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Artificial Intelligence: An analysis of perceptions of the impact of AI on the financial labour market

Kanokkorn Moilanen

AI technology has become increasingly prevalent within the finance sector and undeniably, the impact of AI has been revolutionary and will continue to progress and become the basis of multiple innovative ideas and technologies. On the contrary, AI may result in uneven gains in the labour market as a result of multiple job displacements and/or lead to an increase in unemployment. Artificial Intelligence is a topic of significant importance in all spectrums of its capabilities and influence on people's everyday lives. The focus of this thesis remains predominantly on the finance industry. This research aims to analyse people's perceptions of the impact of artificial intelligence (AI) on the financial labour market. The purpose of this is to analyse the perceptions surrounding how and to what extent AI affects the financial labour market. Understanding an individual's perceptions of the impact is just as insightful as people are likely to steer their actions accordingly to their perceptions.

A survey was conducted whereby the sample selection process was based on voluntary response sampling via requests placed on LinkedIn. The sample retrieved included 46 respondents who were then sorted into strata based on their knowledge on the finance sector and its developments. The data was interpreted using two methods, interpretation by calculating the correlation coefficient and by cross tabulation. The results demonstrated that knowledge on the finance industry would influence the strength of their perceptions and their ability to justify them. In addition, there were varying perceptions on employment as a result of AI implementation per sector whereby the most impacted sector is believed to be accounting. The results also displayed that those who perceived there to be an increase in AI consequentially perceived a greater impact on the labour market levels in the finance industry.

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1 INTRODUCTION

Artificial Intelligence continues to be a topic of significant importance in all spectrums of its capabilities and influence on people's everyday lives. Artificial intelligence refers to algorithms that learn to complete tasks by identifying statistical patterns in data to essentially mimic human actions and patterns (Reynoso, 2019). Artificial Intelligence has continuously provided a strong basis for technological innovation in all sectors of business including the marketing sector, logistics, as well as the finance sector. Artificial Intelligence from here henceforth will be referred to under the abbreviation, "AI". AI acts as a catalyst for economic growth and technological innovation for businesses and economies due to the obvious advantages of AI applications. The focus of this thesis remains predominantly on the finance industry. This research aims to analyse people's perceptions of the impact of AI on the financial labour market.

There are numerous benefits of AI technology implementation in the finance industry; the benefits may include cost reduction, increased efficiency, and the development of customized services/programs (e.g. personalized banking applications) (Marr, 2019). Also, AI technology has become increasingly prevalent within the finance sector, especially concerning personalized banking, trading, fraud prevention and a few other key aspects of the finance industry. Undeniably, the impact of AI has been revolutionary and will continue to progress and become the basis of multiple innovative ideas and technologies.

New innovative technology such as AI may result in uneven gains in the labour market due to multiple job displacements and/or multiple losses of jobs. The range of industries that AI can be associated may vary from "low wage" occupations to "high wage" occupations. The occupations vary on a spectrum from the agricultural sector, to the business sector, to the medical sector. This may result in employment inequality displacing workers' jobs and replacing them with automated systems configured based on AI technology and algorithms. This displays the advantages and disadvantages of AI in the financial labour market and demonstrates how the impact of AI technology remains debatable within the labour market. (Reynoso, 2019) (Keynes, 1937)

1.1 Background Information

AI's technological development throughout history has impacted multiple different business markets, industries, governments, and general day-to-day life for many individuals. AI is a form of computer science and algorithms which focus on "*machine-driven intelligence*" (Reynoso, 2019). As aforementioned, AI identifies statistical patterns in data to mimic human actions and patterns to think, act and learn similarly to humans. The entire concept of AI began with the assumption and notion made by John McCarthy (1989) that human thought processes such as "*logical reasoning and common-sense knowledge*" can be replicated, mechanised, and automated. (McCarthy, 1989)

AI rapidly gained popularity in the 1960s, consequently leading to further research and development in the late 20th century. Since then, it has been evolving and strengthening the modern understanding of what AI is, and exploring the full extent of its capabilities.

AI technological development in the business industry has widespread applications. The most common forms of AI tech include, virtual assistance, decision management, deep learning platforms, and data analytics where AI technology has been applied (UIPath, 2020). This is done for a multitude of reasons such as: to improve customer service, automate daily tasks, optimize routine processes, predict performance/behaviour, and analyse data to come up with meaningful insights into the market or the business's assets, brand, etc. Multiple well-known corporations such as Sony, Heineken, Apple, and Amazon all utilise AI technology to their advantage (Marr, 2019).

There is a mass platform for theoretical background on the roles of innovate technology on its effects in shaping future employment. Predominantly, neoclassical, and classical economic theory suggest that innovative technologies increase a company's productivity and efficiency. The claim that technological development negatively influences employment levels was first introduced by economist, John Maynard Keynes. Keynes (1937) suggested that technological innovation would directly replace and eventually displace workers from their job as well as increase demand for labour in jobs that come into existence due to these technological innovations. (Keynes, 1937)

In order to get a grasp of different perspectives, A study/theory will be explained and analysed to better understand the perceptions behind the role of AI in shaping future employment. The study is significantly newer than the classic Keynesian theories, in doing so, this provides a more modern approach and understanding of how AI is believed to impact current day employment in the finance industry. This also provides a basis for a multi-faceted approach to examining the impacts of AI on labour in more general terms.

1.2 Research Objectives

This research aims to analyse people's perceptions of the impact of AI the financial labour market. The purpose of this is to analyse the perceptions surrounding how and to what extent AI affects the financial labour market. This topic has become highly relevant, especially in the last couple of decades, due to a substantial increase in unemployment as a result of the progression and active implementation of AI into various markets (Sulleyman, 2017). More specifically, the finance market has taken a hit in their employment levels due to the expansion of automated processes and the use of AI tech and algorithms within the industry (Sulleyman, 2017). This consequently leaves many individuals at the loss of a job or have been displaced in their sector as a result. Assessing the impact of AI on labour markets is difficult as AI is still relatively new and progressive technology.

However, understanding individual perceptions of the impact is just as insightful as people are likely to steer their actions accordingly to their perceptions. This may be a key factor when developing a framework for guidelines and policies for promoting efficient labour markets to the benefit of all parties (i.e. employees, shareholders, investors, and employers). This is an assumption formed as an individual's perception of a situation may correlate with their actions and decisions with said situation.

1.3 Research Questions

With this being said, this research poses the following research questions:

1. Do perceptions vary per individual depending on their knowledge of the finance industry and it's developments?

2. What are the advantages and disadvantages of implementing AI technology compared to predominantly maintaining the use of human labour within the finance industry?

3. Are there varying perceptions of the impact on employment levels per department (e.g. banking and accounting) in the finance industry?

4. To what extent does the level of implementation of AI into the finance industry consequently impact people's perceptions of the employment levels in the financial labour market?

These research questions will be used to guide this study thoroughly in the following research paper.

2   LITERATURE REVIEW

2.1 Artificial intelligence vs. Automation

Often, the terms "*artificial intelligence*" and "*automation*" are used interchangeably and for further understanding it is crucial to identify the difference between the two terms. AI technologies continue to develop and flourish within the finance industry and a lot of this technology is still a relatively new concept within the past decade whereas automation is a much older concept. The terms "*automation*" and "*artificial intelligence*" are often used interchangeably. This is due to the fact that they are both associated with software, algorithms, and/or machinery which increase efficiency. Automation has the ability to be based on AI but the essential difference between the two is the level of complexity involved with each system.

Automation is more simplistic as the general idea of automation is to make a software which is capable of processing and doing actions automatically with minimal to no human intervention (Goldberg, 2012, p.9). Alternatively, AI refers to the algorithms and engineering processes used to form intelligent machines in order for to make these machines and software's mimic human behaviour and processes (McCarthy, 1989). This process should be done with minimal human intervention. The software should be

programmed to mimic the tasks which would have been done by humans in order to streamline processes and increase speed as well as efficiency. (Francis, 2018)

2.2 Historical background on Artificial Intelligence

AI's technological development throughout history has impacted different business markets, industries, governments, and general day-to-day life for many individuals. AI is a form of computer science and algorithms which essentially focus on "*machine-driven intelligence*" (Reynoso, 2019). As aforementioned, AI identifies statistical patterns in data to mimic human actions and patterns to think, act and learn similarly to humans. The entire concept of AI began with the assumption and notion made by John McCarthy (1989) that human thought processes such as "*logical reasoning and common-sense knowledge*" can be replicated, mechanized, and automated. (McCarthy, 1989)

The history of AI is immense and goes back through decades of research and development. AI had been conceptualized as far back as the early 1700s in English literature (UIPath,2020). However, the time of major advancements and the birth of AI was during the 1950s where research by Alan Turing and John McCarthy had revolutionised the world. Initially, the foundation of AI had been tested in research by renowned scientist and mathematician, Alan Turing, which consequently led to his published research, "*Computing machinery and intelligence*" (Turing, 1950). His research focused on the idea of the imitation game (later referred to as the Turing test) which put into question whether machines could think. This laid down foundations for future discussions on intelligence and consciousness in machines. (Turing, 1950)

The term "*artificial intelligence*" was first coined by computer scientist pioneer John McCarthy in 1955 after defining the field of research purely devoted to the development of intelligent machines (UIPath, 2020). This was done with the help of a team that participated in a workshop on AI which later led to the development of LISP (a programming language for AI applications) in the late 1950s (Reynoso, 2019). Not long after the revolutionary discovery, a mass innovative period was provoked in the following decade in the 1960s. This was a catalyst for the outburst of multiple fields of research related to AI. Turing and McCarthy's foundations began research which led to the

formation of new programming languages, automated robots, and interactive computer programs in the late 20th century (UIPath,2020). AI had rapidly gained popularity in the 1960s, consequently leading to further research and development in the late 20th century. Since then, it has been evolving into the 21st century into forming and strengthening the modern understanding of what AI is and the full extent of its capabilities. Safe to say, AI has reached capabilities far beyond any fantasy in the early 20th century and has now become a palpable reality that continues to defy expectations on innovative ideas, projects, and concepts as the decades go on.

2.3 Automation in the Business Industry

Technological development in the business industry has had widespread applications in all sectors of business. The most common forms of AI tech include automation, virtual assistance, decision management, deep learning platforms, and data analytics. This is done to improve customer service, automate daily tasks, optimize routine processes, predict performance/behaviour, and analyse data to come up with meaningful insights into the market or the business's assets, brand, etc. Multiple well-known corporations such as Sony, Heineken, Roomba, Apple, and Amazon all utilize AI technology to their advantage (Marr, 2019).

AI has had a substantial impact on the business industry as it has become intertwined in multiple operations in all sectors of business including, marketing, logistics, retail, and finance. AI technology for a business is seen as a valuable asset as it immediately provides them with a competitive advantage relative to cost and timesaving. Businesses implement AI technology from the bottom stage of the business life cycle upwards through their operations. This is done by understanding consumers' needs/demands, optimizing warehousing, optimizing delivery routes, and improving overall operations and customer service. (Zammuto, 2017)

2.4 Automation in the Finance Industry

Automation in the finance sector refers to the use of software's and programmes to automate relevant daily and key tasks such as ledger entries and financial statement

preparations. This process should be done with minimal human intervention as the software should be programmed to mimic the tasks which would have been done by humans to streamline processes and increase speed and efficiency. (Francis, 2018)

There are multiple benefits to automating processes in a business, increased efficiency being one of the most prevalent advantages. Automating the finance sector in a business additionally allows for increased data integrity, quicker approvals, improved decision making, centralized visibility and control, and multiple other benefits (Team, 2019). Nevertheless, there are some risks posed by automating a business's finance sector. These risks include issues concerning regulatory compliance for reporting, tech-related issues, potential loss and/or displacement of jobs, inaccuracies in reporting and compatibility issues with existing technological platforms within the business (Knowles, 2018).

One of the most popular technologies used in finance sector automation is the use of robotic process automation (RPA). RPA involves the use of specialized computer programmes (also referred to as robots) to automate and standardize actions and/or tasks. The performances are repeated identically each time and are standardized, meaning that they do not learn or change their actions from one repetition to another. RPA is often used alongside human labour to help them with redundant tasks to ease off their workload and use their valuable time for more important tasks at hand. The way RPA Robots essentially work is through mimicking the actions of human users. This may involve simple redundant tasks such as moving files, copying and pasting, and auto filling a form. A simple example of RPA is the automatic response email function. (UIPath,2020)

RPA is often mistaken to be a form of AI, however, despite baring similarities to AI technologies they are remarkably different forms of technology. RPA and AI are two of the most notable and successful technologies for businesses to possess in order to organise, automate, and streamline their business processes and achieve other corporate goals. However, the key difference between RPA and AI is regarding their use in conjunction with humans or alternatively their use in the replacement of humans. Fundamentally, RPA is used in coordination and alongside people by using structured input and logic by predetermined programming. This is referred to as attended automation. Alternatively, AI is used in replacement of people and human labour to

automate end-to-end processes by using unstructured inputs and developing a logic of its own based on predetermined programming. This is referred to as unattended automation. (Bots, 2018) (Belanche, Casaló & Flavián, 2019)

2.5 Machine Learning

Machine learning as described by IBM Cloud Education (2020), "*focuses on applications that learn from experience and improve their decision-making or predictive accuracy over time*". The term machine learning is often intertwined with AI as it is a key branch of AI that allows softwares, applications, and systems to learn from experience and consequently improve the level of accuracy over a period of time without being explicitly programmed to do so. This is done through algorithms which learn to identify statistical patterns in data to mimic human actions and patterns in order to make suitable and accurate decisions ad predictions based on presented data. IBM Cloud Education (2020)

2.6 Artificial Intelligence in Business

As a result of the development and implementation of AI technology and algorithms into the business industry, there have been major implications in the labour markets. This had been initially represented after the invention of the industrial robot in the 1950s by George Devol which was introduced into assembly lines in manufacturing factories such as General Motors. Initially, these robots were built to complete tasks that were seen to be too dangerous for humans to complete. These robots not long after had some alterations to optimise and automate the invention to increase efficiency. This resulted in companies implementing these industrial robots into their assembly lines to do more basic and redundant manufacturing tasks that had previously been done by humans. As a result, there was a large number of lay off's as companies quickly realized that the industrial robots could do simple daily and repetitive tasks quicker and more efficiently. (Reynoso, 2019)

The postulation of technological development negatively influencing employment levels was first introduced by economist, John Maynard Keynes. He fundamentally changed the practice of macroeconomics with his set of theories which now comprises Keynesian

economics. Keynes (1937) suggested that technological innovation would influence employment levels in two ways. Firstly, by directly replacing workers from tasks they were previously assigned to and performing, and therefore, displacing workers from their job. Secondly, by increasing demand for labour in jobs that come into existence due to these said technological innovations and progress, such as programmers and engineers. (Keynes, 1937)

2.7 AI Technology in the Finance Sector

This section of this thesis discusses AI technology within the finance sector. The term "FinTech" is an important definition to mention especially when discussing AI technology in the finance industry. "FinTech", short for, "Financial Technology" is defined as "*…technologically enabled financial innovations that could result in new business models, applications, processes, or products with an associated material effect on financial markets and institutions…*" (Financial Stability Board, 2017). FinTech solutions often make use of AI technologies and is being introduced at an exceptional rate. While not necessarily a new concept, the focus lens on AI technological innovations have been amplified and is progressing at a rapid rate which have led to massive changes in the industry. This increase in the presence of AI in the financial industry has led to weakened bonds. This implies that bonds previously tying together and composing the key components of the binding financial institutions have now begun divulging into new operating models, systems, and financial processes (Deloitte, 2020).

Academics, scientists, and engineers have actively developed advanced techniques and models to utilize the large data sets within the finance industry and gain insights quickly and accurately. This has been achieved by implementing AI to utilize computational tools to complete tasks which "*traditionally require human sophistication*" (Financial Stability Board, 2017) and perform said tasks by learning from experience (Brito, 2014). In this research, the focus lays predominantly within the frame of the applications of AI in accounting and banking. Each sector plays a substantial role in the finance industry and is prevalent in people's everyday lives.

While the core objectives of financial accounting have remained, the revolutionary methods and AI technologies implemented have challenged the traditional accounting methods, processes, and the delivery of these services. This is because AI has vigorously displayed increases in productivity, efficiency, accuracy, and all at a reduced cost. (Smith, Brian, and Wilson., 1997, p. 1105-1130). The processes in which AI can and has taken over include bookkeeping (e.g. processing of accounts payable and receivables), audit, and forecasting.

Bookkeeping is a very routine process which requires a lot of time input into competing the tasks. Due to the redundant and repetitive nature of bookkeeping it becomes highly susceptible to automation and allows for AI implementation to complete the work. The bookkeeping process involving recording transactions into ledgers/journals and the coding of accounting entries into the either the balance sheet or income statement can be fully automated by using machine learning algorithms and software. In addition, the accuracy of data and speed of the recording will increase overall therefore increasing efficiency.

Moreover, another process where AI can be implemented into is forecasting, specifically, revenue forecasting. Revenue forecasting defines a firms budget and allows for the formation of medium-to-long term planning and preparation by calculating the amount of money/revenue that a firm would receive from sales during a given time period (Danninger, Cangiano, and Kyobe, 2005). Forecasting is prone to uncertainties, inaccuracies, and information asymmetry which results in inaccurate forecasts despite using valid models and techniques. Due to the heavy reliance on the forecast for the planning and budgeting it is crucial for the revenue forecasts to display as accurate of a forecast as possible. In order to improve the level of certainty, AI technology and algorithms may be applied. By implementing AI and their predictive models and algorithms, this would consequently improve their budgeting and strategic management within the firm (Ul Huq, 2014). However, human labour completed by accountants still proceeds to play a parallel role in the revenue forecasting. This is because the accountants are required to input and monitor the data and the quality of the data being used for the revenue forecasts and forecasting models (Shimamoto, 2018).

Lastly, auditing has substantial potential and prospects for AI application as a Computer Assisted Auditing Tools and Techniques (CAATTs). AI can be used in combination with and for assistance to auditors. Auditors are able to manage entire financial ledgers through an automated analysis software which would then be sorted into sets of transactions. These sets would then be provided to an AI tool which would identify any patterns prevalent providing a basis for what should be considered to be "normal transactions" and alternatively, "abnormal transactions". This process is without susceptibility to bias by the AI tool as the AI tool can only analyse and identify patterns based off of the data and information provided by the auditor. Auditors will continue to be required in the finance industry, though their role in audits may change from executing the performance into designing the performance and procedure by monitoring the effectiveness of the interpretation as well as themselves interpreting the results. (Shimamoto, 2018)

AI and automated software have become the favoured functionary of choice within the banking sector as artificially intelligent programs and machines have now been replacing many human-initiated tasks and have been handed off to websites, robots, and applications (Lin, 2016., p 652). Applications of AI in banking range from peer-to-peer lending, robot advisory such as in portfolio management and credit evaluation (Giudici, 2018).

Within the banking sector of the finance industry, the introduction of AI has been swift and escalating day-by-day. A very common application of AI within the banking sector is the use of automated consultants or otherwise known as, robot advisors. Robot advisors in practical use are used to build personalised investment portfolios for instance. This is done based on the inputted data containing the investor's information such as his/her age, risk tolerance, net income, etc. (Deloitte, 2020). The AI software then proceeds to classify investors into risk classes whilst also providing the account investor with suitable portfolio prospects (Giudici, 2018). In addition, banks are also implementing AI and the robot advisors to streamline customer processes such as identification and authentication. The robot advisors also mimic customer service employees through the chatbot function for instance; this provides customers with quick access and solutions to their inquiries whilst still receiving personalised insights and recommendations (Digalaki, 2019).

2.8 Impact of AI in the Finance Labour Market

The impact of AI in the finance labour market is a heated topic of discussion amongst many researchers and professionals working within the field. The negative impact on the labour markets associated with AI has been discussed by CEO's, economists, and scientists where many perceive AI matching human intelligence to be an inevitable and given contribution into the "*ending of mankind*" (Kontzer 2015). On the other hand, there are some economists such as Burnstein and researchers, Stewart, De & Cole (2015), who take a more optimistic stance on the impact of AI on the finance labour market, claiming that the negative effects are considerably exaggerated and without consideration for the positive effects.

Well-renowned co-founder of Tesla, Elon Musk, has actively shared his opinion on the impact of AI on the labour market in general. During the World Government Summit in 2017, Musk claims that "*human have already started losing their jobs to machines*" (Sulleyman, 2017). Labour displacement and unemployment often occurs in rapid waves post-AI implementation if new positions and roles for individuals are not created or figured out. Moreover, another acclaimed physicist, Stephen Hawking, has similarly warned people of the likes of the dangers of AI implementation and progression. He claims that humans "w*ho are limited by slow biological evolution, couldn't compete and would be superseded*" (Cellan-Jones, 2014). This insinuates that humans who may be less skilful or slower in certain aspects of their respective jobs would not be able to compete with the pace and efficiency of AI. To the contrary, there are those who promote AI implementation and have an optimistic stance on AI implementation. As aforementioned there are still some economists such as Jeff Burnstein who disputes the "exaggerated" negative effects and claims on the impact of AI on the labour market. Burnstein instead claims the opponents views are highly exaggerated and jobs will be created and/or renewed the further along AI technology is applied in the finance market and will compensate for the initial loss of jobs (Kontzer 2015). Furthermore, research conducted has also supported the idea of AI having a positive impact on the financial market. This is demonstrated by Tene & Polonetski (2013) where their research demonstrates that there are approximately five to six percent increases in efficiency when AI use is active in the finance industry relative to individual sectors (Tene & Polonetski, 2013).

2.8.1 Makridakis, 2017 – AI *revolution: Its impact on society and firms*

The theory posed by Spyros Makridakis (2017) aimed to examine "analogous inventions of the industrial, digital and AI revolutions" in order to determine what role individuals will play given that their jobs would be substituted, supplemented, or amplified by AI. Makridakis argues that the future of employment could result in four plausible scenarios which present four different perceptions of AI impact on human lives and its societal environment and labour patterns, respectively. The four scenarios was used to attempt to answer his research question: "*what will the role of humans be at a time when computers and robots could perform as well or better and much cheaper, practically all tasks that humans do at present?*" (Makridakis, 2017, p. 50). The four scenarios/perspectives are presented in table 1. The table is a summary of the four scenarios derived from the original study in 2017 by Makridakis titled "*The forthcoming Artificial Intelligence (AI) revolution: Its impact on society and firms*". Table 1 is as summarized by Eleonora Stancheva, a notable professor in finance and accounting.

Scenarios	General implications	AI impacts on employment
Optimistic (utopian)	• An era of nanotechnology, genetics and robotics; • People use to the highest possible extend computers' capacities; • Genetics enables changing of humans genes to avoid diseases and extend humans lives.	• Robots fully substitute humans at their work; • Humans spend their free time on leisure activities and work what they actually want.
Pessimistic	• Machines take control over the most important decisions; • Humans become endangered species; • Complex societal problems occur.	• Humans are reduced to second rate status and are fully substituted by computers; • People are not motivated to work and leave all important decisions to computers; • Full labour displacement by computers.
Pragmatic	• Control over AI technologies and their strict effective regulation; • People manage to stay a step ahead of AI.	• People exploit the power of computers and augment their skills and human decision making.
Doubting	• AI never become threat to humanity; • Computers never achieve human ability to be creative.	• In all tasks requiring creativity humans keep clear priority over the computers.

Table 1: The Four Scenarios – Source: Stancheva, Eleonora. (2018).

The four scenarios are titled as follows in the original study: the optimists, the pessimists, the pragmatists, and the doubters. The optimists similar to those of the likes of Ray Kurzweil, essentially predict a utopian future with genetics, nanotechnology, and robotics where individuals are able to use most efficiently computers to their full capacity therefore allowing humans "*to harness the speed, memory capacities, and sharing ability of computers and our brain being directly connected to the cloud*" (Makridakis, 2017, p.50) implying that robots will fully substitute human labour (Kurzweil, 2005). This is seen to be the optimistic point of view as once robots substitute and replace humans, then humans are able to freely dedicate their time to leisure.

On the other hand, the pessimists scenario, claim that powerful AI technologies will drive humans to become an endangered species due to the advancements of AI intelligence respective to the increased complexities of societal issues. This was then said to result in intelligent machines making big important decisions on the behalf of humans. This is said to result in humans being second-in-command and will be dependent on computers taking initiative and effective control of important decisions where in the long term will eventually lead to full labour displacement as humans will lose the motivation to work.

The third scenario is the pragmatists, such as John Markoff (2016), who have the perspective who believe AI can be controlled through effective regulation whereby humans would eventually learn to utilize the power capacities of computers to alter and expand our own knowledge to always supersede AI intelligence. Pragmatists claim they can minimize the dangers of AI, as feared by pessimists, by placing research and development efforts predominantly on intelligence augmentation and AI.

The last scenario/perspective are the doubters. Doubters essentially believe that AI is not possible and "*... it will never become a threat to humanity*" (Makridakis, 2017, p. 52). Doubters argue that human intelligence, expertise, and creativity cannot be duplicated under clear consigned paradigms. The main viewpoint and proponents of optimists or pragmatists is the claim that the viewpoints of optimists are unwarranted and possess multiple false assumptions upon the idea that human intelligence functions based on information processing as a computer does. Moreover, doubters fundamentally believe

that the creativity in humans will always surpass a computers value and therefore result in humans pertaining clear superiority over AI technology and machinery. (Makridakis, 2017)

The ideology behind all four scenarios are significantly different from one another and are all very extreme ends of each scenario. The scenarios should be looked at with a close eye and should not be taken literally but rather as a framework to understand the core perceptions of individuals and why they come about. There are clear issues with probability and objectivity with the scenarios but as aforementioned, this should be used as a framework to support ones understanding rather than a definitive reasoning for individuals perceptions. Perceptions are a product of an individual's own thoughts, fears, imagination, and opinions. As a result, this makes perceptions highly subjective and personal.

3 METHODOLOGY

This chapter aims to review the research questions through the utilisation of a methodological approach. The chosen approach should bring to light an individual's perception of the following: their opinion on the advantages and disadvantages of implementing AI technology compared to predominantly maintaining the use of human labour within the finance sector, whether the impact on employment would vary per department in the finance industry, and ultimately providing an overview of an individual's perception on the employment levels in the financial labour market as a result of AI implementation. Lastly, the empirical section of this study seeks to answer whether or not perceptions vary per individual depending on their knowledge of the finance sector and it is developments. The empirical data gained is utilised with the aim to provide an answer for all four research questions. The chosen method involves a quantitative approach for analysis, as the choice of method is a survey.

The methodology chapter further discusses the method chosen, sample selection process, how the data is collected and analysed as well as any concerns regarding validity and reliability of the approach.

3.1 Quantitative Analysis

For this study, a quantitative approach was selected. This is due to the fact that the method of choice, being a survey, allows for the use of close ended questions and rating questions to be used to then be analysed using correlation and cross tabulation. By implementing quantitative analysis this allows for the study to address "does X vary with Y", "to what extent", and "how often" (Yin, 2004).

A quantitative method analysis was chosen as the research method. The quantitative method analysis deals with understanding the relationship between one thing and another within a sample population. As suggested by Firestone (1987) the use of a quantitative method analysis is beneficial as it de-emphasizes individual judgement whilst maintaining the use of "…established procedures, leading to results that are generalizable to populations" (Firestone, 1987). This often involves the use of statistical and/or numerical analysis to measure and understand the relationship or lack of. The use of a quantitative method analysis allows for a statistical-based understanding into the relationship between the independent variable and the dependent variable

3.2 Method – Survey

The method chosen for this study is a survey. Conducting survey for easy administration, a broad range of data collection (sample size and data amount) and can be conducted remotely which is highly advantageous due to the ongoing corona pandemic whilst this study is being conducted. A survey allows for multiple questions to be asked, including open-ended questions which give participants more flexibility in their answers to go in-depth. Also, rating questions to rate their feelings toward a situation on a given scale making it quick and easy to answer, as well as closed questions providing a simple yes or no answer for instance. The dependent variable in this survey was the respondents and the independent variables was the questions asked as the researcher can selectively choose the questions.

3.2.1 Survey construction

The general plan for the construction of the survey is as follows. The process of survey construction required focus on all four different approaches to the analysis, the research questions and to form questions relevant to them. The idea is to ensure the questions reflect the variables and will provide empirical data to answer the research questions at hand. This required the research to distinguish between four main categories of questions: general demographic, experience/knowledge on the finance industry, opinions on AI, and lastly, the perceived general impact. The third category of "opinions on AI" requires sub-categories concerning: perceived advantages and disadvantages of AI, AI in various sectors and, perceptions on employment level in various sectors. The fourth category is to act as a summary and will pertain more general questions which evidently ties all concepts together from the questions in the survey to gather a broader outlook on the individual's perceptions.

3.3 Data collection

This section describes the process and procedures used to recruit participants in the sample selection process. It also describes the data interpretation process describing which data analysis tools were used, why they were used and how they were applied onto the data retrieved from the survey.

3.3.1 Sample Selection

The sample selection process was based on voluntary response sampling. The voluntary response sampling involved putting out a request to answer the survey on LinkedIn. The sample has no requirement for finance knowledge. To adjust for the variable for the level of finance knowledge, students, working professionals, and finance-workers are suitable for this group. The choice to gather the sample from LinkedIn allows for a more targeted group in the sense that those volunteering are those who are suitable for partaking in the survey. Posting the survey on LinkedIn avoids any random and/or spam responders and gives access to the survey to those interested in answering or interested in the topic. Limitations of this method of sampling include the geographical demographic of the individual is limited to those living in Europe which may not reflect for a more "global"

view. Following this, the sample retrieved was sorted into strata based on whether their knowledge on the finance sector and it is developments. Their level of knowledge was based on their occupations, general day-to-day interactions concerning the finance industry, and usage of any relevant applications whereby AI in the finance industry was implemented. This was to cover for both conscious and aware knowledge as well as what could have been knowledge, they were not directly aware of. This is done to account for the fourth research question.

3.4 Data interpretation

The data was interpreted in two parts, interpretation by calculating the correlation coefficient using Pearson's correlation and by cross tabulation. The quantitative data retrieved comes from the data from rating questions and yes/no close-ended questions.

The data was analysed to find the correlations as mentioned below by finding the correlation coefficient and the data was also cross tabulated to analyse any variations. Data sets will then be compared alongside each other to pinpoint recurring patterns and/or variations in their perceptions. This is done to determine whether there are varying perceptions and to understand whether they are generally more negative, positive, or equal. The discussion section of this thesis will go into details further. The empirical data retrieved from the surveys will then be used to analyse four different correlation sets in order to answer the four research questions proposed.

The first analysis was to answer the research question on whether perceptions would vary per individual depending on their knowledge of the finance industry and it is developments. This also represents the strata into which the respondents was divided into based on their level of knowledge and experience on the finance industry.

The second analysis aims to answer the research question, "to what extent does the level of implementation of AI into the finance industry consequently impact people's perceptions of the employment levels in the financial labour market?". Where respondents perceived benefits of utilisation of AI technology was measured against their perception of the general impact on labour levels.

The third analysis used was to display how the data analysis would approach understanding the correlations and/or variations between each individual finance departments and the perceived impact on employment levels post AI implementation. This answers the the research question, "Are there varying perceptions of the impact on employment levels per department (e.g. banking and accounting) in the finance industry?". This plays a crucial role in avoiding generalisations throughout the finance industry as certain departments and sectors may be more likely to be affected than others. Also, level of impact between sectors may differ which should be accounted for.

Lastly, analysis four answers the research question, "to what extent does the level of implementation of AI into the finance industry consequently impact people's perceptions of the employment levels in the financial labour market? ". This is ultimately the critical question of the entire research.

3.5 Scope and Limitations of Research

The scope of this research is refined in studying the impact of artificial intelligence (AI) within the finance industry and its effect on the labour market. The scope of this research will entail analysing people's perceptions of the extent to which AI implementation in the finance industry will influence the financial labour market. It is crucial to also recognize this research will analyse the impact on labour per different sectors in the finance industry, such as trading, banking, accounting, etc. This is to ensure more accurate results throughout the data collection process as certain sectors may be proportionately more affected by AI than others therefore by doing this, a generalization of the "financial industry" is avoided.

On the other hand, the limitations posed will naturally narrow the scope of the research. As aforementioned, assessing the impact of AI on labour markets is difficult as AI is still relatively new and progressive tech making data collection difficult. Therefore, as an alternative to understanding how AI has impacted the labour market is to understand people's perceptions of the situation. Another limitation is that this study is predominantly based off people's perceptions of the situation which may not directly

reflect the actual situation in the finance sector. However, it should represent the situation accurately to some extent given that the individual may be actively aware and following the updates on AI in the finance sector or is familiar with the finance sector themselves. As a result, this research will predominantly focused on quantitative analysis of data by using surveys. The research will analyse individuals' perceptions of what the advantages and disadvantages of implementing AI technology are compared to predominantly maintaining the use of human labour within the finance sector. In addition, this study aims to understand and analyse the perceptions relative to each finance department, and generally as well.

3.6 Validity and Reliability

In regard to the validity of the study the methodology has a few prominent issues which would directly affect the strength of the validity of this methodology. These issues include the fact that the researcher's measure of finance sector knowledge that a participant has is relative and is not defined or determined implicating possible researcher bias.

In addition, the choice for voluntary response sampling has downfalls as it is a biased method of sampling. Those most likely to answer are most likely to have predominantly strong opinions which may skew the data retrieved. A lack of limitations of the target group may result in an unrepresentative sample. However, this has been avoided by selecting the sample refined to students, finance workers, and/or working professionals.

A further study should be done and is needed in order to strengthen the data collection process to remove any biases and improve the sampling selection process. In addition, human perceptions are typically subjective and prone to change which means that the data retrieved in this study may not be applicable in the next coming years hence why, once again, a further study should be completed. The general ability to replicate this study is at most fair as there are some downfalls in the sampling selection process which should be changed to strengthen the validity.

4 RESULTS

This research has been conducted respective to the research questions posed in the beginning of this thesis and is answered in accordance. The method used for the analysis include both cross tabulations, and the use of calculating Pearson's correlation coefficient to determine strength of correlation. For reference, below are the research questions reiterated.

1. Do perceptions vary per individual depending on their knowledge of the finance industry and it is developments?
2. What are the advantages and disadvantages of implementing AI technology compared to predominantly maintaining the use of human labour within the finance industry?
3. Are there varying perceptions of the impact on employment levels per department (e.g. banking and accounting) in the finance industry?
4. To what extent does the level of implementation of AI into the finance industry consequently impact people's perceptions of the employment levels in the financial labour market?

The expected results were dependant on the group (high knowledge or low knowledge). High knowledge being those marking themselves with a response of 3 or higher for acquaintance level. Generally speaking, across all 4 analysis, there was expected to be variances in the individuals' perception of the advantages and disadvantages of AI applications in the finance industry and to what extent the impact on the financial labour market would be. This is due to the high knowledge groups presumably being more likely to have strong previous opinions on the subject and are more knowledgeable on the surrounding subject. Therefore, the high knowledge individuals would be more capable of justifying their perceptions and opinions.

4.1 Analysis 1

Firstly, to answer the first of four research questions, "do perceptions vary per individual depending on their knowledge of the finance industry and it is developments?". Cross tabulation was used to analyse this question as there were multiple sub-factors under what

classifies an individual's "level of knowledge" on the finance industry and its current affairs relative to new AI implementations. The sub-factors included: their familiarity with ongoing current affairs in the finance industry, their level of acquaintance/association with the finance industry, and lastly, their familiarity with AI utilisation and implementation within the finance industry.

	A	B	C	D	E	F	G	H	I	J	K	L
1	Positive/Negative/Neutral respective to their level of knowledge											
2												
3							Acquaintance level					
4		Total response out of 46						level 3 or above				
5	Positive	24				Positive		6		out of 24		
6	Negative	8				Negative		6		out of 8		
7	Neutral	12				Neutral		5		out of 12		
8	No Response	2				No Response		0		out of 2		
9	Total	46										
10												
11												
12		Familiarity with AI implementation					Familiarity with Current Affairs					
13		level 3 or above					level 3 or above					
14	Positive	8			out of 24	Positive		13		out of 24		
15	Negative	6			out of 8	Negative		8		out of 8		
16	Neutral	4			out of 12	Neutral		7		out of 12		
17	No Response	0			out of 2	No Response		0		out of 2		
18												

Figure 1: Summary table for Analysis 1

These sub-factors were cross tabulated against two other factors representing their "perceived impact on finance labour market". These sub-factors included the perceived general impact on labour levels and whether they perceived AI implementation to have a positive, negative, or neutral impact on the finance industry. This cross tabulation can be viewed in accordance with Appendix 5.1.

Generally speaking, results show that those with an acquaintance level of three or higher were more likely to believe there to be a relatively high to extremely high impact on labour market levels in the finance industry as a result of AI implementation. However, whether they believed the impact to be positive, negative, or neutral was still up for question. As shown in Appendix 5.2, those with high knowledge level based off the sub factors aforementioned are still likely to perceive the impact as positive rather than negative.

Regardless of level of knowledge, a majority of the respondents still perceived the impact of AI implementation on the finance industry to be for the most part positive (24/46 responses) then neutral (12/46 responses). This could suggest that despite level of knowledge there is to some degree a pre-existing opinion or perception many people have due to exposure and preview to related news on social media or news platforms for

instance. Despite not being actively exposed to news on current affairs in the finance industry, an individual may have briefly come across such information thereby leaving some hint of knowledge to help form their perceptions.

A pitfall in this analysis was that there were two respondents who did not provide a response to these questions, presumably due to lack of opinion or knowledge on the subject at hand as had been noted in their previous responses. Despite this, the direction of the analysis is relatively clear and a relationship between one's level of knowledge and their perceived impact on finance labour market is prevalent.

4.2 Analysis 2

Perceived benefits of utilisation of AI tech relative to perceived general impact on labour levels	
Coefficient (r)	0.479959149
N	46
T Statistic	4.414808625
DF	44
p value	0.0000648

Figure 2: Results for Analysis 2

Furthermore, another question posed is "to what extent does the level of implementation of AI into the finance industry consequently impact people's perceptions of the employment levels in the financial labour market?". In order to answer this question, a Pearson correlation coefficient was determined in order to measure the strength of correlation, or if there is any correlation at all. The expectation was that there will be a positive correlation between the level of perceived impact on the financial labour market and the level of perceived benefit of AI tech utilisation.

When interpreting a Pearson's correlation coefficient as seen in Figure 2, it is crucial to understand what each degree of correlation indicates. In this case, the coefficient (r) can

be rounded up to 0.48 which according to Fenton and Neil (2019) is referred to as a "moderate degree" of correlation. This means that there is a correlation but not a strong correlation. This may suggest that people may believe there are benefits to utilising and implementing AI into different processes within the finance industry but may not necessarily believe that these "benefits" would directly influence the finance labour market.

4.3 Analysis 3

To answer the third research question, "Are there varying perceptions of the impact on employment levels per department (e.g. banking and accounting) in the finance industry?". The variations and/or correlations between finance departments perceived employment levels post AI implementation was analysed.
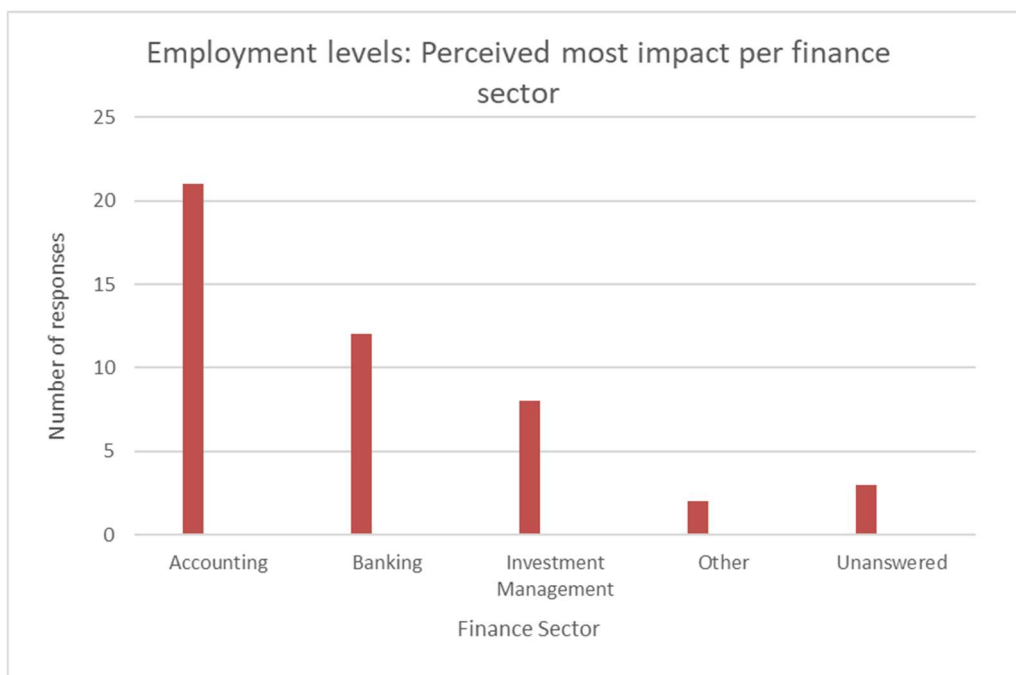
Figure 3: Results for Analysis 3

The results displayed that there were varying perceptions of the impact of AI on employment per department in the finance industry. The results shown in Figure 3 display that the finance sector believed to be most heavily impacted by AI is accounting, banking,

then investment management, respectively. The other responses were for "other" or were left unanswered.

This may be because each department works as an individual unit and serves a different function to another department/sector i.e., bookkeeping and auditing. No two sectors serve the same purpose but rather work parallel to each other. Consequently, the AI applications for each department varies whereby some departments such as accounting may be more prone to job displacements as a result of AI implementation in comparison to the investment management sector. However, this is not necessarily common knowledge and those who are less knowledgeable on the finance industry and its processes are less likely to make the association.

4.4 Analysis 4

To answer the final research question, "To what extent does the level of implementation of AI into the finance industry consequently impact people's perceptions of the employment levels in the financial labour market? ", the correlation between perceived increase in AI implementation and perceived employment level increases/decreases in the financial labour market was examined. Generally speaking, the expected results was that people are more likely to associate increases in AI implementation in the finance industry to an increase in unemployment and job displacements. However, as shown below in Figure 4, after determining the correlation coefficient of 0.39, this indicates a weak correlation. This means that there is but a small relationship between perceived increase in AI implementation and perceived employment level increases/decreases in the financial labour market for this research group. It is however another concern of whether this group accurately reflects the views of the greater population.

4.4.1 Analysis 4.1: Pearson's correlation coefficient

Perceived increase in AI relative to perceived general impact on labour levels	
Coefficient (r)	0.388242782
N	46
T Statistic	3.292609126

DF	44
p value	0.001963147

Figure 4: Results for Analysis 4

4.4.2 Analysis 4.2: Cross-Tabulation

Furthermore, in order to answer the fourth research question, "Do perceptions vary per individual depending on their knowledge of the finance industry and it is developments?", the use of stratification was used to separate and identify respondents into groups based on their level of knowledge in the finance industry. Their level of knowledge was based on their occupations, general day-to-day interactions concerning the finance industry, and awareness of the current affairs within the finance industry. As aforementioned, those considered to be more knowledgeable were those marking themselves with a response of 3 or higher for acquaintance level.

As aforementioned, there was expected to be differences between the low-finance knowledge group and the high-finance knowledge group. This is a natural assumption as those who have more knowledge in an industry may generally have more strong opinions and stances due to their personal interaction and integration within the finance industry. A majority of the participants will probably have an opinion and perception of the situation to some extent though what varies is their ability to justify their perception and the "strength" of their opinion.

The results displayed that those who perceived there to be an increase in AI were more likely to perceive a consequentially greater impact on the labour market levels in the finance industry. The cross tabulation of analysis 4.2 can be found in Appendix 7.

5   DISCUSSION

Previous studies mentioned in the theoretical review had been used to provide the expected results and will be discussed respectively in this discussion section in comparison to the results received. In general, the expected results presumed a clear correlation between perceived changes in AI implementation and perceived changes in the employment levels in the financial labour market. Moreover, the perceptions many

individuals had varied in accordance with the sector in question, as well as, depending on the respondents level of finance knowledge.

However, as shown in analysis 4.2 in the cross-tabulation, those who perceived there to be an increase in AI were more likely to perceive a consequentially greater impact on the labour market levels in the finance industry. Regardless, the weak correlation indicated from the correlation coefficient test in analysis 4.1is still notable as this implies that the strength of correlation between the two variables are not as strong as presumed however, this may also be due to issues concerning the research group. The research group was a mix of high and low knowledge finance individuals, however the threshold for those considered to be in the high-knowledge group may have been too wide. An addition of a mid-ground knowledge group may have been a useful addition to the stratification process as a majority of respondents would have fallen into said group.

As aforementioned, Makridakis (2017) provides a solid framework by summarising perceptions and "scenarios" into four different groups: the optimists, the pessimists, the pragmatists, and the doubters. In relation to this study, it accounts for the theory that there are varying perceptions on how AI would impact employment. However, Makridakis' study does not account for level of knowledge of the finance industry and/or sector specific variances. Generally, increasing efficiency would be considered as a positive connotation and is an advantage of AI implementation. However. this may be viewed under different perception frames as similarly described by Makridakis (2017). For instance, a pragmatic yet pessimistic perception may be utilised. This is whereby the respondent could perceive the situation to be beneficial to the overall company's efficiency and profits, but detrimental to the individual employee as a result of the potential job displacement as the human is unable to conduct their work to the same efficiency level. The different perceptions that individuals may have are limitless and may often be a combination of negative and positive perceptions and opinions. These opinions and perceptions may be strengthened depending on their level of knowledge as aforementioned.

Unlike Makridakis (2017), Tene & Polonetski's (2013) study does account for sector specific variances in regard to efficiency levels. Tene & Polonetski's (2013) research

demonstrates that there are approximately five to six percent increases in efficiency when AI usage is active in the finance industry. This is relevant as different sectors benefit on different levels from AI applications and may be necessary to different degrees. This may be due to a multitude of reasons. For example, some sectors such as the accounting and audit sector can benefit from AI implementations but will be more efficient when used in combination with the already existing auditors and accountants (Shimamoto, 2018). Alternatively, some sectors may not require AI assistance at all or at a very minimal level. Therefore, individuals may perceive a higher prevalence of AI implementation/applications in a specific sector with higher job displacement levels. This is demonstrated above in analysis 3 whereby respondents had varying perceptions of the impact of AI on employment per department in the finance industry. This may suggest that people believe that some sectors require and/or benefit more from AI applications and is used to a higher degree therefore impacting the labour market in the respective finance sector. As shown in analysis 3 (figure 3) display the finance sector perceived to be most heavily impacted by AI is accounting, banking, then investment management, respectively. This supports Shimamoto's (2018) theory that AI can be most heavily applied in sectors such as accounting but prove to be most beneficial when used in combination with human work. However, this assumption once again may not be obvious to those who are not so acquainted with the processes within the accounting sector.

Alternatively, individuals who utilise a more pragmatic perspective may weigh out the benefits of AI implementation proportionate to human labour before coming to any personal conclusions on how they perceive employment levels (Makridakis, 2017). This is to account for the sectors where an increase in AI implementation may not necessarily increase unemployment but will instead change the roles of the job instead (Shimamoto, 2018). As a result, individuals do take into account sector specific considerations, but to what extent, is the uncertain factor in question.

Moreover, the individual's level of knowledge in the finance industry may influence the individual's perception of the situation. However, the assumption behind this is that the individuals who are more knowledgeable on the finance industry may be more likely to have stronger opinions due to their personal interaction and integration within the finance industry. In addition, they will be able to justify their perceptions and opinions more as

they are substantially more acquainted with the developments in the finance industry than a "regular individual". This assumption is explored in analysis 1 through cross tabulation. Analysis 1 demonstrated that those with an acquaintance level of three or higher were more likely to believe there to be a relatively high to extremely high impact on labour market levels in the finance industry as a result of AI implementation. However, a matter of whether the impact is believed to be positive, neutral, or negative was still up for question and would benefit from additional research.

The individuals who have lower knowledge on the finance industry are still bound to have certain understandings and perceptions of the presence and developments of AI in the finance industry but definitely not to the level of those who may work, or are personally involved in the finance industry (high-finance knowledge group). Those with lower knowledge on the finance industry are bound to have their respective perceptions however, what is susceptible to variances is the individual's ability to justify their perception and the "strength" of their opinion with academic or fact-based reasoning.

In addition, their level of knowledge of the finance industry may what distinguishes them from a pragmatist to a doubter, the summarised groups from Makridakis' (2017) study. The pragmatist and doubter perception groups are polar opposites from each other. The pragmatic perception may come from the high-finance knowledge group as they are more knowledgeable on the developments surrounding AI in the finance industry, both theoretically and in practical terms, therefore have more applicable knowledge on the topic to form a pragmatic perception. Whereas doubters are generally the more extreme perception group where they entirely doubt that AI will have any implications on the employment levels in the finance industry. Low-finance knowledge individuals may jump to this perception as a result of asymmetric knowledge and incomplete knowledge of ongoing developments and their impact on the finance labour market. However, the doubter perception may also come from high-finance knowledge individuals as it is a generally strong opinion which come from how the individual interprets the situation based off his/her knowledge and experience and will be more than likely able to strongly justify with fact-based reasoning.

6 CONCLUSION

AI innovations are substantially changing the worlds economics, societal norms and patterns as observed by researchers, scientists, physicists, and engineers in all industries worldwide, not just the finance industry. There is no doubt AI will contribute into the labour market and will continue to actively reshape the future of many occupations and jobs within the finance industry though considerations into potential for displacement per sector as a result of AI implementation must be taken into account. A suitable approach for this consideration would be to assess the potential for displacement/loss of employment relative to the task content of the work.

The research conducted to some degree answered the research questions posed by establishing clear difference between strata groups and their responses. The research questions were answered however the extent of understanding the analysis lacks depth. This may possibly be due to a too small sample group, an unrepresentative sample, and/or because of the choice to analyse perceptions. Perception as aforementioned is prone to change and influence by a multitude of factors therefore, these results and the answers provided to the research questions may not directly reflect the actual situation in the finance sector.

However, the results theoretically should represent the situation somewhat accurately given that the individual may be actively aware and following the updates on AI in the finance sector or is familiar with the finance sector themselves. The voluntary sampling process via LinkedIn allowed for professionals in the field to participate as well as those not so acquainted with the finance field. Regardless, there are some concerns regarding the validity and reliability of the results due to a lack of strong correlation between variables measured for the research questions. Additionally, the sample had proportionately lower-to-mid knowledge responders in comparison to high-knowledge responders which makes the validity and reliability of the results slightly lower. Overall, the research questions should be viewed as a domino sequence, whereby one factor influences another factor from another research question. For example, level of knowledge influencing perceived impact on labour markets (negative or positive).

AI will continue to prevail and supersede human labour within the finance industry in various tasks and/or sectors as certain tasks such as bookkeeping and redundant general administrative tasks can and most likely will be substituted by these AI algorithms, software, and technology. However, the matter at hand is to what extent will AI be able to substitute human labour within the respective industry and sub-sectors. Due to the relatively recent advances of AI and its capabilities, there is an insufficient amount of research to undoubtedly claim whether or not AI implementation will have such dire effects as claimed amongst the likes of the aforementioned Musk and Hawking.

Regardless of this, many opportunities will arise as a result of the creation of new jobs and roles to come from AI implementation. In addition, traditional jobs, and occupations such as auditing for instance will be likely to undergo reformation and alteration but is unlikely to be lost, but instead to be used complimentary to the AI technologies. AI will continue to develop regardless of the negative connotations associated with AI. In order for employees within the finance industry to benefit they should educate themselves more on these technologies and be aware of their opportunities and possibilities as well as the risks that accompany them. The mindset on AI should change. The threat of labour displacement should not be treated as a myth but rather a probable future prospect. Therefore, further research should be conducted in order to better understand individual and group perceptions on how the implementation of AI may influence global labour market levels. This research need not to be specifically refined to the finance industry but can be applied to a multitude of other fields as well.

REFERENCES

Belanche, D., Casaló, L. and Flavián, C. (2019), Artificial Intelligence in FinTech: understanding robo-advisors adoption among customers. Industrial Management & Data Systems, Vol. 119 No. 7, pp. 1411-1430. Retrieved March 11, 2020, from https://doi-org.ezproxy.arcada.fi:2443/10.1108/IMDS-08-2018-0368

Brito, P. (2014). Symbolic Data Analysis: another look at the interaction of Data Mining and Statistics. Wiley Interdisciplinary Reviews: Data Mining and Knowledge Discovery, 4(4), p. 281–284. http://doi.org/10.1002/widm.1133

Bots, C. F. B. (2018, April 21). The Difference between Robotic Process Automation and Artificial Intelligence. Retrieved February 11, 2020, from https://medium.com/@cfb_bots/the-difference-between-robotic-process-automation-and-artificial-intelligence-4a71b4834788

Cellan-Jones, R. (2014, December 2). Stephen Hawking warns artificial intelligence could end mankind. Retrieved April 5, 2020, from https://www.bbc.com/news/technology-30290540

Contri, B., Global Financial Services, & Deloitte. (2018, October 29). How artificial intelligence is transforming the financial ecosystem. Retrieved April 27, 2020, from https://www2.deloitte.com/global/en/pages/financial-services/articles/artificial-intelligence-transforming-financial-ecosystem-deloitte-fsi.html

Danninger, S., Kyobe, A., & Cangiano, M. (2005). The Political Economy of Revenue-Forecasting Experience From Low-Income Countries. IMF Working Papers, 05(2). p. 13-15 ., http://doi.org/10.5089/9781451860214.001

Digalaki, E. (2019, December 17). The impact of artificial intelligence in the banking sector & how AI is being used in 2020. Retrieved April 20, 2020, from https://www.businessinsider.com/ai-in-banking-report?r=US&IR=T

Fenton, N., & Neil, M. (2019). *Risk assessment and decision analysis with Bayesian networks*. Boca Raton: Chapman & Hall/CRC.

Financial Stability Board. (2017). Financial Stability Implications from FinTech. Financial Stability Board . Retrieved from https://www.fsb.org/wp-content/uploads/R270617.pdf

Firestone, W.A. (1987), "Meaning in method: the rhetoric of quantitative and qualitative research", Educational Researcher, Vol. 16 No. 7, p. 16-21.

Francis, J., & Francis, J. (2019, September 6). Finance Automation - The Future of Finance and Accounting? Retrieved February 11, 2020, from https://kissflow.com/finance/why-adopt-finance-automation/

Giudici, P. (2018). Fintech Risk Management: A Research Challenge for Artificial Intelligence in Finance. Frontiers in Artificial Intelligence, p. 1. http://doi.org/10.3389/frai.2018.00001

Goldberg, K. (2012). What Is Automation? IEEE Transactions on Automation Science and Engineering, p. 1-2 . http://doi.org/10.1109/TASE.2011.2178910

IBM Cloud Education. "What Is Machine Learning?" IBM, July 15, 2020. https://www.ibm.com/cloud/learn/machine-learning.

Institute of Chartered Accountants in England and Wales. (2017). Artificial intelligence and the future of accountancy. ICAEW Thought Leadership. Retrieved from https://www.icaew.com/-/media/corporate/files/technical/information-technology/thought-leadership/artificial-intelligence-report.ashx

J. M. Keynes, The General Theory of Employment, The Quarterly Journal of Economics, Volume 51, Issue 2, February 1937, Pages 209–223, https://doi.org/10.2307/1882087

Knowles, Bija. (2018, February 12th), Benefits and risks of automating finance & accounting. Retrieved February 11, 2020, from https://ctmfile.com/story/benefits-and-risks-of-automating-finance-accounting

Kontzer, T. (2015, March 13). Robots Take Over The World!: Not Such A Crazy Fear. Retrieved April 2, 2020, from https://www.investors.com/news/technology/ai-warnings-from-hawking-musk-gates-taken-to-heart/

Kurzweil, R. (2005). The Singularity Is Near: When Humans Transcend Biology. Viking Press. p. 260

Lin, Tom C. W., Infinite Financial Intermediation (2016). Wake Forest Law Review, Vol. 50, No. 643, p. 2-14; Temple University Legal Studies Research Paper No. 2016-06. https://ssrn.com/abstract=2711379

Makridakis, S. (2017). The forthcoming Artificial Intelligence (AI) revolution: Its impact on society and firms. Futures, 90, p. 47–60. http://doi.org/10.1016/j.futures.2017.03.006

Markoff, J. (2016). Machines of loving grace: The quest for common grounds between humans and robots. Ecco; Reprint edition. p. 43-45.

Marr, B. (2019, December 9). The 10 Best Examples of How Companies Use Artificial Intelligence In Practice. Retrieved February 16, 2020, from https://www.forbes.com/sites/bernardmarr/2019/12/09/the-10-best-examples-of-how-companies-use-artificial-intelligence-in-practice/#2a65f9967978

Mccarthy, J. (1989). Artificial Intelligence, Logic and Formalizing Common Sense. Philosophical Logic and Artificial Intelligence, p.161–190. http://doi.org/10.1007/978-94-009-2448-2_6

Reynoso, R. (2019, March 1). A Complete History of Artificial Intelligence. Retrieved February 3, 2020, from https://learn.g2.com/history-of-artificial-intelligence

Shimamoto, D. C. (2019, December 9). Why Accountants Must Embrace Machine Learning. Retrieved April 21, 2020, from https://www.ifac.org/knowledge-gateway/preparing-future-ready-professionals/discussion/why-accountants-must-embrace

Smith, B. W., & Wilson, R. J. How Best to Guide the Evolution of Electronic Currency Law. American University Law Review, 46(4), 1105–1130. Retrieved from https://digitalcommons.wcl.american.edu/cgi/viewcontent.cgi?article=1388&context=aulr

Stancheva, E. (2018). How artificial intelligence is challenging accounting profession. Journal of International Scientific Publications, 12, p. 126–141. Retrieved from https://www.researchgate.net/publication/333728223_HOW_ARTIFICIAL_INTELLIGENCE_IS_CHALLENGING_ACCOUNTING_PROFESSION

Sulleyman, A. (2017, February 15). Elon Musk says humans will become irrelevant if they don't merge with machines. Retrieved April 5, 2020, from https://www.independent.co.uk/life-style/gadgets-and-tech/news/elon-musk-humans-cyborgs-ai-domination-robots-artificial-intelligence-ex-machina-a7581036.html

Team, E. (2019, June 7). 10 reasons why automation is good for financial service providers. Retrieved February 11, 2020, from https://www.finextra.com/blogposting/17340/10-reasons-why-automation-is-good-for-financial-service-providers

Tene, O & Polonetski, J 2013, 'Big Data for All: Privacy and User Control in the Age of Analytics', Northwestern Journal of Technology and Intellectual Property, vol. 11, no. 5, pp. 240-273.

Turing, A. M. (1950). Computing Machinery And Intelligence. Mind 49, LIX(236), p. 433–460. http://doi.org/10.1093/mind/lix.236.433

UiPath Inc. What is Robotic Process Automation - RPA Software. Retrieved March 18, 2020, from https://www.uipath.com/rpa/robotic-process-automation

Ul-Huq, S. M. (2014). The Role of Artificial Intelligence in the Development of Accounting Systems: A Review. The IUP Journal of Accounting Research and Audit Practices, 2, p. 7–19.

Yin, R.K. (2004), Case Study Research: Design and Methods, 3rd ed., Applied Social Research Methods Series, Vol. 5, Sage, p.59-60, Thousand Oaks, CA

APPENDIX 1: COPY OF SURVEY

Artificial Intelligence (AI) in the Finance Industry

Kindly answer all the questions by clicking on your answer. Only choose one answer unless stated otherwise.

Thank you for your time and answering this survey!
* Required

1. What is your employment status? *

   Mark only one oval.

   ◯ Employed

   ◯ Unemployed

   ◯ Retired or Other

2. Which of the following best describes you? " I am ..." *

   Mark only one oval.

   ◯ A student studying in a finance/business related programme

   ◯ A student studying in a non-finance/business programme

   ◯ Employed within the finance sector

   ◯ Employed outside of the finance sector

3. How associated/acquainted with the finance industry do you consider yourself? *

   Mark only one oval.

   ◯ Little-to-no acquaintance

   ◯ Fairly acquainted

   ◯ Well acquainted

   ◯ Very well acquainted

4. On a scale of 1-5, how would you rate your familiarity with current affairs in the finance industry? *

Mark only one oval.

	1	2	3	4	5	
No familiarity	◯	◯	◯	◯	◯	Extremely familiar

5. On a scale of 1-5, how familiar are you with AI progression and utilisation within the finance industry? *

Mark only one oval.

	1	2	3	4	5	
No familairity	◯	◯	◯	◯	◯	Extremely familiar

6. On a scale of 1-5, how beneficial would you consider the utilisation of AI technologies in the finance industry? *

Mark only one oval.

	1	2	3	4	5	
Not beneficial at all	◯	◯	◯	◯	◯	Very beneficial

7. Would you consider the benefits of AI implementation in the finance industry to outweigh the downfalls? *

Mark only one oval.

◯ Yes

◯ No

8. Would you consider there to be an active increase in AI implementation in the finance industry? *

   Mark only one oval.

   ⬭ Yes

   ⬭ No

9. Do you believe employment levels in certain sectors in the finance industry are more affected by AI technologies than others? *

   Mark only one oval.

   ⬭ Yes

   ⬭ No

10. If yes, which sector would you believe to be most impacted by implantation of AI technology in regard to their employment levels? *

    Mark only one oval.

    ⬭ Accounting

    ⬭ Investment Management

    ⬭ Banking

    ⬭ Other

11. On a scale of 1-5, how much of an expected impact would the upcoming AI technology implementation on the finance labour market globally? *

    Mark only one oval.

	1	2	3	4	5	
No impact	⬭	⬭	⬭	⬭	⬭	Extremely impactful

12. Do you believe AI implementation into the finance industry will create an overall positive or negative impact? *

Mark only one oval.

◯ Positive

◯ Negative

◯ Neutral

Google Forms

APPENDIX 2/1 (184): SURVEY RESPONSES

Artificial Intelligence (AI) in the Finance Industry

Kindly answer all the questions by clicking on your answer. Only choose one answer unless stated otherwise.

Thank you for your time and answering this survey!

What is your employment status? *

- 🔘 Employed
- ⚪ Unemployed
- ⚪ Retired or Other

Which of the following best describes you? " I am ..." *

- ⚪ A student studying in a finance/business related programme
- 🔘 A student studying in a non-finance/business programme
- ⚪ Employed within the finance sector
- ⚪ Employed outside of the finance sector

APPENDIX 3.1: RAW DATA TABLES – ANALYSIS 1

Analysis 1				
Analysing relationship between level of knowledge and perceived impact on finance labour market				
	Scale: 1-4	Scale: 1-5	Scale: 1-5	Scale: 1-5	1-P/2-Neg/3-Neu
Participant no.	Accquaintance level	Familiarity with C.A	Familiarity with AI utilisation	Percieved general impact on labour	Pos/Neg/Neutral?
1	3	2	1	3	3
2	1	3	2	5	1
3	1	2	2	3	1
4	2	3	2	4	1
5	1	2	2	4	3
6	4	4	3	4	3
7	2	4	3	4	1
8	1	2	1	0	0
9	1	1	1	0	0
10	2	3	2	3	1
11	2	2	1	4	1
12	1	2	1	3	3
13	2	4	2	4	3
14	2	1	1	4	1
15	2	3	3	4	1
16	4	4	4	3	1
17	2	2	3	3	1
18	1	1	1	3	1
19	2	2	1	3	1
20	1	3	2	5	1
21	1	3	2	5	1
22	4	4	3	3	3
23	2	2	2	3	1
24	2	2	2	5	1
25	2	4	2	4	3
26	2	3	1	3	2
27	2	2	2	4	3
28	4	3	2	4	1
29	4	4	4	3	2
30	5	5	5	3	1
31	1	2	2	3	1
32	2	2	2	2	1
33	1	1	1	4	1
34	2	3	2	4	2
35	4	4	2	5	3
36	5	5	5	5	1
37	4	5	5	5	1
38	5	5	4	5	2
39	5	5	4	5	3
40	5	4	5	5	2
41	4	5	4	5	2
42	5	4	4	5	1
43	4	5	4	5	3
44	4	4	3	5	2
45	2	3	3	5	2
46	1	2	2	4	3

APPENDIX 3.2: RAW DATA TABLES – ANALYSIS 2

	Analysis 2	
	Perception of benefits/downfalls of AI respective to perception of impact on labour market levels	
	Scale: 1-5	Scale: 1-5
Participant no.	Scale of percieved benefits of utilisation of AI tech	Percieved general impact on labour
1	2	3
2	5	5
3	4	3
4	4	4
5	4	4
6	4	4
7	4	4
8	3	0
9	3	0
10	4	3
11	4	4
12	3	3
13	3	4
14	5	4
15	4	4
16	5	3
17	4	3
18	4	3
19	1	3
20	5	5
21	5	5
22	4	3
23	4	3
24	5	5
25	3	4
26	2	3
27	3	4
28	4	4
29	4	3
30	5	3
31	3	3
32	3	2
33	5	4
34	4	4
35	5	5
36	5	5
37	4	5
38	3	5
39	5	5
40	5	5
41	5	5
42	5	5
43	4	5
44	4	5
45	4	5
46	2	4

APPENDIX 3.3: RAW DATA TABLES – ANALYSIS 3

Analysis 3					
Employment levels: Sector percieved to be most impacted by implantation of AI technology					
Participant no.	Accounting	Banking	Investment	Other	Unanswered
1	1				
2	1				
3	1				
4		1			
5	1				
6	1				
7			1		
8					1
9					1
10	1				
11	1				
12			1		
13	1				
14					1
15			1		
16	1				
17			1		
18	1				
19	1				
20	1				
21	1				
22		1			
23	1				
24		1			
25		1			
26		1			
27		1			
28	1				
29		1			
30		1			
31				1	
32				1	
33		1			
34			1		
35		1			
36			1		
37	1				
38			1		
39	1				
40			1		
41		1			
42	1				
43	1				
44	1				
45	1				
46		1			
Total	21	12	8	2	3

APPENDIX 3.4: RAW DATA TABLES – ANALYSIS 4

Participant no.	Increase in AI?	Sector believed to be most impacted	General impact on labour levels
	Analysis 4		
	Relationship between percieved increase in AI imp. and percieved changes in employment level in the financial labour market		
	1 - Yes/ 2- No		Scale: 1-5
1	1	Accounting	3
2	2	Accounting	5
3	1	Accounting	3
4	1	Banking	4
5	1	Accounting	4
6	1	Accounting	4
7	1	Investment Management	4
8	1	Unanswered	0
9	0	Unanswered	0
10	0	Accounting	3
11	1	Accounting	4
12	1	Investment Management	3
13	1	Accounting	4
14	1	Unanswered	4
15	2	Investment Management	4
16	1	Accounting	3
17	1	Investment Management	3
18	2	Accounting	3
19	1	Accounting	3
20	1	Accounting	5
21	1	Accounting	5
22	1	Banking	3
23	1	Accounting	3
24	1	Banking	5
25	1	Banking	4
26	1	Banking	3
27	1	Banking	4
28	1	Accounting	4
29	1	Banking	3
30	1	Banking	3
31	1	Other	3
32	1	Other	2
33	1	Banking	4
34	1	Investment Management	4
35	2	Banking	5
36	2	Investment Management	5
37	1	Accounting	5
38	1	Investment Management	5
39	1	Accounting	5
40	2	Investment Management	5
41	1	Banking	5
42	1	Accounting	5
43	1	Accounting	5
44	1	Accounting	5
45	1	Accounting	5
46	2	Banking	4

APPENDIX 4.1: SUMMARY TABLE FOR ANALYSIS 2

Perceived benefits of utilisation of AI tech relative to perceived general impact on labour levels	
Coefficient (r)	0.479959149
N	46
T Statistic	4.414808625
DF	44
p value	0.0000648

APPENDIX 4.2: SUMMARY TABLE FOR ANALYSIS 3

Total: Sector perceived to be most impacted by implantation of AI technology	
Accounting	21
Banking	12
Investment Management	8
Other	2
Unanswered	3

APPENDIX 4.3: SUMMARY TABLE FOR ANALYSIS 4

Perceived increase in AI relative to perceived general impact on labour levels	
Coefficient (r)	0.388242782
N	46
T Statistic	3.292609126
DF	44
p value	0.001963147

APPENDIX 5.1: EXCEL PIVOT TABLES FOR ANALYSIS 1

	A	B	D	E
1				
2	Pos/Neg/Neutral?	(All)		
3	Percieved general impact on lab	(All)		
4				
5	Participant number	Sum of Familiarity with AI uti	Sum of Familiarity with C.A	
6	1	1	2	
7	2	2	3	
8	3	2	2	
9	4	2	3	
10	5	2	2	
11	6	3	4	
12	7	3	4	
13	8	1	2	
14	9	1	1	
15	10	2	3	
16	11	1	2	
17	12	1	2	
18	13	2	4	
19	14	1	1	
20	15	3	3	
21	16	4	4	
22	17	3	2	
23	18	1	1	
24	19	1	2	
25	20	2	3	
26	21	2	3	
27	22	3	4	
28	23	2	2	
29	24	2	2	
30	25	2	4	
31	26	1	3	
32	27	2	2	
33	28	2	3	
34	29	4	4	
35	30	5	5	
36	31	2	2	
37	32	2	2	
38	33	1	1	
39	34	2	3	
40	35	2	4	
41	36	5	5	
42	37	5	5	
43	38	4	5	
44	39	4	5	
45	40	5	4	
46	41	4	5	
47	42	4	4	
48	43	4	5	
49	44	3	4	
50	45	3	3	
51	46	2	2	
52	Grand Total	115	141	

APPENDIX 5.2: SUMMARY TABLE FOR ANALYSIS 1

	A	B	C	D	E	F	G	H	I	J	K	L
1	Positive/Negative/Neutral respective to their level of knowledge											
2												
3							Acquaintance level					
4	Total response out of 46						level 3 or above					
5	Positive	24				Positive		6		out of 24		
6	Negative	8				Negative		6		out of 8		
7	Neutral	12				Neutral		5		out of 12		
8	No Response	2				No Response		0		out of 2		
9	Total	46										
10												
11												
12		Familiarity with AI implementation						Familiarity with Current Affairs				
13		level 3 or above						level 3 or above				
14	Positive	8		out of 24		Positive		13		out of 24		
15	Negative	6		out of 8		Negative		8		out of 8		
16	Neutral	4		out of 12		Neutral		7		out of 12		
17	No Response	0		out of 2		No Response		0		out of 2		
18												

APPENDIX 6: BAR CHART FOR ANALYSIS 3

Employment levels: Perceived most impact per finance sector
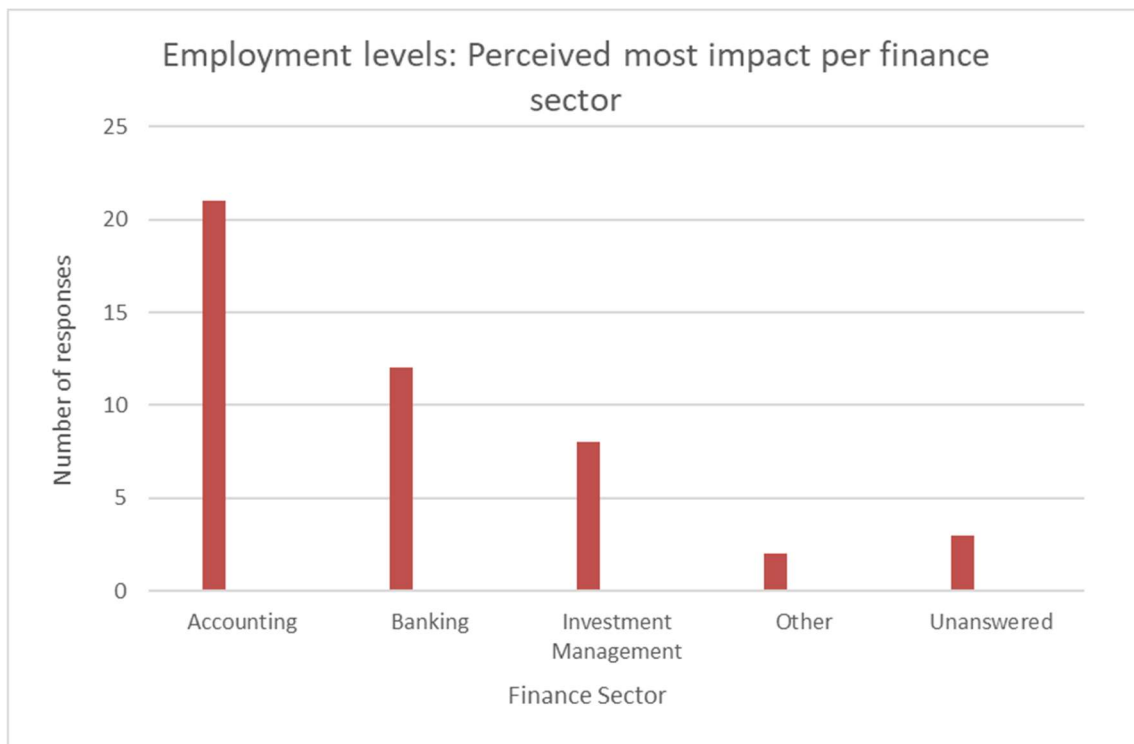
APPENDIX 7: PIVOT TABLE FOR ANALYSIS 4.2

	A	B
1		
2	Sector believed to be most impa (All)	
3	General impact on labour levels (All)	
4		
5	Participant Number	Sum of Increase in AI?
6	1	1
7	2	2
8	3	1
9	4	1
10	5	1
11	6	1
12	7	1
13	8	1
14	9	0
15	10	0
16	11	1
17	12	1
18	13	1
19	14	1
20	15	2
21	16	1
22	17	1
23	18	2
24	19	1
25	20	1
26	21	1
27	22	1
28	23	1
29	24	1
30	25	1
31	26	1
32	27	1
33	28	1
34	29	1
35	30	1
36	31	1
37	32	1
38	33	1
39	34	1
40	35	2
41	36	2
42	37	1
43	38	1
44	39	1
45	40	2
46	41	1
47	42	1
48	43	1
49	44	1
50	45	1
51	46	2
52	Grand Total	51