

A Literature Review of Artificial intelligence, skill gap, Big Tech, upskilling, reskilling, workforce development, labour market transformation, human AI collaboration

¹Tammy Williams, ²Alaina Singh, ³Allison Margaret Lewis, ⁴Imran Hosein, ⁵Jennifer Ramdhan

¹The University of the West Indies, Trinidad and Tobago

²The University of the West Indies, Trinidad and Tobago

³Institut Brittany d'Enseignement Supérieur

⁴The University of the West Indies, Trinidad and Tobago

⁵School of Practical Accounting (S. P. A.) Education Ltd., Trinidad and Tobago

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ABSTRACT

This literature review examines the impact of artificial intelligence (AI) on workforce skills and organisational dynamics within “Big Tech” firms, with a particular focus on the emerging skill gap, workforce development, and the interplay between human labour and AI. The review synthesizes both qualitative and quantitative sources, including academic journals, industry reports, and corporate initiatives from leading technology companies such as Apple, Microsoft, Amazon, Google, and Meta. Key themes explored include the diminishing value of traditional educational credentials, the shift in demand toward AI-related and technical skillsets, and the strategic responses of organisations through upskilling and reskilling programs. The review further investigates the complementary and substitutive roles of AI in the workforce, highlighting a hybrid outcome where automation coexists with enhanced human productivity. Finally, gaps in the existing literature are identified, including the need for longitudinal research, integrated frameworks linking AI adoption to workforce outcomes, and evaluations of long-term effectiveness of organisational skill development strategies. The findings provide a comprehensive understanding of how AI-driven technological transformation is reshaping skills, labour market expectations, and human AI collaboration within the technology sector.

Keywords: Artificial intelligence, skill gap, Big Tech, upskilling, reskilling, workforce development, labour market transformation, human AI collaboration

Literature Review

INTRODUCTION

The rapid adoption of artificial intelligence (AI) in large technology firms, commonly referred to as Big Tech, has transformed organisational processes, workforce expectations, and labour market dynamics. This literature review explores the intersections between AI adoption, the emerging skill gap, and workforce development strategies, including upskilling and reskilling. It situates the discussion within the context of labour market transformation and human–AI collaboration, synthesising evidence from academic journals, industry reports, and corporate initiatives to provide a comprehensive understanding of current trends.

The review addresses key themes, beginning with an analysis of AI’s influence on the value of current skills and formal education. Next, it examines shifts in skill demand, organisational risks associated with skill shortages, and mitigation strategies through upskilling and reskilling programs. Finally, it evaluates the complementary and substitutive nature of AI in the workplace, before identifying gaps in the current literature to inform future research.

Artificial Intelligence and Skill Gaps in Big Tech

Artificial intelligence is broadly defined as computational systems that are capable of performing tasks traditionally associated with human intelligence, including reasoning, learning, problem-solving, and decision-making (Copeland

& B.J., 2025). Within the context of Big Tech, AI applications are multifaceted, encompassing the automation of routine administrative and operational processes, the deployment of advanced analytics for strategic decision-making, and the creation of generative content. These developments have fundamentally transformed workforce requirements, reshaping both the skills employees must possess and the expectations placed on organisational performance. The adoption of AI has introduced new demands for technical proficiency, including expertise in machine learning, data analytics, cybersecurity, and software development, while simultaneously reducing the relevance of certain traditional skill sets that were previously integral to organisational operations.

The skill gap, defined as the discrepancy between the competencies required to perform specific roles effectively and the capabilities currently available within the workforce, has become increasingly salient in the AI era (Coursera, 2024). This gap is particularly pronounced in Big Tech firms, where the rapid integration of AI technologies has created a high demand for specialised skills that are scarce relative to supply. Employees lacking competencies in AI-related domains face the risk of professional obsolescence, reduced employability, and limited career advancement opportunities. Simultaneously, organisations contend with potential productivity losses, slowed innovation, and the risk of failed AI initiatives if they are unable to secure the necessary human capital to support complex AI systems (Torres, 2025; David, 2025). The scarcity of AI-skilled personnel is further exacerbated by the competitive recruitment environment, where firms must compete both locally and globally to attract and retain a limited pool of qualified experts, creating wage disparities and increasing turnover risks within high-demand roles.

The skill-biased technological change framework offers a valuable theoretical lens to interpret these dynamics, positing that technological advancements disproportionately increase the demand for highly skilled labour while simultaneously reducing the demand for low-skilled roles (Katz & Murphy, 1992). Within Big Tech, this framework helps explain why organisations increasingly rely on a concentrated group of AI developers and technical specialists, while routine, repetitive, or low-skilled tasks are increasingly automated. The SBTC perspective also highlights the potential consequences for labour market inequality, as highly skilled workers benefit from increased wages, career opportunities, and organisational influence, whereas employees in low-skilled roles face marginalisation, displacement, or the need for significant retraining to remain relevant. Moreover, the framework underscores the broader organisational implications of AI integration, including shifts in workflow design, knowledge concentration within specialised teams, and the necessity for strategic human resource interventions, such as targeted upskilling and reskilling initiatives, to address both the operational and ethical challenges associated with the skill gap.

The Evolving Value of Skills and Education

The integration of artificial intelligence within Big Tech firms has significantly altered the perceived value of formal education and traditional academic credentials in the labour market. Historically, university degrees functioned as key indicators of competence and employability within the technology sector. However, the rapid advancement of AI technologies has prompted organisations to reassess the relevance of conventional educational qualifications in relation to evolving workplace demands. Empirical evidence suggests that generative AI tools have contributed to a shift in hiring priorities, where demonstrable technical skills and practical competencies are increasingly valued over formal educational attainment. In particular, research indicates that many Generation Z job seekers perceive their university education as less relevant within the emerging AI-driven labour market, as employers increasingly prioritise candidates who possess specialised AI-related capabilities rather than traditional academic credentials (Ltheissen, 2024; Grace, 2024). This shift reflects broader structural changes in how knowledge, expertise, and employability are evaluated within the technology industry.

The growing emphasis on skills rather than formal education is further reinforced by global labour market projections. According to the World Economic Forum (2025), approximately 39 per cent of existing workforce skills are expected to become outdated by 2030 as a result of rapid technological change and AI-driven automation. In particular, competencies in areas such as software engineering, programming, and data analysis are undergoing substantial transformation as AI systems increasingly automate complex analytical processes that were previously performed by human workers. While these technical fields remain important, their nature is evolving, requiring workers to develop complementary capabilities that allow them to effectively interact with, manage, and interpret AI

technologies. Consequently, organisations are placing greater emphasis on adaptive learning, technical versatility, and the continuous development of AI-related competencies.

This evolving labour market environment has contributed to the emergence of skill-first hiring approaches within Big Tech firms, where practical ability and demonstrated proficiency are prioritised over formal academic qualifications. Employers are increasingly evaluating candidates based on their capacity to apply AI tools, analyse large datasets, and collaborate effectively with advanced technological systems. As a result, workforce development strategies such as upskilling and reskilling have become critical mechanisms for ensuring that employees remain competitive and capable within AI-intensive organisational environments. The shift away from education-based hiring towards skill-focused recruitment therefore highlights the growing importance of lifelong learning and continuous professional development in sustaining employability in the era of artificial intelligence.

Shifts in Skill Demand and Labour Market Transformation

The adoption of artificial intelligence has significantly reshaped the demand for skills within Big Tech firms, fundamentally transforming the competencies required for effective participation in the modern technology workforce. As organisations increasingly integrate AI systems into their operational processes, the demand for employees with specialised technical capabilities has risen considerably. Empirical evidence demonstrates that job postings requiring AI-related competencies have increased substantially in recent years, highlighting both the scarcity of qualified professionals and the strategic importance of these skills for organisational competitiveness and innovation (Ruder, 2025). The expansion of AI technologies across multiple functions, including data management, automation, and predictive analytics, has created a growing need for professionals who possess the expertise necessary to develop, implement, and manage these advanced systems.

In response to these changing demands, several major technology firms have shifted towards skills-based hiring and promotion practices. Organisations such as Amazon, Dell, IBM, and Accenture have increasingly prioritised practical competencies and demonstrable technical expertise over traditional hiring criteria in order to ensure that their workforce capabilities align with evolving AI-driven strategies (Goel et al., 2025). This approach reflects a broader recognition within the technology sector that conventional educational pathways alone may not sufficiently prepare workers for the rapidly evolving requirements associated with artificial intelligence integration. Consequently, firms are placing greater emphasis on identifying individuals with specialised technical knowledge, problem-solving abilities, and the capacity to adapt to emerging digital tools and platforms.

The types of competencies currently in highest demand reflect the expanding role of AI within organisational operations. Skills related to artificial intelligence development, big data analytics, cybersecurity, and advanced digital literacy have become increasingly valuable as companies seek to harness the full potential of AI technologies. Professionals who are capable of designing machine learning models, managing large and complex datasets, protecting digital infrastructures, and interpreting algorithmic outputs are particularly sought after in this evolving labour market. Conversely, tasks that rely heavily on manual labour, repetitive activities, or lower-level cognitive functions have experienced a decline in relevance due to the ability of AI systems to perform these tasks more efficiently and at a larger scale.

This transformation illustrates a broader shift in labour market dynamics, where technological innovation continuously redefines the nature of work and the competencies required to perform it effectively. Employees are therefore required to engage in ongoing learning and skill development in order to remain competitive within the workforce. As AI technologies continue to evolve, the ability to adapt to new technological environments and acquire emerging technical competencies has become an essential component of long-term employability within the technology sector.

Risks for Big Tech Firms Due to Skill Gaps

The scarcity of artificial intelligence related skills presents significant organisational risks for firms operating within the technology sector. Although many organisations have invested heavily in the development and implementation of artificial intelligence systems, the availability of qualified professionals capable of designing, managing, and integrating these technologies remains limited. Evidence suggests that more than half of technology firms report

shortages of personnel with the necessary AI competencies, highlighting the growing disparity between technological investment and workforce readiness (Harvey Nash UK, 2025). As organisations accelerate their adoption of AI in order to remain competitive, the demand for specialised expertise in areas such as machine learning, data science, algorithm development, and AI system integration continues to outpace the available supply of skilled professionals.

This imbalance between workforce supply and organisational demand has generated a range of operational and strategic challenges. The rapid escalation in the demand for AI expertise has created conditions in which firms struggle to recruit and retain the specialised talent required to support complex technological initiatives. As a result, organisations may experience delays in the development and implementation of AI projects, as well as increased vulnerability to project inefficiencies or outright failure when adequate technical support is unavailable (Torres, 2025). In addition, the limited availability of highly skilled AI professionals often results in the concentration of technical knowledge within small groups of specialised employees. This phenomenon, commonly described as skill silos, can hinder collaboration across departments and create organisational dependencies on a narrow group of experts. When critical knowledge is concentrated within a small segment of the workforce, firms may face increased operational risks if these individuals leave the organisation or become unavailable.

The scarcity of AI talent also contributes to broader workforce inequalities within organisations. Highly skilled AI professionals frequently command significantly higher wages and greater bargaining power due to the limited supply of their expertise. While these conditions benefit employees with specialised technical skills, they can simultaneously create disparities within the workforce, leading to perceptions of inequity among other employees. Such disparities may negatively affect organisational cohesion, employee morale, and workplace motivation (David, 2025). Furthermore, employees who lack opportunities to develop AI-related competencies may experience anxiety regarding job security and career progression, particularly as automation increasingly reshapes traditional job roles.

These risks highlight the complex challenges faced by organisations attempting to sustain AI-driven growth while maintaining workforce stability. Firms must not only invest in technological infrastructure but also ensure that their employees possess the capabilities required to effectively support and manage these systems. Workforce instability resulting from skill shortages can disrupt innovation processes, limit organisational adaptability, and weaken long-term competitive advantage. Consequently, addressing the AI skills shortage through strategic workforce development initiatives, including targeted upskilling and reskilling programs, has become an essential priority for organisations seeking to fully realise the potential of artificial intelligence while maintaining sustainable organisational growth.

Workforce Development: Upskilling and Reskilling Strategies

To mitigate these challenges, Big Tech firms have implemented comprehensive workforce development programs. Upskilling initiatives focus on enhancing existing employee competencies, enabling workers to perform AI-integrated tasks within their current roles (LinkedIn Learning, n.d.). Reskilling involves retraining employees to acquire entirely new skills to meet organisational needs, such as transitioning into robotics, Mechatronics, or data analytics (Veena, 2025).

Microsoft's Skills for Jobs program, Amazon's Skills to Jobs Tech Alliance, and Google's AI Opportunity Initiative exemplify large-scale interventions designed to address skill gaps, reach thousands of employees, and facilitate human-AI collaboration within organisations (Behncken, 2022; Walker, 2022; Chen, Srinivasan and Zakerinia, 2024). These programs demonstrate how strategic investment in workforce development enhances productivity, mitigates risk, and aligns employee skills with technological demands.

Artificial Intelligence as a Complement and Substitute for Human Labour

The adoption of artificial intelligence has generated diverse and often contrasting perspectives regarding its role within the modern workforce. Scholars and industry practitioners continue to debate whether artificial intelligence primarily functions as a complement to human labour or as a substitute that replaces certain categories of work. One perspective emphasises the complementary role of artificial intelligence, suggesting that AI technologies enhance human capabilities rather than replace them. In this context, artificial intelligence systems are used to automate routine and repetitive tasks, thereby enabling employees to redirect their time and effort toward more complex,

creative, and strategic responsibilities. By reducing the burden of time consuming administrative or data processing activities, AI allows workers to engage in higher value tasks that require critical thinking, innovation, and interpersonal collaboration. This form of human–AI collaboration has been associated with improvements in organisational productivity, operational efficiency, and employee job satisfaction, as workers are able to focus on aspects of their roles that require uniquely human skills such as judgement, creativity, and strategic decision making (Georgieff and Hye, 2022; Chen, Srinivasan and Zakerinia, 2024).

In contrast, another perspective highlights the substitutive effects of artificial intelligence on human labour. From this viewpoint, AI systems have the capacity to replace certain categories of work, particularly those involving repetitive, routine, or lower level cognitive tasks. Advances in machine learning, automation, and data processing technologies have enabled AI systems to perform functions that were previously carried out by human workers, including data analysis, pattern recognition, customer service interactions, and administrative operations. As a result, the integration of artificial intelligence into organisational processes can lead to a reduction in labour demand for roles that rely heavily on these types of tasks. Scholars have therefore raised concerns regarding potential workforce displacement, employment restructuring, and the long term implications of automation for job security and labour market stability (Acemoglu and Restrepo, 2018).

Despite these contrasting viewpoints, much of the contemporary literature suggests that the relationship between artificial intelligence and human labour is more accurately characterised as a hybrid interaction rather than a purely complementary or substitutive dynamic. In practice, AI technologies often perform both functions simultaneously. While certain tasks may be automated or replaced by AI systems, other aspects of work are enhanced through collaboration between humans and intelligent technologies. The extent to which artificial intelligence complements or substitutes human labour largely depends on several factors, including the complexity of tasks, the skill levels required to perform them, and the strategic approach adopted by organisations when implementing AI technologies. Consequently, rather than eliminating human labour entirely, artificial intelligence is reshaping job roles and redefining the skills required within the workforce. This evolving relationship underscores the importance of workforce adaptation, continuous learning, and organisational strategies such as upskilling and reskilling to ensure that employees can effectively collaborate with emerging AI technologies.

Research Gaps

Despite extensive scholarship, several gaps persist. First, integrated theoretical frameworks connecting AI adoption, skill value, and workforce outcomes are limited. Second, longitudinal research tracking AI-driven workforce changes over time is scarce due to the emerging nature of the technology. Third, qualitative studies capturing employee experiences and organisational perspectives remain underrepresented. Finally, the long-term effectiveness of upskilling and reskilling programs is insufficiently evaluated, limiting understanding of sustainable workforce development strategies.

Summary

This literature review demonstrates that AI adoption in Big Tech has transformed skill demands, workforce expectations, and labour market dynamics. Traditional education is increasingly insufficient, while AI-related technical competencies are in high demand. Skill gaps generate significant organisational and workforce risks, which are mitigated through strategic upskilling and reskilling initiatives. AI serves both complementary and substitutive functions, necessitating adaptive workforce planning and continuous learning. Addressing current research gaps through longitudinal and qualitative studies will enhance understanding of sustainable workforce development and human AI collaboration in the technology sector.

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