the human-cantered aspects of AI, addressing real human problems. Qualitative research is seen as vital for ongoing accountability and regulatory efforts in AI development. It also facilitates a necessary shift in the mindset of tech professionals toward ethical and societal implications (Mary L. Gray & Krish Arora, 2022). Hence, qualitative research is considered essential for a holistic and human-cantered approach to AI innovation and regulation.

3.2 Research sampling method

Gathering all relevant information related to my topic. This encompasses literature on machine learning, AI theories regarding decision making, AI tools and applications, challenges in the current financial landscape, and reports from scholars highlighting current AI advancements. Alan Bryman describes this approach as purposive sampling, where everything relevant to the research question is included in the sample. (Alan Bryman, 1984).

I plan to utilize theoretical sampling as a form of purposive sampling. This involves systematically collecting data to refine the emerging theory. (Alan Bryman, 1984). The main advantage of theoretical sampling lies in prioritizing theoretical reflection on data to determine the need for additional data. (Alan Bryman, 1984).

Theoretical sampling is better suited for qualitative methodology. Its purpose is to identify categories and their properties, as well as to propose the interrelationships within a theory. (Alan Bryman, 1984).

What sets theoretical sampling apart from other sampling methods is the focus on selecting cases and units in the pursuit of generating a theoretical understanding. (Alan Bryman, 1984). Alan Bryman observes that in grounded theory, data collection through theoretical sampling continues until we achieve theoretical saturation. (Alan Bryman, 1984). In my study, keep collecting information on my topic until the new data does not add anything new to our theoretical understanding.

3.3 Interviews and data collection

> *"If you want to know how people understand their world and their lives, why not talk to them? Conversation is a basic mode of human interaction. Human beings talk with each other; they interact, pose questions, and answer questions" - Kvale and Brinkmann (Eric J. Blown & Tom G. K. Bryce, 2022)*

After completing the data collection and analysis phase for my research topic, it became evident that there is a notable gap in available data regarding the specific skills required for the financial professions. To address this gap, I have decided on

to use interviews as a means of gathering insights directly from professionals in the finance and AI sector who can provide sophisticated perspectives on the necessary skill set.

Interviews, essentially structured conversations with a defined purpose, have been a widely utilized method in qualitative research due to their inherent flexibility. In recognizing their significance, I acknowledge that interviews will play an essential role in augmenting my understanding of the research questions, offering a firsthand account of experiences related to the integration of AI in the Finnish financial sector.

In the context of my research, I have chosen to conduct semi-structured interviews. This approach involves posing questions in a systematic and consistent manner, allowing for deviations in the conversation based on the interviewee's responses. The intentional flexibility of this method is especially valuable in situations where participants provide diverse answers, enabling me to explore into varying perspectives on the research problem.

One of the appealing aspects of semi-structured interviews for me is their alignment with the focus on AI research. This method has gained prominence in recent years as it facilitates a dynamic and interactive conversation, providing participants the freedom to express their thoughts and ideas more freely while ensuring that key aspects of the research are addressed.

In the course of my research, I conducted interviews with two sources, as outlined in detail in the upcoming analysis chapter. This choice was made with the understanding that if theoretical saturation had not been reached, the number of interviews could have been increased to ensure comprehensive coverage.

- Person A, began as a trainee in a different department, initially managing purchase invoices and later transitioning to an accountant role for two years. Subsequently, she moved to another department handling payment tasks while continuing her role as an accountant. Over the past six years

she has held a managerial position and has been actively involved in various projects focusing on automatization and harmonization. The interview lasted 47 minutes, the discussion explored the general landscape of artificial intelligence, robotics, automation and the AI skill gap.

- Person B, currently a senior accountant with three years of experience, previously served as a financial expert for five years. During the 35-minute interview, she discussed her daily tasks, highlighting encounters with AI robots like RPA (Robotic Process Automation).
- Person C, currently a senior accountant for three years, previously worked in accounts payable for two years. Their responsibilities encompass various financial tasks such as making payments, handling taxes, processing reimbursements, and posting bank statements. Notably, the interviewee has substantial experience with AI and RPA in their daily work, the interview lasted 25-minutes.
- Person D, serves as an accountant, over the course of 38-minute interview, she detailed her tasks, explaining how she integrates AI into processes such as executing payment runs, handling accounts receivable clearings based on business requests, and performing audits.

While I followed an interview guide and posed questions, I encouraged each participant to share their unique perspective. This diversity is evident in the varied focal points each participant emphasized. Alan Bryman highlights the importance of questioning in allowing interviews to uncover how research participants perceive their social world, emphasizing the need for flexibility in the interview process.

Questions throughout the interviews were crafted based on author recommendations, incorporating introductory, follow-up, probing, specifying, direct, and indirect questions, as well as structured questions. Ensuring privacy and creating a comfortable setting for both the interviewee and myself was a priority during the interviews, aligning with Horrocks' assertion that both physical and psychological comfort are crucial in interview settings.

After concluding the interview process, I possessed approximately 120 minutes of recorded material. The subsequent step involved employing a "cutting" and "coding" method. In the cutting method, the data was segmented at various levels, such as word, phrase, sentence, or full transcripts. The rationale behind this approach is to break down the text or condense information to identify key phrases.

Following the cutting method, the coding process ensued. The overarching aim of coding is to generate constructs devised by the researcher, representing, and attributing interpreted meaning to each individual piece of data. This serves the later purpose of detecting patterns, categorizing, developing themes and concepts, building assertions, theorizing, and engaging in other analytical practices.

4 ANALYSIS AND DISCUSSION

4.1 Summary of Interview findings

A summarized version of the topics addressed in the chapter on Interviews and Data Collection is provided below.

- Recognize and prioritize individuals within the company expressing genuine interest in AI and automation for targeted skill development
- Maintains a predominant focus on robotics and automation, integrating AI-inspired software for specific tasks.
- Emphasizes learning-based processes and probability analysis in automation and AI tools.
- Stresses the crucial role of soft skills for efficiency and added value.
- AI, while performing various tasks, cannot fully replicate human emotional intelligence and empathy.
- Timesaving through automation, particularly in handling routine tasks.
- Challenges in building a basic robot for specific processes using RPA, with efforts being time-consuming and susceptible to issues.
- Recognition of AI's potential in addressing cybercrime.
- Emphasis on embracing change, drawing parallels to robotics.
- View of AI as an evolving tool, not a replacement
- Critical nature of understanding RPA, robotics, automation, and AI.
- Concerns arise from potential ethically questionable use of sensitive data.
- Balancing opportunities for enthusiasts and addressing concerns for successful integration of new technologies in finance.

4.2 Data analysis and discussion

This chapter unfolds in three parts. Firstly, presenting data acquired through my fieldwork, offering insights into the perspectives of my interviewees on AI in their daily lives. Moving on to the second part, analyze the interview findings, drawing connections to my research questions. Lastly, the chapter concludes with my insights and conclusions.

> *"Empasis on the importance of identifying individuals within the company who are genuinely interested in learning more about AI and automation. It is crucial to focus efforts on those who have an inherent interest in these fields, as trying to increase the skill level of individuals not interested in AI or automation might be less effective. It is highlighted that the she has to target and engage individuals who are keen to explore and advance their knowledge in these areas".*(Person A, 2023)

The interviewee emphasized that, in the context of their work, addressing the AI skill gap involves recognizing and prioritizing individuals within the company who genuinely express an interest in learning about AI and automation. They stressed the importance of directing efforts towards those already inclined toward these fields, as attempting to enhance the skills of individuals who lack interest in AI or automation may not yield optimal results. The interviewee highlighted the need to specifically target and engage individuals eager to explore and advance their knowledge in AI and automation, underlining the significance of aligning skill development initiatives with the genuine interests of the workforce. The interviewee's response doesn't necessarily imply that having AI skills is not important in the financial industry. Instead, it underscores the idea of strategically focusing efforts on individuals who already show an interest in learning about AI and automation. The emphasis is on efficiency and effectiveness in skill development. It suggests that it might be more productive to invest resources in employees who are naturally inclined towards AI and automation, as they are more likely to engage with and benefit from the training. It doesn't discount the importance of AI skills in the financial industry but rather suggests a targeted and strategic approach to skill development based on individual interest and inclination.

> *"Shared their involvement in the company's initial foray into robotics in 2015, actively participating in piloting processes and creating the first use cases for Robotic Process Automation (RPA). The company continues to utilize RPA actively in its processes. While there has been a recent shift towards a greater focus on AI solutions in the past 2-3 years, the tools around AI are still in development. Despite this, the company remains predominantly focused on robotics and automation, integrating AI-inspired software for tasks such as image recognition, document reading, and*

> *data finding. It was highlighted that the use of learning-based processes and probability analysis in their automation and AI tools within the company's operations".*(Person A, 2023)

The interviewee conveyed their active involvement in the company's initial exploration of robotics back in 2015, where they played a role in piloting processes and establishing the first use cases for Robotic Process Automation (RPA). The company continues to actively utilize RPA in its operations. Although there has been a recent shift towards a greater emphasis on AI solutions in the past 2-3 years, the tools related to AI are still in the development phase. Despite this shift, the company maintains a predominant focus on robotics and automation, incorporating AI-inspired software for specific tasks such as image recognition, document reading, and data finding. The interviewee emphasized the integration of learning-based processes and probability analysis within their automation and AI tools in the company's operations.

> *"It is important for individuals to have a genuine interest and curiosity in learning about AI and automation processes, emphasizing that soft skills are crucial in this regard. Without a sincere interest, efficiency and added value cannot be achieved. When considering the incorporation of AI in processes, I believe that while AI can perform various tasks, it cannot fully replicate the emotional intelligence and empathy inherent in human beings. Despite AI's ability to mimic these qualities to some extent, there remains a distinction in the depth of understanding and expression compared to human capabilities"*(Person A, 2023)

In response to the question about essential skills for success in the financial industry today, the interviewee emphasized the significance of a genuine interest and curiosity in learning about AI and automation processes. They underscored the crucial role of soft skills in this context, highlighting that without sincere interest, achieving efficiency and added value becomes challenging. However, when discussing the integration of AI in financial processes, the interviewee expressed the belief that while AI can perform various tasks, it falls short of fully replicating the emotional intelligence and empathy inherent in humans. Despite AI's ability to mimic these qualities to some extent, the interviewee emphasized a notable distinction in the depth of understanding and expression compared to human capabilities. The overall implication is that a combination of technical curiosity, soft

skills, and the recognition of the unique human qualities remains essential for success in the evolving revolution of the financial industry.

> *"I'm genuinely interested in AI, automation, and related technologies, especially in the context of improving efficiency, security, and speed in our work area. Although my role doesn't necessitate detailed knowledge of how AI works, my focus is on facilitating its use for team members. My goal is to enable them to explore into the technical details while I grasp the overall picture and the interconnectedness of various elements, emphasizing understanding without the need for intricated technical knowledge"*(Person A, 2023)

> *"Using robots and automation in our work has proven immensely beneficial. It significantly reduces our work time, making our processes much more efficient than before. For instance, when dealing with a large volume of a specific payment, robots simplify the task of posting them, saving time that would otherwise be spent on manual date entry. However, robots excel at handling tasks like updating customer information in the system, a process that could be time-consuming when done through human contact, especially across different countries and time zones. The overall impact is a notable increase in efficiency and a reduction in the time required for routine and sometimes tedious tasks"* (Person B, 2023)

Both Person A and Person B are describing the positive impact of AI and automation in their respective roles. Person A expresses a personal interest in AI and related technologies, emphasizing a focus on improving efficiency, security, and speed in the work area. They clarify that although their role doesn't demand detailed technical knowledge of AI, their goal is to facilitate its use for team members, allowing them to explore technical details while maintaining an understanding of the broader context.

Person B provides specific examples of how robots and automation have benefited their work particularly in reducing the time spent on tasks like posting a large volume of payments. They highlight the efficiency gains achieved through automation, especially in handling routine and sometimes tedious tasks such as updating

customer information. Person B highlighted the time-saving aspect, particularly when dealing with tasks that might involve different countries and time zones.

> *"While RPA is beneficial, building even a simple robot for a specific process is time-consuming and prone to issues. Common problems like access issues or malfunctions often require specialized knowledge to resolve. Recently, I faced an access issue that, despite having full access, needed to collaborate with a technician for a solution"*(Person B, 2023; Person C, 2023)

In response to the question about challenges in adapting to AI technologies in financial work, it was emphasized the difficulties encountered when working with Robotic Process Automation (RPA). Despite acknowledging the benefits of RPA, the interviewees highlighted challenges in build even a basic robot for a specific process, citing time-consuming efforts and susceptibility to issues. Common problems such as access issues or malfunctions were mentioned, requiring specialized knowledge for resolution. The interviewee shared a recent experience with an access issue, underlining the need for collaboration with a technician to find a solution.

> *"I believe the success of incorporating AI technologies in our work largely depends on having the right people in the right positions. When individuals with genuine interest and expertise drive the process, it tends to go smoothly. However, if the right people are not involved, it can become frustrating and may lead to abandonment. In the worst cases, AI can be used negatively or with malicious intent".(Person A, 2023)*

In response to the question about proficiency in AI-related skills and areas for improvement, the interviewee emphasized the critical importance of having the right individuals with genuine interest and expertise driving the incorporation of AI technologies in their work. Success is attributed to the presence of these individuals in the right positions. Conversely, a lack of the right people can lead to frustration, potential abandonment of AI initiative, and in extreme cases, the misuse of AI for negative or malicious purposes.

> *"We are already using AI extensively in areas where human observation might miss certain details. Although AI has potential applications in addressing cybercrime, the challenge lies in the evolving nature of cyber threats driven by AI itself. The difficulty*

> *is staying ahead of criminals who are using similar tools. Outsmarting these evolving threats becomes a challenging aspect in the ongoing efforts to combat cybercrime".* (Person A, 2023)

In response to the question about overlooked AI tools or technologies beneficial for financial professionals, the interviewee highlighted the extensive use of AI in areas where human observation may fall short. While recognizing AI's potential in addressing cybercrime, the interviewee highlighted the challenge of staying ahead of evolving threats, as cybercriminals also leverage AI tools. The central difficulty is outsmarting these criminals who employ similar technologies.

> *"I believe it's about embracing change, similar to when we introduced robotics in 2015. Initially, there was concern about job displacement, but instead, it freed us from mundane tasks. Utilizing RPA allowed our roles to evolve into more challenging and fulfilling tasks. Similarly, with AI, I do not see it as a replacement but as a tool that will evolve. There's a need for administrators and developers to ensure AI follows processes correctly, contributing to the ongoing evolution of our tasks rather than replacing them".(Person A, 2023)*

In response to the question about the role of industry collaborations in addressing the AI skill gap in finance, the interviewee emphasized the importance of embracing change. Drawing parallels to the introduction of robotics in 2015, they highlighted the initial concerns about job displacement, which ultimately led to the freeing up of individuals from mundane tasks. By utilizing Robotic Process Automation (RPA), roles evolved into more challenging and fulfilling tasks. The interviewee expressed a similar perspective regarding AI, viewing it not as a replacement but as an evolving tool. They emphasized the need for administrators and developers to guide AI processes, contributing to the ongoing evolution of tasks rather than replacing them. The underlying message is that industry collaborations can facilitate skill development by adapting to technological changes and ensuring a smooth transition into more complex and fulfilling roles.

> *"I believe it is crucial for individuals to focus on and understand RPA, robotics, automation, and AI, as I have been advocating for the past five years, especially when guiding students. Studying and comprehending these technologies is essential because they*

> *will undoubtedly become integral to future tasks. Having a solid understanding enables individuals to work with, rather than against, these technologies, facilitating their progress. As AI continues to evolve, having knowledge in these areas becomes even more beneficial, particularly for those pursuing career opportunities in finance".(Person A, 2023)*

The question about the importance of AI skills for the future of financial professions, the interviewee emphasized the critical nature of understanding RPA, robotics, automation, and AI. Their advocacy over the past five years, particularly when advising students, underscores the belief that studying and comprehending these technologies is essential. The interviewee highlighted the inevitability of these technologies becoming integral to future tasks and stressed that a solid understanding empowers individuals to collaborate effectively with these tools, fostering progress. The ongoing evolution of AI further enhances the significance of knowledge in these areas, particularly for those aspiring to careers in finance professions. The core message is that AI skills are crucial for staying relevant and successful in the evolving landscape of financial professions.

> *"I've encountered situations where people have requested code to extract information, particularly in scenarios where the information is confidential. The concern arises when individuals inquire about obtaining sensitive data and utilizing it in ways that could be ethically questionable. This highlights a potential evolution in the use of code for accessing confidential information, raising ethical considerations about how such tools might be employed in the future".(Person A, 2023)*

Ethical concerns related to AI use in finance, the interviewee highlighted instances where individuals sought code for extracting information, especially in cases involving confidential data. The concern arises from inquiries about obtaining sensitive information and the potential for ethically questionable use. The interviewee emphasized the evolving landscape of code use, particularly for accessing confidential information, prompting ethical considerations regarding the future deployment of such tools. The underlying message is the need to address ethical challenges associated with the utilization of AI in finance, especially in scenarios involving sensitive and confidential data.

> *"It all comes down to the people involved. Identifying individuals with an interest in the field is crucial, as not everyone shares the same level of enthusiasm. Providing opportunities for those interested to learn and develop is essential for fostering growth. Simultaneously, it's important to be mindful of individuals who may not be interested and anticipate their reactions, especially when introducing technologies like RPA and chat GPT. Addressing concerns and educating those less interested helps alleviate fears and uncertainties about potential job displacement. Overall, balancing opportunities for enthusiasts and addressing concerns for the less interested is key to successful integration of new technologies".*(Person A, 2023)

The question about strategies for closing the AI skill gap for financial professionals, the interviewee emphasized the centrality of people in the process. They stressed the importance of identifying individuals with an interest in the field, offering them opportunities for learning and development to foster growth. Simultaneously, the interviewee highlighted the need to be mindful of individuals less interested in AI, particularly when introducing technologies like RPA and ChatGPT. Addressing concerns and providing education for those less interested were mentioned as crucial steps to alleviate fears and uncertainties about potential job displacement. The overall strategy proposed involved finding a balance between providing opportunities for enthusiasts and addressing concerns for those less interested, aiming for the successful integration of new technologies in the financial professions.

5 CONCLUSION

The investigation into the relationship between the fields of Artificial Intelligence (AI) and the financial sector was motivated by two fundamental questions: how does AI affect the complex structure of financial services, and what insights can be gained from an examination of the AI skill gap within the financial sector?

As the chapter progressed, the complexity of AI's impact on finance began to emerge. The thesis explored the path of evolution as well as the adoption patterns, the thesis revealed AI's transformational power. The impact of AI can be seen in a variety of ways, from improving communication and customer service to changing recruitment practices and triggering a revolution in asset management. The attention then shifted to specific finance operations, revealing the possibilities for automation in asset management, credit intermediation, algorithmic trading, and the complex world of accounts payable invoicing. As the thesis progressed, it revealed not only the technical workings of AI, but also the true benefits, as AI led the way for simplified operations, increased efficiency, and advanced financial management.

Yet, as we embrace AI's prospects, several obstacles remain large. The investigation into the AI skill gap raised serious concerns about the workforce's condition for an AI-driven future. Ethical dimensions, biased training data, and the lack of emotional intelligence in AI systems add additional complication to the narrative.

This thesis used a qualitative research methodology to not only answer questions but also to increase understanding of AI in finance. The study went beyond the theoretical to capture the core of AI's impact on real-world financial circumstances through thorough research sampling and insightful interviews.

As we can see, this thesis is not just a synthesis of information but an exploration into the topic. Beginning with questions, this journey finishes in a comprehensive understanding of how AI operates in financial services, while also emphasizing the critical need to close the AI skill gap. As we navigate a future in which AI is integrated into the finance, the findings of this study uncovered both challenges and opportunities. From the challenges of RPA to the importance of the proper team.

AI can help with cybercrime, but it requires ongoing supervision. It is a useful tool that emerged in the company X in 2015. Mastering AI terms is essential, with ethical consideration encouraging caution. Addressing the AI skill gap entails striking a balance, growing interest, and assisting others who are less eager for a smooth AI integration in finance.

REFERENCES

A. M. TURING. (1950). I.—COMPUTING MACHINERY AND INTELLIGENCE. *Https://Academic.Oup.Com/Mind/Article/LIX/236/433/986238*.

AASHISH KRISHNA KUMAR. (2023, October 1). *Mastering SaaS Hybrid Pricing: Strategies, Models, and Benefits Explored*. Https://Www.To-gai.Com/Blog/Saas-Hybrid-Pricing-Strategy-Rise/.

Abbyy. (2023, September 25). *Automated Invoice Processing: How to Streamline Your Invoice Process*. Https://Www.Abbyy.Com/Blog/Automated-Invoice-Processing/.

Abid Haleem, Mohd Javaid, Mohd Asim Qadri, Ravi Pratap Singh, & Rajiv Suman. (2022). Artificial intelligence (AI) applications for marketing: A literature-based study. *Https://Www.Sciencedirect.Com/Science/Article/Pii/S2666603022000136*.

Accenture. (2021, March). *Fintech and the evolving landscape: landing points for the industry*. Https://Fintechinnovationlab.Com/Wp-Content/Uploads/2021/03/Fintech_Evolving_Landscape_2016.Pdf.

AIContentfy team. (2023a, September 11). *The future of startups in the digital age*. Https://Aicontentfy.Com/En/Blog/Future-of-Startups-in-Digital-Age.

AIContentfy team. (2023b, October 3). *The Impact of AI and machine learning on Startups*. Https://Aicontentfy.Com/En/Blog/Impact-of-Ai-and-Machine-Learning-on-Startups.

AI-Mastermind. (2023, August 28). *Exploring the Evolution and Impact of Artificial Intelligence*. Https://Medium.Com/@Ai-Mastermind/Exploring-the-Evolution-and-Impact-of-Artificial-Intelligence-Afaa70bd9e04.

Alan Bryman. (1984). *The Debate about Quantitative and Qualitative Research: A Question of Method or Epistemology?*

Alan Hester. (2023). *180+ Intriguing Automation Statistics*.

Alex Hern. (2016, September 28). “Partnership on AI” formed by Google, Facebook, Amazon, IBM, and Microsoft. *Https://Www.Theguardian.Com/Technology/2016/Sep/28/Google-Facebook-Amazon-Ibm-Microsoft-Partnership-on-Ai-Tech-Firms*.

Alexis Damen. (2023, October 5). *AI in Payments: How It’s Transforming the Industry*. Https://Monei.Com/Blog/Ai-in-Payments/.

Alison Moodie. (2014, February 24). *Is digital really greener than paper?* Https://Www.Theguardian.Com/Sustainable-Business/Digital-Really-Greener-Paper-Marketing.

Anne O. Krueger. (2006). The World Economy at the Start of the 21st Century, Remarks by Anne O. Krueger, First Deputy Managing Director, IMF. *Https://Www.Imf.Org/En/News/Articles/2015/09/28/04/53/Sp040606*.

Appen. (2021). What is Optical Character Recognition? *Https://Appen.Com/Blog/Optical-Character-Recognition/*.

Arjun Kharpal. (2018, June 13). *Adyen IPO: Everything you need to know about the $8 billion fintech company*. Https://Www.Cnbc.Com/2018/06/13/Adyen-Ipo-Everything-You-Need-to-Know-about-the-8-Billion-Fintech-Company.Html.

Artsyl. (2019.). *What is Invoice Automation, and How Can it Benefit Your Business?* Https://Www.Artsyltech.Com/Blog/What-Is-Invoice-Automation.

Atte Ojanen, Anna Björk, & Johannes Mikkonen. (2022). *Promoting equality in the use of Artificial Intelligence – an assessment framework for non-discriminatory AI*. Https://Julkaisut.Valtioneuvosto.Fi/Bitstream/Handle/10024/164290/25-2022-Promoting%20equality%20in%20the%20use%20of%20Artificial%20Intelligence-An%20assessment%20framework%20for%20non-Discriminatory%20AI.Pdf?Sequence=7&isAllowed=y.

Avi Yaeli, Peter Bak, & G. Feigenblat. (2014, September). *Understanding customer behavior using indoor location analysis and visualization*. Https://Www.Researchgate.Net/Publication/269222059_Understanding_customer_behavior_using_indoor_location_analysis_and_visualization.

Bankingly. (2019, April 2). *How financial institutions interact with their customers*. Https://Www.Bankingly.Com/News/How-Financial-Institutions-Interact-with-Their-Customers/.

basware. (2023.-a). *AI-Powered AP Automation*. Https://Www.Basware.Com/En/Solutions/Ap-Automation.

basware. (2023.-b). *How to automate non-PO invoices for touchless invoice processing*. Https://Blog.Basware.Com/En/How-to-Automate-Non-Po-Invoices-for-Touchless-Invoice-Processing.

Basware. (2023). *Maximise automation for PO-based invoices for complex use cases*. Https://Blog.Basware.Com/En/Maximise-Automation-for-Po-Based-Invoices.

BiggBrains. (2023, July 6). *Fintech: Revolutionizing Financial Services in the Eyes of Millennials and Generation Z*. Https://Www.Linkedin.Com/Pulse/Fintech-Revolutionizing-Financial-Services-Eyes-Millennials/.

BIS Markets Committee. (2023.). *BIS Markets Committee*.

BlackRock. (2019). *Artificial intelligence and machine learning in asset management*.

Boaz Gam. (2023, April 19). *Why Is Payments Data the Key to Understanding Your Customers?* Https://Payneteasy.Com/Blog/Why-Is-Payments-Data-the-Key-to-Understanding-Your-Customers.

Brianna Blaney. (2023.). *The Impact of AI in Accounts Payable*. Https://Tipalti.Com/Ai-in-Accounts-Payable/.

Brosix. (2023, August 14). *7 Reasons to Use Instant Messaging in the Workplace*. Https://Www.Brosix.Com/Blog/Work-Instant-Messenger/.

Bruhati. (2023, May 23). *The evolution of Digital Banking: How it benefits organisations and customers*. Https://Www.Linkedin.Com/Pulse/Evolution-Digital-Banking-How-Benefits-Organisations-Customers-1e/.

Cade Metz. (2016, January 25). *The Rise of the Artificially Intelligent Hedge Fund*.

canecom. (2023.). *Is AI fighting on both sides of Financial Fraud?* Https://Canecom.Com/Is-Ai-Fighting-on-Both-Sides-of-Financial-Fraud/.

Carl Benedikt Frey, & Michael A. Osborne. (2017, January). *The future of employment: How susceptible are jobs to computerisation? **. Https://Www.Sciencedirect.Com/Science/Article/Abs/Pii/S0040162516302244.

CBC News. (2013, September 26). *EBay acquires online payment firm Braintree*. Https://Www.Cbc.ca/News/Business/Ebay-Acquires-Online-Payment-Firm-Braintree-1.1869565.

cevinio. (2023, October 26). *How AI simplifies Accounts Payable invoice processing.* Https://Cevinio.Com/Artificial-Intelligence-in-Accounts-Payable/.

Ceyla Pazarbasioglu, Alfonso Garcia Mora, Mahesh Uttamchandani, Harish Natarajan, Erik Feyen, & Mathew Saal. (2020, April). *DIGITAL FINANCIAL SERVICES*. Https://Pubdocs.Worldbank.Org/En/230281588169110691/Digital-Financial-Services.Pdf.

checkout. (2023, January 19). *What is payment orchestration & how can it benefit businesses?* Https://Www.Checkout.Com/Blog/What-Is-Payment-Orchestration.

Chirag Shah. (2023, June 7). *How is AI bias being tackled by the credit sector*. Https://Www.Finextra.Com/Blogposting/24336/How-Is-Ai-Bias-Being-Tackled-by-the-Credit-Sector.

Chugh. (2023, July 11). *Artificial Intelligence: Unleashing the power of innovation*. Https://Timesofindia.Indiatimes.Com/Readersblog/Mywriteexpress/Artificial-Intelligence-Unleashing-the-Power-of-Innovation-56241/.

Comparables. (2023). *The Future of Market Analysis: AI-Powered Insights*. Https://Www.Comparables.Ai/Articles/Future-of-Market-Analysis-Ai-Powered-Insights.

Coursera. (2023). *Global Skills Report 2023 by Coursera*. Https://Pages.Coursera-for-Business.Org/Rs/748-MIV-116/Images/Coursera_Global_Skills_Report_2023.Pdf.

David Winter. (2018.). *AI ERRORS VS. HUMAN ERRORS*.

deloitte. (2023.). *How Artificial Intelligence is Transforming the Financial Services Industry*.

Deloitte. (2019). *The future of digital payments Choices to consider for a new ecosystem*. Https://Www2.Deloitte.Com/Content/Dam/Deloitte/Sg/Documents/Financial-Services/Sg-Fsi-Future-of-Digital-Payments.Pdf.

Deloitte. (2021). *The Financial Services AI Dossier*.

Dennis Hillemann. (2023, June 29). *Can AI Truly Experience Emotion and Should We Trust It in the Public Sector Decision-Making Process?* Https://Dhillemann.Medium.Com/Can-Ai-Truly-Experience-Emotion-and-Should-We-Trust-It-in-the-Public-Sector-Decision-Making-Process-9797211e9bcb.

Derrick McMahon. (2023, October 6). *The Benefits of Using Automatic Receipts System in Hospitality Businesses*. Https://Altametrics.Com/Invoice-Management/Automatic-Receipts.Html.

Dilara Bereket. (2023.). *AI, Payments Orchestration, Payment Intelligence*. Chingona Ventures Https://Medium.Com/Chingona-Ventures/Ai-Payments-Orchestration-Payment-Intelligence-Cd5578446e94.

Du, S., & Xie, C. (2021). Paradoxes of artificial intelligence in consumer markets: Ethical challenges and opportunities. *Journal of Business Research*, *129*, 961–974.

DXC. (2023). *DXC Technology Identifies Five Cybersecurity Trends that will Impact Life and Business in 2023 and beyond*.

El Bachir Boukherouaa, Khaled AlAjmi, Jose Deodoro, Aquiles Farias, & Rangachary Ravikumar. (2021, October 22). *Powering the Digital Economy: Opportunities and Risks of Artificial Intelligence in Finance*. Https://Www.Elibrary.Imf.Org/View/Journals/087/2021/024/Article-A001-En.Xml.

Emily Johnson. (2023, August 3). *The Role of Artificial Intelligence in Improving Cross-Border Payments*. Https://Blog.Flash-Payments.Com/the-Role-of-Artificial-Intelligence-in-Improving-Cross-Border-Payments/.

Eric J. Blown, & Tom G. K. Bryce. (2022). *When Is an Interview an Inter View? The Historical and Recent Development of Methodologies Used to Investigate Children's Astronomy Knowledge*.

ethics-of-ai.mooc.fi. (2023). *Should AI be fair and non-discriminative*. Https://Ethics-of-Ai.Mooc.Fi/Chapter-6/3-Discrimination-and-Biases.

Financial Stability Board. (2017). *Artificial intelligence and machine learning in financial services Market developments and financial stability implications*.

finix. (2021, December 2). *Understanding the Payments Layer Cake with Richie Serna*. Https://Finix.Com/Resources/Webinars/Understanding-the-Payments-Layer-Cake-with-Richie-Serna.

FM Contributors. (2023, April 24). *The Evolution of Digital Payments and E-Commerce*. Https://Www.Financemagnates.Com/Fintech/Payments/the-Evolution-of-Digital-Payments-and-e-Commerce/.

Francesco Audrino, Fabio Sigrist, & Daniele Ballinari. (2020, June). *The impact of sentiment and attention measures on stock market volatility*. Https://Www.Sciencedirect.Com/Science/Article/Pii/S0169207019301645.

Gerardo Uña, Alok Verma, Majid Bazarbash, & Ms. Naomi N Griffin. (2023, February 3). *Fintech Payments in Public Financial Management: Benefits and Risks*. Https://Www.Elibrary.Imf.Org/View/Journals/001/2023/020/Article-A001-En.Xml.

Giorgio Barilla. (2023, September 29). *History of Machine Learning: How We Got Here*. Https://Www.Akkio.Com/Post/History-of-Machine-Learning#:~:Text=Arthur%20Samuel%27s%20Checkers%20Program%20(1952,Minimax%20algorithm%2C%20and%20rote%20learning.

GOV.UK. (2022.). *National Cyber Strategy 2022* .

Graip.AI. (2022, September 22). *Automated Invoice Processing. What is it and how it works?* Https://Www.Linkedin.Com/Pulse/Automated-Invoice-Processing-What-How-Works-Graip/.

H. James Wilson, & Paul Daugherty. (2018, July). Collaborative Intelligence: Humans and AI Are Joining Forces. *Https://Hbr.Org/2018/07/Collaborative-Intelligence-Humans-and-Ai-Are-Joining-Forces*.

Haroon Sheikh, Corien Prins, & Erik Schrijvers. (2023, January 31). *Artificial Intelligence: Definition and Background*. Https://Link.Springer.Com/Chapter/10.1007/978-3-031-21448-6_2.

Ibm. (2023.). *What is data mining?* Https://Www.Ibm.Com/Topics/Data-Mining.

Ivy Wigmore. (2023, April). *Natural language generation (NLG)*.

JAKE FRANKENFIELD. (2023). *What Is a Robo-Advisor?* Https://Www.Investopedia.Com/Terms/r/Roboadvisor-Roboadviser.Asp.

Jane Southworth, Kati Migliaccio, Joe Glover, Ja'Net Glover, David Reed, Christopher McCarty, Joel Brendemuhl, & Aaron Thomas. (2023). *Developing a model for AI Across the curriculum: Transforming the higher education landscape via innovation in AI literacy*. Https://Www.Sciencedirect.Com/Science/Article/Pii/S2666920X23000061.

Jim Marous. (2023, July 25). *The power of personalization in finance*. Https://Www.Fisglobal.Com/En/Insights/the-Power-of-Personalization-in-Finance.

Jinisha Ghodasara. (2023.). AI in Recruitment: Future-proofing Your Hiring Process. *Https://Www.Ismartrecruit.Com/Blog-Ai-in-Recruitment-for-Future-Proof-Hiring-Process*.

Jordan McKee. (2023a). Payments: A Tool For Driving Growth During An Economic Downturn. *Https://Www.Forbes.Com/Sites/Jordanmckee/2023/01/09/Payments-a-Tool-for-Driving-Growth-during-an-Economic-Downturn/*.

Jordan McKee. (2023b, September 28). *A primer on payments orchestration*. Https://Www.Spglobal.Com/Marketintelligence/En/News-Insights/Research/a-Primer-on-Payments-Orchestration.

Joshua Almeria. (2023, July 27). *Discovering AI's Impact on Marketing — Plus Bonus AI-Powered Tools You Can Use*. Https://Medium.Com/@bsbm.Almeria/Discovering-Ais-Impact-on-Marketing-plus-Bonus-Ai-Powered-Tools-You-Can-Use-785e70123f0a.

Kaur, D. N., Sahdev, S. L., Sharma, D. M., & Siddiqui, L. (2020). Banking 4.0:'the influence of artificial intelligence on the banking industry & how ai is changing the face of modern day banks.' *International Journal of Management*, *11*(6).

klippa. (2022, August 26). *Invoice digitization: How and why to digitize invoices with OCR*. Https://Www.Klippa.Com/En/Blog/Information/Digitize-Invoices/.

knowyourpayments. (2023.). *TRANSACTION BASICS*. Https://Www.Knowyourpayments.Com/Transaction-Basics/.

KPMG. (2017, June). *Spotlight on the Asset Management Industry: B2B Customer Experience: Winning in the Moments that Matter*. Https://Assets.Kpmg.Com/Content/Dam/Kpmg/Xx/Pdf/2017/07/Spotlight-on-the-Asset-Management-Industry.Pdf.

KPMG. (2019a). *Forging the future How financial institutions are embracing fintech to evolve and grow*. Https://Assets.Kpmg.Com/Content/Dam/Kpmg/Ke/Pdf/Thought-Leaderships/Forging-With%20bleeds.Pdf.

KPMG. (2019b, October). *10 predictions for the future of payments*. Https://Assets.Kpmg.Com/Content/Dam/Kpmg/Uz/Pdf/2020/04/Uz-10-Predictions-for-the-Future-of-Payments.Pdf.

KPMG Pulse of Fintech. (2023). *Global fintech funding falls to US$52.4bn, but it's not all bad news*. Https://Kpmg.Com/Xx/En/Home/Media/Press-Releases/2023/07/Global-Fintech-Funding-Falls-to-52-Bn.Html.

Kyle Ferreira. (2022, June 28). *White Label Business Models – A Helpful Comparison*. Https://Www.Appenate.Com/Blog/White-Label-Business-Models-Comparison/.

Lisa B. Limeri, Nathan T. Carter, Jun Choe, Hannah G. Harper, Hannah R. Martin, Annaleigh Benton, & Erin L. Dolan. (2020, July 8). *Growing a growth mindset: characterizing how and why undergraduate students' mindsets change*. Https://Stemeducationjournal.Springeropen.Com/Articles/10.1186/S40594-020-00227-2.

Lucas Liew. (2020, June 24). *What is a Walk-Forward Optimization and How to Run It?*

MARCUS REEVES, ERIKA RASURE, & SCOTT NEVIL. (2023, May 31). *Distributed Ledger Technology (DLT): Definition and How It Works*.

Marketing Skaleet. (2022, September 6). *Payments in Marketplaces - The 6 Key Considerations for Success!* . Https://Skaleet.Com/En/Blog/Payments-in-Marketplaces-the-6-Key-Considerations-for-Success/.

Martyn Hammerslay. (2012). *What is Qualitative Research?*

Mary L. Gray, & Krish Arora. (2022, December 7). *The Importance of Qualitative Research within AI Systems: Takeaways from a Leading Researcher*.

Matt Osborn. (2023, April 27). *Revolutionizing AP: AI & Machine Learning in Action*. Https://Www.Ascendsoftware.Com/Blog/Ai-in-Accounts-Payable-Revolutionizing-Invoice-Processing.

mckinsey. (2017, June). *ARTIFICIAL INTELLIGENCE THE NEXT DIGITAL FRONTIER?* Https://Www.Mckinsey.Com/~/Media/Mckinsey/Industries/Advanced%20electronics/Our%20insights/How%20artificial%20intelligence%20can%20deliver%20real%20value%20to%20companies/Mgi-Artificial-Intelligence-Discussion-Paper.Ashx.

McKinsey & Company. (2021, May). *Building the AI bank of the future*. Https://Www.Mckinsey.Com/~/Media/Mckinsey/Industries/Financial%20services/Our%20insights/Building%20the%20ai%20bank%20of%20the%20future/Building-the-Ai-Bank-of-the-Future.Pdf.

McKinsey & Company. (2022, August 17). *What are Industry 4.0, the Fourth Industrial Revolution, and 4IR?* Https://Www.Mckinsey.Com/Featured-Insights/Mckinsey-Explainers/What-Are-Industry-4-0-the-Fourth-Industrial-Revolution-and-4ir.

MICHAEL BROMBERG. (2023). *Robo-Advisor: Advantages and Disadvantages*. Https://Www.Investopedia.Com/Articles/Personal-Finance/010616/Pros-Cons-Using-Roboadvisor.Asp.

Michaela Poláková, Juliet Horváthová Suleimanová, Peter Madzík, Lukáš Copuš, Ivana Molnárová, & Jana Polednová. (2023, August). *Soft skills and their importance in the labour market under the conditions of Industry 5.0*. Https://Www.Sciencedirect.Com/Science/Article/Pii/S2405844023058784.

MinHwa Lee, JinHyo Joseph Yun, Andreas Pyka, DongKyu Won, Fumio Kodama, Giovanni Schiuma, HangSik Park, Jeonghwan Jeon, KyungBae Park, KwangHo Jung, Min-Ren Yan, SamYoul Lee, & Xiaofei Zhao. (2018, September 21). *How to Respond to the Fourth Industrial Revolution, or the Second Information Technology Revolution? Dynamic New Combinations between Technology, Market, and Society through Open Innovation*. Https://Www.Sciencedirect.Com/Science/Article/Pii/S2199853122002761.

Miu. (2023, October 5). *A Short History of AI*. Https://Miu.Sg/a-Short-History-of-Ai/.

Neelima Jauhari. (2023a, March 8). *A brief review of algorithmic trading*.

Neelima Jauhari. (2023b, March 8). *A brief review of algorithmic trading*. Https://Www.Acuitykp.Com/Blog/Ai-Algorithmic-Trading/.

Nikolaos-Alexandros Perifanis, & Fotis Kitsios. (2023, February 2). *Investigating the Influence of Artificial Intelligence on Business Value in the Digital Era of Strategy: A Literature Review*. Https://Www.Mdpi.Com/2078-2489/14/2/85.

OECD. (2023.). 21st Century Technologies: Promises and Perils of a Dynamic Future. *Https://Www.Oecd.Org/Futures/35391210.Pdf*.

OECD. (2019, June). *Regulatory effectiveness in the era of digitalisation*. Https://Www.Oecd.Org/Gov/Regulatory-Policy/Regulatory-Effectiveness-in-the-Era-of-Digitalisation.Pdf.

Digital Disruption in Banking and its Impact on Competition, (2020).

OECD. (2020). *Financial Consumer Protection Policy Approaches in the Digital Age: Protecting consumers' assets, data and privacy*.

OECD. (2021). *Artificial Intelligence, Machine Learning and Big Data in Finance: Opportunities, Challenges, and Implications for Policy Makers*.

Oji Udezue. (2023, September 29). *Why Human-Centered AI Is a Winning Strategy*. Https://Www.Cmswire.Com/Customer-Experience/Why-Human-Centered-Ai-Is-a-Winning-Strategy/.

Olav Maas. (2021, December). *Touchless Invoice Processing: The Engine of Financial Analysis*. Https://Blog.Basware.Com/En/Touchless-Invoice-Processing-the-Engine-of-Financial-Analysis.

Othman Zidane. (2021, November 24). *Global E-Commerce and the Impact of COVID-19*. Https://Infomineo.Com/Economics/Global-e-Commerce-and-the-Impact-of-Covid-19/.

Paddle. (2023.). *SaaS pricing: models, strategies, and examples*. Https://Www.Paddle.Com/Resources/Saas-Pricing-Models.

Patrick Brothers. (2018, June 7). *Education in 2030. The $10 Trillion dollar question. 5 Scenarios for the Future of Learning*. Https://Medium.Com/@patrickbrothers/Education-in-2030-the-10-Trillion-Dollar-Question-Cab902d03b15.

Patrick Mikalef, & Manjul Gupta. (2021). Artificial intelligence capability: Conceptualization, measurement calibration, and empirical study on its impact on organizational creativity and firm performance. *Https://Www.Sciencedirect.Com/Science/Article/Pii/S0378720621000082*.

Per Holmlund. (2023, September 14). *Invoice automation step-by-step*. Https://Qvalia.Com/Invoice-Automation-Step-by-Step/.

Person A. (2023). *Thesis Interview 2023*.

Person B. (2023). *Thesis Interview 2023*.

Person C. (2023). *Thesis Interview 2023*.

Peter Renton. (2023, March 10). *Podcast 418: Ralph Dangelmaier of BlueSnap*. Https://Www.Fintechnexus.Com/Podcast-418-Ralph-Danglemaier-of-Bluesnap/.

Phyllis Messalina Gilch, & Jost Sieweke. (2021). Recruiting digital talent: The strategic role of recruitment in organisations' digital transformation. *Https://Journals.Sagepub.Com/Doi/Pdf/10.1177/2397002220952734*.

PMC8753577. (2021, September 6). *Bridging skill gaps and creating future ready accounting and finance graduates: an exploratory study*. Https://Www.Ncbi.Nlm.Nih.Gov/Pmc/Articles/PMC8753577/.

Pratibha Kumari J. (2023, September 12). *Future of AI in Financial Services & Revolutionizing Financial Services with AI-Powered IT Solutions*.

Https://Www.Linkedin.Com/Pulse/Future-Ai-Financial-Services-Revolutionizing-Ai-Powered-Jha/.

Rajan Nagina. (2023). *How Artificial Intelligence Is Changing Digital Transformation*.

Rockwell Anyoha. (2017, August 28). *The History of Artificial Intelligence*. Https://Sitn.Hms.Harvard.Edu/Flash/2017/History-Artificial-Intelligence/.

Rowan Curran. (2022, October 27). *Predictions 2023: AI Will Become An Indispensable, Trusted Enterprise Coworker*. Https://Www.Forrester.Com/Blogs/Predictions-2023-Ai/.

Roy Choudhury, Kunal Jhanji, Humza Samd, Simon Gleeson, Scott Bennett, Ninad Nirgudkar, & Boston Consulting Group (New York). (2023). *Impact of Distributed Ledger Technology*.

Ryan Boder. (2022, January 18). *The first-party oracles are coming*. API3.

S N. Ankrah, & Omar Al-Tabbaa. (2015, January). *Universities-Industry Collaboration: A Systematic Review*. Https://Www.Researchgate.Net/Publication/314562766_Universities-Industry_Collaboration_A_Systematic_Review.

Sabyasachi Dash, Sushil Kumar Shakyawar, Mohit Sharma, & Sandeep Kaushik. (2019, June 19). *Big data in healthcare: management, analysis and future prospects*. Https://Journalofbigdata.Springeropen.Com/Articles/10.1186/S40537-019-0217-0.

Saidah Saad, & Bilal Saberi. (2017). Sentiment Analysis or Opinion Mining: A Review. *Https://Www.Researchgate.Net/Publication/320762707_Sentiment_Analysis_or_Opinion_Mining_A_Review*.

Sathya Jameson. (2023, May 31). *Invoice Matching*. Https://Nanonets.Com/Blog/Invoice-Matching-Explained/.

Scott A. Wright, & Ainslie E. Schultz. (2018, November). *The rising tide of artificial intelligence and business automation: Developing an ethical framework*.

Https://Www.Sciencedirect.Com/Science/Article/Abs/Pii/S0007681318301046.

Si Katara Forbes. (2023, April 21). *Robo-Revolution (Part One): The Benefits And Risks Of Automated Investing Platforms*. Https://Www.Forbes.Com/Sites/Forbestechcouncil/2023/04/21/Robo-Revolution-Part-One-the-Benefits-and-Risks-of-Automated-Investing-Platforms/.

Signifyd. (2023). A comprehensive guide to fraud detection for merchants. *Https://Www.Signifyd.Com/Resources/Fraud-101/Fraud-Detection-Comprehensive-Guide-for-Merchants/*.

similarweb. (2023.). *Adyen Uses Similarweb Data to Optimize and Scale Sales Efforts*. Https://Www.Similarweb.Com/Corp/Success-Stories/Adyen-Success-Story/.

Skillfloor. (2023, September 25). *The Role of AI in Financial Services: From Robo-Advisors to Fraud Detection*. Https://Medium.Com/@skillfloor_29561/the-Role-of-Ai-in-Financial-Services-from-Robo-Advisors-to-Fraud-Detection-810108aaf8af.

Stephen Cave, & Kanta Dihal. (2023). *Imagining AI: How the World Sees Intelligent Machines Get access Arrow*. Oxford University Press.

Steven Gause, M. (2023, October 2). *Building Skills in Students in Preparation for an AI-Centered Future*. Https://Www.Linkedin.Com/Pulse/Building-Skills-Students-Preparation-Ai-Centered-Steven-Gause-Mpa/.

Stfalcon. (2023, September 15). *The Future of Finance & FinTech*. Https://Stfalcon-com.Medium.Com/the-Future-of-Finance-Fintech-Ffa58ee206cd.

Stripe. (2023, September 1). *Five key benefits of payment gateways for businesses*. Https://Stripe.Com/Nl-Mt/Resources/More/Five-Key-Benefits-of-Payment-Gateways-for-Businesses.

Sukhpreet Singh. (2023, March 2). *Fintech and the Future of Digital Payments*. Https://Www.Linkedin.Com/Pulse/Fintech-Future-Digital-Payments-Sukhpreet-Singh/.

Svitla Team. (2023, October 19). *Use Cases of Predictive Analytics in Finance* . Https://Svitla.Com/Blog/Predictive-Analytics-Finance.

Swetha Amaresan. (2023, June 13). *Why Customer Service is Important: 16 Data-Backed Facts to Know*. Https://Blog.Hubspot.Com/Service/Importance-Customer-Service.

Tableau. (2023.). *What is the history of artificial intelligence (AI)?* Https://Www.Tableau.Com/Data-Insights/Ai/History.

Tobias Adrian. (2019, May 9). *Paving the Way for Fintech*. Https://Www.Imf.Org/En/News/Articles/2019/05/09/Sp050919-Paving-the-Way-for-Fintech.

Toshihide Endo. (2019, June 8). Introductory remarks by Commissioner Toshihide Endo. *Session 2 of the G20 Seminar on Technological Innovation "Our Future in the Digital Age."*

Traders Magazine. (2019, November 4). *What's an "Algo Wheel?" And why should you care?*

tranzzo. (2023, October 2). *Benefits and future of the Payment Orchestration Platform*. Https://Tranzzo.Com/Blog/Benefits-and-Future-of-the-Payment-Orchestration-Platform.

Tuomas Haapsaari. (2018.-a). *AI in finance: what processes to automate and what to leave alone*.

Tuomas Haapsaari. (2018.-b). *Blog: 7 things to consider when buying an AI solution to automate purchase to pay process*. Https://Www.Snowfox.Ai/Blog/Blog/7-Things-to-Consider-When-Buying-an-Ai-Solution-to-Handle-Purchase-Invoices.

TUOMAS HAAPSAARI, PER ÅBERG OPUSCAPITA, & TOMMI KOUHI OPUSCAPITA. (2018, March). *Why are we lacking invoice automation and how to fix it?* Https://Www.Snowfox.Ai/En/Why-Are-We-Still-Lacking-Invoice-Automation-and-How-to-Fix-It.

U.S. DEPARTMENT OF THE TREASURY. (2018). *A Financial System That Creates Economic Opportunities Nonbank Financials, Fintech, and Innovation*.

Usman Aslam. (2022). Understanding the usability of retail fashion brand chatbots: Evidence from customer expectations and experiences. *Https://Www.Sciencedirect.Com/Science/Article/Abs/Pii/S0969698923001248*.

VARTEQ Inc. (2023, August 25). *The Rise of AI-driven Robo-Advisors and Their Impact on Wealth Management*. Https://Www.Linkedin.Com/Pulse/Rise-Ai-Driven-Robo-Advisors-Impact-Wealth-Management-Varteq/.

Venny Turner. (2023, July 24). *The Evolution of AI: From Rule-Based Systems to Machine Learning*. Https://Medium.Com/@vennyturner/the-Evolution-of-Ai-from-Rule-Based-Systems-to-Machine-Learning-Af66d6ce88eb.

Virtual Internships. (2020, August 4). *5 Soft Skills That Stand Out To Employers*. Https://Blog.Virtualinternships.Com/5-Soft-Skills-to-Stand-out-to-Employers.

WORLD ECONOMIC FORUM. (2015, October). *The Future of FinTech A Paradigm Shift in Small Business Finance*. Https://Www3.Weforum.Org/Docs/IP/2015/FS/GAC15_The_Future_of_FinTech_Paradigm_Shift_Small_Business_Finance_report_2015.Pdf.

World Economic Forum. (2020, October 20). *The Future of Jobs Report 2020*. Https://Www.Weforum.Org/Publications/the-Future-of-Jobs-Report-2020/.

worldline. (2023, September 1). *How payment orchestration puts merchants in control*. Https://Worldline.Com/En/Home/Main-Navigation/Resources/Resources-Hub/Blogs/2023/How-Payment-Orchestration-Puts-Merchants-in-Control.Html.

Xiaofei Wang, Ren Xiaoxu, Chao Qiu, Zehui Xiong, Haipeng Yao, & Victor C.M. Leung. (2022). *Integrating Edge Intelligence and Blockchain: What, Why, and How*.

Xiaomin Mou. (2019, September). *Artificial Intelligence: Investment Trends and Selected Industry Uses*. Https://Documents1.Worldbank.Org/Curated/En/617511573040599056/Pdf/Artificial-Intelligence-Investment-Trends-and-Selected-Industry-Uses.Pdf.

Xu, Y., Liu, X., Cao, X., Huang, C., Liu, E., Qian, S., Liu, X., Wu, Y., Dong, F., & Qiu, C.-W. (2021). Artificial intelligence: A powerful paradigm for scientific research. *The Innovation*, *2*(4).

Yangtao Kong. (2021, October 22). *The Role of Experiential Learning on Students' Motivation and Classroom Engagement*. Https://Www.Frontiersin.Org/Articles/10.3389/Fpsyg.2021.771272/Full.

Yogesh K. Dwivedi, Anuj Sharma, Nripendra P. Rana, Mihalis Giannakis, Pooja Goel, & Vincent Dutot. (2023). Evolution of artificial intelligence research in Technological Forecasting and Social Change: Research topics, trends, and future directions. *Https://Www.Sciencedirect.Com/Science/Article/Pii/S0040162523002640*.

Yogesh K. Dwivedi, Elvira Ismagilova, D. Laurie Hughes, Jamie Carlson, Raffaele Filieri, Jenna Jacobson, Varsha Jain, Heikki Karjaluoto, Hajer Kefi, Anjala S. Krishen, Vikram Kumar, Mohammad M. Rahman, Ramakrishnan Raman, Philipp A. Rauschnabel, Jennifer Rowley, Jari Salo, Gina A. Tran, & Yichuan Wang. (2021, August). *Setting the future of digital and social media marketing research: Perspectives and research propositions*. Https://Www.Sciencedirect.Com/Science/Article/Pii/S0268401220308082.

APPENDICES

Questionnaire with semi-structured questions for the interview that was conducted:

Section 1: Introduction and Professional Background

1. **Introducing Themselves**: "Could you please start by introducing yourself, including your current role and a brief overview of your professional background in the financial industry?"
2. **Duration in the Field:** "How long have you been working in the financial industry, and how has your role evolved over time?"
3. **Professional Role Description**: "Can you describe your job in the financial industry and the tasks you handle on a daily basis?"

Section 2: Understanding of AI in Finance

4. **Perception of AI in Finance**: "What does 'AI skill gap' mean to you in the context of your work?"
5. **Experience with AI Tools**: "Could you share any specific AI tools or technologies you currently use or encounter in your role?"

Section 3: Challenges and Adaptation to AI

6. **Adaptation Challenges**: "Have you faced any challenges in adapting to AI technologies in your financial work?"
7. **Essential Skills in AI-driven Finance**: "What skills do you think are essential for success in the financial industry today?"

Section 4: AI Skill Proficiency and Development

8. **Self-Assessment of AI Skills**: "How would you rate your proficiency in AI-related skills, and are there areas where you'd like to improve?"
9. **Training and Educational Programs**: "Have you participated in any training or educational programs to enhance your AI skills in finance?"
10. **Obstacles in Skill Acquisition**: "What obstacles do you see in acquiring AI skills within the financial industry?"

Section 5: Staying Updated and Organizational Support

11. **Keeping Up with AI Developments**: "How do you stay updated on the latest AI developments that may impact your work?"
12. **Organizational Support for AI Skills Development**: "How supportive is your organization in helping employees develop AI skills?"

Section 6: Future of AI in Finance

13. **Potential AI Tools and Technologies**: "Are there any specific AI tools or technologies you believe could benefit financial professionals but aren't widely used yet?"
14. **Role of Industry Collaborations**: "What role do you think industry collaborations could play in addressing the AI skill gap in finance?"

Section 7: Ethical Considerations and Closing the Skill Gap

15. **Importance of AI Skills for the Future**: "How important do you believe AI skills are for the future of financial professions?"

16. **Ethical Concerns in AI Usage**: "Are there any ethical concerns related to AI use in finance that you find noteworthy?"
17. **Strategies for Addressing the Skill Gap**: "What suggestions or strategies do you have for closing the AI skill gap for financial professionals?"

Section 8: Conclusion and Additional Insights

18. **Final Thoughts**: "Is there anything else you'd like to add that we haven't covered?"