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Research Article

The Future of Work in a Sustainable Digital Economy : Human Capital, Automation, and Equity

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Abstract: A sustainable digital economy is an economic system that integrates digital technology, social sustainability, and resource efficiency within production processes and labor distribution. Advances in information technology, automation, and artificial intelligence have transformed the structure of the global labor market and created skill disparities among workers. The unpreparedness of human resources in facing digital transformation has led to gaps in access to training, technological literacy, and equal employment opportunities. Strengthening human capital is therefore a strategic solution to maintain balance between technological progress and social justice. This study employs a descriptive qualitative approach through Focus Group Discussions and literature reviews within the 2022–2025 period to analyze the interrelationships between competency development, automation implementation, and digital equity. The findings indicate that improving digital capabilities through upskilling, reskilling, and technology-based education enhances workforce resilience against disruption. Collaboration among government, industry, and educational institutions is proven to be effective in expanding training access, reducing the digital divide, and creating an inclusive and adaptive work ecosystem in the era of a sustainable digital economy.

Keywords: Automation; Digital Economy; Equity; Future of Work; Human Capital

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1. Introduction

The global economic transformation driven by the advancement of information technology and digitalization has fundamentally altered the way humans think, work, and reshape human capital needs, as well as reorganize the socio-economic structure across various sectors. According to the International Labour Organization (ILO, 2023), more than 40% of existing types of occupations are predicted to undergo significant changes before 2030 as a result of digital technological disruption and automation in multiple fields. The evolution of work is driven by advancements in digital technology alongside economic, social, cultural, and environmental sustainability. The increase in efficiency brought about by automation, supported by appropriate investment in human capital, can ensure fair and sustainable growth not only for firms but also for society at large.

Human capital has become a primary factor in building workforce resilience and adaptability in the era of a sustainable digital economy. The human capital theory in the digital era emphasizes that investments in education, skills, and employee training are increasingly essential as the economy shifts towards a knowledge-based system. Automation and Artificial Intelligence (AI) generate demands for new and more complex skill sets, encouraging firms and individuals to continuously adapt and learn. Human capital plays a crucial role in corporate continuity since it continuously provides new ideas and suggestions for products or services through creativity (Eleyae, N., 2021). The World Economic Forum (2024) highlights that investment in digital literacy, technological competence, and lifelong learning

can help reduce the gap between technological advancement and human capability. Nevertheless, inequality in access to education, digital infrastructure, and training opportunities remains a major barrier that worsens the disparity between high-skilled and low-skilled workers, thus deepening social and economic inequality.

The automation theory asserts that technology, particularly artificial intelligence, continues to push the boundaries of machine capability. Automation now encompasses tasks previously considered too complex to automate. These developments also have the potential to replace human labor, reduce job security, and widen the income gap. Realistically, the future is not one where machines do everything, but rather one where humans do more (Susskind, D., 2020). Excessive adoption of technology without proper human resource adjustment strategies may lead to greater wage inequality and lower labor market inclusivity (Acemoglu & Restrepo, 2022). Therefore, the core challenge is not solely how technology is adopted, but how its benefits can be distributed equitably across all societal groups.

The theory of digital equity recognizes that social inequality may be exacerbated by digital technology if appropriate interventions are not implemented. Equal access to technology, digital literacy, and participation are key determinants. Digital equity also involves understanding and addressing how personal data is exploited within a data-driven economy. Income and wealth inequality have increased as digitalization reshapes markets, business environments, and work structures (Reisdorf, B. C., & Blank, G., 2020). Digital literacy plays an essential role in bridging the digital divide. Beyond having access to technology, individuals must possess the skills and understanding to use it effectively (Couldry, N., & Mejias, U. A., 2019). In essence, the future of work in a sustainable digital economy largely depends on the ability to balance technological advancement with investment in human capital, while ensuring equal access and benefits for all segments of society. Addressing these challenges requires a comprehensive and strategic approach in responding to major changes within the world of work, and ensuring that the benefits of technological progress can be shared fairly and sustainably by all.

2. Literature Review

Human Capital and Workforce Adaptability in the Digital Economy

In the digital era, human capital represents the foundation for innovation, productivity, and workforce resilience. Modern economic systems increasingly depend on digital competencies, lifelong learning, and adaptability to technological change. The OECD (2021) emphasizes that the demand for digitally skilled workers has expanded rapidly as artificial intelligence (AI) and automation transform labor markets. Similarly, Bilal, Torrido, & Mardiyah (2024) reveal that investment in human capital through digital education and skills development is essential to sustain workforce innovation and organizational performance.

Research by Setyanti, Faliza, & Rustandy (2024) further shows that firms prioritizing employee upskilling and retention strategies outperform competitors during periods of technological transition. This supports the view that human capital is not merely an input factor but a strategic capability that enhances resilience and adaptability in the face of disruptive change.

However, structural inequalities in access to digital education persist. According to Nguyen, Doan, & Tran (2022), countries in Southeast Asia still face significant disparities in digital literacy between urban and rural populations. These gaps undermine equitable participation in the digital economy and hinder inclusive growth. Strengthening human capital therefore requires not only skill development but also policies that ensure accessibility, affordability, and gender inclusivity in digital learning.

Automation, Artificial Intelligence, and the Transformation of Work

The theory of digital equity recognizes that social inequality may be exacerbated by digital technology if appropriate interventions are not implemented. Equal access to technology, digital literacy, and participation are key determinants. Digital equity also involves understanding and addressing how personal data is exploited within a data-driven economy. Income and wealth inequality have increased as digitalization reshapes markets, business environments, and work structures (Reisdorf, B. C., & Blank, G., 2020). Digital literacy plays an essential role in bridging the digital divide. Beyond having access to technology, individuals must possess the skills and understanding to use it effectively (Couldry, N., & Mejias, U. A., 2019). In essence, the future of work in a sustainable digital economy largely depends on the ability to balance technological advancement with investment in human capital, while

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The integration of automation and AI has redefined how work is organized, executed, and compensated. Acemoglu & Restrepo (2022) argue that while automation can enhance productivity, it also risks amplifying wage inequality if technological adoption is not complemented by human capital investment. In line with this, Faishal et al. (2023) observe that automation in developed economies contributes to structural labor market shifts—displacing routine jobs but simultaneously generating demand for higher cognitive and creative skills.

A study by Arntz, Gregory, & Zierahn (2023) revisited the automation risk across OECD countries and found that about 14% of jobs remain highly automatable, while 32% are undergoing significant transformation. These findings highlight that automation does not necessarily lead to mass unemployment; rather, it reshapes occupational structures and emphasizes the need for strategic workforce reallocation.

Furthermore, IMF (2021) warns that excessive technological substitution without proper inclusion policies can exacerbate post-pandemic inequality. The organization calls for a "human-centric automation" approach, where technology complements human labor instead of replacing it. In this context, the synergy between automation and human capital development determines whether digital transformation results in inclusive or polarized growth.

From a sustainability perspective, Nosratabadi, Atobishi, & HegedHus (2023) found that integrating automation into environmentally conscious and socially responsible practices enhances firms' social sustainability performance. This demonstrates that automation, when aligned with sustainable development principles, can drive equitable and long-term prosperity.

Digital Equity and Inclusive Participation in the Sustainable Digital Economy

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Digital equity refers to fair and inclusive access to digital technologies, skills, and opportunities. It is an essential precondition for achieving social justice in a data-driven economy. According to Reisdorf & Blank (2020) and reaffirmed by Peláez-Sánchez & Glasserman-Morales (2023), digital divides based on income, gender, and geography continue to deepen inequalities in education and employment opportunities.

Empirical findings from Astari & Yulianto (2025) show that disparities in digital resource utilization among teachers in urban and rural areas directly affect learning outcomes and long-term human capital formation. Similarly, Gurumurthy & Chami (2022) emphasize that equitable access to digital infrastructure and data governance mechanisms are vital for protecting citizens from algorithmic discrimination and data exploitation.

Digital equity, therefore, acts as a moderating factor linking human capital and automation outcomes. Without equitable access, the benefits of automation and skill advancement will remain concentrated among privileged groups. Policies that promote open access to technology, digital public goods, and inclusive training ecosystems are crucial to ensure that technological progress supports all segments of society rather than widening divides.

Problem Formulation

How can human resources adapt to the demands of job transformation in relation to a sustainable digital economy, automation, social equity, and the development of new skills?

3. Proposed Method

Research methodology refers to a set of systematic procedures used by researchers to design, implement, analyze, and interpret research findings in a scientifically accountable manner (Creswell & Creswell, 2023). Through the methodology, researchers determine the most appropriate approach to answer the research questions and achieve the research objectives objectively. This study employs a descriptive qualitative approach, which is a method that focuses on gaining an in-depth understanding of social phenomena through the collection of non-numerical data, with the aim of factually and systematically describing the characteristics of the observed object (Hall, 2024). This approach is suitable for examining the future of work issues within a sustainable digital economy, as it enables the exploration of perceptions, experiences, and social contexts that cannot be measured quantitatively (Hennink et al., 2022).

Primary data in this study refers to information obtained directly from original sources through the researcher's direct involvement with research subjects, either through interaction or observation (Sugiyono, 2022). Data collection was conducted using the Focus Group Discussion (FGD) method. FGD is a qualitative data collection technique that involves a group of academic and practitioner participants to discuss a particular issue in a structured manner to obtain shared views, experiences, and interpretations relevant to the research topic (Krueger & Casey, 2015). In this research, FGDs were used to explore the perspectives of digital workers, human resource managers, and policymakers regarding automation, human capital development, and equity within the digital economy (Hennink et al., 2022). Secondary data refers to previously available data collected from various relevant sources to support the analysis and interpretation of research findings (McKinsey Global Institute, 2021; Lynn, 2023). The secondary data consists of literature including scientific articles, books, international institutional reports, and academic publications published between 2022–2025 discussing issues such as the sustainable digital economy, automation, human capital, and social justice (Almunawar, Ordóñez de Pablos, & Anshari, 2024). Data analysis was conducted using thematic analysis, which is the process of identifying and interpreting patterns of meaning emerging from the FDG results and literature review to obtain relevant insights (Nicmanis, 2024). The study applies source triangulation between primary and secondary data, along with member checking, to verify the interpretation of findings with participants in order to ensure credibility. This approach is expected to produce valid and reliable findings, and contribute significantly to the understanding of the future of work in a sustainable digital economy.

4. Results and Discussion

Results

The findings obtained through Focus Group Discussions (FGDs) and literature review indicate that the transformation of work structures in the era of a sustainable digital economy demands comprehensive adjustments in human resource quality. FGD participants, consisting of digital workers, human resource managers, and policymakers, assessed that automation and Artificial Intelligence (AI) have shifted work functions from routine tasks toward analytical, creative, and technology-based skills. This shift underscores the importance of strengthening human capacity to remain relevant amidst changes in production and service systems. These findings are consistent with De Koning et al. (2021), who demonstrated that digitalization increases the demand for non-routine skills involving high-level cognitive and social capabilities.

The FGD results also revealed a high awareness of the importance of upskilling and reskilling, although access to digital training remains uneven. Such barriers are predominantly experienced by mid-age workers and groups with limited technological infrastructure. According to Gomes et al. (2025), the relationship between human capital and artificial intelligence places learning ability and innovation as key determinants of economic growth. Enhancing competencies becomes imperative in maintaining workforce relevance in the midst of digital transformation. Unequal access to training further widens productivity and career mobility disparities between groups of workers, in line with the World Economic Forum (2024), which emphasizes the importance of digital literacy in reducing cross-sector

skill disparities. The FGDs also identified limited training facilities as a primary obstacle to adapting to digital working systems. Tahar et al. (2022) assert that creativity and mindset transformation are necessary for workers to adapt to technological progress. Efforts to strengthen workforce capacities require continuous training support to improve productivity and readiness in facing digital disruption (Nugis & Sanggarwati, 2024).

Digital equality emerges as a critical issue affecting social justice within economic transformation. FGDs indicate that disparities in digital infrastructure, differences in technological literacy, and limited access to training are widening the gap between urban and rural workers. Zhang et al. (2023) highlight that the contribution of the digital economy to reducing income inequality depends on improving education quality and equal access to technology. Participants from the government sector emphasized the need for policies that ensure equal access to digital education and incentives for companies contributing to workforce training. Evidence from the McKinsey Global Institute (2022) suggests that countries with targeted technology education policies and workforce training programs possess greater economic resilience against automation-driven disruption.

Discussion

The analysis of research findings indicates that human resource capacity determines the success of adaptation to digital transformation. Regions or organizations with high levels of education and technological competence are able to adopt automation productively without generating substantial pressure on the labor market (Acemoglu & Restrepo, 2022). In contrast, regions with low human resource quality are at greater risk of experiencing higher unemployment due to the implementation of technology without adequate training support. Concerns expressed by FGD participants regarding skill disparities among workers with different levels of digital competence reinforce these findings.

AI-augmented human resource practices enhance efficiency and objectivity while simultaneously shifting the HR function from administrative roles toward designing adaptive work experiences (Mikalef et al., 2024). This transformation involves managing human–machine collaboration, mitigating AI ethical risks, and maintaining worker well-being throughout the transition period. A human-centered approach has proven effective in strengthening technological acceptance and improving organizational performance. Digital equality plays an essential role in safeguarding social justice amid the acceleration of the digital economy. Inequality in access to training and digital infrastructure can potentially widen social disparities among worker groups with different levels of technological capability. Heikkilä and Hämäläinen (2024) found that automation has a greater impact on female workers in administrative and HR sectors due to the digitalizable nature of their tasks. Ensuring equitable access to digital training becomes a key strategy to reduce social inequality and strengthen economic fairness.

Human capital functions as a balancing mechanism between automation and social justice. Strengthening formal education, industry-oriented training, and continuous learning represents strategic measures in maintaining labor competitiveness. Almunawar, Ordóñez de Pablos, and Anshari (2024) emphasize that corporate investment in employee competency development enhances adaptability to digital disruptions. OECD (2023) also notes that non-formal learning through online training and micro-credentialing accelerates adjustment to technological change. Public policy plays a strategic role in shaping a fair and adaptive work ecosystem. Government, educational institutions, and industry actors must establish synergy to strengthen digital literacy and expand inclusive access to training. Such synergy serves as the foundation for building a sustainable digital economy that places humans at the core of technological transformation.

5. Conclusions

The findings of this study indicate that job transformation within a sustainable digital economy requires continuous enhancement of human resource capacity. Automation and artificial intelligence have shifted the nature of work from routine tasks toward analytical, creative, and technology-based activities. Human competence thus becomes a crucial factor in maintaining workforce relevance. The FGD results reveal a high level of awareness regarding the importance of upskilling and reskilling; however, access to digital training remains uneven. Inequality in infrastructure and technological literacy further widens productivity disparities. Strong human capital determines an organization's capability to adopt automation technology productively.

Digital equality is essential in achieving social justice. Strengthening education, industrial training, and lifelong learning will improve labor readiness. Public policy plays a significant role in maintaining a balance between technological advancement and social justice through equal access to digital education and workforce training support. The ability of human resources to confront transformative changes in the nature of work depends on the quality of education, development of new skill sets, and inclusive equity policies. Collaboration among government, industry, and educational institutions is key to realizing a sustainable, adaptive, and equitable digital economy.

This study recommends that strengthening human resources should become a primary priority within digital economic development strategies. The government should expand equitable access to digital education and training across regions. Companies need to increase investments in employee reskilling and upskilling programs to enhance their adaptability toward automation. Educational institutions should adjust curricula in accordance with digital labor market needs and reinforce technology-based learning. Public policies should emphasize inclusivity and equitable digital infrastructure distribution. Cross-sectoral collaboration among government, business, and educational institutions must be strengthened to build a digital workforce ecosystem that is productive, competitive, and socially just.

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