The Impact of Artificial Intelligence Application on Job Displacement and Creation: A Systematic Review

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ABSTRACT

The advent of artificial intelligence has profoundly impacted the employment landscape, raising concerns about potential job displacement. This paper employs a systematic literature review method and PRISMA approach to collate and synthesise a substantial body of relevant studies of the last 40 years, intending to sort out the impact of AI on the job market and further analyse the opportunities and challenges associated with the effects of artificial intelligence on job substitution, to fill the gaps in the existing studies. It has been demonstrated that artificial intelligence has a discernible displacement effect in specific repetitive and predictable work environments, leading to the obsolescence of some conventional roles. Conversely, it also engenders new employment opportunities and a demand for highly proficient and adaptable professionals. This paper presents a comprehensive analysis of the current situation of job substitution under the influence of artificial intelligence in different industries and regions. It also offers insights into the corresponding policy countermeasures and other aspects to provide a reference point for further understanding and coping with this growing problem. This study systematically reviews the existing literature and suggests future research directions, including combining emerging technologies such as the Internet of Things and blockchain with artificial intelligence.

Keywords: Artificial intelligence, Labour market, Job displacement, Job creation, Skill demand

JEL Code: J24, O33, J21, J23, J31, O14

INTRODUCTION

The prevalence of artificial intelligence (AI) affecting employment made the study of job displacement significantly relevant to the labour market. The International Monetary Fund (IMF 2024) report highlights that AI will impact 40% of global jobs, with many roles at risk of replacement. Although AI increases productivity, especially in automation and services, it also eliminates jobs in repetitive and routine tasks, for instance, data entry and assembly line work (Ilmārs et al. 2019; Sonderling et al. 2022; Qin et al. 2019; Georgieff & Hyee 2021). The extensive use of AI technologies in many industries significantly impacts the labour market's job characteristics and skill demand.

On the other hand, AI creates many new jobs, such as AI engineers, data analysts, and image recognition experts, by offering better earnings and career prospects (Yu 2011; Alessandra et al. 2024). Furthermore, the adoption of AI has made industries and economic sectors more competitive and productive by transforming them into a digital economy (Dan & Yun-Ling 2023).

It assists governments develop well-balanced policies that secure jobs and promote new industries (Waidlein 2024; Shao 2022; Organ 2021). For companies, it facilitates improved worker adaption to AI's effects and talent planning (Abuselidze & Mamaladze 2021). It motivates people to acquire new abilities to remain competitive (Graglia & Huelsen 2020). In conclusion, research on this topic is crucial for managing upcoming shifts in the labour market and advancing sustainable development (Ding et al 2023).

The global job market is diverse and varies by country, depending on economy and industry factors. Taking China and the United States as examples, both countries are in a leading position in developing and applying AI technology. In China, although manufacturing still dominates, the growth of the service industry and the application of AI technology are driving the transformation of the job market. With the popularisation of AI technology, China is actively cultivating AI talents to meet the market's demand for talents with AI skills. In the United States, the service industry has become the leading force in the job market, and the application of AI technology further drives innovation and development in the service industry. Meanwhile, the United States is also strengthening AI education and training to enhance the overall quality and competitiveness of the workforce (Zhen 2019).

The demand for talents with AI skills in emerging industries such as biomedicine is also constantly increasing (Morikawa 2017). These new jobs require a solid foundation in computer science and mastery of professional skills such as machine learning, deep learning, and natural language processing. In addition, due to the application of AI technology in multiple fields, compound talents with interdisciplinary knowledge and practical experience will also be favoured by the market (Wang 2020). While AI has not had a huge impact yet, the job market is already changing, with new industries and job types emerging.

AI significantly reduces the need for workers in repetitive occupations such as assembly line labour (Wang 2020). However, it also exhibits significant potential for increasing productivity and encouraging the modernisation and transformation of conventional sectors. In addition, interdisciplinary between sectors and demand for highly skilled positions are increasing, especially in developing industries. This led to the labour market's structure progressively shifting toward intellect and skills. To maintain the stability and long-term growth of the labour market, this paper also addresses how to successfully address employment issues caused by AI through company solutions, regulatory support, and education and training.

A review of existing studies reveals that although there have been many studies on AI and employment, most focus only on specific countries or industries and lack a systematic compendium. Therefore, this study applies a systematic literature review to review the impact of artificial intelligence on job substitution. The main objective is to screen and analyse the relevant literature of the last 40 years through this method, comprehensively explore the multidimensional impact of AI on job substitution, and propose adaptive strategies in combination with existing research findings. Specifically, the study addresses three core research questions: First, "*What are the characteristics of studies on AI and job displacement*?" Second, *"What theoretical frameworks are employed in studying the impact of AI on job displacement?"* Third, "*What are the specific impacts of AI adoption on job displacement?*" The paper provides two contributions to the literature. First, this paper provides a theoretical review employed by past studies of AI and its impact on job displacement. Second, findings on the review of AI studies are categorized into the study's characteristics, and its impact on job displacement and creation, skills required by occupational groups, industries, and regions should be scrutinised.

The paper is structured as follows. Section 2 describes the methodology used in this study. Section 3 presents the findings of this study, while Section 4 provides further discussion and recommendations for policy formulation. Finally, Section 5 summarises the main conclusions.

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METHODOLOGY

This study uses a systematic literature review and meta-analyses (PRISMA) approach. To ensure the quality and relevance of the literature, the search strategy employs multiple databases, including Web of Science, Scopus, Springer Link and Elsevier Science-direct, which were used to access high-quality research on AI and employment. and search engines to ensure the quality and relevance of the literature. Web of Science and Scopus help us quickly locate relevant literature and research on the impact of AI on employment; Springer Link and Elsevier Science-direct provide high-quality scholarly resources with the latest scientific research. In order to accurately capture the latest impact of AI technology development on employment, this study limits the literature search to the past four decades (1984-2024). Figure 1 exhibits the search and selection process for articles.

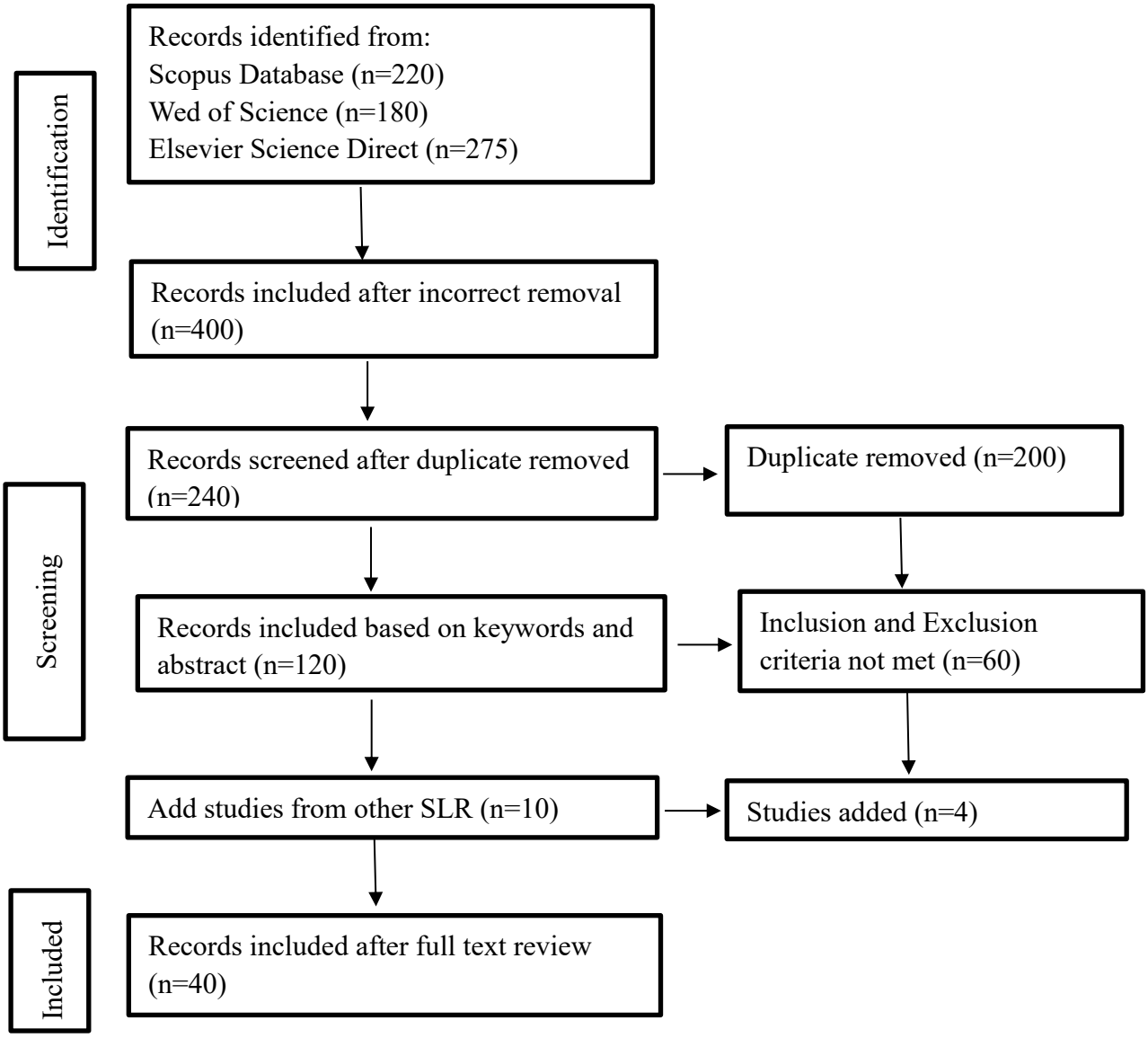

Figure 1. Literature review search and selection process.

Sources: Authors' compilation based on the PRISMA model (2020)

Searching Strategy

To gain a more comprehensive understanding of the impact of AI on employment, we searched using multiple precise keywords. The keywords used are "Artificial Intelligence" and "Job displacement" as core keywords,

and also combined with "Automation", "Labour market impact," "Job creation," and "Skill requirements change" to ensure the comprehensiveness of the search results. The final search string is as follows: (("Artificial Intelligence" OR "AI") AND ("Employment displacement" OR "Job displacement" OR "Workforce displacement") AND ("Automation" OR "Technological Automation") AND ("Labour market impact" OR "Impact on labour market" OR "Workforce impact") AND ("Job creation" OR "New job opportunities" OR "Employment opportunities") AND ("Skill requirements change" OR "Skills transformation" OR "Reskilling" OR "Upskilling")). As mentioned previously, we select literature from high-level academic journals and research institutes from reputable databases (Scopus, Web of Science, Springer Link and Elsevier Science-direct) to ensure the reliability of the search results. This strategy is to obtain a comprehensive and reliable literature.

The following procedure is to investigate the impact of AI on employment further; we conducted a systematic screening and assessment of the literature. Table 1 provides the inclusion and exclusion criteria for the literature. In the literature assessment, we mainly considered three aspects: first, the scientific rigour of the research method. Second, the reliability of the research results, and third, the practicality of the information. We prioritised studies that adopted rigorous research methods, reliable data and clear conclusions. Regarding information extraction, we focus on many dimensions, such as employment replacement rate, job creation, industry impact, and skill change. This information will provide an accurate data foundation for a comprehensive and systematic critical review.

Table 1. Inclusion and exclusion criteria for literature selection

Category	**Criteria**	
	Inclusion	**Exclusion**
Research topic	Studies related to artificial intelligence, employment stability, and policy development.	Studies unrelated to the research topic include AI applications in healthcare, entertainment, and other non-employment fields.
Type of study	Peer-reviewed journal articles or international conference papers, including systematic reviews, empirical studies, and policy analyses.	Books, non-academic reports, blog articles, unpublished working papers.
Time-frame	Studies published between 1984 and 2024 ensure coverage of AI development and its impact on employment policies.	Studies published before 1984 do not align with the modern AI and employment policy discourse.
Research method	Studies using quantitative, qualitative, or mixed-method approaches, including policy evaluation, case studies, and economic modelling.	Studies lacking rigorous methodology or empirical support, such as purely theoretical discussions without practical analysis.
Geographical scope	Studies focus on the impact of government policies, particularly in major AI-developing and economically advanced countries (e.g., the U.S., EU and China).	Studies are limited to individual company cases or industry reports rather than policy-level research.
Language	Academic literature primarily in English.	Literature in other languages without reliable translations.

Source: Authors' compilation (2024)

FINDINGS

This section provides a discussion of the study's characteristics, theoretical background and AI's impact on employment, including employment discrimination and social equity

Characteristics of the study

To address the characteristics of studies on AI and job displacement, we classify the literature by the number of publications by year, location, and theoretical background. Table 2 provides a classification of papers according to the year of publication. There has been a discernible trend in research publications since the commencement of these papers in 1984. Since 2019, this subject has attracted the attention of researchers worldwide. Notably, in 2019, 2020, and 2022, the number of publications in this field was exceptionally high, accounting for approximately 52.5% of the total papers.

Table 2. Study by year of publication

Publication's year	Number of Publication (%)	Cumulative percentage
1984	1 (2.5)	-
2011	1 (2.5)	5.0
2017	1 (2.5)	7.5
2018	5 (12.5)	20.0
2019	7 (17.5)	37.5
2020	8 (20.0)	57.5
2021	4 (10.0)	67.5
2022	6 (15.0)	82.5
2023	3 (7.5)	90.0
2024	4 (10.0)	100.0
Total	40 (100.0)	

Source: Authors' compilation (2024)

Table 3 categorises studies based on their sample coverage. Most studies were single-country analyses, making up 50% of the total publications. China had the highest number of studies, with seven papers, followed by the United States and Japan, with three papers each. Other countries, including India, France, Canada, Latvia, Ghana, Ukraine, and Portugal, each contributed one or two papers.

Only 7.5% used multi-country samples in addition to single-country studies. The countries involved are European countries, including Ireland, Denmark, Slovenia, Croatia, Austria, the United States, OECD countries and other developed countries. Another notable category is research aimed at a specific population (college students). Finally, 16 papers were selected representing a global perspective in examining the worldwide impact of AI on job/employment.

Table 3. Study by country/region

Country	Paper	No. of paper
Single-country sample		
United States	1, 3, 10	3
Japan	16, 21, 28	3
India	26	1
France	27	1
Canada	29	1
China	4, 9, 11, 13, 18, 38, 40	7
Latvia	2	1
Ghana	17	1

Ukraine	30	1
Portugal	32	1
Multi-country sample		
Europe (Ireland、Denmark、France、Slovenia、Spain、Croatia and Austria)	14	1
Developed countries	20	1
OECD countries	23	1
Specific population sample		
College student	35	1
Global perspective	5, 6, 7, 8, 12, 15, 19, 22, 24, 25, 31, 33, 34, 36, 37, 39	16

Note: This table lists the number of publications by country/region.

The paper numbers (1-40) correspond to the list in the Appendix.
Source: Authors' compilation (2024)

The study by theoretical background

Studies employ many different theoretical bases in analyzing the impact of AI on the labour market from different perspectives and provide a theoretical basis for understanding the challenges and opportunities that technological change brings to the labour market (Sharma et al., 2023; Menon, 2019; Aghion, 2019; Morikawa 2017; Chen 2018). Table 4 summarises the theoretical frameworks utilised in the study on the impact of artificial intelligence (AI) on employment. These frameworks can be grouped into several categories: economic theory, labour market models, and broader regional or social development theories. These theories offer comprehensive tools to understand and analyse the evolving dynamics.

Table 4. Theoretical background

Theoretical background	Paper	No. of paper
Skill-Biased Technological Change	1, 8,19, 25, 40	5
Technological Substitution Theory	4, 6, 15, 16	4
Job Polarization Theory	2, 11, 34, 39	4
Creative Destruction Theory	10, 18, 27	3
Labour market dynamics theory	7	1
Capital-labour substitution model	13	1
Regional economic development and employment disparity theory	5, 21, 36, 38	4
Social inequality theory	23	1
Regional development and employment model	37	1
Keynesian employment theory	22	1
Fintech and employment models	17	1
Industry-specific impact models	26	1
Automation and substitution theory	28	1

Source: Authors' compilation (2024).

Note: The paper numbers correspond to the list provided in the Appendix.

Economic theory is essential for studying the impact of artificial intelligence on employment. For instance, the

skills-biased technological change theory argues that artificial intelligence boosts the demand for highly skilled people while displacing low-skilled jobs (Bluestone et al. 2020; Georgieff & Hyee 2021; Karsten & West 2015). However, the technological substitution theory emphasizes the substitution of traditional jobs by automation, and the creative destruction theory suggests that technological innovation creates new jobs while eliminating old ones (Qin et al. 2019; Nilsson 1984; Alessandra et al. 2024; Graglia & Huelsen 2020; Masayuki 2016). Besides, the job polarisation theory states that automation exacerbates the gap between high and low-skilled employment (Dan & Yun-Ling, 2023; Shaukat et al., 2020). For instance, the employment of medium job positions in Latvia may decrease due to AI (Ilmārs et al. 2019). Moreover, regional economic development and employment gap theories and regional development models further suggest that technological progress affects different regions differently, with high-tech regions having more significant gains but traditional industry regions facing greater challenges (Wang et al. 2018; Hamaguchi & Kondo 2018; Yang 2020; Weiguo 2020; Cui 2020).

Social inequality theory emphasizes that technological advances may exacerbate social disparities. This is especially true in the case of uneven technological diffusion, which can result from using artificial intelligence (Bordot 2022). Furthermore, Keynesian employment theory considers the effective demand for employment. Artificial intelligence affects aggregate demand by increasing productivity and reducing costs, which in turn changes the level of employment (Sharma et al. 2023).

AI's impact on employment

This section analyses AI's impact on employment from different perspectives, including job displacement/changes, new skills required and discrimination. Further, the findings highlight how AI will impact different industries and regions and discuss the new job opportunities created in industries.

Job displacement/changes

In the contemporary era of rapid advancements in science and technology, the development of AI has attracted much attention. It is penetrating various industries and fields at an unprecedented rate, bringing a series of profound and complex impacts on jobs (Chen 2018). Table 5 discusses the multiple roles of AI in job substitution and creation through specific analysis of different sectors/fields, including manufacturing, finance, services, agriculture, and medicine.

In the manufacturing sector, artificial intelligence has replaced many repetitive tasks on traditional production lines, such as the assembly of automotive parts, while driving the demand for highly skilled technicians, especially in smart device operation, maintenance, and research and development (Yakovenko 2022). This has promoted the transformation of jobs to high-end and technical roles, and the skill requirements have also shifted from manual operation to programming, data analysis, and intelligent system operation and maintenance (Yu 2011; Yakovenko 2022).

Table 5. Impact of AI on job displacement across industries

Field	AI application	Impact on job/employment	Emerging skill demands/career transition	Paper
Manufacturing	Intelligent robots for tasks like automotive assembly	Reduction in repetitive assembly line jobs	Technicians for smart device operation, and R&D. Programming, data analysis, intelligent system operation	9, 11, 30
Finance	Algorithms for risk assessment, stock	Replacement of data entry and basic	Fintech professionals and big data analysts.	22, 23

	trading, and credit approval	financial analysis roles	Interdisciplinary expertise in finance.	
Services	Optimization of intelligent system algorithms	Reduction in routine, repetitive tasks	Professionals for man-machine collabouration and complex data handling. Algorithm optimisation and human-machine collabouration skills.	3, 10, 21
Agriculture	Intelligent equipment operation and data-driven decision-making	No impact	AI-enabled agricultural technicians and data analysts. Agricultural knowledge integrated with AI and data analysis skills.	11, 23
Education	Online platforms for personalized teaching, intelligent learning systems	Reduction in traditional tutoring positions	Educational technologists, creators of intelligent educational products. Digital literacy, critical thinking, and educational innovation.	7, 14, 16, 35
Medical	Disease diagnosis, image analysis, AI-enhanced diagnostic systems	Replacement of basic imaging analysis roles	Professionals in AI and medicine, medical data management, decision-making	17, 24, 35
Overall job market	Automation and AI advancements across industries	Reduction in low-skilled and repetitive roles	AI trainers, human-machine collabouration experts, data specialists. Lifelong learning, interdisciplinary and high-tech expertise.	3, 4, 6, 7, 8, 12

Source: Authors' compilation (2024)

Note: The paper numbers correspond to the list provided in the Appendix.

The Financial industry has undergone changes due to the application of artificial intelligence. Intelligent algorithms have demonstrated strong risk assessment, stock trading, and credit approval capabilities, replacing data entry and fundamental financial analysis (Sharma et al. 2023). Simultaneously, there is an increased demand for professionals with interdisciplinary expertise in finance and AI technology. These individuals utilize big data to inform decision-making and facilitate the innovation of financial products and services (Bordot 2022).

In the service sector, routine and repetitive tasks have been replaced by technology, but the need for professionals to optimize intelligent system algorithms, process complex data, and coordinate man-machine collabouration has increased (Alessandra et al. 2024). In the agricultural sector, integrating expertise both in agricultural knowledge and artificial intelligence technology will be pivotal, enabling individuals to operate, maintain, and utilize intelligent equipment and formulate decisions informed by data (Dan & Yun-Ling, 2023).

Artificial intelligence reshapes the field of education and realises personalised teaching through online education platforms and intelligent learning systems, replacing some traditional tutoring positions (Stevenson 2018). It also increases the demand for educational technologists and professional teachers with digital literacy (Yudina & Leskova 2020; Zhen 2019). These professionals must develop intelligent educational products, integrate educational ideas and technologies, and cultivate students' abilities such as critical thinking and creativity, which are difficult to replace with artificial intelligence (Organ 2021).

In the medical field, AI applications have significantly improved the efficiency of disease diagnosis and image

analysis, such as rapidly marking suspicious nodules in lung CT images through intelligent diagnostic systems (Bąba 2024). Some basic imaging analysis jobs are being replaced, but there is a growing demand for professionals at the intersection of medicine and AI who optimise diagnostic systems, manage medical data, and assist physicians (Shaukat et al. 2020; Zhen 2019).

The impact of AI on the job market has been both; substitution and creation (Bluestone et al. 2020; Ilmārs et al. 2019). On the one hand, automation replaces low-skilled jobs in labour-intensive fields (Sonderling et al. 2022; Qin et al. 2019). On the other hand, AI has also spawned many new occupations and facilitated industrial upgrading (Nilsson 1984; Stevenson 2018; Georgieff & Hyee 2021). Overall, the widespread use of AI is reshaping the employment structure and increasing the demand for highly skilled people in the job market (Georgieff & Hyee 2021; Waidlein 2024).

With the development of AI, workers will need to continuously upgrade their skills and enhance their interdisciplinary competencies to adapt to the rapidly changing job market (Graglia & Huelsen 2020). Society should invest more in education and training to provide more learning opportunities for workers and ensure the stability and vitality of employment in society (Alessandra et al. 2024).

Furthermore, various regions and industries need to take measures according to the actual situation, such as promoting industrial upgrading and optimising the employment structure, to alleviate the employment pressure and realize the positive interaction between artificial intelligence and the job market (Shao 2022). This integrated response strategy will help humans and artificial intelligence work together to create a better future (Alessandra et al. 2024; Graglia & Huelsen 2020).

Impact on employment opportunities

The advent of AI has given rise to numerous novel occupations, demonstrating its positive role in job creation. Specifically, with rising demand, AI trainers play a key role in data collection, annotation, and algorithm optimization (Akyulov 2019). Man-machine collabouration experts are responsible for designing efficient man-machine collabouration models to improve production efficiency, which is particularly important in manufacturing and other fields (Alessandra et al. 2024; Omary 2018). Finally, artificial intelligence ethics consultants promote the healthy development of artificial intelligence by providing ethical advice and formulating norms to ensure the reasonable application of technology (Menon 2019).

The rapid development of AI has diversified and specialized the job market while providing employment opportunities for talents from different backgrounds (Hamaguchi & Kondo 2018). The transformation and upgrading of the traditional retail industry have been typified by adopting smart retail, which integrates artificial intelligence technology into traditional physical store models, significantly impacting talent demand (Moniz 2022). E-commerce operation specialists oversee online store operations and precision marketing, while data analysis specialists leverage AI tools to extract data value, aiding enterprises in decision-making and efficiency improvement (Tatomur 2019; Shaukat et al. 2020).

Furthermore, intelligent customer service systems use natural language processing technology to address consumer inquiries, requiring manual assistance for complex inquiries and system optimization (Yakovenko 2022). Intelligent dispatchers utilize algorithms to optimize delivery routes and coordinate emergency responses (Aswathyk 2021). These emerging roles not only create jobs but also drive high-quality development in traditional retail sectors. Therefore, the rapid development of AI technology has led to numerous new occupations, revitalized the job market, and promoted the transformation and upgrading of traditional industries, generating substantial employment opportunities (Chen 2018). The future job market will become more diversified and professional, offering broad development opportunities for talents (Zhen 2019). However, changes in skill demands and adjustments in employment structures due to artificial intelligence present

challenges that must be addressed through strengthened education and training policies (Alessandra et al. 2024).

Addressing AI-related employment challenges requires coordinated efforts across all sectors of society. The Government has to support the development of new technologies and simultaneously protect the rights and interests of workers (Graglia & Huelsen 2020). Enterprises must actively embrace new technologies and provide training for their employees (Ding et al 2023). Educational institutions must adjust their teaching content to train people for the future (Stevenson 2018), for AI to play a more significant role in making our society a better place, governments, businesses, and research organizations must work together and cooperate with each other (Zhen 2019; Yang 2020). Table 6 summarises the job opportunities created by AI, which are spread across various industries and require people with specialised skills.

Table 6. AI-driven new occupations and skills

Job category	Industry	Job description	Skills required	Paper
AI trainer	AI Technology	Data collection, annotation, and algorithm optimization to improve AI systems.	Data management, algorithm design, programming	7, 20, 33
Man-machine collabouration expert	Manufacturing, AI technology	Designs efficient collabouration models to enhance productivity in manufacturing and other sectors.	System design, human-machine interaction	10, 29
AI ethics consultant	technology, consulting	Provides ethical guidance and develops norms to ensure the responsible use of AI.	Ethics, policy analysis, stakeholder communication	26
E-commerce operation specialist	E-commerce, retail	Manages online store operations and precision marketing using AI tools.	Marketing analytics, AI tool usage, management	32, 33
Data analysis specialist	E-commerce, Technology	Analyzes data to generate insights and assist businesses in decision-making through AI tools.	Data analysis, statistical modelling, AI tools	8, 34
Intelligent customer service	Customer service	Uses natural language processing to answer consumer queries and optimizes the system with manual support for complex inquiries.	-NLP, customer support, troubleshooting	30
Intelligent dispatcher	Logistics, transportation	Optimizes delivery routes and coordinates emergency responses using AI algorithms.	Route planning, algorithm optimization, logistics	31

Source: Authors' compilation (2024)

Note: The paper numbers correspond to the list provided in the Appendix.

Impact on employment by industry and region

The development of AI has exacerbated the disparity between regions and industries (Aghion 2019). Developed countries are developing faster in Artificial Intelligence while developing countries are lagging behind comparatively. This is because developed countries have better technology conditions, more money, and better

talent (Morikawa 2017; Omary 2018). For example, Silicon Valley has brought together the world's top science and technology talents, who have continued to innovate and spawned new industries such as artificial intelligence, making Silicon Valley a global leader in science and technology innovation (Yakovenko 2022; Aswathyk 2021).

In contrast, AI companies are deterred by the lack of talent and backward technology in less developed regions. This leads to slow development of emerging industries and limited employment opportunities (Moniz 2022; Tatomur 2019). Traditional industries are again facing severe employment challenges due to lagging technology upgrading (Yang 2020; Weiguo 2020; Cui 2020; Yang 2020). Table 7 demonstrates the different changes brought by AI to different regions and industries. There is a great difference between developed and less developed regions in terms of the use of AI, employment, and changes in traditional industries.

Table 7. AI application by region and industry

Category	AI application	Impact on job/employment	Regional difference	Paper
Developed region	Well-developed infrastructure and technology resources, extensive application of AI	A high demand for high-skilled jobs, such as the Al engineers and algorithm designers	Advanced infrastructure, financial support, and rich talent reserves enable quick Al application and faster job upgrades	28, 29, 30, 31
Less developed region	A lower degree of Al application, limited economic and technological resources	Negligible impact of job substitution. But challenging to capitalise on emerging job opportunities	Limited resources slow AI adoption, making job creation and structural optimization challenging	32, 33
Traditional industry	Primarily reliant on human labour and traditional technologies, slow technology update	Facing unemployment and structural adjustment difficulties, especially in low-skilled jobs in manufacturing	Slow technological update leads to job substitution risks and difficulties in adjusting employment structures	36, 37, 38
Overall impact	Varying AI application levels and policy support across regions	Employment changes vary across regions, with faster job optimization in developed areas and more challenges in less developed regions	Developed regions experience faster Al adoption and smoother transitions, while less developed regions face slower transformation	27, 39

Source: Authors' compilation (2024)

Note: The paper numbers correspond to the list provided in the Appendix.

Employment discrimination and social equity

Employment discrimination and social equity have gained increased prominence with the pervasive implementation of artificial intelligence in the workplace (Upreti & Sridhar 2021; Menon 2019; Aghion 2019). In recruitment, it has been posited that artificial intelligence algorithms may perpetuate or amplify historical injustices due to their training on biased data (Omary 2018). For instance, in the science and technology industry, due to the high proportion of male practitioners, the algorithm may prefer to select male job applicants, ignoring female abilities, further aggravating gender inequality and violating the principle of social equity (Aghion 2019). Table 8 highlights the issue of employment discrimination brought about by AI and its solutions.

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Table 8. AI-driven employment bias and solutions

Category	Challenge	Proposed Solution	Impact on job/employment	Paper
Recruitment	Algorithms trained on biased data perpetuating historical injustices. Gender bias favoring male candidates.	Develop unbiased datasets. Incorporate fairness evaluation metrics into algorithm design	Excludes minorities, reducing workforce diversity. Women face reduced job opportunities.	27, 29
Interview and job evaluation	Misjudgment of non-traditional factors (e.g. voice, expression). Over-reliance on quantitative metrics ignoring innovation and long-term contributions.	Introduce holistic evaluation combining quantitative and qualitative criteria. Optimize decision-making processes.	Leads to unfair evaluations, especially for diverse candidates. Ignores long-term and creative contributions, limiting innovation.	25, 26, 29
Promotion and career development	Exclusion of creative and interpersonal contributions. Rigid workplace hierarchies limiting growth	Ensure balanced evaluations considering diverse skill sets. Provide transparent career advancement opportunities.	Limits career growth for creative workers. Restricts mobility, leading to dissatisfaction.	26, 27
Impact on vulnerable groups	Low-skilled workers facing long-term unemployment. Discrimination reducing opportunities for minorities	Establish reskilling programs for disadvantaged groups. Promote equitable job access through inclusive policies.	Leads to long-term unemployment and worsens the skills gap. Increases wage inequality and social exclusion.	4, 8, 26
Societal impact	Economic decline in traditional industries due to automation. Social instability caused by unemployment.	Invest in economic recovery for impacted regions. Foster a dynamic job market through supportive legislation.	Increases unemployment in traditional sectors and strains local economies. Creates social unrest and worsens wealth inequality.	26, 33

Source: Authors' compilation (2024)

Note: The paper numbers correspond to the list provided in the Appendix.

The use of AI in interviews and job evaluations could raise fairness issues. Some intelligent interview systems

evaluate job suitability by analyzing non-traditional factors such as facial expressions and voice tones of job applicants (Upreti & Sridhar 2021). but these factors may have nothing to do with actual ability (Menon 2019). For example, People from some cultures who express themselves differently may be mistaken for being unsure of themselves, which can put them at a disadvantage in their job search. This reflects that cultural differences may limit the development of diverse talents (Bordot 2022).

AI is becoming increasingly important in the workplace, but it assesses employees primarily based on data and numbers. As a result, innovative and long-term contributors may be overlooked (Upreti & Sridhar 2021), which is detrimental to diversity in the workplace and limits opportunities for some, potentially exacerbating social inequality (Aghion 2019; Omary 2018).

From a societal standpoint, employment discrimination caused by artificial intelligence will also exacerbate the plight of vulnerable groups. Low-skilled workers may be unemployed for a long time or engage in low-paid and unstable jobs because AI quickly replaces their positions and is disadvantaged due to discrimination in employment competition (Qin et al. 2019; Georgieff & Hyee 2021). This affects individuals' lives and can lead to intergenerational transmission of poverty and social instability (Menon 2019). For example, traditional manufacturing areas may experience economic and social difficulties due to introducing innovative production lines, which may lead to mass unemployment of workers and employment discrimination (Tatomur 2019).

To solve the issues of employment discrimination and social equity caused by artificial intelligence, three approaches are recommended, encompassing technological, legal, and societal dimensions. At the technical level, we should ensure the algorithm's fairness and the data's comprehensiveness, avoid discriminatory results, and introduce the fairness evaluation index optimization algorithm. In the legal field, it is necessary to improve regulations, prohibit AI discrimination in employment, and provide legal relief channels. Finally, at the social level, it is necessary to strengthen the publicity of the concept of fair employment, enhance the awareness of enterprises and the public on the harm of discrimination, and advocate a diverse and inclusive corporate culture. Through these measures, artificial intelligence can be promoted to support employment equity and harmonious social development.

DISCUSSION

This section discusses AI’s impact on job displacement and proposes specific policy recommendations and corporate response strategies to mitigate its effects. For instance, governments should invest in STEM education and reskilling programs, while companies should prioritize employee training and adapt their hiring strategies to focus on high-skilled roles. Additionally, this section provides insights for future research, such as evaluating the effectiveness of reskilling programs, assessing the long-term impact of global AI governance on employment stability, and analyzing how government policies—such as education reforms, employment security measures, and industry guidance—shape labour market dynamics in the AI era.

Coping strategies for workers and enterprise

In the face of the profound changes AI has undergone in the job market, workers need to actively respond to it from multiple dimensions to enhance their competitiveness. First, they need to master knowledge and skills related to AI, such as machine learning and data analysis. Understanding the operating principles and algorithmic logic of AI will help workers adapt to the environment of working with AI, or transform to AI-related positions, such as AI trainers, to meet the new demands of the market (Stevenson 2018). Secondly, workers need to change their career concepts and try emerging careers, such as human-computer collabouration specialists, to create more value for enterprises by learning organizational management, process optimization and other knowledge, combined with AI technology (Yu 2011).

Then, it is also necessary to enhance innovation and adaptability. Workers should be adept at identifying problems, exploring solutions, cultivating innovative thinking, and quickly adapting to changes in work styles brought about by new technologies, such as online office and remote collabouration, and mastering the corresponding tools and skills to improve work efficiency and quality (Ding et al 2023). Finally, the learning of interdisciplinary knowledge is particularly important. With the application of AI in different industries, composite jobs such as medical data analysts are emerging. Workers should organically combine their professional knowledge with AI-related knowledge to broaden the knowledge boundary in order to gain more opportunities in the job market (Akyulov 2019).

Enterprises also need to actively respond to the impact of AI on employment in order to achieve the common development of enterprises and employees (Alessandra et al. 2024). First, in human resource planning, enterprises should optimize the number and structure of employees according to business needs and AI applications, reduce the recruitment of quickly replaceable positions, and at the same time increase the introduction of high-tech talents such as AI engineers and algorithm optimizers (Dan & Yun-Ling 2023). Enterprises must also work closely with universities and research institutions to broaden recruitment channels (Organ 2021).

Second, in terms of employee training and transfer arrangements, enterprises should help employees master new skills and adapt to internal job requirements through retraining. For example, analogue workers are trained as equipment monitoring or maintenance personnel, and basic financial personnel are transformed into management accountants (Yudina & Leskova 2020; Peng-Fei 2018). Concurrently, it improves the internal talent mobility mechanism, encourages cross-departmental transfer, and helps employees find suitable positions that are not easy to replace to enhance stability and loyalty (Upreti & Sridhar 2021).

Third, in the recruitment process, enterprises should adjust the talent demand strategy, not only to professional skills, but also need to consider the candidate's innovation ability, learning ability and interdisciplinary knowledge reserves (Masayuki 2016). With the increase of cooperation between AI and various businesses, enterprises need employees to quickly master new knowledge and technology and have innovative thinking to deal with complex problems (Yang 2022). Therefore, recruitment should focus on comprehensive quality, such as marketing positions need to master artificial intelligence algorithms to achieve precision marketing, research and development positions need to be combined with industry characteristics and artificial intelligence competitive product or service technology development (Giwa & Ngepah 2024).

Last but not least, workers and enterprises need to actively respond to the changes and challenges in the employment structure of artificial intelligence. Workers should take the initiative to learn AI-related knowledge, change career concepts, enhance innovation and adaptability, and strengthen interdisciplinary knowledge learning, to grasp the opportunities in the environment affecting the employment of AI and realize the leap of career development (Sharma et al. 2023). Enterprises, on the other hand, need to give full play to the advantages of AI through scientific human resource planning, practical employee training and transfer arrangements and reasonable recruitment strategy adjustment, to enhance competitiveness and achieve win-win laying of enterprise development and employee employment security (Alessandra et al. 2024).

Global Collabouration in AI Governance

The impact of artificial intelligence on employment will require a concerted global effort to address the challenges and capitalize on the opportunities. While many countries have already taken steps towards job replacement and skills upgrading, the global nature of AI dictates the importance of strengthening international cooperation to ensure that it leads to equitable and sustainable development.

Firstly, the impact of AI cuts across national boundaries, so countries need to develop common ethical and

regulatory standards. For example, international organizations such as the United Nations or the Organization for Economic Co-operation and Development (OECD) can play a key role in bringing countries together to agree on fairness, transparency, and bias-proofing in employment decisions. These harmonized guidelines will ensure that the design and implementation of AI systems contribute to social equity on a global scale. Secondly, AI-driven automation and teleworking technologies have contributed to the globalization of labour, enabling talented people from different regions to participate in the global job market. However, this also increases inequality, as workers from less developed countries may be at a competitive disadvantage due to a lack of AI skills or digital infrastructure. International cooperation can help provide training resources, technical support and employment opportunities in these regions.

Thirdly, countries like the United States and China, which are leaders in AI, can share their experiences on balancing the technological advances and employment impacts brought about by AI through international cooperation. These best practices and research results will help other countries better cope with similar issues. In addition, establishing a global database to track the impact of AI on employment in different regions and industries can provide a reliable basis for policymaking. Fourth, AI education and skills training on a global scale is crucial, especially for workers in less developed regions. Countries can support free or low-cost AI training programs by establishing an international education fund to help workers who have lost their jobs due to automation re-enter the job market. Finally, global collabouration also needs to focus on how to balance technological progress with social equity. Governments and international organizations can be guided by policies that allow AI to create as many jobs as possible while driving innovation. For example, an international AI summit could be convened to ensure that technological development balances employment and social stability.

Policy recommendation

Government policymaking needs to consider AI's impact on the job market. To mitigate job losses, the following aspects can be considered to promote a healthy and stable job market (Alessandra et al. 2024).

Education and training

The government should deepen education reform, especially in the basic education stage; Science, Technology, Engineering, and Mathematics (STEM) education needs to be strengthened to cultivate students' logical thinking, problem-solving and innovation abilities. A solid foundation can be laid for students' future involvement in related fields or collabourative work with AI by adding courses on the basics of AI (Stevenson 2018). Meanwhile, vocational education and continuing education are equally important, and the government should offer AI-related vocational skills training, such as data analysis and machine learning, and collabourate with universities and training institutions to provide transformation opportunities for unemployed or working people affected by AI, helping them to master new skills and move towards emerging positions such as AI engineers and data analysts (Yudina & Leskova 2020). In addition, a special fund for upgrading workers' skills can be set up, drawing on Italy's experience, especially for groups at risk due to automation and technological innovation, as well as those who are unemployed, where skills upgrading can increase their chances of entering the labour market (Karsten & West 2015). The Chinese government should also consider the national context and set up similar specialized funds to provide targeted support to workers in regions and industries more affected by AI (Graglia & Huelsen 2020).

Employment security

Improving the social security system is the key to dealing with the employment substitution effect. The government needs to strengthen the bottom-up social security function, enhance the livelihood protection of the unemployed, and reduce social and economic pressure (Alessandra et al. 2024). The human resources and social security departments should cooperate with digital enterprises to establish a dynamic database of the labour

market, paying special attention to the fields of intelligent manufacturing, intelligent logistics, intelligent travel and other areas and groups engaged in repetitive and procedural work, to strengthen the monitoring of the dynamics of unemployment and to provide data support for decision-making (Omary 2018).

Together, supporting protection policies for the job market are being improved, including the provision of subsidies for vocational switching training to help affected employees rejoin the workforce (Yudina & Leskova 2020), and the formulation of a reasonable unemployment relief policy to ensure the basic livelihood of unemployed people during their job-seeking period, balancing the flexibility and security of the job market (Graglia & Huelsen 2020).

Industry guidance

In order to cope with the challenges posed by AI, the government should take positive actions. The government should guide industrial development, encourage innovation and entrepreneurship, cultivate new industries and occupations, and create more opportunities (Alessandra et al. 2024; Organ 2021; Graglia & Huelsen 2020). In terms of salary distribution, flexible and diverse methods should be explored, such as agreement wages and project wages, etc. It should also improve the labour employment policy in the smart era and protect the legitimate rights and interests of new forms of employment (Graglia & Huelsen 2020).

Simultaneously, it needs the establishment of stability mechanisms, based on the 'new generation of AI ethical norms' to clarify the regulatory responsibility, the construction of the risk pre-planning policing system, the optimisation of the market environment, the development of fair competition rules, and the promotion of the transformation and upgrading of private enterprises (Omary 2018). The government should also implement subsidy policies to promote the transformation of traditional industries, upgrade the skills of middle- and low-skilled workers to ensure that jobs are not replaced, and introduce more highly skilled personnel (Akyulov 2019).

Overall, Governments should focus on education reforms to enhance STEM and artificial intelligence-related training to enable workers to acquire new skills and transition into emerging roles. Improving social security systems is also critical to supporting the unemployed and mitigating the effects of unemployment. The government should actively guide industrial development, promote innovation, and implement targeted measures such as subsidies for skills upgrading, employment protection for new businesses, and supportive policies for the transformation of traditional industries. These strategies can ensure a balanced interaction between technological progress and employment protection, thereby promoting a stable and fair job market (Alessandra et al. 2024; Zhen 2019).

Table 9 outlines key government strategies to address the impact of AI on the job market in terms of education and training, employment security and industry guidance, providing specific measures and highlighting expected impacts. All in all, by formulating effective policies, governments can reduce the impact of AI on employment, and promote the stable development of the job market (Alessandra et al. 2024).

Table 9. Suggestion of government strategies to address AI's impact on job losses

Category	Key action	Specific measures	Paper
Education and training	Strengthen STEM education and introduce AI courses. Provide regional and industry-specific support.	Equip students with AI skills. E.g. Italy's fund for workers affected by automation. Target aid to areas and sectors facing difficulties due to AI challenges	7, 15, 16
Employment security	Enhance social security systems. Create a job market database.	Increase unemployment benefits to alleviate financial burdens.	10, 15, 18, 29, 35

	Offer vocational training programs.	Collabourate with tech companies and social services to better understand employment trends. Help workers adapt to new jobs and ensure flexibility in the job market.	
Industry Guidance	Encourage innovation and new industry growth. Support flexible work arrangements. Assist traditional industries with upgrades.	Create jobs by promoting emerging industries. Ensure protections for workers in innovative industries like telecommuting. Reduce unemployment by transforming industries and improving worker skills.	10, 14, 16, 20, 29, 35

Source: Authors' compilation (2024)

Note: The paper numbers correspond to the list provided in the Appendix.

CONCLUSION

Compared with previous studies, such as those by Georgieff & Hyee (2021) and Shaukat et al. (2020), which primarily focused on the quantitative impact of AI on job loss, this paper provides a more comprehensive analysis through a systematic literature review and PRISMA approach. Different from earlier studies that mainly discussed the impact of AI on unemployment from a quantitative perspective, this paper emphasizes that AI not only has an impact on employment quantitatively, but also promotes a profound transformation of employment structure qualitatively. Additionally, there are significant differences in the impact of AI on different industries. While low-skilled jobs are increasingly being replaced, the demand for high-skilled jobs and new roles is growing, leading to a shift in the job market towards a smarter one, with developed regions and high-tech industries adapting quickly to this shift, while less-developed regions and traditional industries are under more pressure to transform.

In the face of AI's employment challenges, all parties need to work together. First, workers need to upgrade their skills continuously. Second, companies should actively take social responsibility to help employees transition smoothly to new positions by providing training and career planning. In addition, the government should also play an important role in formulating and implementing targeted policies, such as increasing investment in vocational education and training, improving the social security system, and supporting enterprises in technological transformation. When governments, enterprises and individuals work together, the positive effects of AI can be maximized and harmonious economic and social development can be achieved.

The rapid development of artificial intelligence and new technologies such as the Internet of Things and blockchain has attracted the attention of an increasing number of researchers. These new technologies will create many new jobs that require high skills and provide directions for policy-making and labour training. However, applying these technologies will also bring some new problems, such as the application of AI in healthcare and transport, which may raise ethical and legal issues. Moreover, the policies of different countries will also affect the job market, so countries should strengthen their cooperation to deal with these challenges. Future research could further use empirical analyses to quantify the impact of AI on the job market in different industries and regions and to assess the effectiveness of existing policies. In conclusion, the relationship between AI and employment is dynamic and multifaceted, and multifaceted research is needed to ensure that technological advances benefit the job market.

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APPENDIX

Appendix List of papers reviewed

No.	Year of publication	Author/s	Title
1	2020	Bluestone, P., Chike, O. E., & Wallace, S.	The future of industry and employment: COVID-19 effects exacerbate the march of artificial intelligence
2	2019	Ilmārs ukjurovs, Zvirgzdia, R., & Jeromanova-Maura, S.	Artificial intelligence in workplaces and how it will affect employment in Latvia
3	2022	Sonderling, K. E., Kelley, B. J., & Casimir, L.	The promise and the peril: artificial intelligence and employment discrimination
4	2019	Qin, H. E., Management, S. O., & University, B. U.	An exploratory study on artificial intelligence and employment change
5	2018	Wang, J., & Jue, X.	Artificial intelligence and employment
6	1984	Nilsson, N. J.	Artificial intelligence, employment, and income.
7	2018	Stevenson, B.	Artificial intelligence, income, employment, and meaning
8	2021	Georgieff, A., & Hyee, R.	Artificial intelligence and employment: new cross-country evidence
9	2011	Yu, Z.	The role of employment in the process of investment and economic growth.
10	2024	Alessandra, B., Crinò Rosario, Gino, G., & Ioannis, P.	Artificial intelligence and jobs: evidence from us commuting zones
11	2023	Dan, S., & Yun-Ling, Y. E.	Artificial intelligence, employment structure and high-quality development
12	2024	Waidlein, N.	The impact of artificial intelligence on productivity and employment – How can we assess it and what can we observe?
13	2022	Shao, S., Shi, Z., & Shi, Y.	Impact of AI on employment in the manufacturing industry

14	2021	Organ, J., O'Neill, B., & Stapleton, L.	Artificial intelligence and human-machine symbiosis in public employment services (pes): lessons from engineer and trade unionist,
15	2020	Graglia, M. A. V., & Huelsen, P. G. V.	The sixth wave of innovation: artificial intelligence and the impacts on employment
16	2016	Masayuki, M. O. R. I. K. A. W. A.	The effects of artificial intelligence and robotics on business and employment: Evidence from a survey on Japanese firms
17	2023	Danso, W. B., & Hanson, E.	Artificial intelligence disruption and its impacts on future employment in Africa - a case of the banking and financial sector in Ghana
18	2022	Yang, C. H.	How artificial intelligence technology affects productivity and employment: firm-level evidence from Taiwan
19	2015	Karsten, J., & West, D. M.	How Robots, AI and machine learning will affect employment and public policy
20	2019	Akyulov, R. I.	Modern artificial intelligence technology and employment: problems and prospects of control
21	2018	Hamaguchi, N., & Kondo, K.	Regional employment and artificial intelligence in Japan
22	2023	Sharma, P., Mishra, K. K., Priya, S., & Pant, P.	Artificial intelligence and its impact on employment: A perspective in context of Keynesian employment theory
23	2022	Bordot, F.	Robotics and artificial intelligence: What impacts on employment and inequalities?
24	2024	Bąba, M.	Employment with the use of artificial intelligence: Opportunities and risks
25	2021	Upreti, A., & Sridhar, V.	Artificial intelligence and its effect on employment and skilling
26	2019	Menon, V.	Artificial intelligence and the future of employment: Delving into India's financial sector
27	2019	Aghion, P., Antonin, C., & Bunel, S.	Artificial intelligence, growth and employment: The role of policy
28	2017	Morikawa, M.	The impact of artificial intelligence and robotics on employment: evidence from a survey on individuals (japanese)
29	2018	Omary, J.	Jobs and university skills: artificial intelligence effects on employment in the future
30	2022	Yakovenko, Y. Y., Bilyk, M. Y., & Oliinyk, Y. V.	The transformative impact of the development of artificial intelligence on employment and work motivation in business in the conditions of the information economy
31	2021	Aswathyk, A., Gonzaga, R., & Francis, J. S.	A study on the awareness of artificial intelligence among youth and its impact on employment

32	2022	Moniz, A. B., Candeias, M., & Boavida, N.	Changes in productivity and labour relations: artificial intelligence in the automotive sector in Portugal
33	2019	Tatomur, I.	Employment and education policies in the era of artificial intelligence and robotics
34	2020	Shaukat, K., Iqbal, F., Alam, T. M., & Rubab, A.	The impact of artificial intelligence and robotics on future employment opportunities
35	2019	Zhen hua Y.	The current situation of the use of artificial intelligence and the impact on the employment preparation of college students
36	2020	Yang, Y.	Analysis of the impact of artificial intelligence development on employment
37	2020	Weiguo, Y., Zitong, Q., Qingjun, W., & Deyuan, H.	A review of research on the employment effect of artificial intelligence applications
38	2020	Cui, J., Qian, A., & Yu, F.	Influence of artificial intelligence development on employment in Beijing
39	2020	Wang, F., Hu, M., & Zhu, M.	Threat or opportunity – analysis of the impact of artificial intelligence on future employment.
40	2018	Chen, Yongwei, & Xu, Duo.	The impact of artificial intelligence on employment