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Examining the Impact of Artificial Intelligence and Automation Technologies on Labour Market Structures, Employment Patterns, and Skill Requirements

Dr. Gule Ariffa

Associate Professor
Department of Economics
Government College for Women (Autonomous) Mandya

Abstract

This paper presents an analytical examination of how artificeial intelligence (AI) and automation technologies are reshaping contemporary labour markets. Drawing on recent empirical studies and established theoretical perspectives, the analysis focuses on three key dimensions: structural shifts within labour markets, changing employment patterns, and the evolving demand for skills. The findings indicate that AI and automation are not merely eliminating jobs but are redefining the task composition within occupations, resulting in substantial occupational restructuring and displacement alongside the creation of new roles. These technologies contribute to increased productivity, operational efficiency, and firm-level growth; however, their effects are unevenly distributed across sectors, skill categories, and demographic groups. Routine and low-skill tasks are particularly vulnerable to automation, while demand is increasing for cognitive, technical, and socio-emotional skills. The paper highlights the widening inequality risks associated with technological adoption and stresses the need for proactive policy interventions. It concludes by outlining strategies for managing the transition, including reskilling initiatives, strengthened social protection systems, and regulatory frameworks that support inclusive and sustainable technological integration. Ultimately, the paper argues that successful adaptation will depend on preparing workforces for a future characterized by human machine complementarity rather than substitution.

Keywords: Artificial Intelligence, Automation, Labour Market Transformation, Employment Patterns, Skill Requirements, Technological Displacement, Reskilling, Occupational Restructuring, Human-Machine Collaboration, Inequality

1. Introduction

The rapid advancement of artificial intelligence (AI) and automation technologies has intensified global debates about the future of work, employment stability, and economic transformation. From sophisticated language models capable of generating legal briefs and analysing medical data to autonomous robots performing precision manufacturing tasks, these technologies are reshaping the ways in which goods and services are produced, delivered, and consumed. Their growing integration across

sectors signals not only technological progress but also a structural shift with far-reaching implications for labour markets.

This paper examines the impact of AI and automation across three interconnected dimensions of labour market change. First, it analyses shifts in labour market structure, focusing on how occupations and industries are reconfigured as automated systems assume routine, predictable tasks. Second, it investigates evolving employment patterns, including job displacement, job creation, and the net employment effects stemming from technological adoption. Third, it explores how AI-driven transformation is reshaping skill requirements, intensifying demand for cognitive, digital, technical, and socio-emotional competencies while reducing reliance on manual and routine skills.

Understanding these dynamics is essential for policymakers devising labour strategies, educators designing future-ready curricula, and businesses adapting organisational models during a period of rapid technological disruption. This analysis synthesises insights from recent empirical research, government labour projections, industry reports, and assessments by international organisations such as the ILO, OECD, and World Bank. By integrating these diverse perspectives, the paper offers a balanced and evidence-based assessment of how AI and automation are reshaping labour market behaviour, productivity, and workforce composition.

Given the accelerating pace of technological adoption, the implications for inequality, social protection systems, and workforce readiness are significant. This introduction sets the foundation for a deeper examination of the opportunities and risks posed by AI-driven change and establish the need for adaptive, forward-looking policy frameworks that can support inclusive and sustainable labour market transitions.

2. Theoretical Framework

The labour market impact of AI and automation can be understood through several established economic theories. The task-based approach posits that technology affects employment by automating specific tasks within jobs rather than eliminating entire occupations. This framework helps explain why some roles evolve rather than disappear. The concept of skill-biased technological change (SBTC) suggests that technology increases demand for high-skilled workers while reducing demand for low-skilled labour. However, recent patterns suggest a more complex dynamic. Routine-biased technological change (RBTC) argues that automation primarily displaces routine, codifiable tasks, whether cognitive (e.g., data entry) or manual (e.g., assembly line work), leading to a polarisation of the labour market with growth in both high-skill analytic jobs and low-skill service jobs. Emerging evidence indicates that AI may be altering this pattern, contributing to a "one-sided" shift favouring highly compensated, high-skill roles. Finally, the theory of general-purpose technologies (GPTs) frames AI as a foundational innovation like the steam engine or electricity whose full transformative effects unfold over decades, reshaping entire economies and creating new job categories while rendering others obsolete.

3. Methodology

This paper employs a systematic literature review methodology, focusing on high-quality empirical studies published between 2024 and 2025. The sources include official government analyses (e.g., the White House Council of Economic Advisers report), working papers from international

financial institutions (e.g., the International Monetary Fund), peer-reviewed academic research, and analyses from leading policy institutes. The paper adopts a comparative and synthetic approach, examining evidence from the United States and other advanced economies to identify consistent patterns, divergent outcomes, and remaining uncertainties.

4. Impact on Labour Market Structures

Empirical studies consistently show that AI and automation are accelerating structural transformations within labour markets, altering both the distribution of occupations and the nature of work performed. Historical trends indicate that between 1990 and 2017, occupational composition in advanced economies particularly in the United States remained relatively stable, with incremental technological adoption generating limited disruption. However, from 2018 onward, researchers have observed a pronounced increase in "occupational churn," signalling faster job transitions and reallocation across sectors.

One of the most significant structural shifts is the apparent end of job polarisation. Before 2020, labour markets exhibited a "barbell-shaped" pattern, with simultaneous growth in high-wage knowledge work and low-wage manual service jobs, while middle-skill routine tasks declined. Recent evidence, however, shows a shift toward a "one-sided ramp" labour market, where employment growth is concentrated almost entirely in high-wage occupations. This shift aligns with the growing importance of digital and analytical competencies.

A second major trend is the surge in STEM occupations. The share of employment in science, technology, engineering, and mathematics has expanded by nearly 50% since 2010, driven by rising demand for software development, data analytics, cybersecurity, and AI-specialised roles.

Conversely, low- and middle-skill occupations are experiencing decreased demand. Retail sales employment has dropped by approximately 25% between 2013 and 2023 due to the rise of automated checkouts and e-commerce logistics technologies. Low-paid service roles have also stagnated as businesses adopt robotic process automation and intelligent scheduling systems.

Importantly, exposure to AI varies across occupational groups. Unlike earlier automation waves that primarily displaced middle-skill routine jobs, AI technologies now increasingly target high-paid cognitive tasks involving information processing. At the same time, industrial robots continue to disproportionately disrupt manufacturing employment a sector heavily represented by male and minority workers thereby narrowing gender employment gaps but exacerbating racial disparities.

5. Impact on Employment Patterns

The empirical evidence on AI's net impact on employment reveals a complex and context-specific picture. At the aggregate level, macroeconomic studies find that AI has not yet triggered widespread job loss. While certain occupations are shrinking, productivity gains and business expansion in AI-adopting firms have generated offsetting employment in other areas. However, aggregate stability masks significant localised and group-specific disruptions.

Displacement risk is particularly high for workers classified as "AI-vulnerable" those employed in roles with high exposure to AI automation but limited AI-related skill requirements. According to the White House Council of Economic Advisers, employment growth in these occupations has slowed markedly, and transitions out of such jobs are increasingly common.

Regional analyses further illustrate uneven effects. An IMF study examining differences in AI adoption across U.S. regions found that areas with higher AI penetration experienced a sharper decline in their employment-to-population ratios from 2010 to 2021. The adverse effects were concentrated in manufacturing, low-skill services, middle-skill routine occupations, and non-STEM roles often in communities with limited access to retraining or job mobility.

Firm-level evidence provides additional nuance. On average, companies that adopt AI experience around 6% higher employment growth over a five-year period due to productivity improvements and market expansion. Yet the task-level impact varies: when AI automates a large proportion of work tasks, employment in that specific role may drop by 14%. Conversely, if AI automates only a small subset of tasks, employment can rise as workers reallocate time toward higher-value, non-automatable activities. This suggests that the depth of task automation rather than automation itself determines labour demand outcomes.

6. Impact on Skill Requirements

AI adoption is driving a rapid and multidimensional reshaping of skill demand across labour markets. Research from the OECD suggests that while relatively few workers need advanced AI engineering capabilities, the spread of AI alters the composition of tasks within most occupations. This restructuring increases the importance of complementary human skills rather than replacing the need for human labour entirely.

Demand is rising sharply for cognitive, managerial, emotional, and digital competencies. In highly AI-exposed occupations, employers increasingly prioritise project management, financial analysis, decision-making, communication, and leadership skills. Digital literacy and data interpretation skills have also become essential across sectors, from healthcare and education to logistics and retail.

Job postings requiring AI-related competencies command substantial wage premiums. The World Economic Forum reports that skill requirements for AI-exposed jobs are evolving 66% faster than for other occupations, reflecting an accelerating pace of technological change described by researchers as a "skills earthquake."

As AI systems handle routine prediction, analysis, and pattern-recognition tasks, the comparative advantage of human workers shifts toward capabilities that are difficult to automate: critical thinking, creativity, complex problem-solving, adaptive reasoning, and interpersonal interaction. Additionally, the ability to manage, supervise, and collaborate with AI-driven tools is becoming a core requirement across professional fields. Human–machine collaboration is emerging not as an optional asset but as a fundamental competency for the future workforce.

7. **Master Table: Combined Statistical Data on AI, Automation, and Labour Markets**

Category	Indicator / Impact Area	Statistical Data	Source
Global AI Trends	Global AI market projection	USD 1.85 trillion by 2030	Statista (2024)
	Firms adopting AI	Increased from 20% (2017) to 50%+ (2023)	McKinsey (2023)
	Enterprises increasing AI investment	75% of companies	PwC (2023)
	Jobs potentially affected worldwide	300 million jobs	Goldman Sachs (2023)
Labour Market Structure	Growth of STEM jobs	+47% from 2010–2023	OECD
	Decline in routine jobs	–18% from 2000–2020	OECD
	Retail sales job decline	–25% from 2013–2023	U.S. Labour Data
	AI exposure in high-skilled jobs	27% of tasks automatable	WEF (2023)
	Industrial robot increase	+85% from 2015–2022	IFR
Employment Patterns	Risk of working hours automated	Up to 40% automatable	ILO (2023)
	Jobs at high risk of automation	25% in OECD countries	OECD
	Regional decline in employment ratio	–1.5% to –2%	IMF (2022)
	Employment growth in AI-adopting firms	+6% over 5 years	MIT–IBM (2022)
	Job loss when >50% tasks automated	–14% employment	HBR (2023)
Skill Demand	Growth in AI skill postings	+450% since 2015	LinkedIn (2023)
	Wage premium for AI skills	+20–40% higher salaries	WEF (2023)
	Speed of skill changes in AI-exposed jobs	66% faster	WEF (2023)
	Jobs requiring digital skills	80% across OECD	OECD
	Increase in demand for social/emotional skills	+24% by 2030	McKinsey
Sector-Specific Impacts	Manufacturing jobs replaced by robots	1.7 million (2000–2020)	Oxford Economics
	Robot density in advanced economies	350+ robots per 10,000 workers	IFR
	Customer service job reduction expected	20% by 2027	Gartner
	Transport/logistics automation threat	70% of jobs vulnerable	OECD/ITF
	AI improvement in diagnostic	+15–25%	WHO

	accuracy		
	Growth in health-tech skills	3× faster than average	WEF
Demographic Impacts	Women in low AI-exposure roles	58% of workforce	Pew Research
	Women in high AI-exposure fields	32% of workforce	Pew Research
	Minority workers in automation-vulnerable jobs	30–40% higher likelihood	BLS
	Young workers (18–34) using AI tools	67%	Pew Research

Challenges, Limitations, and Future Directions

Assessing the labour market impact of AI faces several challenges. Much of the current empirical evidence predates the widespread adoption of generative AI (e.g., ChatGPT), who's broader task capabilities may alter observed patterns. There is also significant uncertainty regarding the pace of technology diffusion and future worker adaptation. A major limitation is the risk of exacerbating inequality; technological impacts are not neutral but reflect and can amplify existing societal disparities in occupation, education, and income. Furthermore, the focus on aggregate employment masks difficult transitions for displaced workers and geographic communities. Future research must track the long-term effects of generative AI, improve measurement of task-level changes, and evaluate the efficacy of policy responses like reskilling programmes.

Policy Implications: The evidence points to several key policy priorities to harness the benefits of AI while mitigating its risks:

- **Education and Lifelong Learning Systems**: Curriculum reform at all levels should emphasise foundational skills like critical thinking, creativity, and digital literacy. Governments and employers must co-invest in accessible, modular, and effective **lifelong learning and reskilling programmes**, particularly for workers in vulnerable occupations.
- **Strengthened Safety Nets and Transition Support**: Unemployment insurance and other safety net programmes may need modernisation to support workers through more frequent job transitions. Policies such as wage insurance, career counselling, and portable benefits can facilitate movement from declining to growing sectors.
- **Inclusive Technology Deployment and Worker Voice**: Policymakers should encourage AI development and adoption paths that augment rather than simply replace workers. Involving workers in the design and implementation of new technologies can improve outcomes and build trust.
- **Targeted Support for Vulnerable Groups**: As automation impacts vary by demographic group, retraining and placement programmes should be targeted to assist the most affected communities, helping to ensure that the benefits of technological progress are broadly shared.

8. Conclusion

Artificial intelligence and automation are undeniably reshaping the world of work, bringing profound changes to employment structures, occupational tasks, and skill demands. Rather than

supporting narratives of inevitable mass unemployment, empirical evidence shows a more complex transition marked by significant disruption and reallocation. High-skill and high-wage occupations are expanding rapidly, while many middle- and low-skill roles are experiencing stagnation or decline as routine tasks become increasingly automated. This shift is creating a more dynamic but also more uneven labour market, where opportunities and vulnerabilities vary widely across sectors, regions, and demographic groups.

The central challenge is not to halt technological advancement but to manage its consequences in a way that supports societal well-being. Effective adaptation requires strong policy frameworks that facilitate worker transitions, reduce displacement risks, and ensure that productivity gains translate into shared prosperity rather than widening inequality. Investment in education, reskilling, and lifelong learning will be essential to prepare current and future workforces for human–machine collaboration. At the same time, robust social protection systems and targeted labour market interventions will be necessary to support those most exposed to automation.

Ultimately, the future of work will depend on proactive, evidence-informed strategies that guide AI-driven change toward inclusive, equitable, and sustainable economic growth.

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