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Green Digital Transformation and Korea's Cooperation Strategy with Developing Countries

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I. Introduction

Amid the accelerating global trends of green transformation (GX) to address climate change and digital transformation (DX) driven by technological progress, the need for an integrated approach to these two transitions has become increasingly important. In this context, the concept of **green digital transformation,** or the twin transformation, has emerged as a key policy agenda, defined as an approach that simultaneously promotes climate response through digital technologies and the decarbonization and greening of digital transformation itself.

Digital technologies can serve as powerful enablers of green transformation. They improve climate early warning systems, enhance energy efficiency, support smart grids, and facilitate more effective environmental monitoring. At the same time, however, digital transformation also generates new environmental pressures, including increased energy and water consumption and growing volumes of electronic waste. Such duality highlights the importance of pursuing digital and green transformation in an integrated manner rather than as separate policy agendas.

Although middle- and high-income developing countries are showing growing demand for both green and digital transformation, policy strategies and support mechanisms for integrated green digital transformation remain limited. To address this gap, Oh et al. (2025) proposes Korea's international development cooperation strategies and policy directions for promoting green digital transformation as an initial step toward cooperation with developing countries. The purpose of this report is

to present the main findings of Oh et al. (2025), which draws on international policy discussions, cross-country analyses, major donor strategies, and developing countries' needs and constraints.

II. Importance of Green Digital Transformation

Green digital transformation can be understood along two distinct but interrelated dimensions. The first is "**by digital,**" which refers to the use of digital technologies to support climate mitigation and adaptation efforts—for example, through smart grids, climate monitoring systems, and AI-based energy optimization. The second is "**of digital,**" which emphasizes the need to reduce the environmental footprint of digital transformation itself, including lowering water and energy consumption of data centers and addressing electronic waste. While both dimensions are essential for achieving sustainable outcomes, current international discussions and cooperation efforts have largely concentrated on the "by digital" dimension, with relatively limited attention given to the "of digital" aspect.

Oh et al. (2025) highlights the importance of a **balanced approach that addresses both "by digital" and "of digital" dimensions** by demonstrating that while digital transformation can increase carbon emissions, its integration with green transformation significantly reduces environmental impacts.

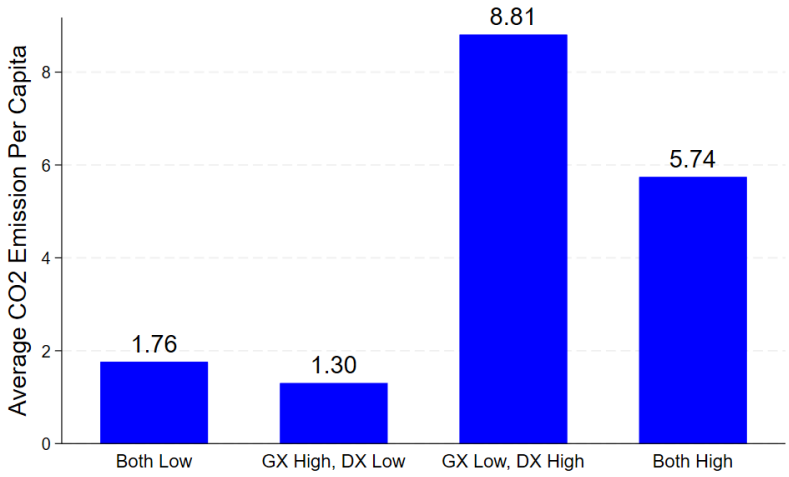
1. Interaction between Digital Transformation and Environmental Outcomes

To be more specific, their empirical analysis provides important insights into the relationship between digital transformation and environmental outcomes. On average, higher levels of digital transformation are associated with increased per capita greenhouse gas emissions (refer to Figure 1). This finding reflects the energy-intensive nature of digital infrastructure, including data centers, communication networks, and digital devices.

However, this relationship is not linear. The analysis shows that when green transformation progresses alongside digital transformation, the negative environmental impact of digitalization is significantly mitigated (refer to Figure 2). In countries where renewable energy deployment, energy efficiency improvements, and climate policies are more advanced, digital technologies contribute to emissions reduction rather than increasing emissions.

This interaction effect underscores a critical policy implication: digital transformation alone is not inherently environmentally sustainable, but when integrated with green policies, it can become a powerful tool for decarbonization. This reinforces the importance of pursuing green and digital transitions simultaneously rather than independently.

Figure 1. Average C02 Emission Levels by GX-DX levels



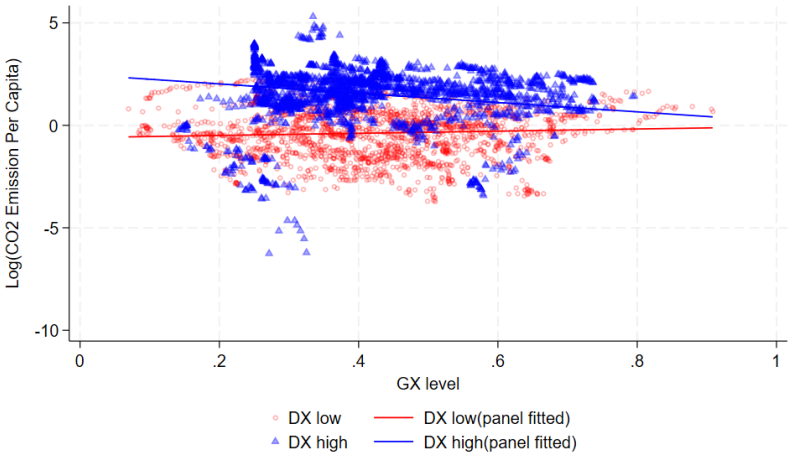
Note: Countries are categorized by their GX and DX levels.
Source: Oh et al. (2025).

2. Role of Policy and Institutions

Beyond technological factors, the analysis highlights the importance of policy and institutional conditions in shaping transformation outcomes. Countries with strong political commitment, coherent policy frameworks, and effective governance structures tend to achieve more favorable results in green transformation.

This suggests that green digital transformation is not solely a technological or industrial issue but a broader development challenge that requires coordinated policy efforts, institutional capacity, and long-term strategic vision. Development cooperation can play a crucial role in supporting these enabling conditions, particularly in countries where domestic capacity is limited.

Figure 2. Effects of GX on C02 Emission by DX levels



Note: Country-level panel analysis result.
Source: Oh et al. (2025).

III. Donor Approaches and Emerging Trends

A review of major donor countries' development cooperation strategies reveals several common trends in the integration of green and digital agendas.

First, many donors are increasingly **mainstreaming climate considerations into digital development programs**. For example, Australia and the United Kingdom position climate change as a central development priority while treating digital technologies as key implementation tools. This approach is reflected in the incorporation of climate safeguards into digital infrastructure projects, ensuring that environmental risks are assessed and mitigated.

Second, there is growing emphasis on **private sector participation**. Donors are leveraging public-private partnerships to mobilize investment in digital solutions for climate action, particularly in areas such as renewable energy management, smart infrastructure, and environmental monitoring.

Third, donors are expanding the use of **blended finance mechanisms**, combining public funding with private investment to scale up projects and improve financial sustainability.

These trends indicate that development cooperation is evolving toward a model that integrates climate and digital objectives while emphasizing scalability, sustainability, and innovation.

IV. Developing Countries' Demand and Constraints

Developing countries are increasingly recognizing the importance of integrating green and digital transformation, but implementation remains constrained by multiple factors.

Key barriers include inadequate infrastructure, limited institutional capacity, and insufficient financial resources. In many countries, digital and green initiatives are pursued separately, potentially resulting in fragmented and less effective outcomes.

Despite these challenges, several common areas of demand can be identified:

- Energy systems: Smart grids, digital energy management, and AI-based forecasting for renewable energy integration
- Climate monitoring: Satellite, drone, and data analytics technologies for environmental monitoring and disaster response
- Digital infrastructure sustainability: Green data centers and energy-efficient ICT systems
- Circular economy: E-waste management and resource recycling systems

Smart cities are also emerging as integrated platforms where green and digital transformation can be pursued simultaneously.

V. Policy Implications

Korea possesses strong capabilities in digital government, data governance, and energy management systems. These strengths provide a solid foundation for supporting developing countries in areas such as climate data platforms, renewable energy monitoring, and sustainable ICT infrastructure.

Based on the analysis, this report proposes a **three-phase cooperation strategy** for Korea. The initial phase focuses on establishing the institutional and financial foundations for green digital transformation. For example, institutional mechanisms such as environmental screening ("green filter") should be introduced to large-scale digital infrastructure projects to ensure sustainability. Financing mechanisms should be diversified through blended finance and global partnerships, including initiatives such as K-GDX. In the second phase, pilot projects should be implemented using public funding and then expanded through blended finance mechanisms. With enhanced private sector participation, strategic priority should be given to areas such as energy, climate adaptation, and the circular economy. The final phase aims to ensure long-term sustainability through localization and technology transfers.

For Korea, adopting an integrated, phased, and partnership-based approach will be essential for enhancing its contribution to global sustainable development. By aligning its digital strengths with green objectives, Korea can play a leading role in promoting inclusive and sustainable green digital transformation worldwide.KIEP