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Relationship between humanity and automation in the job market

The societal impact of unemployment from the technological revolution

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Abstract

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This thesis explores the relationship between automation and the human workforce. Automation has been utilized by corporations in taking care of the menial tasks in a wide range of fields, ranging from assembly to transportation. New strides in artificial intelligence, hardware and robotics bring difficulties in employing the lower-class of workers. The modern worker must accept the possibility of complete replacement or radical task augmentation through the influence of artificial intelligence. As employers are looking to maximize their profits, there is a considerable suspicion that the idea of paying a living wage to workers might not be the best choice when it comes to staying competitive.

Artificial intelligence has initially been utilized for novelty purposes, but as availability, capability and the number of AI solutions increase in the professional climate, so can the displacement of workers. This thesis focused on creating guidelines for relevancy for modern-day professionals and entrepreneurs. This project examined what kind of work becomes automated and who remains relevant when most traditional work will be taken over by AI and automation.

The result of the findings established that a reformed system of education must be considered to not alienate the general population from the rising technical boundaries of work, and that the event of a post-work society is a very small threat in the coming years. A strong recommendation for newer workers and entrepreneurs is to recognize that AI cannot completely replace the human qualities for decision-making behaviour, as evidenced by the currently existing solution. Automation and AI remain as tools to amplify human actions and make room for more specialized and creative parts of work.

Keywords: AI, Automation, Chatbots, Unemployment, Business Management, Technology

Contents

Glossary

AI	Artificial Intelligence.
CA	Conversational Agent
Chatbot	A conversational agent utilizing artificial intelligence.
UBI	Abbreviation for “Universal Basic Income”

1 Introduction

This thesis aims to examine how the rising number of automated solutions that replace human work can influence society and the professional environments of the present and the future. Technological revolutions have often resulted in menial and repetitive tasks landing in the threat of automation in such professional environments. But with the introduction of newer technologies that can easily replicate more sophisticated work, such as communications and the arts, it is important to examine whether such transformations to the process of work can impact society at large.

This project examines the possibilities of human elements in the workspace that can be automated, if human characteristics like rhetoric, empathy and persuasion are feasible to be replaced with machine solutions. This thesis will simultaneously investigate what society should shift the focus on to provide a decent quality of life to the population at large, in the case of a potential post-work, post-scarcity society taking place. Technological progress in the workplace can also cause displacements in labour, as with passing time, more tasks are lost to automation. With fears of the event of the majority replacement of workers through technological dynamism, the impact from the lack of available work can have heavy societal impact on the lives of individuals across the globe.

Computation and automation can either complement workers and help them be more efficient, or it may replace them altogether. If the human is deemed to be unnecessary in the pursuits for profit, then the reasonable course of action by a company is to opt out of using human labour for good. This work examines the state of various artificial intelligence-based solutions and examines the possibility of machines having developed the level of competence that allows the managerial-class to remove the need for human work altogether.

1.1 Overview

AI research is speculated to be one of the largest growth opportunities for businesses worldwide. With massive investments from large-scale firms such as Microsoft funding AI research with a billion-dollar investment, it is safe to assume that the trend warrants a closer examination. The partnership between the software distribution giant, Microsoft, with the spearhead developers of AI research, OpenAI could bring forth big changes in the personal and professional lives of people everywhere through rampant transformations in general communication. (Capoot 2023)

Machine driven conversational agents can offer help in a multitude of areas of in business, for example: helping customers streamline shopping, booking trips, hotels and to assist internal affairs within companies through aiding in communications. Andrew Puzder: a former CEO of CKE Restaurants, a large-scale food service corporation, has described the benefits of robot labour as: “always polite, always upselling, no need for vacation, they do not show up late and they never discriminate.” (West 2018)

The former quote was delivered in a comical tone, but it does simultaneously convey a point. For these reasons alone, companies have a massive incentive to explore any available options in automating labour. Doing this can spare the managing class within a company any potential misfortunes of dealing with human error. Automation can add to security; eliminating the problems that come from human bias and improving the efficiency of any supply chain through eliminating the productivity fluctuations that come from human nature.

The purpose of this thesis is to provide a set of guidelines to help the reader retain a competitive advantage within the contemporary climate of the rapidly transforming standards of what is professionally relevant. These oncoming

technological changes can create rampant changes in society, which is the topic which will be addressed in this thesis.

When jobs become automated, it creates the responsibility of maintenance for the newly adopted technologies, leading to additional jobs created. But when machines are introduced to automate away the jobs of the many, how longer can this cycle persist until the majority in the world find themselves being challenged by the rising skill floor to work alongside or compete against these evolving technologies. The competitiveness of a business is measured by how automated its process flow is, as machine solutions deliver faster, with a lower rate of error. This next wave of innovations in automation powered by AI has the capacity to bring forth a new wave of technological unemployment. AI has seen widespread use in the modern-day corporate climate for helping companies streamline the decision-making process in internal developments and in building their offering through quick software-driven analysis of historical data.

McKinsey Global Institute have made estimations regarding the spread and development of the artificial intelligence-based solutions in question, and the development speeds in AI technology have been measured to be three hundred times faster when compared to the speed of developments during the 18th century's Industrial Revolution. (Petropoulos 2018)

AI is utilized to provide fast and accurate market analysis. The AI driven tools provide timely and strong analysis on the prices of goods and services from other competing firms as well as helping to identify potential benefits of expanding the product and service line-up. These tools are also offered to identify if offering customisation options for products and services can prove to be beneficial for the stakeholders. Efficiencies in information flow in the supply-side can translate into lower costs for providing your goods and services, thus providing the firm with a competitive advantage. Customers can benefit from the end-result of AI-driven supply through various means, examples being services

that allow the customer's needs to be automatically analysed to hasten the decision-making process of the client. (OECD Business and Finance Outlook 2021)

AI has the capacity to advance the rate of productivity for all workers. According to research conducted by Accenture, a consultancy based in Ireland, the economic impact of AI was measured in fourteen specific industries, and the benefits of augmentation and AI technologies are projected to take over repetitive tasks, such as generic customer support and market research. This impact was measured through the key performance indicator of GVA, the gross value added: the projections of how much industries will grow by the year 2035. The fourteen specified industries investigated as part of the research are as follows:

- manufacturing
- professional services
- wholesale and retail
- information and communication
- financial services
- construction
- transportation and storage
- healthcare
- accommodation and food services
- social services
- utilities
- education
- agriculture, forestry, and fishing
- arts, entertainment, and recreation

The results in the study were measured using the GVA, since this metric displays the value of produced goods and services provided by these specific industries.

The most impactful example of projected growth in GVA from implementation of AI-solutions is in the field of information and communication, where the projected growth for GVA is expected to be 4.8%, with the baseline for growth of 3.4%. The study explains that the industries that are the most laden with existing technologies which serve as a good base for implementation of newer technologies, such as AI-platforms designed to offer additional layers of cybersecurity to their customers. This growth manifests through different forms, automation of routine work, enhancing the talents of existing manpower and powering additional innovations. (Purdy & Daugherty 2018)

2 Literature Review

2.1 Replacement of the human element

Daniel Susskind's work takes a deeper look into the more emotional response of our current workforce and their fears of oncoming technological unemployment. Susskind's vision involves the idea that machines will do everything we can more efficiently, and more. The demand for human labour will diminish and hiring people that are able to do any remaining tasks is deemed unfeasible in terms of profitability. The number of available tasks will diminish with each coming decade. Susskind's book argues that automation can make the wage inequalities of today even worse by leaving the worker out of the equation completely. Even if a redistribution of wealth were to happen, then the general population would find themselves in a lack of political power. (Susskind 2020)

Technological progress is inevitable, and technology will eventually make certain types of labour obsolete. A perspective explored in Susskind's work does not seem to completely disregard the Luddite movement as a reasonless angry mob. The displacement of jobs through technological upgrade can have the potential to leave harmful dents in living standards via technological unemployment. Automation is described being a cause for the next wave of economic dislocation, as a greater driver of economic dislocations that will displace low-class and middle-class jobs alike. Economic inequality has been a long-standing issue of society, and a society that is free from interdependence and the concept of wealth is a myth, as for most recorded societies, civilizations, and tribes inevitably must take on the challenge of dividing the fruits of their labour. (Susskind 2020)

Susskind argues that education is our best measure to prevent the population from widespread technological unemployment, but the scepticism for higher education today as a measure against this is not completely unfounded, for there can exist an "ability bias", in the sense that graduates of higher education are proven to earn more on average, but the people that have the capacity to graduate could have earned just as much without the expertise of universities. The approach to implement "more education" as a means to combat irrelevance in the skill-level of the average worker is a challenge, because expertise in emerging technologies is a scarce ability, and building a curriculum revolving around the skills that are in demand at the time will prove to be difficult when the skilled are likely to be contributing to their field, rather than offering their hand at retraining students. (Susskind 2020)

Routine work will be easily automatable, so education should focus on identifying tasks that are not easily automatable, such as learning how to build your own machinery and software implementations. The broad recommendation of not focusing on teaching tasks that machines can do better is said to be vital, yet widely overlooked. A survey conducted in 2020 studied the capabilities and

credentials of the computer science teachers in the United Kingdom. The results revealed that many teachers mentioned having no prior experience in the subject, as well as reporting a lack of confidence in regard to teaching the subject. Reform is necessary to ensure that the majority of tomorrow's workforce at large will stay relevant. The tasks that are currently the least automatable do not belong in fields that are highly compensated, although they take place in professions like education, emergency response services and social work. The educational system requires a steep reform to help people acclimate to the more demanding bar of entry to enter the workforce. (Susskind 2020)

Technological displacement of work via machines is bound to happen, but the manner of change has been portrayed as far too optimistic. Rising automation is commonly perceived as something that improves the economy, creates new demand and services and through this, creating more professions ready to be occupied. Inequality imposed by the decreasing work provides slight difficulty in determining the way forward in terms of getting a fair consensus out of people. People can be strongarmed into believing a certain way through financial means or simply means of force if they are deprived of basic human needs, leading to skewed results when it comes to democratic pursuits on trying to determine what needs to be different, especially when pursuing the democratizing of work. (West 2020)

2.2 Society disrupted by technology

A selection of countries; France, Germany, Italy, Spain, Sweden, and the United Kingdom have reported to experience a lot of growth in the high-education market and the middle-education jobs in assembly and machine operation are on the decline. The speculation remains that machines will be able to replace high-skill and non-routine tasks in the coming future. In the past, the impact of technology was speculated to impose a "skill-biased technical change",

meaning that the newly emerging technologies will transform the low-class workforce into a higher-class through implementation and exposure. (Petropoulos 2018)

Technology is perceived to have a polarizing effect on work, for it places demand on high-class non-routine behaviour. The greater use of technology has resulted in a decline of demand in routine work, as was the case with the rise the use of information and communications technology in the early 2000s. Automation displaces labour as it has the power to replace workers by doing these routine tasks in a more efficient manner, simultaneously increasing the productivity of the workforce by opening up time and resources from repetitive tasks to take on those which are not currently automatable. The last benefit of automation is the potential to open the possibility of offering completely new services and markets through increasing the offering. (Petropoulos 2018)

Darrell M. West's work analyses the aspects of technological revolution. The material displays perspectives of low skill labour, and it shows how currently existing jobs get redefined through changes on a technological level. Changes on a massive scale have happened before in terms of economic disruption and with massive shifts in employment numbers. He states that a good example of technology working against the people's needs is by giving certain actors too much power over online discourse, his work mentioning a quote from a Federal Communications Manager named Tom Wheeler stating that "technology has become a tool to undermine truth and trust". (West 2018)

The wealth of the world is becoming more concentrated as time goes on and how societal problems that are to do with inequality have a deep connection with technological advancements. People that are holding the existing wealth are more likely to create advancements that will further accelerate the accumulation of additional wealth. The wealthier class are incentivised to profit

off any technological advancements that can make the fulfilment of tasks more affordable, which gives automated labour a strong use-case. (West 2018)

2.3 Decrease in employment, growth in wealth

The bigger pie argument has been used in discussions technological progress. Technology may displace a vast selection of workers, but it might open new doors for the same people as time goes on. Modern technologies create new types of demand and new products, therefore increasing global demand. Additional demand from the base of consumers creates a demand for additional workers, and thus the pie gets bigger for every actor involved. Susskind's book contains a quote from the Nobel-Prize winner and economist Kenneth Arrow stating that the replacement of men by machines has not increased the rate of unemployment, since the market does find other jobs for workers. When wealth is created, people are prone to spending, which further fuels the need for additional workers. (Susskind 2020)

Economic inequality shows a rate of growth over time, regardless of the influence of automation. The effects of the COVID-19 pandemic had affected the service job market with mass layoffs and structural and massive changes to procedure. The pandemic was disastrous for people working service jobs which made up 70-80% of employment in high-income countries. These very same service jobs have historically had the least amount of change in terms of global recessions. (Benanav 2019)

The currently existing economic inequalities can fuel the interest of private organizations to automate their services even further. Political movements that push for an increased minimum wage can further the incentive for large companies to seek automation as an option. The federal minimum wage of the United States in 2015 is set to $7.25 per hour. The 10 states which adjust their minimum wages annually are subject to more pursuits in automation from large-

scale firms. According to the views expressed in this article, businesses have a clear incentive to look at automation for replacing labour that can prove to be too expensive. The food service industry is a large example of a field that is in constant danger of having to balance interest in the prices of their products and the level of pay offered for entry-level workers. Workers that experience displacement are expected to specialize and to increase their offering to continue employment and to stay a viable choice for hiring, and to reach that desired level of skill, the worker is expected to further their education and training. (Karsten & West 2015)

The proposed solution to achieving a use for everyone's time in a post-scarcity society is to hand an equal voice to all involved and to democratize work. If a utopian post-scarcity world were to be developed by governments worldwide, then realizing such a concept would involve people collectively announcing their current needs and directing the work and efforts of the community to work towards any collective necessities. The article points blame towards the wealthier class of individuals with interests in keeping the status-quo of stagnating wages as is to retain power, and to loosen regulations to keep all their own investments, businesses or even peers in power. The theory Benanav supports is that the current hurdle in the path towards a utopian society is the currently reigning ultra-wealthy class of individuals. (Benanav 2019)

To support Benanav's argument, West's book mentions how American politics influenced by large-scale corporations and that the ultra-wealthy found to be quite active in politics, mentioning a study that 99% of the wealthiest executives are active in politics. The study states that individuals from a wealthier class are very likely to be politically active than the average person. The pursuit of staying politically influential enable the individual to make sure that their wealth holds as much power as possible. The wealthier set of people are reported to also have taken more measures than usual in terms of being active in politics, such as a 40% indication on contacting regulatory officials from that same sample of top-

ranking executives from the Execureach proprietary database of professionals. (West 2018)

2.4 Skill-biased inequality in opportunities and wages

While AI and Automation can continue to contribute to technological unemployment, there can be positives to the ongoing changes in the world that come from the introduction of technology. The partnership of man and machine can liberate the population at large from wasting time and resource from mindless busywork and unnecessary toil. The technological jumps during the Industrial Revolution had reduced the demand for raw energy required from man and shifted the focus of the work for man to more civilised tasks. This was evidenced by the lessening use of horses for transportation and farmwork in the 1900s. Advanced machinery would trivialise complex tasks, which aided cost-cutting and lowering the barrier of entry for industrial work, which would equate to lower costs in production. (Byrnjolfsson & McAfee 2012)

As automation in the Industrial Revolution was symbolized for eliminating physical toil, the ongoing improvements with the currently exponential growth of AI can signify the elimination of creative toil through the streamlining of the processes involved in bringing out innovative ideas to life, or to lessen the burden of clerical tasks. The innovations of today can significantly help various fields in business. The results of AI use can equate to faster service, better time capitalization and planning in production. The process of automation seeks to eliminate the need for staffing when it comes to fulfilling a task. The generation of wealth through the usage of more advanced technology has been vital to generating profits, but the success of an industry does not translate to equal growth in the rewards for the worker. Erik Brynjolfsson, a Senior Fellow at the Stanford Institute for Human-Centered AI and Andrew McAfee, principal research scientist at Massachusetts Institute of Technology, have stated that the job growth in the United States has been slowing down since the 2000s,

because the measured productivity of labour has risen, but the wages and job prospects have dwindled down for the average worker. They report the similar trend in wage stagnation to be present in Europe, in countries such as Germany, Sweden and Finland, albeit less severe than in the United States. Byrnjolfsson & McAfee speculate that technology is the underlying reason for the growing inequality of income. Software driven solutions in corporations replace workers in high-routine communications work as well as information processing, lowering demand for workers in clerical positions. The same technologies strengthen the outputs of people working in the fields of engineering and design, leading to a skill-biased growth in income and employment options. (Berenstein & Raman 2015)

2.5 Economic restructure, shielding the workers

Getting a consensus from the public on how to dictate what society needs is going to require considerable amounts of effort from all sorts of politically motivated people. For people seeking to be more politically conscious, the first step of action is to usually turn to the local news to be up to date on all sorts of contemporary policy shifts and discussions. (West 2018)

A polarized rhetoric from the general media exists which can create difficulties when it comes to aiding people to formulate more educated approaches on how to deal with a transition to a post-scarcity society. There is great divisiveness on how wealth-inequality should be managed, how wealth should be distributed and if it should be distributed at all. West (2018) expresses the belief of media coverage being superficial and uninformative when it comes to explaining controversial economic issues.

An industrial shift is to be expected, but there is no guarantee that it will be a smooth shift for most regular people involved. If automation eliminates the need for low-class work, then it could close off any economic prosperity for people

that do not have the appropriate professional skills. This can include trainee and internship positions, where AI can automate the simpler types of tasks required, removing the need for a junior-level worker. Such circumstances can lead to lack of employment from the untrained, younger generation of prospective employees. A lack of work for this class of people can result in a higher rate of crime. The unemployment rate for the people ages 16-24 in the United States is about 9.4%, compared to the second highest unemployment rate being people aged 45+ with a rate of 2.6%. In war-torn countries, a high youth unemployment rate can serve as a cause for a high rate of crime and instability. Service jobs still require people to be present to generate an output with reasonable costs. (Susskind 2020)

A state of complete automation of human toil is likely to not happen. Automation removes the need for mundane repetitive tasks, enabling any sort of worker to focus on more dynamic work. Freeing up more time gives the possibility for an employee to perform more satisfying jobs for the firm and the individual. The challenge of managing the labour crunch will involve imposing heavy changes. As AI are designed by people with experience in fields like software engineering, computer science and data processing, this means that the economic incentives are funnelled to fields surrounding these professions. (Susskind 2020)

The McKinsey Institute claims that 2,000 work activities from more than 800 occupations are easily automatable, mainly activities that are highly predictable and take place in structured environments, tasks in data collection and the processing and analysis of said data. The estimation is that 30% of activities in 60% of all occupations can be automated, and that around 15% of the global workforce are to be displaced by the year 2030. (McKinsey Global Institute 2018)

Technology improves the efficiency of the work done by humans, but the predicted outcome of the rise in productivity is that the human worker will be viewed as the less desirable option if the machine is measured to do a task better than a human. The moment a machine delivers better results, the machine will take the place of the man. The UK agricultural sector is cited as a good example of workforce displacement through technological progress. For example, the UK agricultural sector used to employ 26.9% of the total workforce in 1861, down to 1.2%, with an output of product that is five times more plentiful than what it was in the 1800s. The workforce involved in the UK agriculture was measured to be 3.2 million employees in the 1800s, down to 380 thousand employees in 2020. This displacement was driven by access to better technologies in producing output. The amount of investment in manufacturing and production has been greater than ever, but the demand for additional workers proves to be waning. (Susskind 2020)

Companies usually utilize technology to make the process of work more efficient. Assembly lines utilize robotics for the sake of being able to do tasks in an unceasing and precise manner. AI is used to generating illustrations for published media, handling basic secretary work, and providing customer support without any kind of downtime involved. The use of artificial intelligence has also been utilized in writing articles for various popular news outlets. The use of automation in communications can also weaponized to further political influence and to dilute and undermine the quality of information found in social media. There is a strong correlation between political involvement and wealth, according to a study conducted by political activists Benjamin Page, Larry Bartels, and Jason Seawright found that the top 1% of wealth holders in the United States have a 68% rate of providing campaign contributions. (West 2018)

The ChatGPT model has been utilized by large press companies in writing articles by major news outlets from the names of CNET and American news

website Buzzfeed. This model of AI is used for producing written text and is used for producing any text-based necessity that the authors might need. ChatGPT has the possibility of writing out code, long legal documents as well as offering general life advice. The model is not exempt from making errors, and the output it delivers is dependent on constant maintenance from human workers. (Bacchi & Asher-Schapiro 2020)

The presence of demand for artificial intelligence has a destructive role on employment. A heavily automated governance of the workforce can lead to the issues of destroying the upward political mobility or communications from the lower-class workforce, thus further feeding into the issues of potential worker dissatisfaction and management. In an example from the company Uber, the performance indicators used to automatically survey the importance of workers has led to a practice of automated layoffs of employees, which can be unethical if the livelihood of an employee depends on an uncaring set of calculations. The method of performance measurement is not disclosed to the employees. Implementation of HR technology in this same vein receives complaints for the issue of being weaponized in union-busting activities, as the data-collected can endanger the job safety and privacies of the employee. Transparency is key to providing a fair environment for work, and a black box model of management can lead to poor worker satisfaction. Poor communications can lead to a high employee turnover rate as well as deficient performance. (Bacchi & Asher-Schapiro 2020)

The studies conducted by Aaron Benanav point out the issue of robotic solutions introduced in the modern era suffer the problem of being unreliable without constant monitoring. Self-driving cars and machine learning algorithms miss the mark very often when it comes to returning stable performance, which solidifies scepticism about the existence of a complete liberation from toil. Technological unemployment has been in effect for a long time, for the phenomenon of technological displacement is not exclusive to the megatrends

explored in this topic. Benanav's work examines the arguments and ideas from futurist authors and suggested that a strong answer to ensure prosperity among the displaced workers is through the implementation of a universal basic income, commonly referred to as UBI, to sever the necessity of work to guarantee an income to lessen the impact of majority replacement and the negatives of such an outcome. The promise of all workers benefitting from technological advances is not a guarantee, as the demand in labour drops with every technological breakthrough in efficiency. The direction where society is headed is placing less importance on labour in the grand scheme of global economy. The adoption of robotization in areas of the world can offer competitive advantages and can lead to a strong degree of deindustrialization. The result of technological advancements can manifest themselves as mass-underemployment, rather than mass unemployment. The rising use of efficient solutions will eliminate the need to hire additional labour, but the currently existing professions will just experience retooling. The decreasing wages and the number of jobs can result from technological advancements can stem from decreasing rates of output-growth from industries, showing that automation cannot be blamed as the primary cause for the decreasing demand for labour. The global economy can only grow so much at the peak of global market saturation. Development of recent technologies can threaten currently existing work and end up being a secondary cause of unemployment when compared to the forces of economic stagnation being the main driver of negative rates of growth in available work. (Benanav 2019)

The current iterations of AI are not a threat to the job market at large, as the jobs that are currently in danger of being automated are positions that engage in primarily rule-based, routine work. The models that are currently in use are believed to be increasing the net number of vacant job positions and transforming the currently existing responsibilities and tasks of workers. The concept of universal basic income is to deliver cash to all actors without the requirement of labour, in the case where mass unemployment becomes an

issue when most of the population are deemed to be redundant for not being able to keep up with the efficiency of machinery, thus meeting the required financial goals to retain a feasible quality of life. The necessity of this action is contested by the state of AI today, where the necessity for the retooling a job is incredibly minor, if such changes were to occur. The option of using UBI or any options that resemble this solution are described to reduce the emotional burden of individuals that are reliant on the currently existing welfare programmes through and reducing the internal managerial complexity and costs that come within maintaining the existing multitudes of welfare programs through simplification. (Alexandra & Wright 2021)

3 Methodology

This thesis is built upon existing analysis which uses the currently existing literature which showcase the uses of AI-based automation in modern-day corporate environments. The main sources of information are from interviews with experts in AI-research, news articles about the impact of AI in professional and societal aspects of life, and general media concerning newly emerging technologies in AI-based automation. The key technologies discussed concerning this topic include chatbots, automated scheduling software, and general solutions that employ visual-learning networks.

Through using historical research and analysing the currently growing trends of AI and automation by firms. By doing so, the end result provides a set of findings that can aid the reader in retaining a competitive edge within the trend of advanced automation powered by AI.

The methods used to manage a business can transform with technological breakthroughs, and preparing for such changes that might come with modern technologies is paramount for staying competitive when it comes to starting, maintaining, or working within a business. To achieve a better understanding of

the subject, historical perspectives of technological displacement will be studied.

The main approach to exploring this subject is to examine the current market leaders in various industries and to examine contemporary reports of situations pertaining to displacement in employees caused by the interest of adopting new technology to the supply chain. The main source of information for this thesis will comprise of futurist literature and recent news coverage about the currently growing megatrend of AI and neural networks in software and machine solutions. To reach the desired end-result, examination of the leading industries and their pursuits in automation will be investigated to substantiate the closing finds. The main source of information will be futurist literature and contemporary news articles about the rise of use of AI and automation in current times and studies about the currently growing megatrends in software and machinery.

Futurist literature has the potential problem of not being very grounded in terms of giving out predictions of what the future might look like. Predictions will always remain as predictions, and not fact. The perspectives of well-learned experts in this field will remain as a valuable source of information when it comes to constructing guidelines, but the problems of AI and automation have faced the perspective of overestimated threat. Exploring the transformative process of AI adoption in modern day business involves analysing and surveying the workforce in companies that find enough success to introduce innovative technologies in the supply chain. Such investigations require a larger investment of time and preparation that is beyond the scope of this thesis.

This research seeks to understand the process of the currently existing prevalence of AI-based automation within current-day market leaders in various businesses, and to estimate the impact of these changes on society and the labour market. The negatives and positives of automation will be considered in

trying to evaluate the scale and severity of changes imposed by AI-powered solutions utilized by multinational firms.

3.1 CAs in customer service

A major example of AI use in business are chatbots. The use of chatbots today is wide and prevalent, considered the go-to tool for general customer support. Starting off as tools for entertainment, as they were initially made to mimic human conversation, chatbots had been adapted to improve general customer support. During the early 2000s, iterations of chatbot had the capacity to give the impression to the end-user that they were talking to a real person for a certain amount of time. Early chatbots in the same vein saw minor use in educational software for language teaching. As time goes on, the public can end up regularly conversing with machines once these ideas get fleshed out in a similar fashion as the currently booming AI technology used for advanced pattern recognition in software to deliver a more human output. (Shawar & Atwell 2007)

Chatbots currently utilized by companies to provide customer support in e-commerce because of their characteristics of being efficient, affordable, always online, and for their capability to provide human-like interactions. Chatbots, or CAs can actively replace human workers in providing sufficient attention to the client at a low cost. (Adam, Wessel & Benlian 2021)

3.2 AI in logistics planning

The field of logistics has seen notable changes with the advent of AI-solutions. A stream of data and key indicators for performance can all be monitored with sensors and automated measurements made by software to generate a stream of information, spanning from all parts of the world delivered to a single point in a timely, real-time manner. AI analysis can be used to enhance production in the ways of improving connectivity between all points of the supply chain, to

offer more flexibility, and efficiency between all the points in the supply chain. AI solutions have been utilized by logistics firms in improving intelligent transport systems and processes. (Woschank, Rauch & Zsifkovits 2020)

Large corporations are utilizing AI solutions to maintain and survey their globally spanning supply chains. A strong example are the services offered by an AI startup by the name of Elementum. The services provided by the company are employed by large-scale companies such as Tesla, and Johnson & Johnson to oversee their supply chains, to log transportation and manufacturing outputs and inputs. Their services are stated to analyse around ten million incidents a day and to warn their employers of potential problems and to offer alternative solutions to any problems that might surface within their supply chains. The AI-driven approach to distributing and receiving information within the supply chain was said to deliver information to its clients about impending material shortages within minutes, as opposed to days when not utilizing such services, proving the effectiveness of a heavily automated stream of information within a supply chain. (Purdy & Daugherty 2018)

Small and automated; the autonomous delivery robots manufactured and maintained by companies like Starship and Kiwi Campus, offer options for automated door-to-door deliveries using compact, 4-wheeled machines operating on pedestrian roads. The robots can pick-up small goods like groceries and deliver them out to the customer’s doorstep. These robots are marketed as being fully autonomous, but to maintain a stable output, any complications within deliveries often require human intervention in the form of remote-driving, likely to be done by a remote-working employee operating as a backup driver. These remote workers are outsourced by companies from countries with a lower average salary. An example of this is a company called Geoffrey, based out of Canada, which outsources employees from Colombia to supply their pool of remote drivers to assist in completing deliveries, with a

comparatively low average salary of 2 USD per hour to assist in deliveries within other nations. (Marx 2023)

3.3 Use of AI in Human Resource Management

Human resource management has seen extensive use of AI in larger corporations of today. The payment processing giant, Mastercard, has taken approaches in implementing AI solutions designed to assist the process of hiring and training workers with AI-driven software that can help measure the development needs of their workforce. Designed in 2020, Mastercard built the AI engine that has analysed the development needs of 17000 employees. Mastercard has utilized this information to explore investment options in terms of internal training and internal developments. The technology has been credited for implementing productive learning commitments to the workers, although it is mentioned that the human leadership is still vital to get the most value out of this solution. (Hakikat 2020)

AI has seen use in the field of Human Resources Management for its capacity to predict, collect, and analyse information about recruitment requirements from different departments. The data collected can aid employees working in human resources to quicken their decision-making process in hiring. These AI services can use tools that can take quicker approaches to solving problems to combat employee dissatisfaction. HR teams use AI-driven surveying tools to gauge employee morale and to combat general burnout, which helps retain productivity levels and reduce employee turnover. The utilisation of AI-based tools has the power to assess and survey a wider range of employees within less time which can help HR teams to quickly assess attitudes about topics in the workspace and to implement additional solutions within an easier and timelier manner. (Maskey 2022)

AI and chatbot-based solutions are being implemented to digital facets of work by HR teams in order alleviate the burdens of repetitive work, and to maintain a responsive link to general employee satisfaction. Électricité de France, a multinational power company owned by the French government has employed the use of chatbots which has the capacity to exchange information to workers about their legal concerns, as well as distributing information about pay, absences, vacation days and company policies. This chatbot has received a 75% satisfaction rating from a sample of 800 end-users, saving time for all stakeholders involved that would otherwise gone to answering reoccurring questions. (Chevalier 2023)

AI has the capacity to find and distribute appropriate legal documentation to the end-user as well as examining the accuracy and validity of declarations. But the systems can be far from perfect, for the capacity of AI depends on the foundation built by the data fed into the model. In other words, data is food for AI. A model operating off a biased data set can end up with a strong possibility of delivering results riddled with the same bias. In the field of AI use in HR, the leading company in the western hemisphere for e-commerce, Amazon, has employed the use of AI in recruitment, and had ended up with a model that gave male applicants a biased priority over female applicants for the sheer reason of the base data set containing applications made by workers from the past 10 years, which male workers ended up being the majority in. The software interpreted any male mannerisms in data as the desired form, giving female applicants less consideration. (Chevalier 2023)

3.4 Use of AI in product design and illustration

With the rise of AI-generated art, companies like the 3D-modelling software distributor, Autodesk, are utilizing AI technology to generate and design prototypes for future products according to inputs that are in the form of desired design goals in a text-based fashion. The computer-design system is dubbed

“Dreamcatcher”, and it has seen use in the healthcare industry for designing facial implants, and in automotive industry for designing prototypes for motor vehicles. (Purdy & Daugherty 2018)

AI-based tools also see increased use for generating visual media. Using a wide-base of illustrations and photography as a dataset, they can provide near-professional level illustrations in a small amount of time. Art that has been generated with AI has been used to win accolades as well as seeing commercial use through appearing on printed merchandise, such as book covers, advertisements, and apparel. The data that is utilized by most currently existing AI-driven art generators use existing, man-made art as the dataset which dictates their output. However, unpermitted use of work from artists can lead into potential copyright issues in the future. The presence of copyrighted material inside the datasets should be considered in terms of legality before seeing use. Implementing the use of the said data scraped from the publicly available banks of media from the world wide web, can lead to copyright disputes down the line. (Salkowitz 2022)

AI models that have been used for generating art have been under scrutiny by artists and courts. For example: a court case in the United States filed by the Joseph Saveri Law Firm accuse the popular tools in AI-driven art generation; Stable Diffusion by Stability, DreamUp by Deviantart to be an act of copyright infringement against artists everywhere, as the data fed into these models is composed of approximately five billion images scraped from the web without consent or credit. (Vincent 2023)

3.5 Predicted outcome and actions.

Demands for a higher minimum wage will increase the cost of labour, leading companies into seeking additional automation as a strategy. Before increasing the minimum wage, lawmakers should make a strong consideration of

improving the access to training in that can justify the hikes in minimum wage. (Karsten & West 2015)

As more jobs face automation, it is in the best interest of society to heavily tax any invasive automated solutions and to consider the possibility of implementing stronger systems of social security, for example: the implementation of a universal basic income. Futurist literature has the potential issue of overstating the possibility of a post-work utopia. When examining multiple works related to predicting future economic displacements through automation, and analysing the current state of automation, it is reasonable to identify the possibility of post-work society as a fringe case. Due to the indispensability of man in the order of designing and supporting AI-driven tools and solutions, this further proves the idea of a post-work society to be a very idealistic prediction. To fully reap the benefits of AI, machine and human minds must work in close tandem, as the growth of AI depends on the human input in the task of constructing of a new iteration of an AI model. (Purdy & Daugherty 2018)

Interfacing with machinery will become a deeper part of general communication in the future as evidenced by the recent push caused by the COVID-19 pandemic's demand of better digital communications options in conferencing, online payments, and even forms of virtual vanity. Ideas such as this have the potential to become deeply ingrained in the businesses of tomorrow. Technology can cause major displacement in the job market, as it can make alternative and more organic approaches in production and providing services completely irrelevant in terms of competitive power. A growing reliance on automation will reduce the need for additional workers, resulting in a trend that will reduce the global employment rate. (Susskind 2020)

Businesses will need to take into consideration the morals and ethics of AI should conform to societal standards across the world. If AI has the capability to

augment the workforce and to improve itself over time, it needs to be set up in a way that it provides a positive outcome for all stakeholders involved. The approach to improve these systems is a reiterative process; as the current iterations of AI follow models that are constructed by software engineers, rather than the AI continuously creating improvements on itself. (Purdy & Daugherty 2018)

A common theme in AI-solutions implemented by companies is that the acquired tools are often not very efficient or sufficiently interconnected with the existing solutions in place, or they lack the capability to deliver steady results.

As AI is a massively growing field, there are now numerous AI companies that offer their solutions for optimizing various parts of a companies' production tasks. However, companies that end up implementing automation aids from varying sources can find themselves challenged with inconsistent output and clashes of standards between products. (Pink, Berg, Lupton & Ruckenstein 2021)

The mainstream adoption of AI of comes with the task of garnering trust towards AI solutions. People are observed to trust the word recommendations provided by their messaging apps without any sort of questioning, but making people trust a medical diagnosis by created by AI can lead to strong scepticism. As of now, humans will remain the designers of AI systems, and to reach a sufficient level of trust from the public in AI solutions, it should be important to keep ethics in mind with a system of governance that can ensure that the model is fit for use before being deployed to handle important issues, such as politics or healthcare. The models of AI need to be transparent and easily interpretable to human designers, and to be explainable by design to the point where reactively fixing catastrophic problems will not be necessary. (PWC 2018)

4 Discussion

4.1 Summary

On the examination of the currently existing technologies implemented in enterprises, it is understandable that most AI-tools facing adoption will require a lot of input and feedback from workers to better calibrate the tools. The examples explored in this thesis show patterns of the leading AI-powered tools requiring a human fallback option to continue delivering results, which is a testament to the fact that human work has not yet been invalidated by the new solutions introduced. Management and social work will continue to require human minds to make creative decisions, as the currently existing AI solutions work because of datasets created from the end-results of human creative work, inhibiting the power of creativity from the tool.

Advanced automation technology is a prominent driver for economic inequality, as it reinforces a labour market where the few can design systems that take on the work of the many, as well as delivering more substantial returns.

The use of AI can invalidate the need for additional human workforce required for completing the simpler types of work. The human element will always remain a crucial factor in management and process, but if a single person can take on the bulk of the work with a robust set of tools, the need to hire additional people wanes. The pursuit of scalability suggests that this does not need to be the case, but from sectors of business that only require a fixed output to operate, this can mean less workers involved in the process, thus reducing the number of available tasks available to the average person.

AI-based solutions have seen widespread adoption in leading industries, which further proves the significance of this emerging technology. There will be simpler work for low-skill employees, and there is a reasonable amount of

evidence of human importance to suggest that middle-class work will face heavy computerization, but not full-on replacement.

The literature review plays a key role in shaping the direction and scope of this research, providing a solid foundation for the analysis and findings presented in this thesis. The question of how society will change through AI-based solutions is a challenging issue to employ end-all solutions for, so instead this work seeks to provide a set of findings to help the individual adapt to the new wave of modernized automation. By examining the current state of AI technology and its potential applications, this study aims to shed light on the ways in which AI-based solutions could impact various aspects of society, including the economy, healthcare, education, and more.

4.2 Research questions

The questions pursued in this topic were explored with the literature used in this thesis. This literature review provided a comprehensive analysis of the existing research and theories related to the topic at hand, allowing for a detailed examination of the key issues and debates in the field.

The insights gained from the literature review informed the development of the research questions and methodology used in this study, ensuring that the research was relevant to the current state of the field. By utilizing a range of sources, including articles, futurist literature, and other relevant publications, the research presented can further solidify the current knowledge on the subject.

In addition to exploring the potential benefits and drawbacks of AI-based solutions, this work will also examine the ethical and social implications of their implementation. By considering issues such as economic inequality, bias, and accountability, this study will aim to provide a balanced and nuanced perspective on the transformative potential of AI in society.

Overall, this research seeks to contribute to a broader understanding of the opportunities and challenges presented by AI-based solutions, and to provide insights that can support corporate and public policy as well as global decision-making alongside this rapidly growing trend.

This thesis seeks to identify where the AI-driven technologies are used in modern day businesses and to identify their capabilities to gauge how widespread the adoption of AI-tools is throughout most prevalent industries.

4.3 Conclusions

Low-skill work will continue to exist in more digital forms. As the currently existing AI models require human input to maintain and sanitize the output of a machine learning model in a case-by-case basis, it will generate a substantial number of positions to people across the world. The options explored by current-day companies resort to outsourcing the low-skill work involved in digital solutions, prime example being the manual navigation of robot delivery vehicles. This information serves as a base for the claim that a completely toil-free society cannot exist if practices like this continue.

Communications related jobs in customer service can be expected to have a drop in positions. As AI can ease simple communication and assist the basic needs of most customers, it can be expected that the size of the workforce in affected fields will lessen. The examples of US manufacturing and the UK agriculture serve as important reminders of eventual replacement of routine work. Complete employment is not a guarantee, and technological innovations lessen the need for human labour. If the severity of this problem continues, then the solution of universal basic income is to remain a strong consideration.

The leading solutions in conversational agents are maintained by companies that do not have interest in providing transparency into the inner workings of their systems. The ChatGPT model has seen heavy financial backing from

private interest groups akin to Microsoft, which means that the current market standards for AI are likely to remain closed source, thus carrying on the issue of the lack of transparency within the technology, which can manifest itself as a model that is difficult to maintain and to govern by external stakeholders. Closed-source technologies are difficult to maintain by any outside actors due to the nature of proprietary technologies providing limited access for them to configure. One of the imperative actions to maintain the stability of the technology is that it meets most, if not all ethical standards across the globe.

Text-based communication can be easily fulfilled by machines, giving a very human feel to human-to-machine communications. Companies actively implement AI-driven CA in online customer service fronts that fit the surface-level needs of most customers.

The ability of CA to use neural networks to create a believable human presence in text form is beneficial for customer fulfilment, but this powerful tool can see misuse in social media through bloating online discussions with mass produced AI-generated messages, with the purpose to further the goals or to disrupt discussions to further the goals of private interest groups. AI can see misuse in the form of furthering political ideologies under the guise of it being a real individual online, further contributing to the problems of helping individuals be more politically conscious through disrupting information and communications regarding the news and opinions from people.

Repetitive tasks are the most likely to become automated, which assures the importance to engaging in non-routine aspects of professional life to increase the offering of an individual to stay relevant amidst rampant automation. The more socially oriented professions that require a strong degree of communication, such as teaching, and emergency response services, require skills in decision-making and ethics as a priority to perform. Currently existing technologies have the issue of not being able to decide which actions remain to

be the best options possible in terms of serving society, as machines lack the capability to be held accountable.

Automation requires constant maintenance to be effective, this is evidenced by the practices of the output sanitization process employed by the leading the development of the leading CA model, ChatGPT. Every AI implementation requires the existing staff to maintain the service, ensure uptime, and to proactively remove faulty outputs.

The necessity of the human fallback option within the AI sector is incredibly descriptive of the current condition of the technologies in use. Currently existing technologies arguably do not possess the human qualities of ethics and empathy. Completely automating the human qualities in business is a difficult feat. Inducing the buying behaviour of a client depends on analysing their wants, goals and beliefs, and automation can respond to the surface-level needs of a client. But to better understand the client, it will take a lot of development for machines to completely understand the complicated facets of what induces buying behaviour within humans.

Education requires a steep reform, for the traditional approach to teaching does not reflect upon the professional climates of the contemporary workspace. The ideas on what to teach, and how to teach should be thoroughly rebuilt to aid the workforce of tomorrow to attain the skills needed to prosper in an AI-reliant society. There should be a strong consideration to reshape the means of education in order to provide individuals the tools necessary to understand AI-driven solutions, as well as to better leverage tools that utilize AI.

The use of AI-models can easily fall under legal issues if the reference material of the datasets on which power the AI-model are not responsibly sourced. If the source data sets that have been fed to an AI consist of text from copyrighted works, photography, and art banks, then the use of such tools can result in potential legal disputes. This is an area that requires a bit more time in terms of

global litigations to determine the rights and wrongs of scraping the internet for feeding data for machine-learning algorithms.

4.4 Limitations

This thesis is a literature-based look into the topic of the effects of AI within the job markets, the reliability of the data parsed is reliant on the quality of writing of the articles. This thesis is heavily based on futurist literature and contemporary news articles about a technology that has only recently been starting a new wave of exponential growth and investment from private sector giants. Finding completely reliable information is difficult, for it is not within the means of most of leading AI firms to be completely transparent about the efficiency of their technology.

The post-work condition can be used as an advertisement tool by corporations currently offering AI-based solutions to customers. The idea of employees receiving more time through complete automation of routine tasks is used to draw more appeal and a stronger emotional response out of potential customers.

As AI is a newly emerging technology that is very unorthodox compared to any other existing technologies, historical research of prior breakthroughs might not be the best choice for making predictions to where AI may lead us.

The idea of hiding the drawbacks of AI can be incentivised by companies eager to advertise their solutions to businesses. This stems from the nature of AI research being profit-driven, rather than being driven by progress.

Ethical considerations of choosing information included examining the information parsed for potential bias. As the research and development of AI solutions is subject to large investments worldwide, there must exist a suspicion that articles are constructed by news agencies in bad faith due to possible

monetary conflicts of interest in their journalistic endeavours. Prior observations suggest that there exist news groups that welcome the adoption of AI to the process of journalism through the adoption of the technology.

5 Conclusion

5.1 Recapitulation

The incoming social changes and technological changes could affect ordinary citizens as well as seasoned professionals alike. The field of business administration requires a wide of perspective on future trends and being able to identify the demands of your workforce amidst innovations in automation is vital to success. Keeping a firm operational in the competitive grounds when competing with other businesses within times of constant technological changes will require innovations in conditioning your labour force to be more familiar with the impending changes.

AI in its current form is a technology that heavily relies on pre-existing data. As machine learning is a powerful tool, it is up to the end-user to decide what it learns. AI can be harnessed by anyone to exponentiate human action, but it cannot engage in creating anything completely new. In operating AI-powered tools in professions that require thorough consideration, for example: the fields of medicine and judicial practice; there must be extra care and constant inspection to validate critical judgements created by these machines.

The complete exclusion of workers from the equation due to automation can further today's wage inequalities. Even if wealth redistribution were to occur, it may not be sufficient to address the issue, as the general population may find themselves with limited political power.

Automation displaces labour by replacing workers with more efficient routine task performance, freeing up time and resources for non-automatable tasks and potential new services and markets.

Implementing 'more education' as a solution to combat worker skill-level irrelevance presents challenges, as expertise in emerging technologies is scarce. Developing a curriculum around in-demand skills is difficult when skilled professionals are focused on advancing their field, rather than retraining the labour force.

Technological disruptions to labour can impose strong negative effects on society if not handled properly, as unemployment within younger age groups can be a driver of growth in criminal activity.

It is imperative to have easy access to expunge false or outdated data, and to use sanitized and licensed material as the base for AI-driven interfaces in professional settings. It is paramount to the sustainability of AI use to make the medium as accessible as possible to make it beneficial to stakeholders everywhere.

As lower to middle-class work are substituted with machinery, the opportunities of tomorrow for middle-class work might grow smaller than now, as there might be a massive skill bias to stay relevant, as the work of one can substitute the work of many. The average person will need more education to prosper in job markets about 30 years from now.

As the job displacement can affect many people, there should be a push for assisting any workers come to terms with the changes. Options to provide displaced workers with any kind of safety net will be a positive move for every stakeholder involved.

Implementation of Universal Basic Income, or a negative income tax for automation will become necessary once the population at large is considered redundant. The threat of automation is present in the sense that technological displacement can impose changes on many industries in the first world, and governments around the globe will face a large challenge ahead in the case of widespread technological displacement rendering the majority redundant, should the situation ever require such measures.

5.2 Societal impact

Automation in recruitment will help companies identify additional candidates for recruitment, rather than fewer. As expectations of providing service within a faster rate is expected from businesses of tomorrow, the AI-assisted method of work will become more common than ever. AI-driven software-based tools can aid workers in generating more value than before through quickening the process of creating, transforming, and distributing data.

The McKinsey Institute expects that there will be enough work for most of the population by the year 2030 (McKinsey Global Institute 2018), but the process of adopting the newer solutions of automation and AI will make changes for the lives of most of the population. Future employees can expect that the required level of education will be adjusted as well as the expertise needed for the tasks themselves, meaning that heightening the people’s education and expertise is strong choice to help employment rates in the future. Investing in the funding in either types of worker training, public or private is imperative to combat unemployment through technological displacement.

ChatGPT, the most capable example of a conversational agent, utilizes workers behind the scenes to correct behaviours expressed by the language-based model. The chatbots of today still require attention from human agent if the automated dialogue fails to satisfy the client. ChatGPT is reported to have

utilized outsourced remote labour from Kenya to sanitize the output of the neural network through suppressing any mentions of general harm, sexual abuse, and suicide from appearing from the content output of the CA. OpenAI serves as the market leader for text-based AI research and is also the leader for advancing the progress of CA development. Market behaviour dictates that the competition is directly influenced by the example of the market leader. As it stands, the AI solutions of today require a lot of input from large groups of workers in order to maintain the quality of said solutions through the means of large teams of low-skill workers fine-tuning the output of the model. Lower-class work will continue to exist, but it will become more supervisory in nature, and less direct. (Marx 2023)

5.3 Recommendations for future research

This thesis explores a subject which is on the cusp of exponential growth. A strong recommendation by the author is to wait for further developments until the most prevalent advancements are in widespread use by a wider number of firms. Waiting for further developments can aid future research as there is a strong possibility for new and unbiased information to surface about this technology in a rapid stage of growth is likely to happen.

Based on studies from prior literature, a strong recommendation is to investigate on how to acclimate the workforce of tomorrow to the AI revolution. to study any potential improvements and changes to any publicly or privately offered curriculums.

The threat of technological disruption to the unemployment rate in first-world countries is a legitimate concern. This drives the recommendation of further study of how to reshape social security systems to withstand a larger number of individuals finding themselves without a place to work.

5.4 Closing statements

This thesis explored the use of current-day AI applications in modern businesses, as well as exploring the possibility of a post-work society as the endpoint of advanced automation to evaluate if the idea of complete replacement is within the realm of possibility for the average person.

The phenomenon of worker empowerment through AI-powered automation will help a single employee to take on tasks that used to require much more staffing. This can incentivize the drive for scalability for staffing within a company, depending on the work required. Innovations have the power to expand the offerings of a firm to the customer, which can lead to an increased number of options in vacant roles for workers.

Based on the findings, a strong recommendation is that the education system requires a strong degree of reform to prevent the general population from alienation by the increasing technical demands of work through the introduction of more contemporary information about the technologies facing widespread use. The likelihood of a post-work society emerging soon is minimal. Reliance on AI decision making is unwise as machines do not possess the human quality of accountability.

A consideration for new workers and entrepreneurs alike is that AI cannot completely replace the human capacity for decision-making behaviour. Automation and AI remain as tools to amplify human actions and make room for more specialized and creative parts of work. Through appropriate measures in increasing the quality of education to fit the needs of the worker, the severity of worker displacement through technology can be lessened. It is imperative for the individual to recognize any skills that are not susceptible to being automated, as these kinds of skills can give the individual a competitive edge in the times of widespread AI adoption.

These recent technologies can have transformative effects on the working lives of people across the globe, but the complete replacement of humans in the workplace can never be guaranteed, as behind every creation of every machine and line of code is a person with the tools to manufacture, to control and to maintain them.

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