

Embracing Automation: Unraveling the Future of Workforce in the United States and the United Kingdom

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Abstract: *This research paper investigates how the workforce is transforming with respect to the evolution of automation in the United States and the United Kingdom, countries that are at the forefront of technological development. To understand how technological advancements can shape employment patterns, job requirements, and skill demands, we have analyzed the results published by Brookings Analysis of Webb (2019) for the US and the Office for National Statistics for the UK. These findings for different sectors and states help to predict the potential impact of AI and the probability of automation in the foreseeable future. Additionally, the research delves into the challenges faced and strategies required to adapt to the changing work landscape.*

Keywords: Automation, United States, United Kingdom, Job displacement, Future of work, Industry Impact

1. Introduction

Automation is a broad concept that applies to modern workplaces in more ways than what meets the eye. Key technologies such as machine learning, robotics, IoT, big data, and Natural language processing (NLP) have landed society in the midst of a fast-paced technological revolution and allow the performance of tasks without or with minimal human intervention.

Over the past couple of years, in the United States and the United Kingdom, companies have embraced technology and automation to stay current with market trends and cater to the needs of their customers. This adaption and inclusion of automation for the better is particularly demanding. Employment website Indeed through its report found an enormous rise in demand for people with skills in AI and ML. In 2018, the number of AI roles advertised in the United Kingdom was 1,300 for every one million which was 20 percent more than in the United States¹.

According to a study by the University of Pennsylvania, 80 percent of American jobs are likely to witness over 10 percent of their tasks altered by AI while nearly 20 percent of jobs will see at least 50 percent of alternation of tasks². Having a higher level of education or a college degree is shown to have given protection from job loss by at least 29%. A staggering 36 million US jobs are at high risk for automation, while 52 million American jobs are somewhat

vulnerable to the risk of disruption. 57 million jobs fall into the “low-risk” category, but it’s fairly reasonable to state that almost every job will be affected by automation in some way³.

In terms of the composite effect on employment in the UK, a report by PwC published in 2021 estimates that around 7% of existing UK jobs could be displaced by 2026 and even more with the passing of years⁴.

Automation offers a multitude of benefits, including reduced dependency on human labour, enhanced quality consistency, mitigated risks of human error, improved health and safety standards, and increased operational efficiency. However, it is crucial for global powers such as the US and UK to recognize that adopting automation requires careful consideration of the need for manual labour, the upfront investment and it’s ROI.

2. Review of Literature

The research paper "Embracing Automation: Unraveling the Future of Workforce in the United States and the United Kingdom" aims to explore the precursory and potential impact of automation on the workforce in these two international powers. By synthesizing existing research, scholarly articles, and reports related to automation, this comprehensive literature review examines how automation will shape the future workforce in the aforementioned countries.

¹Ellis, “UK demand for AI professionals.”16/03/18

²U.S. Chamber of Commerce. “AI and the Future of Work”31/03/23

³Flynn, “Automation & Job Loss Statistics, 2023” 8/06/23

⁴GOV.UK, “The impact of AI on jobs.”08/21

In the early stages in the era of automation, job growth was spurred because of elastic demand. As this level of demand reduced, automation expedited job losses. Since then, the relationship between automation and job displacement has been subject to extensive research. A study by Acemoglu, Daron, and Pascual Restrepo (2019) suggests that the displacement of jobs is compensated by the creation of new ones, thus restoring balance between humans and machines in the work environment. This may cause some industries to flourish, and some to decline.

The advent of automation calls for amendments in skill sets within the employment sector and its workforce. Studies by Brynjolfsson and McAfee (2017) emphasize the growing importance of skills such as digital literacy, computational thinking, and problem-solving abilities. Additionally, the World Economic Forum's Future of Jobs Report (2020) highlights the rising demand for multi-functional skills such as those that combine technical expertise with creativity. Big data, cloud computing, and e-commerce adoption continue to be prioritized by business leaders. In addition, there has been a noticeable rise in interest in artificial intelligence, non-humanoid robots, and encryption. Other researchers have explored different facets of this argument and present alternative viewpoints. For instance, James E. Bessen (2016) in their paper on How Computer Automation Affects Occupations: Technology, Jobs, and Skills presents that computer use is associated with substantially greater within-occupation wage inequality because new skills are costly to learn.

Automation's impact on income inequality is a topic of significant concern. Laura D. Tyson and John Zysman (2022) suspect that AI will intensify to cause the polarization of employment, minimum wage growth for middle and low-skill workers, and growing inequality. Narrow AI can replace humans in performing tasks that do not demand high-level cognition, reasoning, or social interactions.

According to the World Economic Forum's "The Future of Jobs Report 2020," artificial intelligence is projected to displace approximately 85 million jobs globally by 2025. However, an analysis and paper by Melanie Arntz et al. (2017) implies that the risk of automation taking over jobs is overestimated. According to their data, the reduction in the number of jobs in the US when considering the wide spectrum of tasks at hand, *ceteris paribus*, drops 38% to 9%. Michael Chui et al, through their detailed analysis, found that automation is unlikely to eliminate many occupations in the next decade, but it will affect different aspects of almost all jobs to varying degrees based on their nature. More research is to be conducted to gain more clarity and certainty about the aforementioned arguments.

The reviewed literature demonstrates that automation is a transformative force that will significantly impact and redefine the future of workforce. While automation poses challenges such as job displacement and income inequality, it also presents opportunities for the development of new skills and the enhancement of productivity. Effective policy measures and a focus on continuous learning and adaptability are imperative to harness automation and

technology in the most efficient, cautious, and ethical way possible.

Job displacement and transformation

Ever since the Industrial Revolution, the concern about human jobs being replaced by machines has only augmented. Up until now, automation has served to enhance certain jobs, rather than take over them. With the mounting advancement of automation and AI, the effect these progressions will have on the employment landscape is a point of debate. Artificial intelligence will replace close to 85 million jobs by 2025, the World Economic Forum estimates.

Industries and sectors most affected (dominated) by automation

Certain industries and sectors have experienced a significant level of dominance and transformation due to automation's pervasive influence.

- Manufacturing industry

According to a report by McKinsey, manufacturing is projected to be one of the most impacted industries by automation. Over 64% of global manufacturing activities are considered to be automatable. This employment of automation in a workforce-heavy industry such as manufacturing helps in keeping track of larger orders and sales, coordinates with suppliers for procurement of goods, and efficiently manages the assembly line of products.

- Retail Sector and Customer Service

Chatbots use Natural Language Processing (NLP). Advanced programs such as Chat-GPT have the ability to learn from their previous interactions with the user, facilitating a personalized interaction. On account of their ability to learn from predefined responses through a dataset, chatbots and AI-operated customer helplines can easily resolve common queries that customers might face. Automation is dominating the retail sector. Services such as Amazon Go have completely transformed the shopping experience through deep learning.

- Healthcare

Through predictive analytics, AI can help doctors detect and diagnose diseases that may go unnoticed at an earlier stage. Through IoT-enabled embedded devices, doctors can remotely monitor the health of their patients. Image recognition and neural networks allow doctors to analyze and diagnose the problem swiftly and with greater accuracy⁵.

Changes in job roles and skills required

Individuals ought to engage more comprehensively with machines as part of their everyday activities and acquire new skills that will be in demand in the near future.

⁵Spiceworks, "10 Industries AI Will Disrupt"10/02/22

According to Nishika de Rosairo at HumanQ Inc, it is imperative to learn to work with automation, not against it⁶. With the ushering of powerful automation, it is of urgent need that employees upskill and reskill to make the best use of the technological resources at hand. To stay relevant and employable in the changing job market, workers need to develop technological literacy that allows them to work alongside automated systems. By adapting to the latest technology, humans and machines complement each other's work by taking on and assigning roles they're most efficient in. For instance, the capabilities of automation may fall short when it comes to human interaction and displaying soft skills. In such cases, developing soft skills such as empathy and emotional intelligence becomes pivotal for those trying to secure roles that are less vulnerable to replacement by automation.

Future of work in the US and the UK

The dynamic nature of work is constantly evolving due to technological advancements, economic forces, and social transformations. The United States and the United Kingdom, as two leading global economies, have been at the forefront of these changes, witnessing shifts in employment patterns, job structures, and the overall nature of work. As we navigate the complex landscape of the 21st century, it is crucial to examine the future of work in both countries, as their experiences and strategies can offer valuable insights into the challenges and opportunities faced by nations worldwide.

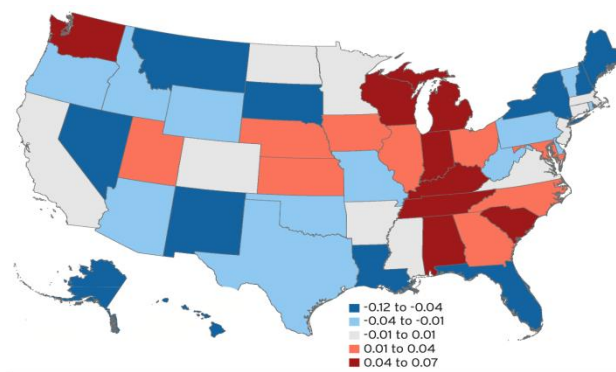
USA

According to the data provided by Brookings Analysis of Webb (2019), as per the average standardized AI exposure scores, occupations in the US with higher positive scores are likely to continue experiencing increased AI exposure in the future. This includes industries such as farming, fishing, and forestry (1.48); life, physical, and social sciences (1.19); computer and math (1.04); and architecture and engineering (0.86). These higher positive values reflect that these fields have a higher potential for AI exposure and are already leveraging AI for improved efficiency and productivity, while the lower negative scores indicate occupations with a lower potential for AI exposure. Occupations such as community and social services (-0.25), office and administrative support, education, building and grounds cleaning, healthcare support, sales, personal care services (-0.34), and food preparation and service (-0.92), may continue to see gradual automation and integration of AI technologies⁷.

Brookings Analysis of Webb (2019) also draws a comparative analysis of Average Standardized AI Exposure Scores across the US States. States with higher AI exposure scores, such as Indiana (0.07), Kentucky (0.06), Michigan (0.05), and Washington (0.05) are likely to continue experiencing increased AI adoption and integration across industries including manufacturing, healthcare, technology,

government, and research. States with thriving technology ecosystems, such as California (0.00), Massachusetts (0.00), and North Carolina (0.01), are expected to witness further growth in AI-related research, development, and innovation because of their strong foundations in academia, research institutions, and tech companies, making them prime locations for AI advancements and emerging startups.

Over time, states with lower AI exposure scores, such as Arkansas (-0.01), Louisiana (-0.04), New York (-0.07), Nevada (-0.11), and Hawaii (0.12), may experience increased AI adoption across various sectors. As AI technologies become more accessible and mature, industries within these states, including agriculture, energy, finance, tourism, and hospitality, could explore AI applications to enhance operations, decision-making processes, and customer experiences.



Source: Brookings analysis of Webb (2019) and OES data

Figure 1: AI Exposure Scores in the USA

United Kingdom

Table 1: Average probability of automation across different occupations

Major Group	Average of Probability of automation
Administrative and secretarial occupations	0.558790351
Associate professional and technical occupations	0.380518704
Caring, leisure and other service occupations	0.510325505
Elementary occupations	0.643556178
Managers, directors and senior officials	0.307275084
Process, plant and machine operatives	0.611984324
Professional occupations	0.248070901
Sales and customer service occupations	0.5449802
Skilled trades occupations	0.516778794
Grand Total	0.445201573

Source:

<https://www.ons.gov.uk/visualisations/dvc599/chatbot/data/data.xlsx>

Analyzing United Kingdom's data based on current trends, it is evident that automation is poised to have a significant impact on the workforce. The data below presents the average probability of automation across various occupational categories.

The category with the highest average probability of automation is Elementary occupations with a value of 0.644. This category includes jobs that involve routine tasks and manual labor, such as agricultural workers, cleaners, and construction laborers. These positions are often characterized by repetitive and predictable activities, making them more susceptible to automation. With the advancement of technologies like robotics and artificial

⁶ Forbes Councils Member, 14 Ways Automation will Affect the Job Market"24/02/23

⁷Muro, Whiton, Maxim. "What jobs are affected by AI?" 20/11/19

intelligence, the automation of these roles seems likely in the near future. Similarly, the Process, plant and machine operatives group also show a high average probability of automation at 0.612. This category comprises jobs involving the operation of machinery and equipment, such as assembly line workers and machine operators. As automation technologies improve and become more cost-effective, the potential for machines to take over these tasks increases. This trend aligns with the ongoing development of automated systems and the drive for increased efficiency in industrial processes.

On the other hand, the Managers, directors, and senior officials group exhibits the lowest average probability of automation at 0.307. These roles typically involve decision-making, strategic planning, and leadership responsibilities

that rely heavily on human judgment, intuition, and interpersonal skills. While automation may support these roles by providing data-driven insights, the complexity of managerial tasks makes full automation unlikely in the foreseeable future.

The remaining occupational categories fall within a moderate range of average probability of automation. Professional occupations and Associate professional and technical occupations have relatively low probabilities at 0.248 and 0.381 respectively, indicating that these roles require specialized knowledge and expertise that are not easily replicable by automation.

The following graph depicts the automation probability across different cities as of 2017.

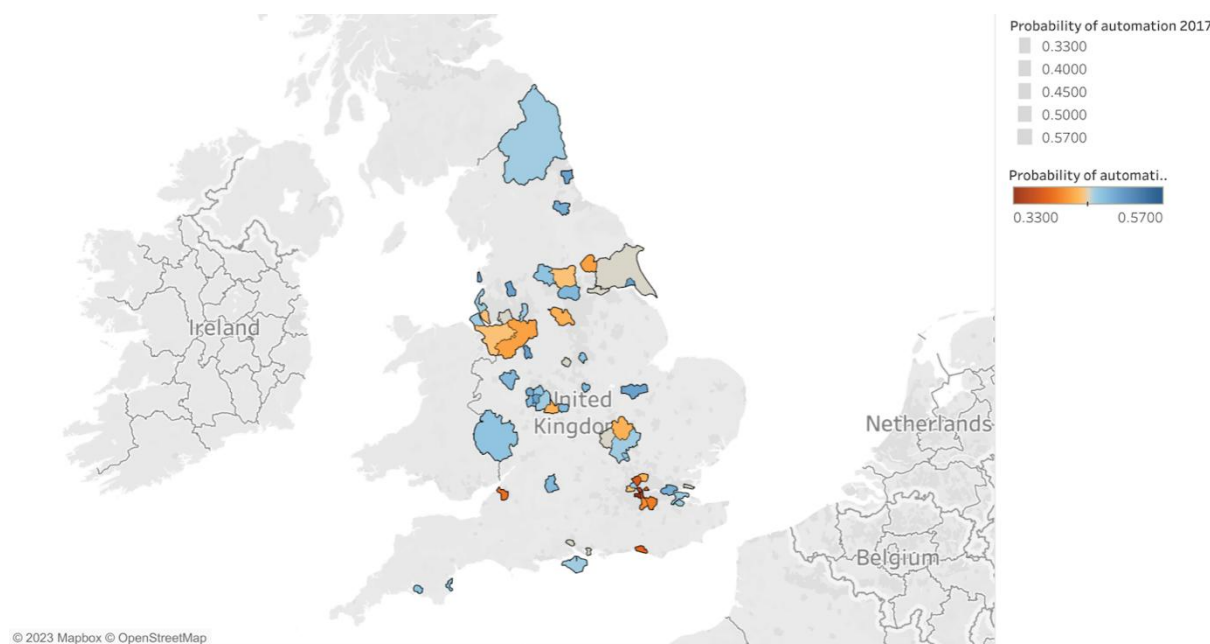


Figure 2: Probability Scores of Automation in the UK

Industry-Specific Demand of Workers.

Table 2: Comparison of skill surplus and deficit across various industries and sectors in US and UK

Skills	Arts and Humanities Knowledge	Business Processes	Cognitive Skills	Communication Skills	Computer Programming	Law and Public Safety knowledge	Medicine Knowledge	Physical Skills	Production and Technology Knowledge	Production and Technology Knowledge		Resource Management	Scientific Knowledge (biology, chemistry, geography, physics, sociology, and anthropology)	Social Skills	Training and Education
										Building and Construction	Transportation				
Country															
UK	-0.096	-0.504	0.095	0.009	0.153	0.169	0.418	-0.446	0.028	0.046	0.04	0.116	0.273	0.088	0.501
US (As of September 2022)	0.07	0.411	0.077	0.13	-0.103	-0.108	0.361	-0.088	-0.242	-0.487	-0.109	0.148	-0.251	-0.105	0.27

Table 2 effectively compares and contrasts various skill requirements for the two countries, US and UK. Negative values suggest a skill surplus while positive ones indicate a skill shortage. A larger absolute value corresponds to a larger imbalance. The value of 1 represents the largest shortage and the value of -1 the largest surplus across OECD countries, skill categories and years. Positive values indicate skill shortage while negative values point to skill surplus. The larger the absolute value, the larger the imbalance. The value of 1 represents the largest shortage and the value of -1 the largest surplus across OECD countries, skill categories and years.

The table helps identify industries, skills, and sectors where one country exhibits a higher demand compared to the other. For instance, the US shows greater demand for business processes (0.411), physical skills (-0.088), and resource management (0.148), whereas the UK demonstrates a higher demand for arts and humanities knowledge (-0.096), communication skills (0.009), computer programming (0.153), law and public safety knowledge (0.169), medicine knowledge (0.418), production and technology knowledge (0.028), scientific knowledge (0.273), social skills (0.088), and training and education (0.501).

Challenges

McKinsey reports that up to 800 million global workers will lose their jobs by 2030 as a result of automation and between almost zero and thirty per cent of the hours worked globally could be automated by 2030. For today's employers and employees to survive the automation curve, they must address and resolve issues like the lack of data literacy, the perils of career automation, and upfront expenditure for AI implementation in terms of software support and training. These automation challenges are very risky, and workers won't be able to retain their jobs without the right skills⁸⁹. [8] [9]

Automation can increase the productivity of employees and companies by providing resources to them to manage complex system architectures efficiently. In this new era of automation, some machines are capable of matching or overpowering human cognitive ability in completing predictable and monotonous tasks. Such jobs remain at risk to be replaced by machines. From an employer's perspective in terms of the economic growth of the company, this frees up time, requires a lesser workforce, and reduces errors. This prospect may seem profitable but reducing the workforce in a big setting is also risky. Thus, despite the automation of some tasks, there may not necessarily be a decline in employment within those occupations. Instead, workers may transition to performing new responsibilities or tasks. It is important to note that the advent of technology doesn't only lead to the redundancy of jobs but also gives way to the creation of new ones. Professions such as academia, nursing assistants, and computer professionals are projected to experience an increase in demand for labour in the near future.

Automation can worsen income inequality by benefiting business owners and highly skilled individuals, leaving lower-skilled workers with limited job opportunities and stagnant wages. As a response to automation-related job displacements, policymakers may be required to enhance social safety nets, such as unemployment benefits, job retraining programs, and income support mechanisms.

Collaboration between employees, employers, policymakers, and other stakeholders is necessary to address these issues. Through proactive intervention, it is possible to navigate the transition and harness technological advancements while acknowledging any potential negative consequences.

3. Conclusion

Through an analysis of existing data and trends, we have explored the potential impact of automation on various industries and job roles, as well as the challenges and strategies associated with adapting to this changing work landscape. Automation, driven by advancements in technologies such as machine learning, robotics, IoT, big data, and NLP, has become a catalyst for integrating automation into workplaces. It offers numerous benefits,

including improved efficiency, reduced errors, enhanced safety standards, and increased operational productivity. However, the adoption of automation also comes with considerations, such as the need for manual labor and significant upfront investments.

The research findings have indicated that specific industries, including manufacturing, retail, customer service, and healthcare, have experienced significant transformation and dominance due to automation's pervasive influence. Moreover, job roles and skill requirements are evolving, emphasizing the importance of upskilling and reskilling to effectively work alongside automated systems. Interpersonal skills such as empathy and emotional intelligence serve as invaluable assets in safeguarding positions less susceptible to automation's grasp.

According to the data listed above for the United States, there are varying levels of AI exposure across different states and occupations. Industries like manufacturing, healthcare, and technology are likely to continue experiencing increased adoption and integration of AI technologies, while states with thriving technology ecosystems are expected to witness further growth in AI-related research and innovation. It is crucial for the United States to foster an environment that encourages technological literacy, upskilling, and reskilling to ensure the workforce can thrive in an increasingly automated world.

Similarly, in the United Kingdom, the research reveals a potential impact of automation on various occupational categories. Jobs in elementary occupations and process-related roles show a high average probability of automation, while managerial positions requiring human judgment and leadership skills demonstrate a lower probability of automation. The United Kingdom needs to focus on equipping its workforce with the necessary skills and knowledge to adapt to automation, ensuring that workers can transition into roles that are less susceptible to automation and leverage the benefits of AI and other automation technologies.

The implications for the future of work in the US and the UK are significant. As automation continues to shape the workforce, strategic planning, investment in education and training, and supportive policies are crucial. Collaboration between stakeholders, including employees, employers, policymakers, and educators is essential to address challenges related to job displacement and the disparity between wages.

By proactively navigating the transition and embracing automation responsibly, the United States, the United Kingdom, and other countries can create a future of work that combines the strengths of humans and machines, promotes job growth, fosters equitable opportunities, and ensures the well-being and employability of their respective workforces. The future of work in the United States and the United Kingdom will continue to be shaped by technological advancements, economic forces, and social transformations.

⁸McKinsey, "Jobs lost, jobs gained" 28/11/17

⁹Colaberry "5 Automation Challenges" 29/03/19

Author Profiles

Arshiya Mahajan is a junior who is pursuing her undergraduate studies in Economics Honors at Panjab University, India. Here, she served as the Undergraduate Coordinator of the Placement Cell. With a passion for research and data analysis, she has gained notable experience through her engagement in various internships. Her contributions extend to writing insightful articles on "Economic Resilience and Climate Change", and "Trade Wars." Arshiya aspires to continue her research on economics and programming.

Aman is a 3rd-year undergraduate student from Chandigarh, India pursuing Bachelor's in Economics Honors from Panjab University, Chandigarh. Here, he served as the Alumni Cell Coordinator and Placement Cell Executive Member. The career objective of the author is to work towards unraveling the forces that shape the world through the multifaceted subject of economics. The author is driven towards researching in the field of economics. He is interested in studying the ever-changing markets and economic data analysis.

Arshnoor Bhutani is a freshman at the University of Maryland, College Park. With a deep commitment to harness technology for societal good, she plans to pursue a degree in Computer Science during her undergraduate studies. Equipped with a diverse range of interests, she desires to integrate technology with the study of human behavior. She has been developing and experimenting with artificial intelligence to develop different projects and has authored and co-authored other research papers.

Akshadha Bhutani is a sophomore in high school at Strawberry Fields High School, India. With a thirst for knowledge and an insatiable curiosity, she strives to balance her academic pursuits with her extracurricular activities. Through her involvement in summer camps and other programs, she has gained experience and exposure to concepts that lie at the intersection of different disciplines.

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