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Analysis of the Impact of Digital Payments on Consumer Choice

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Abstract:

In this context, digital transformation and green development have become important strategic directions for countries to seek new competitive advantages and achieve sustainable growth. This article systematically explores the interactive relationship between these two trends and their synergistic effects in promoting global economic recovery. Research has found that key technologies such as artificial intelligence, big data analysis, and cloud computing have significantly improved the operational efficiency of various industries and accelerated the pace of innovation. At the same time, the global pursuit of achieving net zero emissions targets and the increasing emphasis on environmental, social, and governance (ESG) principles have brought abundant investment opportunities for renewable energy and sustainable development. The core viewpoint of this study is that there is a significant positive feedback relationship between digital transformation and green transformation: digital technology promotes the construction of intelligent energy networks and the optimization of clean production processes, while green development goals provide broad space for the application of advanced digital technologies. However, this integration process still faces multiple challenges, including the persistent digital divide between developed and developing countries, the introduction of new trade policies such as carbon boundary adjustment mechanisms, and increasing public attention to data security and online privacy issues. However, research findings indicate that promoting the deep integration of digital and green agendas is a key approach to building a more resilient, inclusive, and sustainable future economic system.

Keywords: Global economy; digital transformation; green recovery; ESG; sustainable development.

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1. Introduction

The global economy is currently undergoing a multi-faceted recovery phase, which emerged following the 2019 coronavirus disease health crisis and is accompanied by many ongoing challenges. The main issues include continuous economic stagnation, as evidenced by the fact that the global GDP growth rate remained below 2.5% from 2020 to 2023. Additionally, extensive supply chain interruptions have emerged from logistical constraints and deficits in vital industrial elements, particularly semiconductor chips. Concurrently, inflationary forces have maintained upward pressure, with the international average inflation rate surpassing 8% in 2022, primarily propelled by escalating costs in energy and food sectors across numerous countries. Collectively, these elements have resulted in protracted economic normalization, increased joblessness, and amplified disparities in wealth distribution worldwide [1].

Current studies provide a strong basis for understanding this subject. Important early research on the digital economy, including Schwab's idea of the "Fourth Industrial Revolution," points to its power to completely change industries. In the same way, key reports on the green economy—like Stern's major work on climate change economics—clearly outline both the financial impacts and new possibilities that come with climate-related efforts. Researchers are now paying more attention to where these two fields meet, often in conversations about the UN Sustainable Development Goals (SDGs). Earlier writings show that digital advances can speed up the shift toward sustainability, but combining these areas often runs into big problems like outdated systems and resistance to change. This shows why more real-world studies are still needed [2]. In this context, the shift toward digital and environmentally friendly systems has moved from new ideas to central focuses for nations around the world. Governments are now helping people use digital tools more widely and encouraging spending on clean energy to boost their economies, fight climate change, and handle unexpected changes in the market. All of this helps countries improve their place in the world's changing economic picture [3]. It is very important to understand how these two big changes affect each other, since whether they work together or not will greatly shape future economic systems, global teamwork, and business competition. A deeper understanding of these connections can help create better policies that support fair and lasting growth. This paper follows a clear structure made up of five parts: Main Forces, Overlap, Real-World Examples, and Solutions. After this opening section, Chapter 2 looks at the main reasons behind the push for digital upgrades and green recovery. Chapter 3 studies how these areas can work together and the problems that may come up. Chapter 4 offers a close look at real examples from the United States Chapter 5 suggests useful steps for leaders and companies and shares final thoughts. Each part connects smoothly to the next to make sure the whole topic is fully covered.

2. New Core Drivers of Global Economic Development

2.1 The Driving Role of Digital Transformation

The digital economy has become a key force driving worldwide growth, changing how people make products, operate companies, and go about everyday routines. Important tools like cloud computing, artificial intelligence (AI), and big data are significantly improving efficiency in both established and new industries. A clear example is the popularization of automated smart factories. Systems based on artificial intelligence enable production lines to work better in real time, reducing downtime and material waste. In addition to manufacturing, these technologies also help introduce new business methods and entirely new industries. The sharing economy demonstrated by services such as Airbnb and Uber has changed the way assets are used. With the help of online collaboration platforms such as Zoom and Microsoft teams, remote work has become the standard, providing greater work flexibility and allowing for the search for talent worldwide [4].

Digital transformation has also profoundly changed the international supply chain, making it more intelligent and adaptable. For instance, blockchain can achieve comprehensive tracking from raw materials to the final product, so buyers can quickly scan with their mobile phones to confirm the legality and morality of the goods. Meanwhile, many AI-driven sensors and analytics enable stores to handle inventory in real time, allowing them to adjust inventory levels based on predicted shopping demands - this reduces excessively high inventory costs and ensures the availability of common products. Despite this, these improvements may widen the global digital divide. In many developing countries, poor digital infrastructure - including limited Internet access and unstable 5G networks - hinders the use of smart technologies, which may exacerbate the current economic gap and push some groups to the fringes of the global digital market.

2.2 The Driving Role of Green Recovery

Spurred by worldwide "dual carbon" goals (aiming for peak carbon and neutrality), a major shift in industries is picking up speed, blending eco-friendly practices with modern economic progress. This change stands out clearly in energy production, where wind and solar power are growing each year by around 15%, bringing in trillions of dollars in funding and opening up millions of jobs across

the globe. More and more families are putting solar panels on their roofs and using smart batteries, which cuts down their electricity costs and helps keep the power network steady.

The fast rise of the new energy vehicle (NEV) market shows this change clearly. The sales of electric vehicles are growing at a rate of over 30% annually. Driven by the increase in charging stations and the decline in battery prices, electric vehicles have become a common mode of transportation in cities. Companies like Tesla and BYD have not only transformed transportation methods but also lifestyles, as many electric vehicle users now install solar charging devices at home to reduce the impact on the environment [5,6].

Meanwhile, the ESG framework (environmental, social and governance) has evolved from a specialized concept into a universal metric for evaluating companies and making investment choices. Companies with a good ESG record, such as those that use recyclable packaging or ensure fair treatment of workers, often end up achieving higher market value in the end, as investors now associate green policies with lasting momentum. The global scale of ESG funds exceeds 10 trillion US dollars, investing in green bonds, renewable energy companies and socially conscious enterprises. This movement has also changed consumer behavior: buyers prefer brands that are open to environmental efforts, while job seekers choose companies that care about the environment. However, issues such as the high starting price of green technologies and the differences in rules among countries remain the main obstacles to fair and broad green growth.

3. The Convergence of Drivers and Associated Challenges

3.1 Synergistic Effects Between Digitalization and Green Transition

Digitalization and moving towards sustainable development are two major changes that are increasingly integrating to reshape the way the global economy operates. These changes do not operate in isolation but are interrelated through technological progress, industrial renewal and policymaking, forming a strong partnership that drives the economic system to enhance efficiency and reduce carbon emissions. This kind of cooperation is not merely for increasing benefits; It also means fundamentally rethinking how people produce and consume goods in various departments.

The energy industry is a clear example of such close ties. The smart grid has been improved through Internet of Things sensors and artificial intelligence prediction tools, achieving flexible power distribution and smoother use of decentralized energy. These systems can reduce energy waste by more than 20% while enhancing the reliability of the power grid. For instance, in Denmark, wind turbines equipped with sensors can communicate directly with grid managers in real time, thereby optimizing the use of renewable energy based on weather changes and demand variations.

In the manufacturing industry, a similar trend is obvious. Industrial Internet platforms and digital twin technologies can achieve detailed monitoring and fine-tuning of the production process. A prominent example is Siemens' Amberg electronics factory, where digital twin technology has reduced energy consumption by 20% while maintaining high product quality through virtual testing and optimization before actual implementation [7].

The circular economy is another key area for digital-green teamwork. Blockchain enables transparent tracking of carbon footprints throughout a product's life cycle, as seen in IBM's Food Trust network, which cuts food waste by increasing supply chain visibility. Fast-fashion brands like H&M are using RFID tags and blockchain to create digital IDs for clothing, improving recycling and second-hand sales options. Additionally, AI-based sorting systems in recycling plants, such as those used by ZenRobotics, can identify and separate recyclables with 95% accuracy, greatly raising recycling rates.Agricultural tech shows how these synergies reach primary industries. Precision farming systems that use GPS, drones, and Internet of Things (IoT) sensors allow targeted application of water and fertilizers, reducing usage by up to 30% while sustaining crop yields. Companies like John Deere have built these technologies into their machinery, helping farmers optimize inputs based on real-time soil and plant data. This integration also sparks new business models, for example, platform-based sharing of agricultural equipment among smallholder farmers, reducing capital costs while improving utilization rates [8].

Urban environments showcase integration at a systemic level. Smart city initiatives combine digital sensors, AI analytics, and green infrastructure to create more sustainable living spaces. Singapore's Virtual Singapore project creates digital twins of the entire city, enabling planners to simulate the environmental impact of new developments and optimize energy flows. Barcelona's smart street lighting system adjusts brightness based on pedestrian presence, reducing energy consumption by 30% while maintaining safety standards.

These practical manifestations demonstrate that digital-green integration not only operationalizes the theoretical "new growth pole of the digital economy" but also creates tangible pathways for achieving ESG objectives [9,10]. The convergence is generating new business opportunities while addressing environmental challenges, providing a robust foundation for analyzing how different

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national strategies attempt to harness these synergies.

3.2 Major Challenges

Despite the significant potential of digital-green integration, the pathway is fraught with multifaceted challenges that reflect and amplify existing global inequalities and governance gaps. The obstacles span technological, economic, and political dimensions, requiring coordinated solutions at multiple levels.

The digital divide presents a fundamental barrier to equitable participation in the green digital economy. While wealthy countries quickly adopt 5G and high-speed internet, around 3.7 billion people—mostly in developing areas—still don't have internet access. In Africa, although about 40% of people are online, the numbers hide big differences between cities and rural regions. This gap in connectivity is made worse by a skills shortage—even where technology is available, many people lack the basic digital skills to use it well. This is especially true for green tech, where operating and maintaining advanced systems like smart grids or precision farm tools requires special training [11].

Access to eco-friendly technology shows another side of unfairness. Although solar panel prices have dropped nearly 90% since 2010, the initial cost is still too high for many poorer countries. On top of that, patent laws often make it hard for these nations to use the latest inventions. As a result, a "green technology gap" is forming, pushing developing countries toward older, pollution-heavy ways of growing their economies. Money problems make this worse—developing countries need about 700 billion more each year for climate projects than they can get, leading to what the UN calls a "huge climate money divide."

Trade disputes are turning into new kinds of green trade barriers. The EU's Carbon Border Adjustment Mechanism (CBAM), though meant to help the environment, works like a trade wall that could cost poorer countries up to 16 billion in lost exports by 2030. The US and Canada are thinking about similar rules, which might split world trade based on climate policies. This is especially hard for industries in developing countries that use lots of energy—they face two problems: not having the technology to cut emissions and possibly being shut out of big markets. Things get more confusing because different countries use different green labels, creating extra rules that hurt smaller businesses the most.

Technology safety and right-and-wrong issues are becoming tougher to handle. Since most green digital tech is controlled by a few companies and countries, it creates risks—for example, China makes 80% of the world's solar panels and processes 90% of rare earth metals, giving it major power in the green shift. Privacy worries grow as smart grids gather detailed data on how homes use energy. Also, if computer programs used for environmental decisions are biased—like AI systems trained mostly on data from rich countries—they might ignore the unique needs of poorer regions, keeping old inequalities alive.

Governance might be the biggest challenge. Current global groups were set up in the past and aren't well-equipped to handle worldwide digital and environmental problems. Poor coordination between tech policy groups (like the Internet Governance Forum) and environmental agencies (like the UNFCCC) leaves gaps in rules. At the same time, technology changes so fast that laws can't keep up, causing uncertainty that scares away investors. These issues are especially tricky for global matters like data rules and carbon tracking, where mixed standards block effective action.

Together, these problems show that the advantages of mixing digital and green changes won't spread evenly by themselves. They point to the need for careful policies and worldwide teamwork to make sure the shift to a digital green economy is both successful and fair—key background for understanding how major economies are making choices in this transition.

4. Case Study Analysis: A Comparative Examination of Strategies in the U.S., China, and the EU

4.1 The United States: Strategy and Layout

The US is putting the Inflation Reduction Act (IRA) front and center in its push to boost green technology and grow industries. This law sets aside more than 500 billion for research, development, and support in clean tech, including electric cars, hydrogen power, and carbon capture. It's designed to encourage private companies to invest by offering tax breaks and loan guarantees—a approach that lines up with concepts like "green recovery efforts" and "reward systems" mentioned earlier. At the same time, the US is stressing the idea of bringing manufacturing back to the country, using digital tools to rebuild key supply chains. As an example, the CHIPS and Science Act aims to strengthen America's own computer chip production to protect technology independence and make supply chains more secure. The U.S. strategy highlights market-driven initiatives and innovation leadership, with federal policies and private enterprises collectively shaping a large-scale green digital investment landscape. This also reflects the U.S.'s chosen path in addressing challenges related to the „digital divide" and „technology monopoly."

4.2 China: Strategy and Layout

China promotes the coordinated development of its „Digital China" initiative and „dual-carbon" goals, systematically integrating the two drivers of digitalization and

green transition discussed earlier. On the digital front, China is vigorously advancing the construction of new infrastructure such as 5G base stations and AI computing centers to provide foundational support for industrial digital transformation. In the green domain, China has become the global leader in installed renewable energy capacity, with significant advantages in wind power, photovoltaic manufacturing, and the electric vehicle industry chain. These achievements are direct outcomes of its strategic emphasis on „energy transition“ and „green industrial revolution.“ The government's initiatives, such as the „East Data West Computing“ project, optimize the energy efficiency of digital infrastructure and promote the application of digital technologies in reducing emissions in key sectors like energy and industry. This demonstrates the state's coordinating role in overcoming challenges related to „technological security“ and „developmental imbalances.“ China's model exemplifies a strong state-led industrial policy combined with large-scale market application, offering a paradigm for global dual integration.

4.3 The European Union: Strategy and Layout

The EU focuses on regulatory construction and transnational coordination. Its European Green Deal, which aims for carbon neutrality by 2050, is supported by multiple policies including carbon market reforms and energy taxation directives, demonstrating the EU's ambition to lead global sustainable development through institutional design—a direct response to the „regulatory friction“ and „governance challenges“ explored in Chapter 3. The Digital Compass plan outlines a vision for achieving digital economy sovereignty by 2030, promoting developments in AI, quantum computing, and green data centers to enhance technological competitiveness and address „digital divide“ risks. The EU places particular emphasis on standard-setting and external influence, exemplified by the implementation of the CBAM and data governance regulations such as the Digital Markets Act. Through these measures, the EU seeks to increase its influence and discourse power in the global digital-green transition, establishing itself as a normative force in the integration of digitalization and green transition.

5. Conclusion

This paper systematically examines the dual drivers, integration mechanisms, and practical challenges of digital transformation and green recovery as new engines of global economic development. The research indicates that digital technologies and green transition are not isolated; rather, they interact deeply through technological application, industrial upgrading, and policy coordination, collectively propelling the global economy toward greater efficiency, low-carbon emissions, and inclusivity. By analyzing the strategic pathways of three major economies—the United States, China, and the European Union—it is observed that although each adopts distinct approaches (e.g., the U.S. emphasizes market incentives and technological innovation, China underscores state-led initiatives and large-scale application, and the EU focuses on regulatory frameworks and transnational coordination), all reflect that the deep integration of digitalization and green transition has become a critical route for reshaping the global competitive landscape.

At the same time, it is essential to recognize that this process continues to face multiple challenges, including the digital divide, unequal access to green technologies, trade frictions, and data governance issues, which require urgent addressing through international cooperation, policy coordination, and technological innovation. Looking ahead, the twin drivers of digitalization and green transition will not only shape new industrial ecosystems and economic paradigms but are also expected to inject sustained momentum into achieving a sustainable, resilient, and inclusive global economy—under an effective global governance framework.

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