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Book Review

Digital Sustainability: Leveraging Digital Technology to Combat Climate Change

Thabed Tholib Baladraf

Department of Agroindustrial Technology, Faculty of Agricultural Technology, IPB University, Indonesia

***Correspondence author:** thabedtholib@apps.ipb.ac.id*

Introduction

Digital Sustainability: Leveraging Digital Technology to Combat Climate Change by Theo Lynn, Pierangelo Rosati, David Kreps, and Kieran Conboy is a collective work that positions itself at the crucial intersection between digital transformation and environmental sustainability. Published as part of the Palgrave Studies in Digital Business & Enabling Technologies series, this book reflects the growing academic and practical recognition that digital technologies play a dual role in contemporary society. On the one hand, they are frequently criticized for contributing to environmental degradation by escalating energy consumption, electronic waste, and the extraction of rare earth minerals. However, the same technologies also possess remarkable transformative potential to mitigate climate change, accelerate the achievement of sustainable development goals, and support the transition toward greener economic systems.

The book's core contribution lies in integrating Green IT and Green IS unified framework for digital–environmental governance, offering a coherent conceptual lens for understanding how digital systems shape sustainability transitions. Although previous studies have typically separated the sustainability of digital infrastructures (Green IT) from the enabling role of information systems in environmental governance (Green IS), this book brings both strands together into a single analytical architecture. This integration is conceptually valuable because it frames digitalization not merely as an operational tool but as a structural driver of socio-technical change. However, this conceptual ambition is not matched by empirical rigour. Methodologically, the book does not articulate a clear research design; it lacks systematic case selection, comparative policy evaluation, and quantitative assessments of carbon or energy barriers that limit its usefulness for evidence-based planning and empirical validation. Additionally,

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Address: Jalan Proklamasi 70, Central Jakarta, Indonesia 10320
Phone: +62 21 31928280/31928285
Fax: +62 21 31928281
E-mail: journal.pusbindiklatren@bappenas.go.id

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the predominantly Eurocentric framing restricts the applicability of its claims to development contexts, particularly in low- and middle-income countries, where infrastructural constraints, governance deficits, and digital divides shape the feasibility of sustainability-oriented digital interventions. The book's argumentation is coherent at the conceptual level but insufficiently robust when judged against empirical validation or comparative evidence, limiting the generalizability of its claims.

This review evaluates the book based on four criteria commonly used in digital sustainability scholarship: (1) theoretical coherence, (2) empirical grounding and depth of case evidence, (3) policy applicability, and (4) attention to global inequalities. The book performs strongly on the first criterion by offering a coherent integration of Green IT and Green IS, but it performs weakly on the second because of its lack of systematic case studies, comparative policy evaluations, or quantitative assessments. In terms of policy relevance, the framework provides a useful conceptual direction but does not offer empirically tested strategies for implementation. Finally, the book's limited engagement with the Global South context represents a significant shortcoming with respect to global inequality considerations.

The book's reliance on European cases overlooks the structural realities that define digital sustainability challenges in the Global South, including unequal broadband access, dependence on imported digital hardware, weak regulatory institutions, and persistent gaps in digital literacy. These omissions implicitly universalize a model of digital transition that presumes mature infrastructure and strong governance conditions, assumptions that are rarely held in most developing economies. While the book acknowledges the tensions between computational demand and environmental limits, it does not offer strategies for addressing rebound effects or engaging with global power asymmetries in data governance. These gaps significantly constrain the book's relevance to sustainability transitions in low- and middle-income countries. This book insufficiently addresses climate justice, digital justice, and the unequal distribution of environmental burdens, which are essential considerations for evaluating the societal implications of digital transitions. This omission is a major limitation, as digital sustainability cannot be meaningfully assessed without integrating equity, justice, and the unequal distribution of environmental risk.

Compared to Kitchin's (2014) work on data-driven urbanism and Köhler et al.'s (2019) more data-driven work, this book offers a more integrated framework but is less empirically validated owing to its conceptual nature. Despite these limitations, this framework has several points of practical relevance. For development planners and policymakers, the book's most meaningful contributions emerge from its sectoral insights into energy systems, urban governance, and agriculture. Its framework offers analytical direction for domains such as energy-efficient data centers, circular IT procurement, renewable digital infrastructure, and climate-smart agriculture. Although these insights remain high-level, they provide a basis for assessing digital infrastructure investments, anticipating sustainability trade-offs, and aligning innovation with decarbonization pathways. Yet the lack of empirical grounding and limited engagement with Global South constraints means the framework requires adaptation before informing context-sensitive planning. Structured across seven chapters, the book moves from the conceptual foundations of Green IT and Green IS toward sectoral applications. While largely conceptual, the chapters outline a coherent scaffolding that this review evaluates in greater depth.

Body

The first part of the book provides a strong conceptual foundation by offering a clear definition of *digital sustainability* and by unpacking its core dimensions. The authors carefully distinguished between two complementary perspectives, namely greening of digital technologies (Green IT) and the greening by digital technologies (Green IS). Green IT refers to efforts of minimize the environmental footprint of digital infrastructure and the processes themselves. This includes reducing the energy consumption in data centers, improving hardware efficiency, optimizing software performance, and extending the lifecycle of technological devices to limit electronic waste. In contrast, Green IS emphasizes how digital technologies can be strategically employed as enablers of sustainability in other domains, for example, by supporting carbon monitoring systems, enhancing supply chain transparency, or enabling smart energy grids. Thus, the book situates Green IT and Green IS as two interdependent yet distinct approaches, both of which are crucial for a holistic understanding of digital sustainability. The book acknowledges the trade-off between computational performance and sustainability but does so largely descriptively, without deeper analytical

engagement. In alignment with this theoretical foundation, the book draws on frameworks such as Winkelmann et al. (2024) to situate digital sustainability across the lifecycle of digital technologies and to link it with broader concepts, such as the circular economy and twin transformation. While this contextualization helps position the book within current debates, much of the discussion remains descriptive. It could have been more critically oriented toward evaluating how convincingly these concepts are operationalized throughout the chapters.

The second part of the book traces the evolution of Green IT, beginning with the early recognition of the carbon footprint generated by digital technologies. Initially, debates were centered on the energy consumption of hardware and the environmental burden of large-scale data centers. However, over time, the scope of analysis has expanded toward a systemic perspective, encompassing not only the production and use of digital devices but also their entire lifecycle. Practices aligned with the circular economy, such as repair, reuse, refurbishment, and recycling, are increasingly emphasized as necessary strategies to mitigate e-waste and extend the utility of technological assets. By situating Green IT within a wider value chain, the book critically examines how environmental costs are embedded in each phase, from raw material extraction and manufacturing to usage and disposal. Moreover, it highlights the specific challenges posed by energy-intensive technologies, such as artificial intelligence, blockchain, and high-performance computing. While these innovations generate new opportunities for efficiency and growth, they also create ecological pressure that may undermine sustainability objectives. This paradox reflects the conclusions of Cherepukhin et al. (2022), who argued that the trajectory of digital development often brings profound social vulnerabilities and ecological costs, suggesting the need for a more balanced and responsible approach. The book overlooks several structural issues that fundamentally shape the environmental and social implications of digital technologies, such as rebound effects, the concentration of digital power within major platforms, and the persistence of digital greenwashing. By not engaging with these political and economic dynamics, the analysis risks underestimating the systemic constraints that often undermine sustainability-oriented digital initiatives, particularly in contexts with weak regulation.

Building on this, the third section introduces the concept of artificial intelligence as a transformative accelerator, particularly in the context of twin transformation, the simultaneous pursuit of digital transformation and sustainability transformation. AI is presented not only as a computational tool, but also as a strategic enabler with the capacity to process massive and complex data flows that would otherwise remain unmanageable. Its applications have been discussed across a variety of domains, including energy efficiency optimization, sustainable supply chain management, circular production systems, and natural resource monitoring. Importantly, the authors propose an initial roadmap for interdisciplinary research and practice, structured across three levels of analysis. At the strategic level, AI supports long-term visioning and policy-making; at the tactical level, it guides decision-making in organizational processes and resource allocation; and at the operational level, it enables real-time monitoring and prediction. This layered framework underscores the multidimensional potential of AI in advancing both technological and ecological goals, while also recognizing the importance of governance, ethics, and cross-sectoral collaboration to ensure that its deployment aligns with sustainability imperatives.

The subsequent sections of the book move beyond conceptual discussions to present sector-specific case studies that demonstrate how digital sustainability is operationalized in practice. The fourth section focuses on the energy sector, where advanced computational techniques such as deep learning and reinforcement learning are increasingly applied to smart grids, energy storage systems, and the integration of renewable resources. These approaches not only improve grid efficiency and stability but also enhance resilience in the face of fluctuating demand and intermittent supply from renewable sources. This discussion underscores that digital technologies, while promising, also introduce new vulnerabilities, particularly in relation to cybersecurity, privacy, and data governance. As energy infrastructures become more digitized, ensuring secure and transparent data management is a prerequisite for achieving sustainable outcomes.

The fifth section extends the analysis to urban environments, positioning smart cities as a critical locus where digitalization and sustainability converge. The discussion on smart cities presents numerous examples of digital applications across transportation, buildings, waste, and environmental monitoring. However, much of this section is descriptive in nature. The authors acknowledge governance and equity challenges, but the analysis would be stronger had it more critically assessed how these socio-political factors shape the uneven outcomes of smart city initiatives.

The sixth section focuses on the food and agricultural sector, an area where digital sustainability directly intersects with issues of global food security. Emphasis is placed on smart farming and climate-smart agriculture, which integrate digital tools such as IoT sensors, AI-driven predictive analytics, and blockchain-based traceability systems. These technologies offer three benefits: social (improving farmers' livelihoods), environmental (reducing inputs and emissions), and economic (enhancing productivity and market access). However, the authors also identified significant barriers to adoption, ranging from demographic factors (age and farmers' digital literacy) to psychological resistance, infrastructure gaps, and inadequate policy support. Insights from global organizations such as FAO, OECD, and the European Union situate these technological innovations within the broader context of international governance frameworks for food sustainability, reinforcing the view that technological solutions must be embedded within coherent regulatory, institutional, and cultural ecosystems.

The book concludes by situating its arguments within the broader framework of the circular economy, with an emphasis on sustainable product management. Here, the discussion is enriched through case studies of digital product passports, exemplified in the context of electric vehicle batteries. Digital product passports integrate multiple advanced technologies (artificial intelligence, data analytics, IoT sensors, and blockchain ledgers) to monitor and document the entire lifecycle of products. By capturing data on sourcing, production, usage, and end-of-life phases, passports aim to enable greater transparency, facilitate repair and refurbishment, and ultimately support more effective recycling and resource recovery. In doing so, the book highlights how digital sustainability can move beyond abstract concepts to create concrete mechanisms that operationalize circularity in complex global industries.

From a methodological perspective, the book is strongest in its ability to develop a coherent conceptual framework and synthesize diverse sectoral applications ranging from energy and urban infrastructure to agriculture and food systems. Its analytical breadth makes it valuable as a reference point for both scholars and practitioners interested in understanding the intersections between digitalization and sustainability. However, the book’s chapters are predominantly normative and descriptive, relying heavily on conceptual discussions and illustrative examples rather than empirical testing or quantitative analysis. As a result, while the reader gains an overview of potential applications and guiding principles, there is less clarity on measurable impacts, comparative performance, or trade-offs that can be substantiated with data-driven evidence.

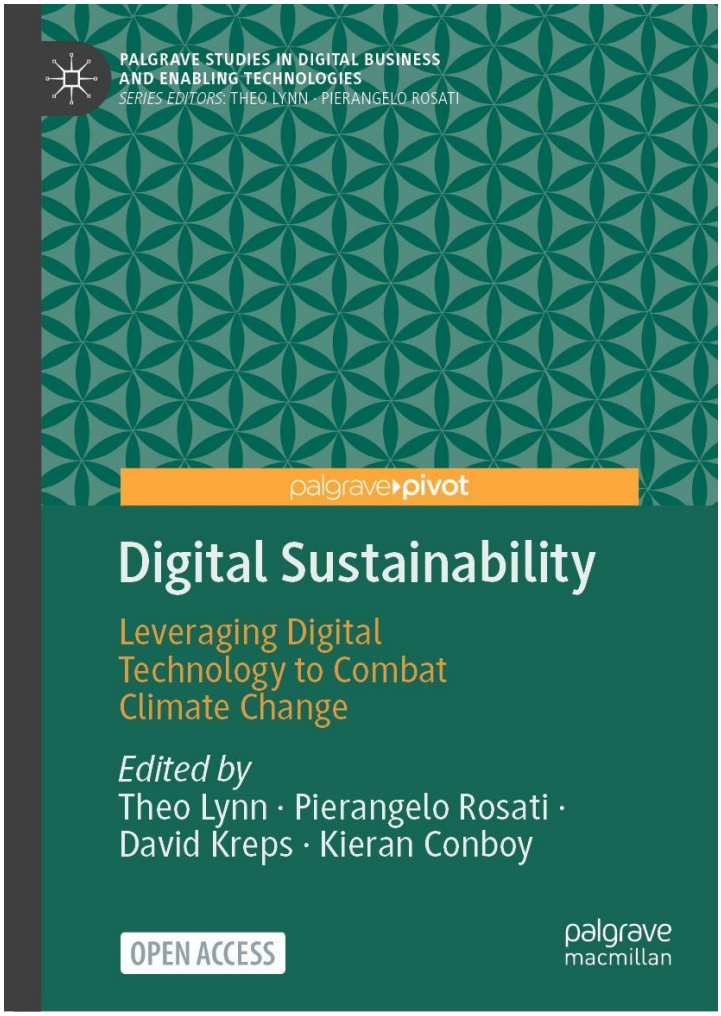
Another notable limitation is the geographical scope of the book. By focusing primarily on European policy and the industrial context, the narrative risks overlooking the challenges and opportunities faced in other regions, particularly in developing countries. These contexts are often characterized by digital divides, infrastructural deficiencies, resource constraints, and governance systems that differ significantly from the European model. Without paying attention to these variations, the book’s relevance to a global audience is somewhat circumscribed. Moreover, certain critical dimensions remain underexplored, such as the ethical implications of pervasive digital monitoring, the potential for rebound effects where efficiency gains paradoxically increase consumption, and the broader social consequences of deploying advanced technologies in contexts with unequal access. These omissions suggest fertile ground for further research, especially in integrating ethical, cultural, and socio-economic perspectives into the discourse on digital sustainability.

Conclusion

For development studies, the book contributes by reframing digitalization as a structural driver of sustainability transitions, providing conceptual tools directly relevant to climate governance, smart urban planning, and food system resilience. It offers an important analytical lens for understanding how digital transformation can be directed to support the Sustainable Development Goals (SDGs), particularly in the areas of clean energy, sustainable agriculture, and responsible consumption and production. However, further research is needed that incorporates the realities of low and middle-income countries, especially regarding infrastructure gaps, unequal technological access, and regulatory limitations. Overall, Digital Sustainability makes a valuable contribution to the literature on twin transformation, combining Green IT and Green IS perspectives with cross-sector analysis relevant to public policy and corporate strategy. Its strength lies in its structured and interdisciplinary presentation of concepts, while its weakness is its empirical limitations and geographical scope. For academics, policymakers, and practitioners, this book

offers a rich conceptual map for navigating the challenges and opportunities of the digital age, which must also be sustainable.

Cover book



References

Cherepukhin, T. Y., Savelyeva, N. K., Kovalenko, A. M., & Ivanova, O. B. (2022). Conflicts of Digital Development's Sustainability and Resolving Them Through the Balance of Social, Ecological, and Economic Interests During Technological Progress (E. G. Popkova & M. Chatterji, Eds.). *Technology, Society, and Conflict*, Vol. 30. Emerald Publishing Limited. https://doi.org/10.1108/S1572-832320220000030008

Kitchin, R. (2014). The Data Revolution: Big Data, Open Data, Data Infrastructures & Their Consequences. United Kingdom: SAGE Publications Ltd. https://doi.org/10.4135/9781473909472

Köhler, J., Geels, F. W., Kern, F., Markard, J., Onsongo, E., Wieczorek, A., … Wells, P. (2019). An agenda for sustainability transitions research: State of the art and future directions. *Environmental Innovation and Societal Transitions*, *31*, 1–32. https://doi.org/10.1016/j.eist.2019.01.004

Winkelmann, S., Guennoun, R., Möller, F., Schoormann, T., & van der Valk, H. (2024). Back to a resilient future: Digital technologies for a sustainable supply chain. In *Information Systems and e-Business Management* (Vol. 22). Springer Berlin Heidelberg. https://doi.org/10.1007/s10257-024-00677-z