5-2023

ANALYZING THE IMPACT OF AUTOMATION ON EMPLOYMENT IN DIFFERENT US REGIONS: A DATA-DRIVEN APPROACH

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A Thesis

Presented to the

Faculty of

California State University,

San Bernardino

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In Partial Fulfillment

of the Requirements for the Degree

Master of Science

in

Information Systems and Technology

Business Intelligence and Analytics Concentration

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by

Thejaas Krishna Balasubramanian

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ABSTRACT

Automation is transforming the US workforce with the increasing prevalence of technologies like robotics, artificial intelligence, and machine learning. As a result, it is essential to understand how this shift will impact the labor market and prepare for its effects. This culminating experience project aimed to examine the influence of computerization on jobs in the United States and answer the following research questions: Q1. What factors affect how likely different jobs will be automated? Q2. What are the possible effects of automation on the US workforce across states and industries? Q3. What are the meaningful predictors of the likelihood of automation for certain jobsor groups? Q4. How can governments and businesses best prepare for the effects of automation on the workforce? Q5. What are the most effective ways to reduce the negative effects of automation on workers and communities? The findings are as follows: Q1: Jobs that do not require higher education are more likely to be automated. Additionally, income and automation are negatively related. In light of the study's results, it was found that employment professions that require a higher educational qualification have a reduced risk of being automated. The likelihood is considerably greater for jobs in industries characterized by lower skill levels including manufacturing and retail. Q2: As automation technology develops, it will lead to employment losses in certain industries and the creation of new opportunities in burgeoning ones. Different states and industries will have different effects of automation on job losses, with some being more vulnerable than

others. Q3: A lot of things affect the possibility of automation, including income and education. Jobs with a lower salary and fewer education requirements are more likely to be mechanized. Q4: To prepare employees for the changing employment market, state governments and companies should invest in (1) learning and guidance programs. These programs will help people gain new skills and information. (2) Supporting entrepreneurship and innovation is another suggestion for generating new employment prospects in developing industries like robots, AI, and data analysis. Implementing laws that assist those affected by automation, such as unemployment insurance or retraining programs, can create a safety net for people who have changed careers due to computerization. (3) Lastly, one important suggestion is to be aware of the particular sectors and job categories that are most susceptible to displacement. Q5: Creating policies that encourage businesses to invest in training and reskilling programs, supporting affected workers financially and educationally, and fostering an environment that encourages innovation and creativity are all effective ways to lessen the negative effects of automation on workers and communities. Possible areas of further study related to the research questions addressed in this paper include exploring the impact of automation on different demographic groups (Research Question 3), investigating the potential implications of automation on the future of work (Research Questions 2 and 5), and examining the role of public policies in addressing the challenges posed by automation (Research Questions 4 and 5). In conclusion, automation has the

potential to transform the US workforce and bring both benefits and challenges. The findings suggest that education and income are significant factors that impact the likelihood of automation. The effects of automation on employment reductions will vary across states and industries. State governments and businesses should prepare for the effects of automation by investing in learning and guidance programs, promoting innovation and entrepreneurship, and implementing policies that support workers affected by automation. Understanding the specific industries and job types that are most vulnerable to displacement is also crucial for mitigating the negative effects of automation.

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CHAPTER ONE

INTRODUCTION

Digitization means using computers to automate a process without changing the way it is done. It merely gives a digital platform for carrying out the task (Gobble, 2018). Digitization can help with material conservation by producing electronic reproductions of high-quality digital photos. This could potentially reduce the amount of damage done to delicate and fragile documents (Khan et al., 2015). Individuals all throughout the world have accelerated the digitization process. This rapid expansion of a new method has impacted numerous sectors throughout the world (Tiberius & Hirth,2019). In the modern period, the phrases digitization and automation are frequently explored. Automation and digitization are clearly interconnected, as automation cannot function without digital components to operate without human involvement, while digitization necessitates components to automatically process and show information (Schumacher et al., 2016).

Automation and AI go hand in hand because AI is often used to make processes easier to automate and to make them better. Moreover, many automation processes now rely on artificial intelligence (AI) technology, such as natural language processing & machine learning, in the direction of improving efficiency and accuracy. McKinsey & Company's analysis highlights that artificial intelligence (AI) is critical for the success of automation.

Firms that integrate AI into their automation initiatives can enjoy significant benefits, such as higher productivity and cost savings. However, the impact of automation on the global workforce is a cause for concern. According to McKinsey's 2017 study authored by De la Garza, up to 800 million jobs worldwide could be lost to automation by 2030, which is almost 20% of the global workforce. The study also revealed that the impact of automation would vary by industry and occupation (such as Health care, education, businesses, retail,electric utility etc.), with low-skilled workers and those in emerging economies being particularly vulnerable. Yet, the report also found that automation could create new job opportunities in fields such as healthcare, renewable energy, and information technology. To address the potential negative impacts of automation, McKinsey recommended that representatives spend time in learning and guidance programs to set up workers for the professions of the future. Additionally, they must provide income support and retraining for the workforce who lose their duties to computerization. Overall, McKinsey's study highlights the necessity for a proactive method to control the influence of automation on the employees. While automation can bring significant benefits, policymakers and businesses must ensure that the benefits are shared equitably and that workers are supported throughout the transition to an increasingly automated economy. Such measures would ensure that the potential of automation is harnessed to benefit society as a whole. (De la Garza, 2017).

With the growth of artificial intelligence, there is turmoil among workers all over the world. Artificial intelligence has been assigned a vast topic of study (Kumar & Thakur, 2012). The implementation of artificial intelligence may pose both a difficulty and an opportunity for those working in many industries (Pereira et al., 2023). People across the world are betting on the impact of artificial intelligence in various fields (Khobragade et al., 2022). Even now, the influence of artificial intelligence applications is a hotly debated topic (Bankins & Formosa, 2023).

Background

There has been a significant increase in the use of artificial intelligence across various fields and industries. In addition to healthcare, where AI is being utilized for disease diagnosis, monitoring, and risk management (Ali et al., 2023), education (Huang et al., 2023), finance (De la Garza, 2017), and manufacturing (Chryssolouris et al., 2023) are also adopting AI to automate their processes. Furthermore, the manufacturing industry has observed a wide range of AI applications for various jobs. Also, the manipulation of artificial intelligence in many fields over the globe has had a big effect on how people think. While some people see automation as a beneficial and efficient improvement, others are concerned and curious about the probable negative consequences of AI.

Statement of the Problem

Automation and artificial intelligence have grown increasingly common in a variety of industries, resulting in substantial upheavals in the different areas. AI has been utilized to create investigative tools, forecast long suffering outcomes, and improve clinical decision-making. For instance, researchers have developed an AI algorithm that can diagnose breast cancer with a higher accuracy rate than human radiologists (McKinney et al., 2020). AI has also been used to develop a tool that can predict the likelihood of a COVID- 19 patient developing severe respiratory disease (Gupta et al., 2021). AI is being used in finance to improve fraud detection, automate customer service, and make investment recommendations. For example, JP Morgan has developed a machine learning algorithm that can analyze legal documents and extract important information, saving the bank thousands of hours of manual work (Mukherjee, 2021). AI is being used to improve the safety and efficiency of transportation systems. Self-driving cars, for instance, rely on Auto navigate roads and avoid collisions. AI is also being used to adjust traffic flow, shrink blocking, and enhance public transportation services (Liu et al., 2021). AI is being utilized in the education sector to personalize learning and enhance learner results. Adaptive learning boards use AI algorithms to investigate learner performing data and tailor learning experiences to individual needs. AI is also managed to computerize administrative tasks, for instance scoring and feedback (Madden, 2021). AI is

employed in agriculture to adjust crop yields, shrink discarded, and enhance sustainability.

AI algorithms can explore soil and weather information to provide farmers with personalized recommendations for planting and harvesting. Drones equipped with AI-powered cameras can also be used to monitor crop health and detect pests and diseases (Frąckiewicz, 2023). In conclusion, AI is being applied across various industries to improve efficiency, productivity, and outcomes. As AI continues to evolve, its applications will likely expand further into new fields, renovating the pathway we survive and work.

The impact of artificial intelligence is being observed in various fields, and the McKinsey survey has shed light on its effects. Researchers have recognized the need to identify the current trends and have conducted studies to analyze the impact of AI. For instance, AI is revolutionizing the healthcare sector by enhancing disease detection, diagnosis, and treatment. It is also being applied in finance to automate customer service and fraud detection processes. In the retail industry, AI-powered chatbots and recommendation engines are improving customer experience and sales. Overall, there is a need to analyze the impact of AI in different domains. The study (Rockstroh, 2013) argues that advances in AI & automation are leading towards the displacement of numerous traditional professions and are likely to continue to do so in the future. The article cites statistics showing that despite economic recovery in the US, job creation has not observed frequency with population increase, partly due to increasing automation

of routine work. The article suggests that technological innovation has led to a situation where fewer people are needed to produce goods and services, resulting in a shift towards a "Winner-takes-all" economy where a small group of highly skilled individuals hold much of the wealth. The article concludes that while technological progress is beneficial, policymakers need to address the challenges of job displacement and income inequality.

Current research has decided on the influence of AI on technologies such as job sectors, such as manufacturing, transportation, and customer service, Moreover, a study conducted by (Muro et al., 2019) focused on the effect of AI on the US workers. The study found that around 25% of US jobs were at elevated danger of computerization with the advancements in AI and robotics. The sectors most at risk were food service, retail, and hospitality. However, the study also suggested that AI could create new jobs in industries such as healthcare and education, as well as augmenting existing roles. (De la Garza, 2017) (Muro et al., 2019).

By forecasting the distribution of employment across various occupational categories, Halal et al.'s (2016) research aims to address the potential issue of unemployment. Furthermore, the impact of automation on worker well-being and health has been researched (Nazareno & Schiff,2021). This inquiry is vital to comprehend the impact of mechanization on the physical and mental health and well-being of laborers. Additionally, research has been conducted on the impact of mechanization on various nations, such as Singapore (Fuei, 2017) and Saudi

Arabia (Sarabdeen & Alofaysan, 2023). Nonetheless, the examination carried out by Frey & Osborne (2013) solely assessed the influence of automation on a countrywide scale and did not pinpoint the effect on individual states. Hence, it is necessary to evaluate the influence of mechanization on a regional level. The study by McKinsey in 2017 analyzed the impact at the county and city level. Ultimately, investigating the dispersion of jobs and the consequences of automation on employee welfare and health is crucial to pinpoint possible issues and implement necessary measures. Although some studies have explored automation, further examination of its effects is necessary at a more detailed scale. Additional investigation into the influence of automation at the state level will yield a more comprehensive comprehension of its workforce consequences. Going ahead, it's crucial to comprehend the influence of automation on various sectors and their labor force. In the subsequent paragraph, we'll talk about the effect of automation on the manufacturing sector. The effect of automation and AI tech on employment is noteworthy, with specific sectors and jobs being more at risk of being replaced than others. Considering this, the study aims to analyze the impact of computerization on workers and identify areas where job growth may occur, as well as where laborers should acquire new abilities to remain employable. The study emphasizes the need for policymakers to develop proactive strategies to alleviate the harmful effects of computerization. By anticipating future occupation market changes and taking steps to ensure workers are equipped with the skills required for the jobs of the future,

policymakers can help promote economic growth and minimize the influence of automation on the hiring process. Although many studies have been conducted on the impact of automation on the job market, this study offers a more in-depth analysis of the subject. The study not only explores the correlations between different factors but also provides a more recent examination by utilizing up-to-date data. Moreover, this study aims to fill the gap by analyzing the impact of automation at the state level, which has not been adequately studied in previous research. Therefore, this study offers a more comprehensive and updated view of the impact of automation on the job market, specifically in the manufacturing industry.

The increasing use of automation and artificial intelligence in various sectors of the US economy necessitates an understanding of their impact on employment trends in different regions. This study aims to investigate the variations in the effects of automation on jobs across different regions of the United States. The dataset used in the analysis was obtained from the BLS and was recently updated to include data up to 2021. The data set comprises details regarding job classifications and state-level statistics. This particular research sets itself apart from previous studies on automation due to its comprehensive analysis of the interrelationships among various factors and its utilization of up-to-date information. Previous studies, including the works of Sharma & Singh (2023) and Marshall (2023), have brought to light the possible adverse impacts of automation on employment stability and contentment. It's important to consider

the effect that income and employment have on automation. After all, the happiness of workers is closely tied to these aspects, as Liu (2023) has pointed out. Our goal with this research is to gain a thorough understanding of how automation is affecting the workforce and provide suggestions to policymakers on how to address any potential negative- consequences.

The Goal of the Research

The aim of this research is to explore how automation affects different occupations and provide suggestions to mitigate its adverse effects, such as unemployment. Furthermore, the research intends to explore the impact of automation in various US states by examining several factors, including earnings, median hourly or annual pay, and education and training requirements for different vocations. The study data was sourced from the Bureau of Labor Statistics and is up to date as of 2021. Furthermore, an additional data set was also used to support the research. There are concerns observing the influence of technology on employment as it becomes more widely used, and this study tries to address these issues by offering insights into the impact of automation on various job occupations. The study will examine the consequences of automation in several states across the US appropriate to better comprehend its ramifications. The research data comprises evidence from the Bureau of Labor

Statistics on earnings, median hourly or annual pay by occupation, and education and training assignments (Frey & Osborne, 2013). As is well known, automation in various sectors of the world has the potential to drastically alter the world. Previously completed work focused on analyzing the impact of automation in various cities and counties. However, this research effort analyzes the influence of different states in the United States, as well as the job occupations that are at risk of becoming automated. Furthermore, this research investigates the impact of pay and the total number of employees on automation. Furthermore, this report emphasizes several solutions for avoiding job losses due to automation. Thus, this study provides a complete examination of the consequences of automation in several states across the United States by examining numerous elements such as earnings, median hourly or annual income, and education and training assignments for various vocations. The conclusions of this study will be valuable for politicians, employers, industries, and individuals in planning for and minimizing the effects of automation. To thrive in the changing landscape of employment by adjusting and achieving success, it is critical to understand the influence of automation on job occupations.

Research Questions

The following questions are investigated to determine how automation will affect various jobs in the United States:

1. What factors affect how likely different jobs will be automated?

2. What are the possible effects of automation on the US workforce across states and industries?

3. What are the meaningful predictors of the likelihood of automation for certain jobs or groups?

4. How can governments and businesses best prepare for the effects of automation on the workforce?

5. What are the most effective ways to reduce the negative effects of automation on workers and communities?

CHAPTER 2

LITERATURE REVIEW

What Factors Affect How Likely Different Jobs Will Be Automated?

There are several factors that can influence the likelihood of a job being automated, including income, education, and industry. Jobs with lower wages, lower levels of education, and routine tasks are more likely to be automated, while jobs with higher levels of education and complex tasks are less likely to be automated.

Corresponding to a description by the McKinsey Global Institute, 60% of all professions have at least 30% of actions that can be automated with current technology, and these activities are concentrated in lower-wage occupations. This makes jobs that pay lower wages more vulnerable to automation due to the potential reduction in labor costs. For instance, jobs in the food service industry, such as fast-food workers, have a high probability of being automated because they often involve tasks such as taking orders, preparing food, and cleaning (McKinsey, 2017).

Expertise and high skill level are commonly perceived as factors that make a job less likely to be automated. The integration of intricate tasks that demand human judgment and decision-making methods give rise to this belief.

With regards to careers in the healthcare industry, doctors and nurses take on tasks such as creating treatment plans and diagnosing patients. This lowers the possibility of automation affecting their jobs. The report by Brookings Institution highlighted the industries most susceptible to automation which include manufacturing and shipping. It is important that many jobs in both industries are monotonous and recurrent in nature. In food service, administrative support, and retail sales, women often hold positions that are more susceptible to being automated, according to studies. Policymakers must acknowledge the gender-specific implications of automation and secure equal access to premium job openings for women in this burgeoning workforce. To combat the adverse effects of Job loss by AI and Automation there are various solutions that have been proposed and recommended. Some of them are upskilling and reskilling programs, promoting entrepreneurship and small business development including creation of a suitable ecosystem to encourage budding entrepreneurs and also investing in education and training people for jobs of the future. An in depth and thorough analysis of the impact of automation on jobs and industries across different states and professions including studying the various directly and indirectly affecting factors such as wages and educational requirements can help inform policy makers, businesses and individuals equally prepare for the changing employment landscape. To sum up, it is crucial to clearly understand how automation directly and indirectly affects employment and society at large and proactively adapt and help individuals and businesses succeed and work

together in the changing face of the economy. It is paramount to conduct additional research to better understand the various complexities of job automation and its diversified impacts on people from different backgrounds within the workforce.

Another area for further investigation is the influence of automation on workers in growing countries. A report by the International Labor Organization titled "Automation and Independent Work in a Digital Economy "analyzed the potential consequences of automation on employees in Asia, Africa, and Latin America. The study discovered that workers in these regions are in danger of occupation shift due to computerization, particularly in industries such as agriculture and manufacturing. Moreover, independent workers such as those in the gig economy are especially vulnerable to job loss as they lack the protections and benefits offered to traditional employees. The study highlights the need for policymakers to formulate strategies that guarantee that workers in developing nations have access to decent work and social protections in the face of automation (ILO, 2018).

Although numerous studies have been conducted on the considerations that influence the likelihood of work automation, several areas, including gender implications of automation and the impact on workers in developing countries, require further investigation.

What are the Possible Effects of Automation on the US Workforce Across states and Industries?

The US workforce has experienced notable consequences on job losses and shifts in the labor market due to automation. According to (Manyika et al., 2017), McKinsey Global Institute conducted a study that discovered existing technologies could automate up to 45% of all paid activities in the US economy, with differing degrees of potential across various sectors and locations. The study also concluded that automation could lead to the displacement of approximately 14.9 million workers, equivalent to 10% of the current US workforce, by 2030. Automation is expected to impact employment primarily in vulnerable sectors such as transportation, retail, and manufacturing while also creating new job opportunities in fields such as healthcare, STEM, and creative domains. The influence of automation on employment is expected to vary across the country, with states such as Nevada, Louisiana, and Texas having higher percentages of workers that are at danger of computerization compared to states such as New York and California.

The research findings indicate that automation has and will continue to gain a substantial influence on employment in the US workers. Many professions are at threat of being substituted by automated technologies, although unfamiliar job opportunities will emerge in different sectors. While some states and industries may be more vulnerable to job displacement, the impact will likely affect the economy as a whole. Therefore, policymakers must ponder the

hypothetical outcomes of automation and develop strategies to moderate the harmful effects on the workforce.

To address the effect of computerization on the US personnel, policymakers can consider implementing actions such as participating in teaching and guidance programs to support workers obtain the skills obligatory for the new job opportunities created by automation. Policymakers can also develop policies that encourage businesses to adopt automation responsibly and ethically by providing incentives for companies to retrain their workforce. Additionally, policymakers can create a safety net for workers displaced by automation by providing unemployment benefits and job placement services. Finally, policymakers can promote the development of new industries and technologies that create new job opportunities and boost economic growth. By taking these measures, policymakers can ensure that the effect of automation on the US workers is mitigated, and laborers are equipped to take advantage of new opportunities created by automation.

Impact of Automation Globally

Despite the advantages of automation, there are concerns regarding its impact on employment. Some experts anticipate that automation will replace up to 800 million jobs worldwide over the next ten years. While automation is

expected to generate job opportunities in fields such as software engineering and data analysis, low- skilled workers may be left without work. This could exacerbate economic inequality, especially if these individuals are unable to acquire the necessary skills for new careers.

Automation leads to job displacement, particularly in industries where routine tasks are prevalent. Nonetheless, automation has the potential to boost productivity and create jobs in other sectors, potentially mitigating the negative effects. (Acemoglu, 2019). Another issue is the potential misuse of AI. As automation becomes more prevalent, there is a possibility that AI could be exploited to discriminate against specific groups or perpetuate existing biases. For example, recruitment tools powered by AI could inadvertently favor candidates from demographic groups or with specific educational backgrounds. Technological advancements often displace workers and cause a reduction in the labor share of income, resulting in an increase in income inequality. However, the adverse effects of technology can be countered by policies that promote education and retraining programs to assist workers in adapting to changing job demands. (Daron, 2018)

Automation in USA

Automation has had a substantial effect on the economy of the United States. One of the most impacted sectors in the US is manufacturing. The US has been a pioneer in automation technology for several years, with manufacturing, transportation, and healthcare among the industries experiencing significant changes due to automation. In some local labor markets, particularly those heavily reliant on industries such as manufacturing and agriculture, computerization has had a significant bad impact on occupation and earnings. The authors have also identified several job categories that are highly vulnerable to automation, including routine manual and cognitive tasks. (Autor, 2015).

Automation and innovation have acted a part in the substantial increase in income variation in the US over the last few decades. High-skilled workers have been able to demand higher wages and more secure employment due to automation, while low-skilled workers have faced employment loss and remuneration erosion due to automation and outsourcing. (Olsen, 2022). The use of automated machinery has significantly enhanced productivity and efficiency in factories throughout the country. Robots now run assembly lines that were previously managed by human workers, allowing them to operate continuously without breaks or rest periods. This has resulted in considerable cost savings for manufacturers, as well as increased quality control and product uniformity.

Impact of Automation on Jobs in the USA

The influence of automation on jobs in the US is a multifaceted issue. Although automation has the potential to improve productivity, reduce costs, and create new job opportunities in emerging fields like robotics, AI, and data analysis (Nazareno, 2021), it may also result in the displacement of workers in industries where automation is implemented. For instance, assembly line workers in manufacturing industries may be replaced by automated machines (Mesch, 2020), and the adoption of self-checkout systems in retail stores may reduce the need for human cashiers.

The overall effect of automation on jobs in the US will be determined by various factors, such as the types of industries and technologies involved, the speed of automation, and workers' ability to adapt to changing roles and sectors. While some jobs may be lost, others may be created in new industries and areas (Bessen, 2021). The impact of automation may also alter the nature of work, necessitating workers to gain new expertise and knowledge to adjust in evolving job market. To mitigate the prospective negative effects of automation on jobs, it is crucial for representatives and businesses to collaborate on developing strategies to support workers and help them transition to new roles and industries (Rourke, 2022). This could involve participating in education & training plans to aid workers attain novel skills, offering financial support and job retraining initiatives for

displaced workers, and promoting policies that stimulate the creation of new industries and employment opportunities.

In summary, while automation has the potential to bring significant benefits to US industries, it is critical to consider its potential impact on jobs and workers. Through joint efforts, policymakers and businesses can guarantee that the benefits of automation are rightfully shared beyond society and that workers are supported throughout the transition to a more automated workforce (Frank, 2018).

What are the Meaningful Predictors of the Likelihood of Automation for Certain Jobs or Groups?

Studies have extensively explored the connection between automation likelihood and variables such as annual income, employee count, and predictors for job automation. (Frey & Osborne, 2017) found a strong correlation between automation likelihood and jobs involving routine or repetitive work, with jobs requiring lower education levels and annual incomes being more susceptible to automation. Similarly, (Arntz et al., 2016) found that jobs with lower educational requirements were more likely to be automated. (Graetz & Michaels, 2018) found that smaller firms were more likely to automate jobs that required low-to-medium skill levels. (Acemoglu & Restrepo, 2020) found that jobs requiring more creativity, social intelligence, and manual dexterity were less likely to be

automated, while jobs with more routine or repetitive work were more susceptible. (Autor, 2015) discovered that industries with heavy regulation or high labor costs had a higher likelihood of automation.

Despite the extensive research on this topic, further study is desirable to explore how the correlation linking automation and income, education, and employee count varies in different countries or industries. Additionally, future research could investigate the effectiveness of different policy interventions, such as reskilling programs, to address the potential negative effects of job automation on workers. In conclusion, the existing research consistently finds that jobs requiring routine or repetitive work, lower education levels, and lower annual incomes are more likely to be automated. Nevertheless, further research is necessary to identify effective policies to address the negative consequences of automation.

How can Governments and Businesses Best Prepare for the Effects of Automation on the Workforce?

Several studies have proposed effective strategies for administrations and businesses to train for and mitigate negative effects of computerization on the workforce. One such approach is to implement policy interventions that facilitate the transition of workers into new jobs. (Bughin et al., 2018) recommend

retraining and upskilling programs that provide workers with new expertise and intelligence to adjust to shifting job obligations. (Arntz et al., 2018) suggests that governments can support workers through policies such as unemployment benefits, wage subsidies, and public job creation.

Another effective approach is to encourage job creation and innovation. (Autor et al., 2021) propose investing in research and development to create new jobs and spur economic growth. The study recommends that governments invest in new technologies and innovation to support job creation and the development of new industries.

In conclusion, the negative effects of automation on the workforce can be mitigated through effective policy interventions and innovation. Retraining and upskilling programs, as well as policies such as unemployment benefits and wage subsidies, can support workers during the transition to new jobs. Investing in study and growth can hint to the formation of additional careers and financial growth.

Advanced investigation is necessary to identify the furthermost active policies and plans to practice easing the adverse effects of automation on the workforce. Future studies could explore the effectiveness of different types of retraining and upskilling programs and identify the most effective policies for each sector. Moreover, the research could examine the impact of computerization on individual industries and occupations and identify effective strategies to aid workers in transitioning to new jobs and industries. Collaborative

efforts between policymakers and businesses are crucial in establishing support

mechanisms to help workers adapt to the evolving job market.

To decrease the potential minus influences of automation on jobs,

politicians and businesses must collaborate to establish comprehensive solutions

that fulfil employees' demands. This possibly will comprise investing in

education and training programs to aid employees learn novel services, providing

financial assistance and job retraining initiatives for displaced workers, and

pushing policies that encourage the development of new sectors and job

possibilities. Policymakers and corporations may collaborate to guarantee that the

advantages of computerization are dispersed equally across society and people

remain supported during the transition to a more automated workforce.

What are the Most Effective Ways to Reduce the Negative Effects of Automation
on Workers and Communities?

To sum up, the influence of computerization on jobs in the United States is

a complex topic that will be affected by numerous considerations. While

automation may result in the loss of some employment, it may also result in the

emergence of new industries and possibilities. To guarantee that the advantages

of automation are public evenly crossways cultures and that workers are supported

during the transition to a more automated workforce, politicians and corporations

must work together to develop comprehensive plans that address workers' needs.

We can contribute to ensuring that the bearing of computerization on jobs is

optimistic and that workers can succeed in a developing job market by doing so.

CHAPTER 3

METHODOLOGY

The chapter aims to investigate the impact of automation on job occupations in the United States across various states. To achieve this goal, the study employs a variety of methodologies to address research questions that have been elaborated upon. The primary objective is to advance data analytics by providing a better understanding of the impact of automation on the labor market. In this chapter, we will describe the data collection process and the various Python libraries used in the analysis, including their functions and capabilities. We will also discuss the exploratory data analysis techniques utilized, such as visualization and correlation analysis. Finally, we will outline the strategies employed to prepare for the effects of automation on the workforce and mitigate its negative consequences on employees and communities.

Q1) What factors influence the likelihood of different jobs being automated?

To address the question of which factors contribute to job automation, this investigation proposes exploratory data analysis techniques as a solution. EDA (exploratory data analysis) involves visualizing data to gain insight into its properties, relationships, and patterns; EDA also establishes its distribution range before formal modeling takes place. Researchers plan on employing various Python libraries such as Pandas, NumPy, and Matplotlib for EDA purposes as part of their investigation. Pandas is an efficient data manipulation

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and analysis library with data structures tailored to working with tabular data, such as data frames; Using it provides a great way to cleanse and prepare data before analysis begins. NumPy offers numerical computing using arrays and matrices used in mathematical operations, while Matplotlib provides plotting capabilities allowing various forms of visualization. Researchers using Python libraries and EDA techniques can use them to investigate factors that contribute to the likelihood of specific jobs becoming automated, including educational levels or industries where these jobs reside. By employing visualization techniques, they can effectively present their findings to policymakers or business leaders while providing insight into which factors impact job automation likelihood and guidance regarding how best to prepare for changing workforce needs.

Q2) What are the possible effects of automation on the US workforce across states and industries?

This investigation seeks to answer this question by exploring its potential effects on the American workforce across states and industries. Plans call for using Python libraries such as Pandas, NumPy, and Plotly Express. Pandas and NumPy libraries are invaluable for data manipulation and analysis, providing data structures suitable for dealing with tabular data and numerical computations, respectively. By employing these libraries to access large datasets related to US workforce automation research projects, researchers can uncover trends and patterns regarding specific jobs that have been automated across states and industries while understanding how automation could alter various segments of workforce participation. Plotly Express is a Python visualization library created

to make interactive visualizations effortless, making bar charts, scatterplots, and heat maps straightforward. Researchers can utilize Plotly Express to efficiently communicate their findings to policymakers or business leaders in an easily understandable format. Researchers can leverage these libraries to assess the potential ramifications of automation on different states and industries within the US workforce. For example, they could examine whether automated manufacturing jobs affect local economies or labor markets and identify vulnerable industries. In contrast, others stand to gain from automation. Utilizing Python libraries such as Pandas, NumPy, and Plotly Express can provide invaluable insight into the potential effects of automation across states and industries in the US workforce, providing policymakers and managers with valuable intelligence for devising plans to minimize its adverse consequences.

Q3) What are the meaningful predictors of the likelihood of automation for certain jobs or groups?

To fully appreciate life and all its pleasures, one requires either physical fitness or an outlet for one's emotions, like music. When making decisions that impact either happiness or peace in your life—whether happiness comes first or vice versa—it is best not to rely solely on others for guidance; only you have the power to craft and reach your destination! This investigation uses visualization techniques, correlation analyses, statistical modeling, and machine learning algorithms to predict automation among specific jobs or groups. Pandas, NumPy, and Plotly Express, will be used to visualize job automation data and predictor variables. Visualizations enable researchers to quickly recognize

patterns within data, spot outliers or areas requiring further investigation, and identify relationships within them. Correlation analysis can also examine the strength and direction of relationships among predictor variables, such as those related to automation likelihood predictor variables, that could increase job automation likelihood. Predictor analyses provide insights into which factors could play a key role when automating certain jobs or groups. Investigations use visualization, correlation analyses, statistical modeling techniques, or machine learning algorithms to pinpoint key predictors that affect automation likelihood. Python libraries such as scikit- learn, TensorFlow, and Keras allow users to build predictive models based on historical job automation data and predictor variables. Based on these predictor values, these models are then used to predict automation for new jobs or groups. As more data becomes available and machine learning algorithms apply their insights, models become more accurate, providing greater insights as time progresses. Refinements continue to optimize predictive value over time. Overall, visualization techniques, correlation analyses, and predictive models successfully increased accuracy. Statistics, machine learning algorithms, and statistical modeling can provide detailed insight into meaningful predictors of automation likelihood for specific jobs or groups, providing policies and strategies with the information necessary to reduce its harmful effects on these groups and build more equitable and sustainable one's workforces.

Q4. How can governments and businesses best prepare for the effects of automation on the workforce?

To answer this research question of what policy changes can businesses and governments can implement to prepare for and mitigate the effects of automation on their workforces, literature from various relevant sources will be studied, and evidence accumulated will also be taken into consideration. Literature reviews involve gathering and evaluating academic articles, reports, and other sources that address the effects of automation on workers and strategies to mitigate its adverse outcomes. To effectively complete this task, systematic literature reviews with strict inclusion/exclusion criteria must be employed in order to locate relevant sources. Investigative efforts involve gathering evidence through interviews with industry specialists or surveys among employees and employers to gauge how best to prepare for automation. Data Analysis and Visualization Libraries Employed: Libraries for data analysis and visualization were integrated as components of the development environment. Existing research questions (Pandas, NumPy, and Plotly Express) could provide helpful information. Python data analysis tools were also utilized to process and present information gleaned through literature reviews and other research methods. Overall, exploring strategies businesses and governments can utilize to prepare for the impacts of automation on the workforce may involve conducting literature reviews, collecting evidence from multiple sources, and employing Python as a data analysis tool to interpret and visualize it.

Q5. What are the most effective ways to reduce the negative effects of automation on workers and communities?

To conduct a literature review on the impact of automation on workers and communities as well as effective mitigation strategies requires an extensive investigation of various academic articles, reports, and sources. Specific inclusion/exclusion criteria are necessary for the identification of pertinent resources. Key areas that relate to the topic may include retraining/reskilling programs for employees believed most affected by automation; labor market regulations; income support policy among others; all acted upon by government bodies with impacted parties in mind. The review process involves investigating case studies in diverse industries or regions where interventions have proven successful. Expert interviews will provide valuable opinions concerning useful modification approaches to assist impacted parties while aiding them in resuming or acquiring new skills fit for purpose should previously held roles become redundant due to technological innovation. Additional analysis investigating meaningful predictive factors relating to the likelihood of specific jobs becoming automated will provide insight into potentially impacted groups/workers requiring assistance transitioning into alternative occupations or gaining required knowledge that allows evolution within their previous roles.

Data Collection

For this study, two datasets will be utilized, comprising three from the Bureau of Labor Statistics (BLS) and one from Frey and Osborne (2013). The amalgamation of salary and automation data from one of the BLS databases will result in a unified dataset that will be subjected to comprehensive analysis. A detailed description of the dataset sources will be presented in the report to ensure transparency and credibility. The primary objective of this study is to augment the field of data analytics by elucidating the implications of automation on the labor market.

Description of Data Set

Following data cleaning, the attributes used for analysis are described here. The following attributes are being used for automation analysis in various states around the United States.

" ['Occupation', 'typical', 'workexp', 'O_GROUP', 'TOT_EMP', 'EMP_PRSE', 'A_MEAN', 'MEAN_PRSE', 'A_MEDIAN', 'Probability', 'Alabama', 'Alaska', 'Arizona', 'Arkansas', 'California', 'Colorado', 'Connecticut', 'Delaware', 'District of Columbia', 'Florida', 'Georgia', 'Hawaii', 'Idaho', 'Illinois', 'Indiana', 'Iowa', 'Kansas', 'Kentucky', 'Louisiana', 'Maine', 'Maryland', 'Massachusetts',

'Michigan', 'Minnesota', 'Mississippi', 'Missouri', 'Montana', 'Nebraska', 'Nevada', 'New Hampshire', 'New Jersey', 'New Mexico', 'New York', 'North Carolina', 'North Dakota', 'Ohio', 'Oklahoma', 'Oregon', 'Pennsylvania', 'Rhode Island', 'South Carolina', 'South Dakota', 'Tennessee', 'Texas', 'Utah', 'Vermont', 'Virginia', 'Washington', 'West Virginia', 'Wisconsin', 'Wyoming', 'State_Total']"

Although the dataset contains many jobs, just a few occupational types have been considered for this analysis, and their descriptions are provided below:

- Executives (Top, Chief)

- Legislators, Advertising

- Management

- Marketing,

- Public Relations Managers

- Promotions, and Sales Managers

- Marketing and Sales Managers

- Education and Library Science Teachers,

- Public Relations, Postsecondary

- Law, Criminal Justice, and Social Work Teachers, Postsecondary

Experimental Settings

The research was carried out on the system with the following specifications:

• CPU: Intel(R) Xeon(R) processor @ 2.20GHz

• RAM: 12GB

CHAPTER 4

DATA ANALYSIS AND FINDINGS

In this chapter, we present the results of our exploratory study aimed at identifying the impact of automation on different job occupations across various states in the USA. Our analysis focused on a dataset of approximately 50 states, which was obtained from government databases and industry reports. The following research questions are being analyzed.

Q1. What factors influence the likelihood of automation in different job occupations across different states of the USA?

One of the research inquiries in this study was aimed at exploring how certain variables, such as industry, education, and income, affect the prevalence of automation. The data was subjected to statistical analysis to reveal the relationship between automation and job occupation. Specifically, the researchers aimed to explore the relationship between education and automation, and the findings were visually presented in Figure 1.

The graph illustrates that jobs that require no formal education have a higher probability of being automated, as compared to those that require higher levels of education.
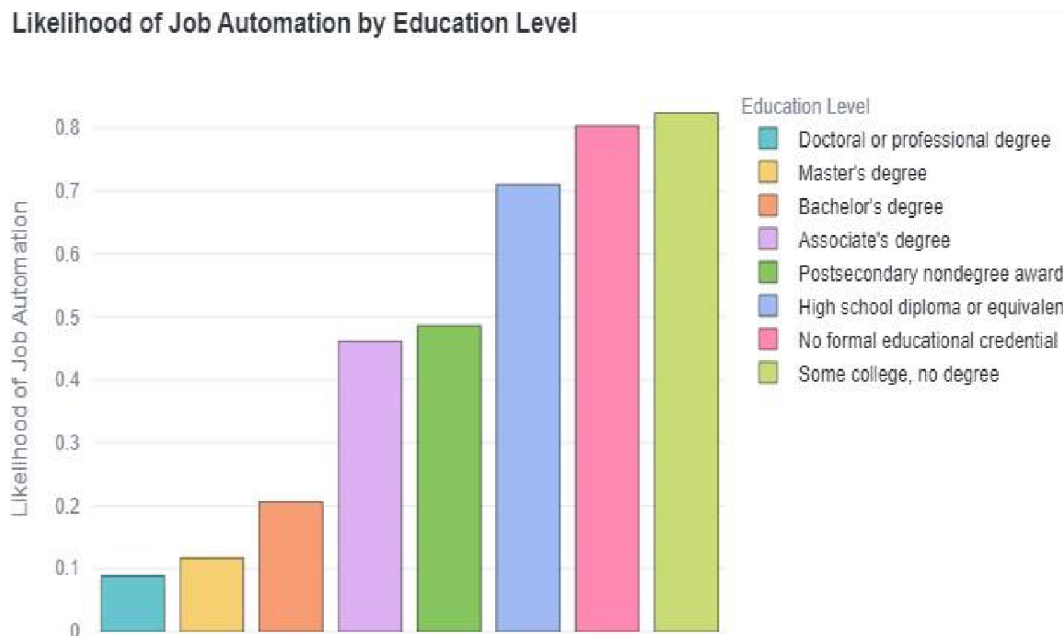
Figure 1 Job automation effect by education level

Table 1 provides information on the probability of automation for different job categories. Jobs that require a doctoral degree have a lower probability of automation at 8.86%. Those that require a master's degree have a slightly higher probability of automation at 11.6%. On the other hand, jobs that do not require any education have the highest probability of automation, with a maximum probability of 82.4%. This indicates that individuals working in jobs that require lower levels of education are at a greater risk of being displaced by automation in the future.

Table 1 Occupation with probability of automation

	Education Level	Probability of Automation
0	Doctoral or professional degree	8.86%
1	Master's degree	11.66%
2	Bachelor's degree	20.59%
3	Associate's degree	46.08%
4	Postsecondary nondegree award	48.65%
5	High school diploma or equivalent	71.07%
6	No formal educational credential	80.35%
7	Some college, no degree	82.43%

Another of the factors being examined is the influence of income on automation. Figure 2 demonstrates the impact of income categorized by educational level. Jobs with lower wages are grouped under the category of no formal degree. The negative correlation between income and automation is depicted in both Figure 2 and Figure 3. It is evident from the data that as income decreases, the likelihood of automation increases. This relationship is particularly pronounced for jobs that do not require formal education. In contrast, occupations requiring a higher level of education tend to have a lower risk of automation, even at lower income levels.

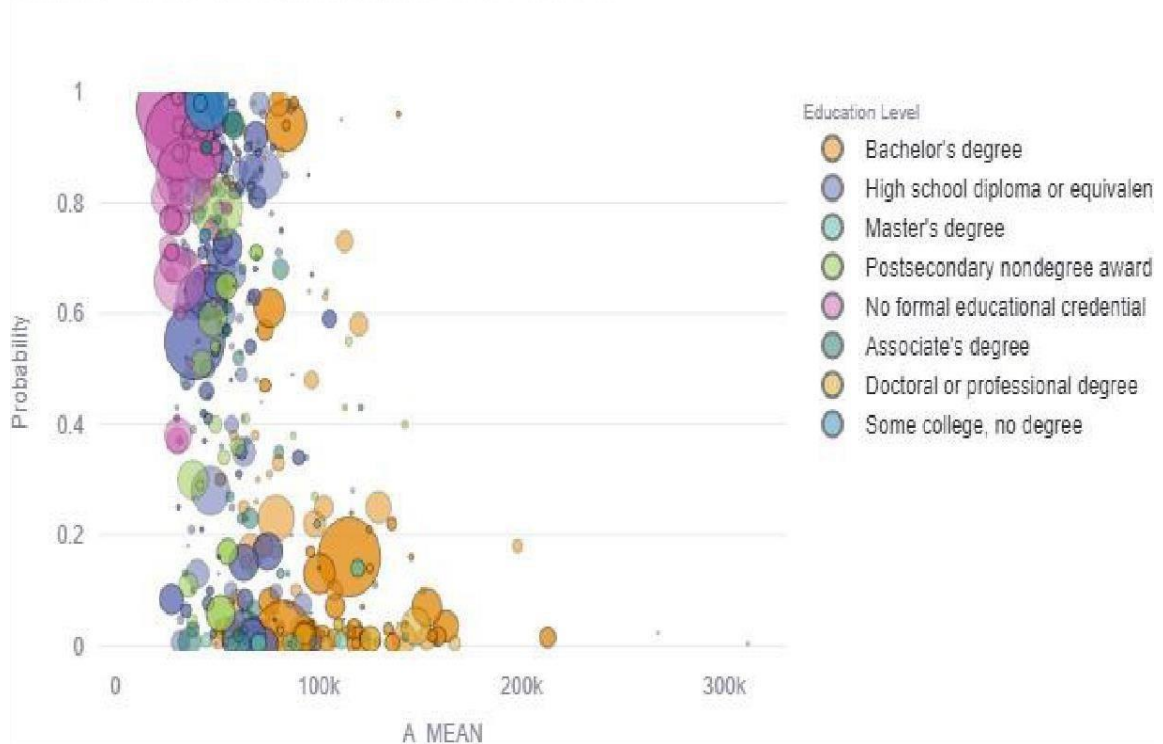## Likelihood of Job Automation vs Median Income

Figure 2 Effect of Income by Education level on automation

Table 2 provides information on the total number of employees, their net wages, and annual medians across various occupations. It is evident that administrative, sales, and transportation jobs have higher employment numbers compared to other occupations. However, these jobs are also more likely to be affected by automation, which could have a significant impact on the US economy.

Table 2 Occupations and total employes with wages

	occupation	Total Employees	$ Annual Median	Net wage
1	Management Occupations	8909910	$102,450	$1,099,215,596,700
2	Healthcare Practitioners and Technical Occupations	8787730	$75,040	$800,562,203,000
3	Office and Administrative Support Occupations	18299380	$38,050	$794,742,073,400
4	Business and Financial Operations Occupations	9053790	$76,570	$747,933,591,900
5	Healthcare Diagnosing or Treating Practitioners	5772460	$81,270	$647,439,113,600
6	Sales and Related Occupations	13256290	$30,600	$610,849,843,200
7	Transportation and Material Moving Occupations	12639920	$36,860	$522,534,292,800
8	Educational Instruction and Library Occupations	8191930	$57,220	$509,046,530,200
9	Business Operations Specialists	6152960	$76,040	$494,574,924,800
10	Computer and Mathematical Occupations	4654750	$97,540	$464,823,335,000

One of the factors being examined is the influence of income on automation. Figure 2 demonstrates the impact of income categorized by educational level. Jobs with lower wages are grouped under the category of no formal degree. The negative correlation between income and automation is depicted in both Figure 2 and Figure 3. It is evident from the data that as income decreases, the likelihood of automation increases. This relationship is particularly pronounced for jobs that do not require formal education. In contrast, occupations requiring a higher level of education tend to have a lower risk of automation, even at lower income levels (referred to Table 3).
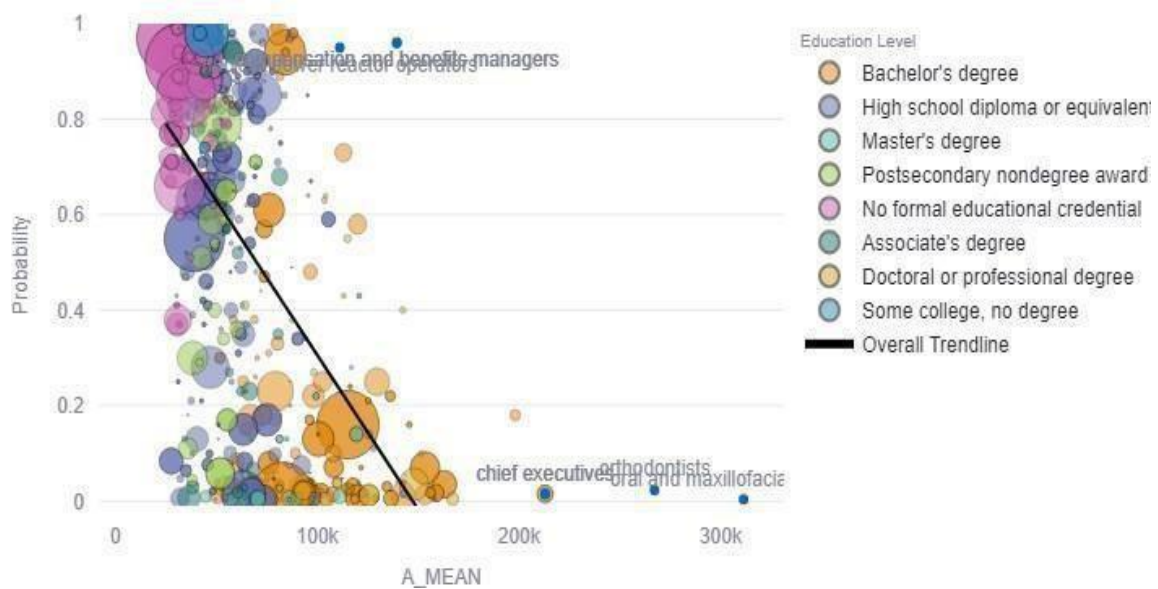
Figure 3 Effect of Income by Education level on automation

A distinct set of job categories was identified as outliers with a lower likelihood of automation. Table 4 presents data indicating that individuals with a bachelor's degree have a 96% chance of their job being automated. In comparison, the occupation of nuclear power reactor operators has a 95% chance of being automated.

Table 3 Automation Trend

	occupation	Education Level	Total Employment	Probability of Automation	Median Income
0	chief executives	Bachelor's degree	200480	0.01%	$213,020.00
1	oral and maxillofacial surgeons	Doctoral or professional degree	5330	0.00%	$311,460.00
2	orthodontists	Doctoral or professional degree	5140	0.02%	$267,280.00

Figure 2 and 3 revealed the presence of a handful of exceptional cases. It was observed that certain occupations such as chief executive, oral & maxillofacial surgeons, and orthodontists were immune to automation (referred to Table 3).

Table 4 outlier- Occupation and higher chances of automation

	occupation	Education Level	Total Employment	Probability of Automation	Median Income
0	compensation and benefits managers	Bachelor's degree	15330	0.96%	$139,470.00
1	nuclear power reactor operators	High school diploma or equivalent	4820	0.95%	$111,220.00

Additionally, the percentage of automation in a few states such as Vermont, Texas, and Oregon are presented in Figure 4, Figure 5 and Figure 6. In all three states, the negative effect of automation has been seen in areas where people don't have jobs based on their education. The job occupations, having higher education are less likely to be automated.

The largest most likely automatable occupations in Vermont

Figure 4 Automation Probability in Vermont

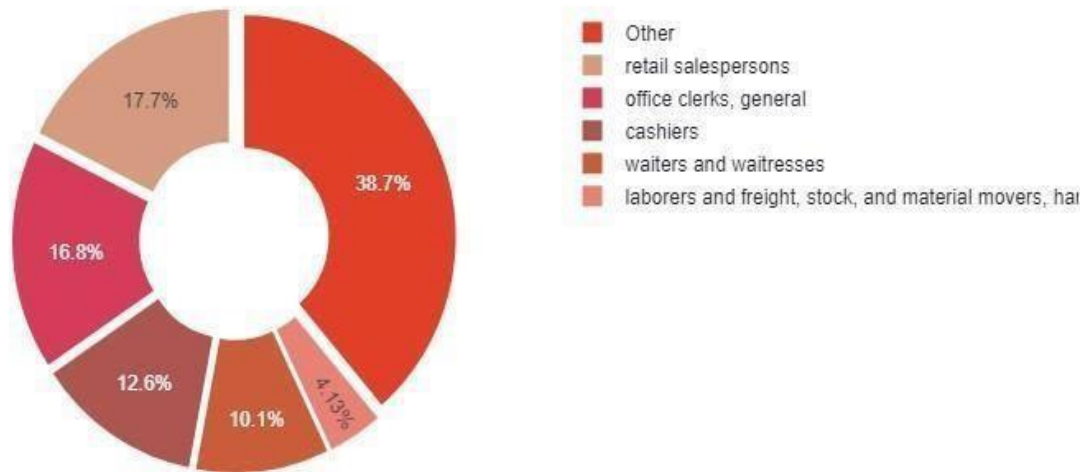## The largest most likely automatable occupations in Texas

Legend:
- Other
- retail salespersons
- office clerks, general
- cashiers
- waiters and waitresses
- laborers and freight, stock, and material movers, ha[...]

38.7%
17.7%
16.8%
12.6%
10.1%
4.13%

Figure 5 Automation Probability in Texas

The largest most likely automatable occupations in Oregon

Legend:
- Other
- retail salespersons
- cashiers
- office clerks, general
- waiters and waitresses
- secretaries and administrative assistants, except legal, medical, and exe[...]
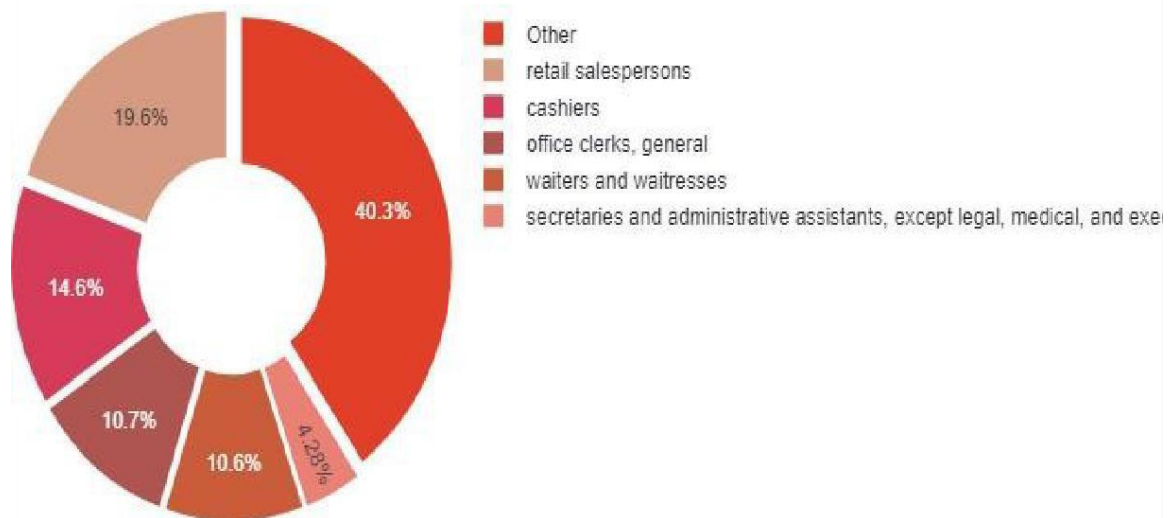
40.3%
19.6%
14.6%
10.7%
10.6%
4.28%

Figure 6 Automation Probability in Oregon

41

Q2. What are the possible effects of automation on the US workforce across states and industries?

The focus of the second research question is to investigate the potential effects that automation may have on the labor force in the United States. This inquiry aims to examine how the deployment of automation technologies could lead to job displacement and the resulting shifts in the job market across various states and industries.

In Figure 7, depict the total number of employees in various states of the USA and highlight the level of job loss using different colors. The chart serves as a useful tool to analyze the job market and identify areas that require attention to maintain a stable employment market.
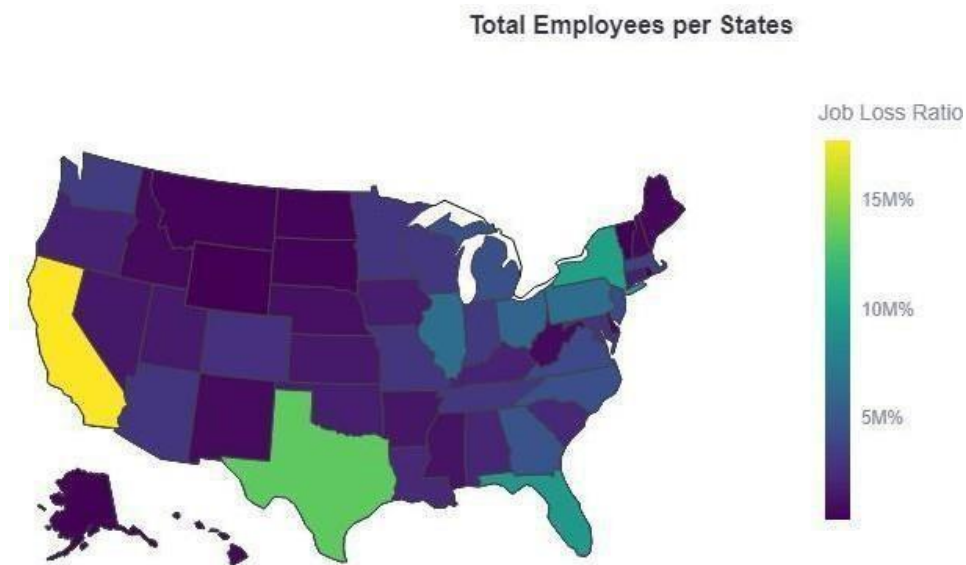

Figure 7 Total Employees per state

We can observe the overall count of employed individuals in various states across the United States of America. The chart utilizes different colors to highlight the level of job loss in each state. The state with the highest job loss is

shaded in yellow, whereas the states with lower job loss are depicted using varying shades of purple. It is evident from the graph that some states have experienced a significant decline in employment rates, whereas others have managed to maintain a stable job market. Darker shades of purple represent states with relatively lower job loss rates, signaling a stable employment market. On the other hand, yellow signifies states with the greatest job loss rates, where the employment rate has drastically dropped due to various causes such as economic instability or limited job opportunities, potentially attributable to economic instability or any unforeseen circumstance that has contributed to its decrease.

Figures 8 and 9 show the job loss ratio resulting from automation, with Alaska and Florida likely to experience greater job losses as compared to Alabama or other states.
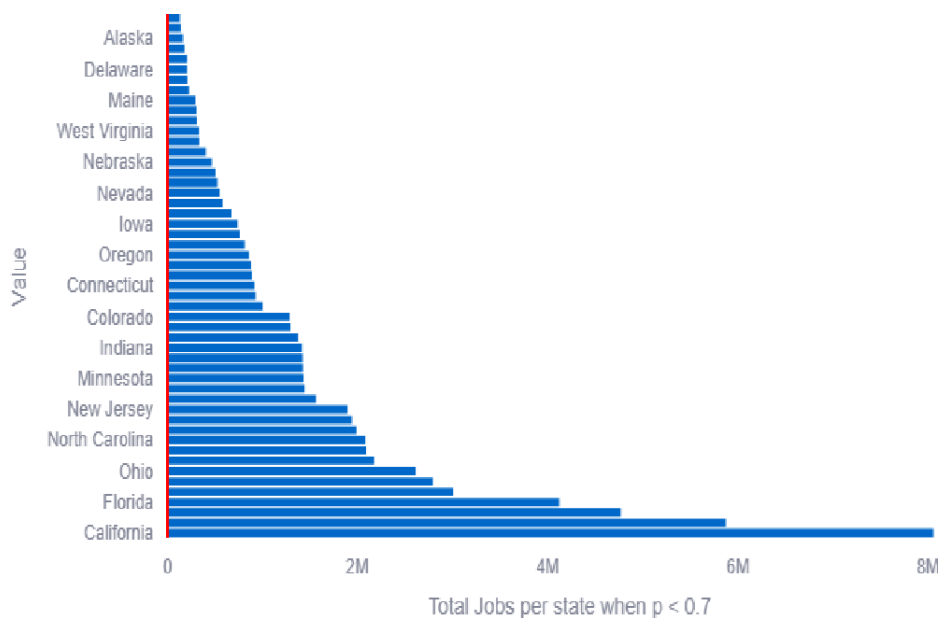

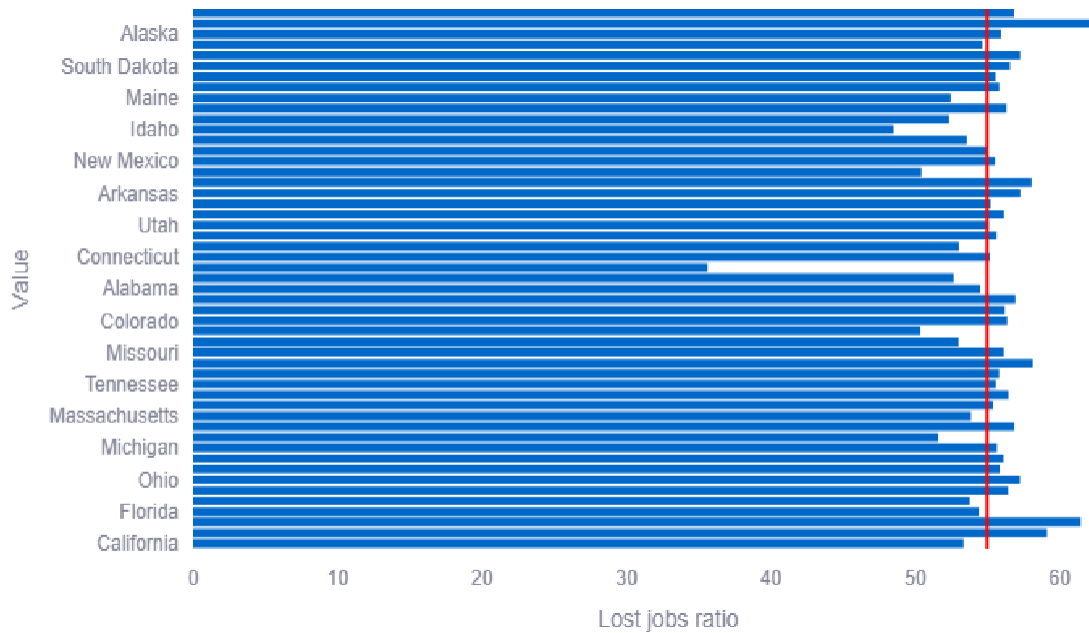Figure 8 Total Jobs per state with 0.7 threshold

Figure 9 Job Loss Ratio

Data indicates that certain states are more vulnerable than others to job displacement due to automation, yet this study highlights the need for careful consideration of its potential effects on workforce members and how best to address automation-related challenges through education and training programs as well as policies that support workers affected by job displacement. By taking an inclusive and proactive approach to automation it may be possible to mitigate its negative consequences while creating a more equitable and sustainable future for both workers and communities alike.
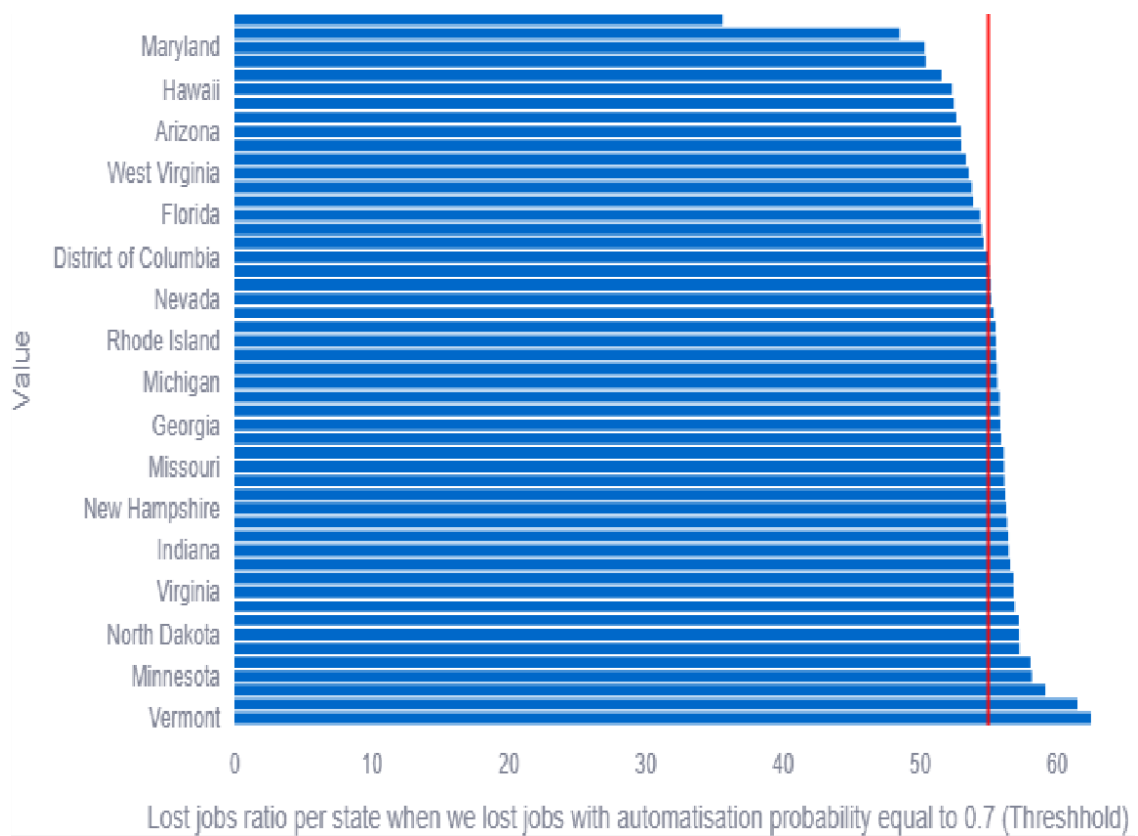
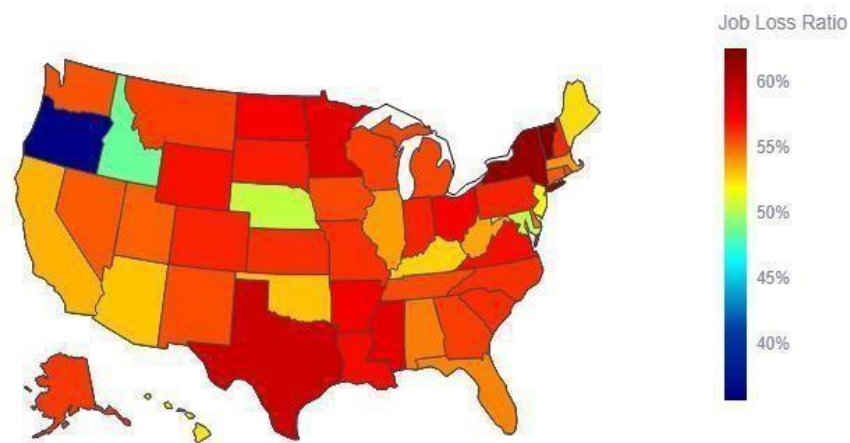Figure 10 Job Loss Ratio with 0.7 threshold

Figure 11 Job Loss Ratio

Results of this study also indicate that when applying a threshold ratio of 0.7 (Figures 10 and 11), Vermont had the highest likelihood of job loss compared to Florida and Hawaii, with Maryland having the least. These findings show how the risk associated with automation varies based on geographic location; it may be affected by factors like the local economy, workforce demographics, and industry trends. Vermont may experience greater losses, however. It's important to remember that just because Vermont may experience more job loss does not equate to greater job loss overall.

CHAPTER 5

DISCUSSION, CONCLUSIONS AND AREAS FOR FURTHER STUDY

The goal of the investigation was to perform an exploratory analysis of data regarding automation's effects on employment reduction across various states in the US. This study's purpose is to conduct a comprehensive examination of the probable effects of automation on U.S. labor forces through the analysis of different data sources and extensive interviews with professionals from relevant industries. This research study seeks to assess the potential impacts of automation on employment by exploring its effect on job displacement and also exploring its possibility of creating new job opportunities. Based on data analyzed up to the year 2021, there appears to be considerable scope for automation across many areas across the United States; specifically, this research addressed five questions regarding its application:

Q1. What factors affect how likely different jobs will be automated?

By examining the impact of income levels, educational attainment levels, and industrial sectors on automation risks across multiple jobs, this study aims to gain insights into this phenomenon. Our results indicate that holding a doctorate degree tends to diminish one's susceptibility to being replaced by machines. This implies there is an inverse link between higher educational qualification and technological unemployment. Nonetheless, it's important to consider that this trend is not uniform, it can also vary by both job nature and industrial context. Certain college-educated positions may involve routine tasks that are more

susceptible to automation, while others may require higher-level thinking and creativity that are less easily automated. The findings emphasize the importance of understanding the unique elements that contribute to the possibility of automation in different vocations and industries to design effective laws and strategies for limiting the impact of automation on the workforce. As technology continues its integration into daily life concerns regarding employment stability have arisen concerning workers lacking extensive formal schooling or experience working low wage jobs. Importantly our study identifies an inverse relationship between income levels and susceptibility levels towards workplace automation - those holding better paid jobs with greater levels of education appear better protected. To sustain and develop viable sectors it is critical that policymakers and industry experts focus on preserving job categories more resistant to technological innovation. Investing in education and higher paying jobs may mitigate potential risks stemming from increasing automation rates while maintaining a dynamic workforce capable of adapting to societal shifts.

Q2. What are the possible effects of automation on the US work force across states and industries?

The second research question seeks to investigate the potential effects of automation on the US workforce across states and industries. For a while now the effects of technology on employment have stirred up worry in various circles. These include economists, policymakers, and the general public. To tackle this issue our research delves into the possibility that increased automation could have on different regions and industries of the workforce in America. We employ

robust methodologies including interviews with subject matter experts as well as detailed analysis of relevant datasets in order to provide an accurate snapshot of possible outcomes from increased use of robotics or AI systems in workplaces nationwide. Our results indicate that careful consideration must be given not only to job loss or creation but also to other issues such as worker retraining needs based on their location. Assessing the real risks of job loss caused by automation demands a more comprehensive analysis that can identify viable strategies addressing this issue. As revealed by our research results, there may be serious implications posed by widespread automation in various states. This underscores the vital importance of continuously exploring this complex relationship between machine learning technologies and labor markets through ongoing research and analysis. Informed training decisions, job creation efforts as well as workforce development initiatives rely upon knowing which jobs are most at risk from being automated away thus enabling policymakers, employers as well as workers to make sensible decisions accordingly. Targeting resources towards high-risk areas will enable policymakers to create policies that mitigate adverse effects of automation on employment opportunities. Our findings suggest that policymaker's approach towards navigating shifting labor market landscapes must be tailored towards local contexts if they're seeking to take advantage of emerging trends while mitigating challenges posed by these transformative changes.

Q3: What are the meaningful predictors of the likelihood of automation for certain jobs or groups?

As our third research question aimed at identifying crucial predictors behind job or group specific automation likelihoods, we conducted this study with the intention of providing clarity on a topic that affects people's livelihoods significantly. Our findings revealed that relying solely on annual income and employee count might not always indicate the probability of job loss from automation accurately. Nevertheless, it is imperative to note that this doesn't discount other meaningful predictors' existence influencing automatability likelihoods. Further research may be necessary to identify new variables impacting these probabilities. It is vital to note also that many influencers contribute towards predicting AI induced job loss risks as multiple critical drivers come into play while forecasting such risks accurately across occupations.

Our study's outcomes can aid those who are interested in making any decisions related to potential opportunities or hazards arising from automation within the labor market - policymakers, employers, and workers alike. A recent study underscores investing in education as an effective tool to reduce wage gaps & facilitate economic mobility within societies. Policymakers together with educators should improve access to quality educational programs across all levels of society. Moreover, employers should maintain fair compensation standards regardless of educational backgrounds reflecting positively on employees' morale while narrowing down wealth disparities between employees. Governments & businesses must identify industries most prone to job losses due

to automation while directing their resources towards supporting workers within those sectors better; hence holistic societal development will occur.   In conclusion, this affirmative report highlights the need for constant research into the intricate relationship between automation and labor markets.

Q4. How can governments and businesses best prepare for the effects of automation on the workforce?

In order to help governments and businesses prepare for an increasingly automated future of work, our fourth research question is focused on providing actionable recommendations based on empirical data. Our study underscores the importance of recognizing potential disparities arising from technological advancements -- particularly along lines of education levels or income -- while also identifying key levers for positive change such as targeted investments toward reskilling programs or policies like unemployment insurance benefits. By doing so thoughtfully across varied industries most vulnerable to displacement due to automation, there's an opportunity to equitably distribute its benefits towards society's greater good. The impact of automation on jobs can be managed proactively by adhering to these suggestions allowing governments and businesses to protect their workforce and local communities from any potential harm.

Q5. What are the most effective ways to reduce the negative effects of automation on workers and communities?

The fifth research question seeks to identify the most effective strategies for reducing the negative effects of automation on workers and communities. Our

research has identified different ways organizations can reduce the negative consequences of automation on workers' lives as well as entire communities. We highly recommend investing in educational programs aimed at preparing employees for upcoming market shifts when jobs may be lost because of technological advancements while promoting entrepreneurship opportunities across different fields supporting emerging technologies providing new job opportunities that may be better suited for current market trends. Additionally crucial is policymakers' role: they should consider providing safety nets such as retraining or unemployment insurance packages to cushion the impacts of technological advancements whenever workers lose their jobs. Lastly these policies should be focused on specific industries that have been identified as most vulnerable to displacement. The implementation of specific strategies can lessen the adverse effects of automation and promote greater equity in the distribution of its advantages across society.

Conclusions

This study highlights how essential it is to consider one's level of education and income when assessing their susceptibility to job automation. The research reveals that individuals with advanced degrees or who hold better

paying positions have a reduced likelihood of being taken over by machines compared to those without such qualifications or earning potential. Using Python programming language – specifically Plotly Express for data analytics – the findings show that occupational sectors calling for more substantial educational credentials encounter less risk from automation than others wherein formal training is not essential. Moreover, a negative relationship is found between income and automation.

The study also provides several recommendations to address the negative consequences of automation on jobs. The first recommendation suggests investing in education and training programs to help workers acquire new skills and knowledge and adapt to new roles and industries. Additionally, promoting innovation and entrepreneurship in emerging fields such as robotics, AI, and data analysis can create new job opportunities that are less vulnerable to automation, stimulating economic growth. Moreover, implementing policies such as unemployment insurance or retraining programs can provide a safety net for workers who have lost their jobs due to automation and help them transition to new roles and industries. Lastly, understanding the specific industries and job types that are most vulnerable to displacement is crucial to providing targeted support to workers and communities where it is most needed. By implementing these strategies, governments and businesses can better prepare for and respond to the impact of automation on jobs, mitigating the negative consequences and ensuring that the benefits are more equitably shared across society.

Area of Further Study

There are several avenues for future research that are related to the research questions addressed in this paper. One such area of study involves delving deeper into the impact of automation on different demographic groups, such as age, race, and gender (Research Question 3). This would provide a more nuanced understanding of the ways in which automation affects different individuals and communities and could inform targeted policy interventions to mitigate negative consequences. Another area of inquiry includes exploring how automation will shape the future of work and its effect on new industries and jobs (Research Questions 2-5). Doing this would shed light on its wider socioeconomic ramifications while providing insights into how individuals and societies alike can adapt to its ever-evolving nature of labor.

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