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THE IMPACT OF ARTIFICIAL INTELLIGENCE ON THE TRANSFORMATION OF THE LABOUR MARKET: CHALLENGES, OPPORTUNITIES, AND PERSPECTIVES

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Abstract
In recent years, artificial intelligence (AI) has become one of the key drivers of transformation in labour markets and human resource management. Its rapid adoption in organizational practice fundamentally alters work organization, HR processes, decision-making mechanisms, and skill requirements for employees. Beyond efficiency gains, AI increasingly reshapes power relations, job design, and the allocation of responsibilities between humans and intelligent systems. The aim of this study is to analyse the main research directions and thematic areas related to the impact of artificial intelligence on labour markets and human resource management, to identify dominant trends in the academic literature, and to highlight key challenges and opportunities associated with the implementation of AI in HR practices.
Methodologically, the study is based on a systematic literature review conducted in accordance with PRISMA principles and complemented by a bibliometric analysis of publications indexed in the Web of Science and Scopus databases between 2015 and 2025. Relevant studies were selected using a search string combining keywords related to artificial intelligence, labour markets, and human resource management. To identify thematic structures and research clusters, a co-occurrence network analysis of keywords was carried out using the VOSviewer tool. This methodological approach enables a comprehensive mapping of the intellectual structure of the field and allows for the identification of emerging research topics and underexplored areas.
The results reveal a significant increase in scientific interest in the analysed topic, particularly after 2020, reflecting accelerated digitalisation of work processes and the rapid development of generative AI technologies. Three main analytical levels of research were identified: the macro level, focusing on economic and institutional impacts of AI on labour markets; the meso level, addressing organisational aspects of AI implementation within firms; and the micro level, concentrating on individuals, changes in skill requirements, wage structures, and human–technology interaction. The analysis further indicates a growing convergence of economic and management-oriented research with legal and ethical scholarship, highlighting the complexity of AI-driven transformation.
A notable finding is the growing emphasis on ethical, social, and regulatory issues, particularly algorithmic fairness, transparency, accountability, and data protection. These aspects are increasingly recognised as critical determinants of trust in AI-supported HR systems and as prerequisites for their long-term acceptance by employees. The study contributes to the systematisation of existing knowledge on the impact of artificial intelligence on human resource management and labour markets and provides a solid theoretical foundation for further empirical research. It also highlights the need for a multidisciplinary approach combining economic, managerial, legal, and ethical perspectives when assessing the long-term consequences of AI adoption in the workplace and its implications for sustainable and inclusive forms of work organisation.
KEY WORDS: artificial intelligence, labour market, literature review, Prisma, WOS
JEL classification: J21, J24, O33

Introduction

The rapid development of artificial intelligence (AI) and automation represents one of the most significant and irreversible trends in contemporary society, with profound implications for the labour market. The labour market is undergoing a transformation that requires not only new skills but also a rethinking of educational policies and human capital development strategies. AI is reshaping both the nature of job positions and the overall employment structure. On the one hand, AI serves as a tool that fosters economic growth and enhances productivity; on the other hand, it raises concerns regarding the disappearance of traditional occupations, the deepening of inequalities, and the consequences of automation.

Emerging jobs that require specialized skills pose challenges for both employees and employers, especially in relation to the need to retrain the workforce and increase the intellectual level of the workforce. In this context, the demand for highly qualified human resources is becoming a central challenge in the labor market. Because a qualified and intellectual workforce contributes to the growth of enterprise efficiency and the sustainability of the enterprise's competitive advantage (Gunaltay & Filiz, 2021).

One of the major advantages of AI lies in its capacity to automate routine and repetitive tasks, thereby enabling workers to focus on more complex and creative activities. At the same time, it can increase productivity and efficiency, especially in sectors where time is a critical factor, such as manufacturing and logistics. Another advantage is the potential to reduce labour costs through the automation of specific tasks, thereby lowering the need for human labour – an aspect particularly relevant in industries with higher wage costs, including healthcare and retail.

AI is also noteworthy for its ability to analyse large volumes of data and to contribute to the development of new products and services. For instance, language translation technologies can facilitate the expansion of companies into new geographic markets. Nevertheless, alongside these undeniable advantages, concerns persist – particularly the threat to existing jobs. It is highly likely that low-skilled positions or jobs involving repetitive tasks will be gradually eliminated. However, adaptation to work

environments shaped by new technologies, combined with the continuous education and upskilling of human resources, will be crucial in ensuring the sustainability of employment in the labour market.

Literature review

Since the late 18th century, the world has experienced several waves of accelerated technological progress, commonly referred to as "industrial revolutions". The First Industrial Revolution, originating in Great Britain, was marked by the invention of the steam engine, which enabled a fundamental shift in production processes. The Second Industrial Revolution, or "technological revolution", emerged nearly a century later in the 1860s with the introduction of electricity and the assembly line. The Third Industrial Revolution, often described as the "digital revolution", began in the 1950s with the spread of digital computers and the rapid development of information and communication technologies (ICT). The term "Fourth Industrial Revolution", coined by Klaus Schwab, is characterized by the widespread adoption of advanced technologies, including AI, the Internet of Things, robotics, and 3D printing (Schwab, 2016). In 2011, the German government launched the strategic initiative *Industry 4.0* to strengthen the industrial sector (Rojko, 2017). As Schwab (2016) notes, each industrial revolution has introduced challenges that societies have had to confront. In this broader context, the question of AI and its impact on labour markets and societies is not new, as technological progress has historically led to the displacement of jobs.

Recent developments in AI are transforming economies and labour markets at an unprecedented pace. This transformation not only demands new skills but also calls for a fundamental rethinking of educational policies and human capital development strategies. Possession of a skilled workforce is recognized as one of the determining factors in the success of enterprises in today's competitive environment, and this can be achieved only with effective management policies and practices (Gunaltay & Filiz, 2021). The nature of work is continuously evolving under the influence of technological progress and innovation.

The impact of AI on employment has become an important theme in the academic debate. Several authors focus specifically on its implications for unemployment (Virgili, 2024; Dall'Anese, 2020; Makridakis, 2017; Kudoh, 2025). Some scholars adopt a pessimistic perspective, warning that AI will largely replace human labour. For instance, Renda (2019), in his publication *Artificial Intelligence*, emphasized the risk of massive job displacement. Others adopt a more balanced view, suggesting that AI adoption does not necessarily lead to higher unemployment, but rather compels workers to adapt to new work environments shaped by digital technologies (Mutascu, 2021; Gries & Naudé, 2018; Abdeldayem & Aldulaimi, 2020). Meister (2019) even argued that AI would ultimately create more jobs than it would eliminate.

Korinek (2023) proposed three possible scenarios regarding the future role of AI. The first envisions AI as a driver of productivity growth and job creation. The second anticipates the emergence of artificial general intelligence (AGI) within two decades, capable of performing all cognitive tasks currently undertaken by humans, thereby fundamentally reshaping the labour market and reducing the role of traditional human labour. The third and most radical scenario foresees the appearance of AGI within as little as five years, leading to large-scale economic and social restructuring.

The growing scholarly attention devoted to AI is reflected in publication trends. For instance, the first Scopus entry on AI dates to 1966 with Jirauch's article *Artificial Intelligence in Automated Design*, which noted that emerging AI techniques at the time were "too remote" to be practically applied. Similarly, the earliest article in WoS linking AI with labour markets appeared in 1994, highlighting the potential of AI to automate production processes in changing manufacturing environments (Yazici et al., 1994).

Aim and Methodology

This study employs bibliometric analysis to examine publications on how artificial intelligence is reshaping the labour market, as well as the opportunities, prospects, and challenges that arise from this transformation. Bibliometric analysis has recently been increasingly applied to identify the characteristics and trends of publications within specific research domains from a quantitative perspective (Mutlu Avinç & Yıldız, 2025). At present, bibliometric analysis is recognized as one of the key methods for evaluating scientific research. The subject of this method is the external characteristics of scientific literature; it investigates the distributional structure, quantitative relationships, and patterns of variation within the body of literature (Xie et al., 2020). Bibliometric analysis enables the assessment of scientific data such as the number of citations and publications, the occurrence of keywords and topics, and related indicators. In this study, bibliometric analysis is applied to publications with the aim of addressing the following central research questions (RQ):

RQ1: Which authors, countries, and institutions have contributed most significantly to the academic debate on artificial intelligence and labor market transformation?

RQ2: How do the most frequently used keywords reflect emerging opportunities, challenges, and perspectives associated with AI-driven changes in employment?

Search Strategy

The search for relevant studies was conducted in accordance with the PRISMA guidelines (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) (King et al., 2022). The final search was performed on September 20, 2025. The primary data source used for this analysis was the Web of Science (WoS) database. WoS was selected as the preferred database in this study due to its advanced search and data extraction capabilities, as well as its extensive coverage of scientific publications across diverse topics, categories, and indices (SSCI, SCI-Expanded, AHCI, ESCI, etc.). In recent years, WoS has become the most widely preferred data source among researchers conducting review studies in the field of social sciences (Yan & Zhiping, 2023). To

identify relevant articles in WoS, a search string was constructed by combining keywords aligned with the study's objective and Boolean operators (AND, OR) (Table 1). The search strategy encompassed concepts related to artificial intelligence and the labor market.

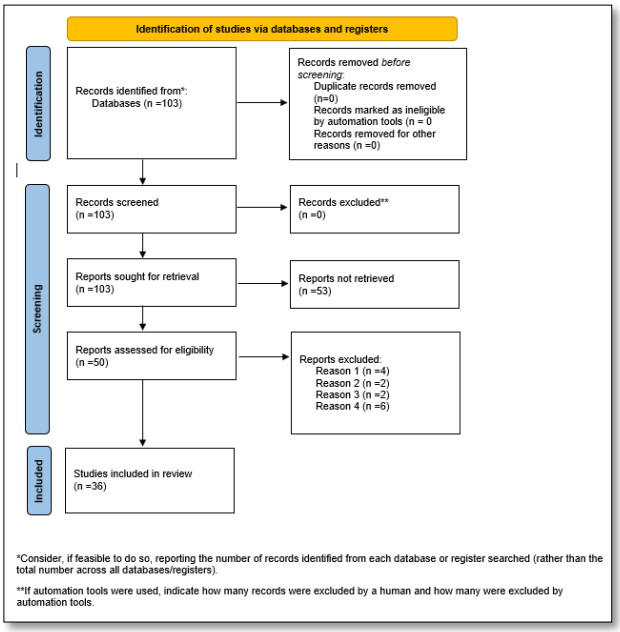

Fig. 1. PRISMA 2020 flow diagram for new systematic reviews which included searches of databases and registers only

Table 1. Search string for the identification of relevant studies in the Web of Science (WoS) database

TITLE-ABS-KEY ("artificial intelligence" OR "AI")
AND
TITLE-ABS-KEY ("labour market" OR "employment" OR "job roles" OR "workforce transformation")
AND
TITLE-ABS-KEY ("automation" OR "job displacement" OR "new professions" OR "skill requirements")
AND
TITLE-ABS-KEY ("social inequality" OR "wage disparities" OR "ethics" OR "lifelong learning" OR "education")

The selection process was carried out in several phases (Fig. 1). Figure 1 presents the details of the search and identification procedure. First, the search string was applied in the WoS database, considering titles, abstracts, and keywords. Through this search, 103 potentially relevant documents were identified. Second, duplicate records were removed, and studies were filtered according to the inclusion and exclusion criteria. Only peer-reviewed journal articles and review papers published in English between 2020 and 2025 were considered; publications, books, book chapters, and conference proceedings in languages other than English were excluded to ensure the consistency and academic rigor of the dataset. Third, the selected articles were read, and only those explicitly addressing the impact of artificial intelligence on the labour market were retained. Finally, the eligible documents were organized in an Excel spreadsheet, and the relevant information was systematically recorded. A total of 36 documents were ultimately included in the study.

Table 2. Inclusion and exclusion criteria for the selection of scientific studies

Inclusion criteria	*Exclusion criteria*
Contributions published in 2020 -2025	Contributions outside the time period
Scientific articles, open access conference papers	Empirical works (conceptual articles, editorials, opinions)
Contributions published in English	Contributions not published in English
Documents related to the purpose of our study	Documents unrelated to the purpose of our study

Results and Discussion

The annual distribution and number of publications reflect the overall state of the literature on a given topic, as well as prevailing research trends and the pace of development (Xie et al., 2020). The results of the WoS database search, after applying the exclusion criteria, indicate that publications addressing the impact of artificial intelligence on the labour market began to emerge at the turn of 2018 and 2019. For this reason, the subsequent analysis was temporally restricted to the period from 2020 to September 2025. The average number of documents published annually during this period is six.

Notably, the number of citations of publications concerning the impact of AI on the labour market shows a pronounced upward trajectory through 2024, with this growth trend expected to continue into 2025. The total number of citations recorded amounts to 994 (993 excluding self-citations), with an average of 27.6 citations per item. This upward trend, which began in 2020, continued strongly until 2024 and is projected to remain positive in 2025. Based on the graphical data, it can be concluded that the increasing trend in citation activity within this field – one that has become a particularly important research theme in recent years – is likely to persist.

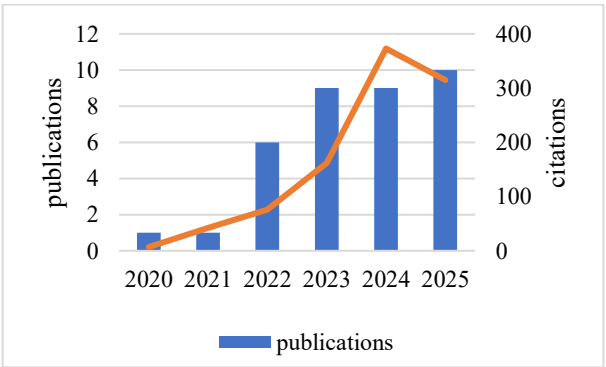

Fig. 2. Times Cited and Publications Over Time

Each journal included in the Web of Science (WoS) Core Collection is assigned to one or more WoS categories. The subject matter and scope of the journal must align with the scope of the WoS categories when such assignments are made. WoS categories are considered an important reference source, as they provide a foundation

for future research and rely on broad classification criteria (Milojević, 2020).

Each journal indexed in the WoS Core Collection is assigned one or more Web of Science categories, with up to six categories possible per journal (Clarivate Support, 2025).

Figure 3 presents the WoS categories of the 35 identified publications in the form of a pie chart. The dominant categories of the articles include Interdisciplinary Social Sciences, Economics, Education and Educational Research, and Management. Other significant WoS categories comprise Industrial Relations and Labor, Multidisciplinary Psychology, Social Issues, Business, as well as Engineering, Electrical and Electronic. These findings indicate that the topic of artificial intelligence and its impact on the labour market represents an interdisciplinary issue that influences diverse areas of both social and economic life.

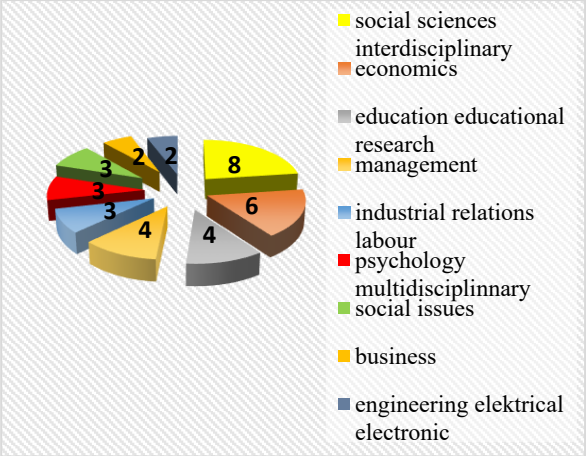

Fig. 3. Web of Science Categories

The number of citations is considered an objective quantitative indicator used to measure the performance and impact of scientific publications, authors, and institutions. Consequently, citation counts are frequently employed in bibliometric analytical studies to reveal the performance of entities within a given field. The citation counts of the top 10 authors who received the highest number of citations in publications on the impact of artificial intelligence on the labour market are presented in Table 3, which also displays the ten most cited countries worldwide.

Table 3. Most cited author and countries/regions

Authors	Record count	Countries/regions	Record count
Chowdhury, S.	12	Peoples China	197
Malik, A.	10	USA	106
Budhwar, P.	7	India	96
Ren S.	7	England	94
Liu Y.	6	Australia	57
Thomas A.	6	Italy	56
Varma A.	6	Malaysia	54
Andalibi N.	4	South Africa	47
Barbosa CE	4	France	44
Chiarello F.	4	Spain	42

When examining citation data from the ten most frequently cited countries, it is evident that China ranks as the most cited country, far ahead of the United States, which holds the second position with 106 citations. Among the ten most cited countries, European nations account for only a 40% share.

The following table (Table 4) presents the five most cited articles. Article citation counts represent the informational output referenced by other publications. Citation analysis enables the determination of how many times a document has been cited by other publications, thereby allowing for an assessment of its impact (Ercan et al., 2025). The journals in which the articles were published, along with their respective indices, are also provided as additional important criteria in evaluating the influence of publications.

The most frequently cited article in this field was published in 2020 and has received a total of 293 citations, with its average annual citation rate ranking as the second highest compared to other articles. The most cited publications discuss topics such as how Industry 4.0 is reshaping workforce requirements, particularly through the growing demand for digital, creative, and interdisciplinary skills. This implies that educational systems must undergo a transformation toward Education 4.0, which encompasses vocational, entrepreneurial, financial, and digital training. The authors highlight that automation leads to the disappearance of routine jobs while simultaneously creating new positions with higher added value (Sima et al., 2020).

Table 4. Most cited publications and author

Publications	Citations		Magazin
	Average per year	Total	Magazin index
Influences of the Industry 4.0 Revolution on the Human Capital Development and Consumer Behavior: A Systematic Review Sima, V; Gheorghe, IG; (...); Nancu, D, (2020)	48,83	293	Sustainability / SSCI
Human resource management in the age of generative artificial intelligence: Perspectives and research directions on ChatGPT Budhwar, P; Chowdhury, S; (...); Varma, A, (2023)	97	291	Human resource management journal/ SSCI
Employment 5.0: The work of the future and the future of work Kolade, O and Owoseni, A., (2022)	25	100	Technology in society / SSCI
The blended future of automation and AI: Examining some long-term societal and ethical impact features Khogali, HO and Mekid, S., (2023)	29,33	88	Technology in society / SSCI
Fostering Graduate Employability: Rethinking Tanzania's University Practices Mgaiwa, SJ., (2021)	6,8	34	Sage open/ SSCI

The article by Budhwar and colleagues provides a multidisciplinary perspective on the impact of generative artificial intelligence (GAI), particularly ChatGPT, on human resource management (HRM) in enterprises. It explains how tools such as ChatGPT are transforming the execution of HR functions, including recruitment, onboarding, performance evaluation, and training. The authors emphasize that while GAI can enhance efficiency in HR processes, it also entails certain risks, such as inaccuracies, biases, ethical dilemmas, and potential job displacement. Moreover, GAI can support sustainable HRM practices (e.g., personalized training, analysis of environmental impacts) but may also exacerbate inequalities (e.g., linguistic, cultural, and gender biases embedded in algorithms) (Budhwar et al., 2023).

The contribution by Kolade and Owoseni provides a systematic review of the scientific literature on the effects of digital transformation on employment and the future of work in the context of Industry 4.0 and Industry 5.0. They describe how skill-biased technological change – where technologies replace routine tasks while simultaneously fostering complex, creative, and social skills among employees – shapes labour market dynamics. They highlight that automation poses a threat to routine jobs. In connection with automation and digitalization processes, new sectors such as the App Economy are emerging, which results in uneven income distribution. The authors conclude that information and communication technologies substantially transform the structure of the labour market, the location of work, and modes of production (Kolade & Owoseni, 2022).

Khogali and Mekid, in their article, analyse concerns related to AI, including fears of identity loss, obsolescence, and alienation among employees. These factors, according to the authors, may hinder the adoption of technologies and reduce their societal benefits. Since AI replaces routine work tasks, it leads to job losses and rising unemployment, thereby necessitating retraining and education for new positions. The authors also emphasize the dehumanization of labour, as employees may feel treated merely as "tools". Monitoring employee well-being in the context of AI applications is therefore crucial, as AI can enhance productivity and flexibility but may also generate stress and uncertainty. Thus, attention to subjective and psychological well-being is essential (Khogali & Mekid, 2023).

Mgaiwa, in his article, examines how universities – particularly in Tanzania – can enhance graduates' employability in the context of high youth unemployment and a rapidly changing labour market shaped by globalization and technology (AI, automation). Many of his findings highlight the weak linkage between universities and employers, resulting in a mismatch between education and labour market requirements. Effective partnerships can improve curricula, internships, research, and consultancy (Mgaiwa, 2021).

Among a total of 26 countries, the leading contributors in terms of publications on how artificial intelligence is reshaping the labour market and the resulting opportunities, prospects, and challenges are the United States with seven publications, the United Kingdom with six, and Spain with four, all of which were included in our analysis.

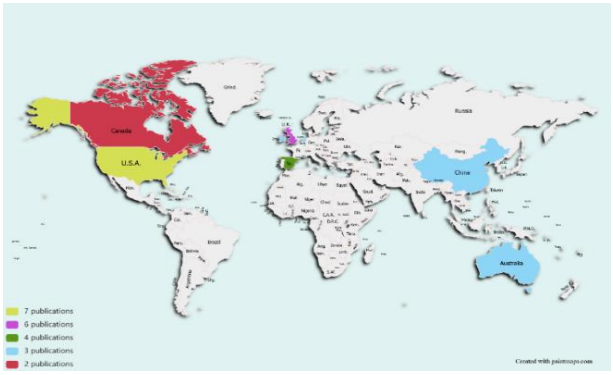

Fig. 4. Map of the most productive countries in the world

Keywords are technical terms that reflect the main content of an article. Keyword analysis helps identify significant and emerging topics within a specific research field (Mutlu Avinç & Yıldız, 2025).

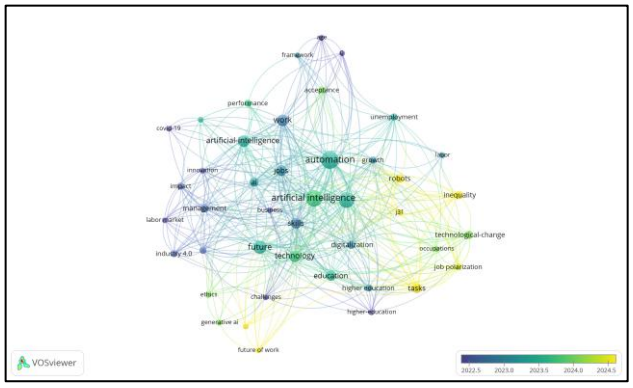

Fig. 5. Visualization of network relationships between keywords with timeline

For this reason, we considered that analysing the occurrence of keywords would be useful for understanding the major themes in publications addressing how artificial intelligence is reshaping the labour market and the resulting opportunities, prospects, and challenges.

The terms artificial intelligence, automation, technology, skill, work, future, and education represent the central concepts in our keyword analysis. Figure 5 illustrates that these keywords are closely interconnected and constitute the foundation of the research domain. Their interlinkages suggest that they are frequently studied together, for example in the context of the application and impact of AI on education, work, and skills. The yellow clusters in the map indicate newly emerging themes (inequality, robots, tasks, generative AI) and possible future research directions. These terms have appeared more frequently in recent publications, suggesting novel research trajectories such as the influence of generative AI and robotics on future work, tasks, and inequalities. Meanwhile, traditional themes such as management, innovation, labour market, and impact (blue clusters) remain important, although research interest appears to be shifting slightly.

Based on the conducted bibliometric analysis, we subsequently evaluated the established research questions.

RQ1: Which authors, countries, and institutions have contributed most significantly to the academic debate on artificial intelligence and labor market transformation?

The bibliometric analysis revealed that the most influential contributions to the academic debate on AI and labor market transformation originate from a limited number of authors, countries, and institutions. Among the authors, Sima et al. (2020), Budhwar et al. (2023), and Kolade & Owoseni (2022) stood out with the highest citation counts, indicating their strong impact on the field. At the country level, China emerged as the most cited and most productive contributor, far ahead of the United States, which ranked second with 106 citations. European countries were represented with only a 40% share among the top ten most cited countries, suggesting that research on this topic remains geographically concentrated. Institutional contributions largely mirrored national trends, with universities and research centers in China, the United States, and the United Kingdom playing leading roles in advancing the debate.

RQ2: How do the most frequently used keywords reflect emerging opportunities, challenges, and perspectives associated with AI-driven changes in employment?

The keyword co-occurrence analysis demonstrated that the terms artificial intelligence, automation, technology, skill, work, future, and education are central concepts forming the backbone of research on AI and the labor market. Their strong interconnections indicate that these topics are frequently studied together, especially in the context of AI's impact on skills, education, and employment structures.

Emerging themes identified through the analysis included inequality, robots, tasks, and generative AI, which were more prominent in recent years. These terms suggest a shift in scholarly attention toward new challenges such as the role of generative AI in shaping job tasks, the potential rise of social and wage inequalities, and the broader implications of robotics for future work. Traditional themes such as management, innovation, labour market, and impact remain relevant but appear to be gradually complemented, if not partially replaced, by more future-oriented research agendas.

Conclusions

The rapid expansion of artificial intelligence (AI) is expected to fundamentally transform industrial sectors and to introduce new challenges for financial decision-makers operating within environmental (Biggi, 2025), social, and governance (ESG) frameworks. Beyond its technological dimension, AI increasingly influences strategic and financial decision-making processes by reshaping how organisations assess risks, measure performance, and allocate resources in line with sustainability objectives. In this context, AI algorithms have emerged as one of the most promising instruments for addressing ESG-related challenges, as they enable the integration of large volumes of generated data with advanced analytical and processing techniques. This combination allows organisations to extract actionable insights, enhance transparency, and support more informed, timely, and efficient decision-making in everyday practice (Burnaev, 2023).

From a research perspective, these developments point to several important research objectives, including the systematic examination of how AI-driven analytics affect the quality and credibility of ESG reporting, the role of AI in mitigating information asymmetries, and its potential contribution to aligning financial performance with environmental and social responsibility. Moreover, there is growing need to investigate the extent to which AI-supported ESG decision-making influences organisational behaviour, stakeholder trust, and long-term value creation across different industries and regulatory environments. Addressing these objectives would significantly advance the understanding of AI as a strategic enabler of sustainable corporate governance.

Another relevant strand of the academic debate concerns the management of AI outsourcing from the perspective of suppliers, encompassing client–vendor relationships, outsourcing contracts, and associated governance mechanisms such as service-level agreements and audit reports (Beulen, 2022). As organisations increasingly rely on external providers for AI solutions, questions related to accountability, risk-sharing, data ownership, and contractual enforcement become central to both operational efficiency and ethical governance. Despite its growing practical relevance, this area remains insufficiently explored in empirical research.

Future research is therefore expected to provide more precise and systematic insights into the economic, organisational, and governance implications of AI outsourcing, including cost–benefit analyses, performance outcomes, and the effectiveness of contractual safeguards. Such research holds considerable potential for informing managerial practice and public policy, particularly in the context of ESG-oriented regulation and responsible AI deployment. By linking technological innovation with governance structures and sustainability goals, this research domain offers a fertile ground for advancing interdisciplinary knowledge at the intersection of artificial intelligence, finance, and corporate governance.

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