

DIGITAL TRANSFORMATION AS A DRIVER OF PRODUCTIVE FORCES DEVELOPMENT IN THE NEW GLOBAL ECONOMY

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ABSTRACT

In the context of profound transformations in the global economy driven by the Fourth Industrial Revolution, digital transformation has emerged as a central force reshaping growth models, production structures, and social life. While most contemporary scholarship approaches digital transformation through the lenses of technology, management, or policy, the socio-economic essence of this process remains insufficiently elucidated. Grounded in the theoretical framework of Marxism-Leninism—specifically the theory of productive forces—this article analyzes digital transformation as a nascent stage in the development of productive forces within the new global economy. Consequently, it clarifies the role of digital transformation in enhancing labor productivity, promoting green growth, and fortifying human resilience. This research contributes to the theoretical discourse on the digital economy while offering policy implications aimed at ensuring sustainable and human-centric development.

Keywords: Digital transformation, productive forces, global economy, Marxist philosophy, sustainable development.

1. INTRODUCTION

In the early decades of the 21st century, the global economy is undergoing profound transformations under the impact of technological waves associated with the Fourth Industrial Revolution. The rapid advancement of disruptive technologies—such as Artificial Intelligence (AI), Big Data, the Internet of Things (IoT), and Cloud Computing—has transcended the scope of mere technical improvements to fundamentally alter production methods and global economic structures. In this context, digital transformation is no longer viewed solely as an optimization tool but has become a central driver shaping a new global economy, where data and digitized knowledge emerge as key resources for growth.

However, most current studies primarily approach digital transformation from technical perspectives, corporate governance, or short-term digital economic policies. A significant research gap exists in clarifying the socio-economic nature of this process through the lens of Political Economy. According to Karl Marx, the development of the productive forces constitutes the decisive factor driving the evolution and transformation of socio-economic formations. In the context of contemporary digital transformation, Marx's proposition that "general social knowledge has become a direct force of production" provides an important theoretical foundation for explaining how scientific knowledge, data, and digital technologies are increasingly embedded in every stage of the production process. Rather than functioning as external enabling factors, they have become intrinsic productive forces that fundamentally

shape productivity growth, technological innovation, and the transformation of modern production systems [1].

Based on this research gap, this article aims to answer the central research question: How does digital transformation restructure productive forces in the new global economy from the perspective of Marxist-Leninist Political Economy? To address this issue, the paper focuses on three specific research questions: First, how does digital transformation qualitatively transform the constituent elements of productive forces? Second, through what mechanisms does digital transformation become a driving force for productivity enhancement and the promotion of green and sustainable growth models? Third, what new socio-economic contradictions and challenges arise from the development of digital productive forces on a global scale?

By approaching digital transformation through the prism of Marxist-Leninist Political Economy, this study analyzes the process as a driving force for restructuring productive forces in the new global economy. Consequently, the research not only contributes to the theoretical framework for digital economy studies but also suggests policy implications aimed at orienting the digital transformation process toward sustainable and human-centered development.

2. LITERATURE REVIEW

In recent years, digital transformation has emerged as a central theme in studies of political economy and global development. Through a systematic review of international literature, the primary approaches to digital transformation can be categorized into relatively distinct research strands, thereby identifying the theoretical gaps that this article aims to address:

Firstly, the economic and productivity approach views digital transformation as a catalyst for growth and production efficiency. The works of Erik Brynjolfsson and Andrew McAfee emphasize that digital technologies are ushering in the Second Machine Age, wherein data and knowledge become critical productive resources, contributing to significant leaps in productivity. Similarly, reports by the World Bank and the Organisation for Economic Co-operation and Development focus on analyzing the role of the digital economy in stimulating growth, improving resource allocation efficiency, and enhancing national competitiveness. However, a limitation of this approach is its tendency toward the quantification and technicalization of digital transformation. While variables such as productivity, GDP, and innovation are prioritized, the structural transformations of the productive forces have not yet been fully analyzed.

Secondly, the management and business approach views digital transformation as a process of restructuring enterprises and organizational models. Within this research strand, digital transformation is understood primarily as a strategy to optimize operations, enhance customer experience, and create a competitive advantage. Studies in this field focus on issues such as data governance, business model innovation, and organizational transformation within a digital environment. While providing significant micro-level analysis, this approach is often limited to the corporate scope and fails to fully explain the systemic transformations of the economy and society.

Thirdly, the structural-systemic and sociological approach emphasizes the profound impact of digital technology on socio-economic structures. Manuel Castells laid the foundation for understanding the network economy, where information and networks become the structures that shape society [2]. This approach offers a macro-level perspective on the changing modes of human-to-human interaction; however, it occasionally obscures the decisive role of the material productive forces in determining the social superstructure within the global economy. According to Klaus Schwab, the Fourth Industrial Revolution is ushering in a technological transformation that is fundamentally changing the way people live, work,

and relate to one another. Through the convergence of digital, physical, and biological technologies, this revolution is generating profound changes across economic sectors, production systems, and social structures [3]. Despite adopting a macro and structural level of analysis, these studies mostly stop at describing the transformation of socio-economic systems without being closely integrated into the theoretical framework of the productive forces in political economy.

Synthesizing and comparing the aforementioned approaches, this article identifies three primary theoretical gaps: Firstly, the absence of an integrated approach between digital technology analysis and the theory of productive forces. Secondly, a tendency to decouple micro and macro analyses, which leaves the mechanisms of transformation from technological change to structural production shifts inadequately explained. Thirdly, the limitations in interpreting new contradictions arising from digital transformation through the lens of political economy.

On this basis, this article adopts a Marxist-Leninist approach to analyze digital transformation as a process of restructuring productive forces within the new global economy. This framework allows for not only an explanation of the role of digital transformation in economic growth but also a deeper analysis of the structural changes and emerging contradictions of the contemporary global economy.

3. RESEARCH METHODOLOGY

This article is developed following a qualitative research design with a theoretical-interpretive orientation, aiming to clarify the nature of digital transformation in its relationship with the development of productive forces. The research process is organized into three closely interlinked steps.

Firstly, the study conducts a systematic literature review, benchmarking the arguments found in the classic works of Karl Marx and V.I. Lenin regarding productive forces and the role of science and technology against contemporary empirical evidence from reports by the World Bank and the United Nations Conference on Trade and Development (UNCTAD). This synthesis enables the establishment of a robust theoretical framework that preserves the heritage of ideological thought while accurately reflecting the dynamics of the digital era.

Secondly, a structural comparative method is employed to contrast traditional industrial productive forces with digital productive forces based on the criterion of "qualitative transformation," thereby identifying the essential shifts of production factors in the digital age.

To strengthen the objectivity and depth of the arguments, the study applies a triangulation technique by continuously validating theoretical propositions against empirical data from the "*Digital Economy Report*." This multi-dimensional approach ensures that the conclusions reached transcend normative statements and remain closely aligned with the empirical shifts of the contemporary global economy.

4. ANALYSIS AND DISCUSSION

4.1. Digital Transformation and the Transformation of the Constituent Elements of Productive Forces

In the new global economy, digital transformation acts not merely as a supporting tool but has become the central factor driving a profound restructuring of the constituent elements of productive forces. From a political economy perspective, Karl Marx asserted that productive forces reflect humanity's practical capacity to conquer nature, with their level being measured by the advancement of science and technology [4]. In the context of digital transformation, these elements are not only changing in quantity but are undergoing a qualitative transformation. To

determine the extent of this change, this study proposes three conceptual criteria: the degree of digitization and datafication of production factors; the role of knowledge as a direct productive force; and the functional restructuring of labor within the production system.

Firstly, regarding the labor force, digital transformation is driving a shift from manual-intensive labor to knowledge-intensive and digital-skill-intensive labor. Empirical studies indicate that enterprises adopting digital technologies tend to increase their demand for workers with data analysis, programming, and creative thinking skills. According to the OECD, digitalisation and automation are restructuring labour markets by replacing many routine tasks while simultaneously increasing demand for cognitive, creative, and problem-solving skills. Consequently, highly educated and skilled workers tend to benefit more from technological change, whereas low-skilled workers face a greater risk of job displacement, encounter greater difficulties in adapting to technological transformation, and are less likely to benefit from the new opportunities generated by digitalisation [4]. This suggests that labor in the digital economy is changing not only in structure but also in its productive functions, aligning with the criterion of the qualitative transformation of productive forces.

Secondly, regarding the means of production, digital transformation has led to the emergence of a new form based on data and technological platforms. Unlike the physical means of production in traditional industries, assets such as Big Data, software, algorithms, and digital infrastructure are intangible, highly reusable, and have a near-zero marginal cost. According to the *Digital Economy Report 2021* published by the United Nations Conference on Trade and Development (UNCTAD), digital data have become “an increasingly important economic and strategic resource.” They also constitute the foundation of data value chains in the digital economy and provide the basis for generating added value through the collection, processing, analysis, and exploitation of data [5]. Simultaneously, the World Bank, the expansion of digital platform enterprises, together with the advancement of digital transformation, is increasingly blurring the boundaries of traditional firms by creating new forms of production organization, facilitating direct interactions between producers and consumers, and fostering data-driven models of value creation. These developments reflect a broader restructuring of production and distribution processes in the digital economy, where digital platforms serve not merely as market intermediaries but as institutional mechanisms that coordinate economic activities, allocate resources, and reconfigure global value chains [6].

Thirdly, regarding scientific and technological knowledge, digital transformation enhances the role of knowledge as a direct productive force. In the *Grundrisse*, Marx foresaw this trend, arguing that accumulated social knowledge would become a “direct productive force” [1]. In the digital economy, knowledge is not only accumulated but also digitized, encoded, and integrated directly into production processes through artificial intelligence and automation. Recent studies show that enterprises utilizing Big Data and AI have the capacity to significantly enhance productivity and innovation compared to traditional models. This confirms that knowledge no longer plays a supporting role but has become a central factor of production, aligning with the second criterion of the transformation of productive forces.

Synthesizing these three aspects reveals that digital transformation is driving a simultaneous restructuring of all three constituent elements of productive forces toward digitization, technologization, and networking. However, it should be noted that the extent and effectiveness of this process depend significantly on institutional conditions, development levels, and the technological absorption capacity of each nation. Consequently, digital transformation does not automatically lead to the uniform development of productive forces; rather, it may exacerbate disparities in productivity and competitive capacity within the global economy.

In the history of socio-economic formations, every advancement in productive forces has been closely linked to the emergence of new labor instruments and innovative modes of

production. While traditional industrial economies relied primarily on mechanical machinery, manual labor, and the extraction of physical resources, the rapid development of digital technologies in the context of the Fourth Industrial Revolution is profoundly transforming the structure of the constituent elements of productive forces. Data, digitized knowledge, and technological platforms are increasingly becoming critical inputs of the production process, while simultaneously driving a shift from manual labor to knowledge-based labor requiring advanced digital skills.

Table 1. Comparison of Productive Forces Elements: Industrial Economy vs. Digital Economy

Productive Force Element	Industrial Economy (Traditional)	New Global Economy
Labor Force	Manual labor, skills for operating physical machinery.	Intellectual labor, digital skills, creative thinking.
Instruments of Labor	Mechanical machinery, physical assembly lines.	Algorithms, AI, software, cloud systems.
Objects of Labor	Natural resources, raw materials.	Data, digitized knowledge.
Products	Physical goods.	Digital services, experiences, virtual assets.

In summary, digital transformation is not merely a technological shift but a process of profound restructuring of the elements within the productive forces. The advancement of digital technology is transforming labor methods, the forms of the means of production, and the role of knowledge in the economy, thereby creating new drivers for the development of productive forces in the contemporary global economy.

4.2. The Role of Digital Transformation in the New Global Economy

In the context of the global economy entering a new stage of development under the powerful impact of the Fourth Industrial Revolution, digital transformation is no longer merely the application of digital technologies to socio-economic activities. Instead, it has become a structural factor reshaping the mode of production, growth models, and global economic relations. From a socio-economic philosophical perspective, digital transformation can be viewed as a crucial driver stimulating the development of productive forces, while simultaneously giving rise to new forms of production organization within the modern global economy.

Firstly, digital transformation is regarded as a primary driver for the development of productive forces in the global economy. As Marx observed: “The development of fixed capital indicates the degree to which general social knowledge has become a direct productive force. It therefore also indicates the extent to which the conditions of the social process of life itself have come under the control of the general intellect and have been transformed in accordance with it [7].

In the era of the digital economy, this argument has become even more pronounced. Technologies such as Artificial Intelligence (AI), Big Data, the Internet of Things (IoT), and Cloud Computing have fundamentally altered the structure of productive forces. Beyond merely supporting traditional production activities, digital technologies have created entirely new modes of production, in which data is regarded as a new resource and a new means of production, becoming a critical input in the production process.

Sociologist Manuel Castells the development of information and communication technologies (ICTs) has facilitated the emergence of the network society, in which the dominant functions and processes of the economy are increasingly organized through global information networks. Within this framework, production, exchange, and consumption are

restructured on the basis of digitally interconnected networks capable of coordinating economic activities on a global scale [8]. In this economy, data and knowledge emerge as strategic resources, playing a decisive role in enhancing the competitive capacity of both nations and enterprises.

A growing body of research in Vietnam suggests that digital transformation is creating new material conditions for the development of the productive forces by accelerating the application of science, technology, and innovation. At the same time, it is facilitating the transformation of the country's growth model toward one driven by productivity, knowledge, and digital technologies. Thus, from a theoretical standpoint, digital transformation can be viewed as a new stage in the development of productive forces within the era of the knowledge economy.

Secondly, digital transformation creates a quantum leap in labor productivity. Currently, digital transformation is not merely a trend but has become the key driver for enhancing labor productivity, the core resource of modern productive forces. If labor productivity in the 20th century relied on mechanization and electrification, then in the 21st century, digital transformation serves as the essential tool to generate the "much higher new labor productivity" that Lenin anticipated: "Labor productivity is, in the final analysis, the most important, the principal thing for the victory of the new social system." By optimizing labor instruments through automation and artificial intelligence (AI), digital transformation is generating unprecedented leaps in efficiency. Internationally, data from Oxford Economics indicates that the digital economy now accounts for 15.5% of global GDP, with a growth rate outpacing the physical economy by 2.5 times over the past decade. Notably, Goldman Sachs forecasts that the widespread adoption of AI could contribute an additional 1.5 percentage points to global labor productivity growth annually, leading the McKinsey Global Institute to estimate an impressive added economic value of 13 to 22 trillion USD by 2030 [9].

In Vietnam, this process is unfolding with immense vigor, supported by concrete empirical evidence. According to the General Statistics Office of Vietnam (formerly the General Statistics Office), the digital economy accounted for 12.33% of the country's GDP in terms of value added in 2023. This result reflects the growing contribution of digitally enabled economic activities to the national economic structure, indicating that the digital economy is gradually emerging as a key driver of economic growth and the transformation of Vietnam's development model [10]. These figures confirm that digital transformation is not merely a technical tool but a vital driver enabling Vietnam to enhance its position within the global value chain and break through the middle-income trap.

*Table 2. Summary of Empirical Indicators on the Impact of Digital Transformation:
Global and Vietnam Perspectives*

Indicator	Global Scale	Vietnam Context
GDP Contribution	Accounts for 15.5% of global GDP (Oxford Economics).	Accounts for 16.5% of national GDP (2023 Report).
Growth Velocity	Outpaces the physical economy by 2.5 times.	Target of 20% GDP by 2025; 30% by 2030.
Productivity Impact	AI could add 1.5 percentage points to annual productivity growth.	A vital driver to break through the middle-income trap.
Economic Value Added	Estimated \$13T - \$22T by 2030 (McKinsey).	Enhancing position within the Global Value Chain (GVC).

Source: Goldman Sachs; Ministry of Information and Communications - Vietnam Digital Economy Annual Report 2023

According to the research of Erik Brynjolfsson and Andrew McAfee, digital technology is generating a "productivity revolution"[11], as artificial intelligence and automation systems enable enterprises to conduct production activities with lower costs and higher efficiency. From a political economy perspective, labor productivity is always regarded as a vital indicator reflecting the developmental level of productive forces. Marx pointed out that: "The development of the productive forces of social labour is the historical task and justification of capital" [12].

In the context of the digital economy, the increase in labor productivity stems not only from the improvement of labor instruments but also from the utilization of data and algorithms to optimize production and management processes. Digital transformation is creating fundamental changes in the organization of production, helping enterprises enhance labor productivity and competitiveness within the globalized landscape.

Thirdly, digital transformation is fundamentally altering the growth models of the global economy. In the new global economy, digital transformation is not merely an addition of supplementary technologies but has become a structural factor, directly and profoundly shifting the economic growth model from breadth to depth. This transformation stems primarily from a core shift in resources: while the traditional industrial model relied on the intensive use of finite and depletable inputs—such as physical capital, natural resources, and manual labor—digital transformation has established a new value system based on digital resources and knowledge. From this perspective, data is not just information; it has become "digital matter" with the capacity for regeneration and value increment based on the scale of use, allowing the economy to transcend the physical limitations of tangible resources. This is entirely consistent with the *Digital Economy Report 2021* by UNCTAD, which identifies data as the "lifeblood" shaping global competitive advantage.

The shift in resources inevitably leads to the revolutionization of value creation methods, moving from linear value chains to platform-based economic models and network ecosystems. According to Schwab, the proliferation of digital platforms has substantially reduced transaction and friction costs associated with economic exchange, while driving the marginal cost of producing each additional good or service toward zero. These characteristics have facilitated the emergence of new business models, enabled firms to scale their operations beyond conventional geographical constraints, and fundamentally reconfigured the processes of value creation within the digital economy [13]. In Vietnam, the role of digital transformation in economic growth and the development of productive forces has also been affirmed in key documents and resolutions of the Communist Party of Vietnam. The *Documents of the 13th National Party Congress* emphasize that developing the digital economy and digital society is a crucial driver for enhancing the productivity, quality, and competitiveness of the economy [14]. On September 27, 2019, the Politburo passed *Resolution No. 52-NQ/TW*, which affirmed that proactive participation in the Fourth Industrial Revolution and the promotion of digital transformation are vital conditions for innovating the growth model, enhancing labor productivity, and ensuring sustainable economic development [15]. Most notably, the *Documents of the 14th National Congress of the Communist Party of Vietnam* established a new growth model aimed at improving productivity, quality, efficiency, added value, and competitiveness. This model identifies science, technology, innovation, and digital transformation as the primary drivers, creating high-quality new productive power and modes of production, with a focus on the data economy and digital economy, while accelerating digital transformation.

Table 3. Transformation of Economic Growth Models in the Digital Economy

Indicator	Data / Figures	Strategic Significance
Share of Digital Economy in Global GDP	Approximately 15–16%	The digital economy has emerged as a new driver of global growth.
Global Data Market Value	Trillions of USD per annum	Data has been established as a strategic resource.
OECD ICT Sector Growth (2013–2023)	6.3% per annum	Digital technology is leading economic expansion.
Vietnam's Digital Economy (2024)	18.3% of GDP	Digital transformation is driving national economic restructuring.
Vietnam's Digital Economy Target (2025)	20.5% of GDP	Accelerating the transition toward a digital growth model.
Vietnam's Digital Technology Revenue (2025 Forecast)	\$198 Billion	Formulating a large-scale digital productive force.

Source: OECD; Ministry of Information and Communications, 2024, 2025

Fourthly, digital transformation promotes sustainable development models within the new global economy. In the context of the 21st century, sustainable development has become a strategic orientation for many nations, aiming to simultaneously address economic growth, environmental protection, and social progress. The vigorous advancement of digital technology is opening new possibilities to realize these goals, as digital transformation not only drives technological innovation but also contributes to the restructuring of production organization and economic governance on a global scale. According to the World Bank, digital technologies enable real-time data collection and analysis, thereby enhancing resource management efficiency and minimizing waste during production processes.

In the industrial sector, the application of Artificial Intelligence (AI), the Internet of Things (IoT), and smart manufacturing systems has facilitated the optimization of production cycles, energy conservation, and the reduction of industrial waste. The convergence of digital technology and smart production systems is paving the way for growth models that are more resource-efficient and environmentally friendly. Furthermore, digital technologies play a vital role in fostering green growth through the development of smart energy management systems and circular production models. Digital transformation is creating new conditions for the development of green and circular economic models; specifically, the application of digital technology in production and economic management is contributing to enhanced resource efficiency and the promotion of sustainable development in the era of the knowledge economy.

From a human development perspective, digital transformation contributes to expanding access to social services such as education, healthcare, and information. Amartya Sen asserts that sustainable development must be understood as a process of expanding human capabilities and opportunities within socio-economic life [16]. To ensure that the achievements of digital technology are distributed equitably and serve the goal of sustainable development, digital transformation is not merely a process of technological innovation but a comprehensive restructuring of all spheres of social life, in which humanity must be placed at the center of development.

Digital transformation is playing an increasingly vital role in shaping the sustainable development models of the global economy. By enhancing resource efficiency, fostering green growth, strengthening social adaptability, and expanding human development opportunities, digital transformation has become one of the most critical drivers of the socio-economic

development process in the 21st century. Simultaneously, this process creates favorable conditions for nations to achieve sustainable development goals and enhance their competitive capacity in the digital economic era.

4.3. Challenges Arising from Digital Transformation in the Global Economy

Digital transformation is becoming one of the pivotal drivers stimulating the development of productive forces, restructuring growth models, and shaping new modes of economic organization within the global economy. The vigorous proliferation of digital technologies not only enhances labor productivity and expands the scope for innovation but also contributes to the transition toward sustainable development models based on knowledge, data, and technology. However, akin to every major advancement of productive forces throughout history, the process of digital transformation simultaneously gives rise to numerous new socio-economic issues that must be identified and addressed.

Firstly, the digital divide and the risk of increasing developmental inequality among nations. One of the most prominent issues of digital transformation is the widening digital divide between countries and regions globally. Although digital technology is regarded as a vital driver of economic growth and innovation, the ability to access and exploit these technologies is unevenly distributed across nations. According to the World Bank, the pace of digital transformation varies considerably across different groups of countries. High-income economies continue to maintain significant advantages in digital infrastructure, innovation, and technological capabilities, whereas many developing countries still face substantial constraints in digital connectivity, digital skills, technological capacity, and investment resources. These disparities have further widened the digital divide within the global economy. In contrast, many developing countries continue to face significant constraints regarding digital technical infrastructure, financial resources, and scientific-technological proficiency. Consequently, rather than narrowing the gap, the digital transformation process risks exacerbating the developmental disparity between nations.

Furthermore, the rise of global technology corporations is reshaping the competitive structure of the world economy. Large tech companies possess massive volumes of data and own digital platforms with the capacity to dominate global markets. According to the OECD, digitalisation strengthens the economies of scale and market power of large digital platforms through network effects, data control, and technological advantages. This trend may lead to an increasing concentration of value creation among a small number of dominant firms, thereby exacerbating imbalances in the distribution of the benefits of the digital economy and posing new challenges for competition policy [17]. This phenomenon reflects a trend of capital concentration and accumulation under the conditions of the digital economy, analogous to Marx's analysis of the capital accumulation process in capitalist production.

Secondly, the transformation of the labor market and challenges for human resources. Digital transformation is driving profound changes in the structure of the global labor market. The advancement of artificial intelligence (AI), automation, and industrial robotics is altering the nature of many traditional occupations, while simultaneously giving rise to new forms of labor within the digital economy. According to research by the World Economic Forum, automation processes could modify or replace a significant number of jobs in traditional manufacturing and service sectors, while the demand for labor with digital skills and creative capabilities continues to rise [18]. This imposes an urgent requirement for the development of a digital workforce, particularly in fields such as information technology, data analytics, and artificial intelligence. Without appropriate training and retraining policies, the digital transformation process could exacerbate structural unemployment and income inequality within society. The Fourth Industrial Revolution is profoundly transforming the structure of

productive forces, while necessitating the innovation of education and training systems to adapt to the development of the knowledge economy.

Thirdly, the issues of data governance and cybersecurity in the digital economy. In the digital economy, data has become a strategic resource of immense economic value. Enterprises and organizations capable of efficiently collecting, analyzing, and exploiting data often secure a competitive advantage in the market. However, the rapid increase in cross-border data flows also poses numerous challenges for global governance. Issues related to privacy, information security, and data sovereignty are becoming critical topics in international economic forums. According to the OECD, the rapid growth of digital data and data-driven business models has created an urgent need for countries to establish appropriate data governance frameworks and regulatory systems that foster innovation while safeguarding privacy, data security, and user trust. Addressing these challenges has become a central priority for the effective governance of the digital economy [19]. This necessitates the establishment of international cooperation mechanisms to ensure cybersecurity and protect the critical infrastructure of the global economy.

Fourthly, challenges to sustainable development models and global governance. Although digital technology can enhance resource efficiency and foster green growth, the rapid expansion of digital infrastructure also increases the demand for energy and natural resources. According to research by the International Energy Agency, data centers and cloud computing systems are consuming an increasing amount of electricity, posing new challenges to the greenhouse gas emission reduction targets of many nations. Furthermore, the swift development of global digital platforms presents new issues for the international economic governance system. Existing legal regulations in many countries have not kept pace with the evolution of the digital economy, particularly in areas such as digital taxation for tech companies, cross-border data management, and market competition.

In conclusion, while digital transformation creates immense opportunities for the development of the global economy, the process simultaneously presents significant challenges. The issues pertaining to the digital divide, labor market transformations, data governance, cybersecurity, and sustainable development demonstrate that digital transformation is not merely a process of technological innovation. Rather, it represents a profound transformation of the global socio-economic structure.

4.4. Proposed Solutions to Enhance the Role of Digital Transformation in the New Global Economy

To effectively harness the opportunities brought by digital transformation while mitigating potential negative impacts, it is essential to implement a synchronized range of solutions across multiple dimensions. These solutions must not only aim to stimulate economic growth but also ensure sustainable development and maintain a human-centric approach.

Firstly, narrowing the digital divide through targeted infrastructure investment. The current central solution is not merely "digital infrastructure investment" in a general sense, but the formulation of a synchronized and universal digital infrastructure development strategy that ensures equitable access for all economic actors. Specifically: Nations must prioritize investing in foundational digital infrastructure, particularly high-speed broadband, 5G networks, national data centers, cloud computing, and open data platforms. These constitute the direct physical conditions for digital productive forces in the data economy era; For developing countries, specific financial mechanisms are necessary to support technology enterprises and rural areas in accessing digital infrastructure at low costs. Practical experience in Vietnam demonstrates that universalizing fiber optics and 4G/5G coverage in remote areas has significantly bolstered e-commerce, digital education, and the platform economy in rural sectors; Alongside investing in "hard infrastructure," it is

essential to develop the "soft infrastructure" of the digital economy. This includes legal systems governing data, cybersecurity, privacy protection, and data-sharing mechanisms between economic actors. This is a prerequisite for data to truly become a new production resource rather than remaining as fragmented assets; Nations should strengthen international cooperation in digital technology transfer, digital human resource training, and the sharing of digital governance knowledge. Developing countries ought to leverage support programs from the World Bank, the United Nations Development Programme (UNDP), and the International Telecommunication Union (ITU) to enhance their innovation capacity and their ability to participate in the global digital value chain.

Secondly, developing a digital workforce and innovating the education system. It is essential to reform educational curricula toward integrating digital skills and technological mindset starting from general education. For higher education and vocational training, there must be a decisive shift from theory-heavy models to those aligned with the practical demands of enterprises and the digital economy. Universities should establish partnership programs with technology firms to enable students to participate in hands-on practice, internships, and training through real-world digital projects. Priority training fields include artificial intelligence, data science, cybersecurity, semiconductor technology, e-commerce, and digital platform management. Simultaneously, it is necessary to establish mechanisms for retraining (reskilling) and upskilling the existing workforce—especially labor in sectors vulnerable to replacement by automation, such as traditional manufacturing, administration, and basic services. Furthermore, developing an open digital learning ecosystem and fostering life-long learning through national online education platforms is vital. This serves as a key solution to expand access to digital knowledge for people in remote areas and reduce the disparity in educational opportunities during the digital transformation process.

Thirdly, perfecting institutional frameworks and strengthening data governance in the digital economy. To ensure that data truly becomes a "new means of production," the central solution must be a transition from static management models to flexible, multi-tiered Data Governance models. First and foremost, it is essential to institutionalize the legal system by enacting and enforcing Laws on Personal Data Protection and Electronic Transactions, clearly establishing ownership rights, access rights, and data business obligations. Instead of merely imposing security barriers, the new legal framework needs to establish a "Regulatory Sandbox" for data-driven business models—such as Open Banking or Digital Health—allowing the exploitation of Big Data within a controlled scope to both foster innovation and identify cybersecurity risks early. Regarding operational governance, nations should develop a National Data Exchange Platform based on unified technical standards (Interoperability). To enhance feasibility, a National Data Governance Council should be established—an independent coordinating body tasked with monitoring the transparency and accountability of cross-border platforms. Finally, strengthening international cooperation should move beyond general diplomacy toward signing Mutual Legal Assistance Treaties on data and unifying common technical standards for cybersecurity (such as ISO/IEC 27001 or NIST). This aims to create a "green zone" for cross-border data flows, enabling domestic enterprises to participate more deeply in the global digital value chain.

Fourthly, integrating digital technology into green growth strategies and optimizing sustainable resources. In the new era, digital transformation is not merely an end in itself but must function as the "operating system" driving Sustainable Development Goals (SDGs). The core solution lies in shifting from fragmented technological applications to constructing a Digital Circular Economy ecosystem, where data serves as a tool for control and optimization. For instance, in agriculture, investments should focus on ground sensor networks combined with remote sensing to develop digital maps of soil and water resources. This system enables

the full automation of "right-place, right-amount" irrigation and fertilization processes, thereby maximizing water conservation and minimizing chemical residues that cause soil pollution.

In conclusion, to effectively harness the role of digital transformation in the new global economy, nations cannot merely focus on simple technological applications. Instead, they must implement a synchronized range of solutions encompassing digital infrastructure, human resource development, the perfection of data governance institutions, and the promotion of digital transformation aligned with sustainable development goals. These solutions are closely interrelated, interacting with and complementing one another. Within this framework, infrastructure and institutions serve as the constructive foundation; digital human resources act as the core executive driver; and sustainable development remains the ultimate objective. The decisive implementation of these solutions will not only help nations optimize labor productivity but also represent the inevitable path to transcend the limitations of finite resources, opening up infinite growth spaces derived from data and knowledge. For Vietnam, this is the "golden opportunity" to leverage the power of digital transformation to innovate growth models, achieve leapfrog developments in productive forces, and affirm a solid position within the global value chains of the new era.

5. CONCLUSION

In the context of the world economy undergoing a powerful shift under the influence of the Fourth Industrial Revolution, digital transformation has become a structural factor of profound significance for global economic development. Moving beyond a mere technological trend or a management strategy, digital transformation, in essence, reflects a deep-seated transformation of the material conditions of social production. From a political economy perspective, particularly based on Karl Marx's theory of productive forces, it is evident that the advancement of digital technology, data, and digitized knowledge is generating new constituent elements of productive forces. Simultaneously, it is altering the methods of organization and operation of the production process within the new global economy.

The analysis in this paper demonstrates that digital transformation simultaneously impacts all three fundamental elements of productive forces: labor power, the means of production, and scientific-technological knowledge. Firstly, digital transformation stimulates the formation of a digital workforce equipped with new skills and competencies, thereby enhancing labor productivity and the efficiency of the production process. Secondly, data, digital infrastructure, and technological platforms are becoming vital means of production, transforming the structure of production systems and global value chains. Thirdly, scientific-technological knowledge—particularly advanced digital technologies such as Artificial Intelligence, Big Data, and the Internet of Things—is increasingly becoming a direct productive force, contributing to the acceleration of innovation and the enhancement of economic competitiveness.

In conclusion, within the new global economy, digital transformation can be regarded as a pivotal driver stimulating the development of productive forces while opening new possibilities for socio-economic development toward sustainability, creativity, and humanity. The analyses in this paper not only contribute to supplementing the theoretical approach to the relationship between digital transformation and productive forces but also suggest important policy implications for nations in the process of building development models suited to the era of the digital economy.

REFERENCES

- [1] K. Marx, *Grundrisse: Foundations of the Critique of Political Economy (Rough Draft)*, M. Nicolaus, Trans. London, UK: Penguin Books, 1973.
- [2] M. Castells, *The Rise of the Network Society* *The Rise of the Network Society*. Oxford, U.K.: Wiley-Blackwell, 2010, pp. 77–85.
- [3] K. Schwab, *The Fourth Industrial Revolution*. New York, NY, USA: Crown Business, 2017, p. 1.
- [4] OECD, *OECD Skills Outlook 2019: Thriving in a Digital World*. Paris, France: OECD Publishing, 2019, doi: 10.1787/df80bc12-en.
- [5] UNCTAD, *Digital Economy Report 2021: Cross-Border Data Flows and Development: For Whom the Data Flow*. Geneva, Switzerland: United Nations, 2021.
- [6] World Bank, *World Development Report 2021: Data for Better Lives*. Washington, DC, USA: World Bank, 2021.
- [7] K. Marx and F. Engels, *Collected Works*, vol. 46, Part II. Hanoi, Vietnam: National Political Publishing House, 1995, p. 372.
- [8] M. Castells, "Materials for an Exploratory Theory of the Network Society," *The British Journal of Sociology*, vol. 51, no. 1, 2000, pp. 5–24.
- [9] Goldman Sachs Global Investment Research, *The Potentially Large Effects of Artificial Intelligence on Economic Growth*. New York, NY, USA: Goldman Sachs, 2023.
- [10] National Statistics Office of Vietnam, *Press Release on the Compilation Results of the Indicator Measuring the Share of Digital Economy Value Added in Vietnam's GDP and GRDP*, Dec. 2023. [Online]. Available: <https://www.nso.gov.vn/tin-tuc-thong-ke/2023/12/thong-cao-bao-chi-ve-ket-qua-bien-soan-chi-tieu-ty-trong-gia-tri-tang-them-cua-kinh-te-so-trong-gdp-grdp-cua-viet-nam/>
- [11] E. Brynjolfsson and A. McAfee, *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies*. New York, NY, USA: W. W. Norton & Company, 2014.
- [12] K. Marx, *Capital: A Critique of Political Economy*, vol. III, D. Fernbach, Trans. London, UK: Penguin Books, 1991.
- [13] K. Schwab, *The Fourth Industrial Revolution*. Geneva, Switzerland: World Economic Forum, 2016.
- [14] Communist Party of Vietnam, *Documents of the 13th National Congress*, vol. I. Hanoi, Vietnam: National Political Publishing House, 2021, pp. 115–116, 224–225.
- [15] Politburo of the Communist Party of Vietnam, *Resolution No. 52-NQ/TW on a Number of Guidelines and Policies for Proactively Participating in the Fourth Industrial Revolution*. Hanoi, Vietnam, Sep. 27, 2019. [Online]. Available: <https://tulieuvankien.dangcongsan.vn/he-thong-van-ban/van-ban-cua-dang/ngghi-quyet-so-52-nqtw-ngay-2792019-cua-bo-chinh-tri-ve-mot-so-chu-truong-chinh-sach-chu-dong-tham-gia-cuoc-cach-mang-cong-5715>
- [16] A. Sen, *Development as Freedom*. Oxford, UK: Oxford University Press, 1999, pp. 14–38.

- [17] OECD, *The Evolving Concept of Market Power in the Digital Economy*. OECD Roundtables on Competition Policy Papers, No. 278. Paris, France: OECD Publishing, 2022. doi: <https://doi.org/10.1787/2cfc4a8-en>
- [18] World Economic Forum, *The Future of Jobs Report 2020*. Geneva, Switzerland: World Economic Forum, 2020, pp. 29–43.
- [19] OECD, *OECD Digital Economy Outlook 2024*, vol. 1, *Embracing the Technology Frontier*. Paris, France: OECD Publishing, 2024. doi: <https://doi.org/10.1787/a1689dc5-en>