INTERNATIONAL JOURNAL OF COMPUTER SCIENCE & INFORMATION SYSTEM

Volume10 Issue11, November-2025, pg. 59-65

Published Date: - 30-11-2025

E-ISSN: 2536-7919
P-ISSN: 2536-7900
SJIF 2019: 4.58 2020: 5.046 2021: 5.328

Circular Business Model Innovation: Integrating Design, Digitalization, and Institutional Perspectives for Sustainable Value Creation

Rajesh V. Menon

Global Institute of Sustainable Innovation, University of Manchester, United Kingdom

Abstract: The transition toward circular economy paradigms has become a central focus in sustainability research and practice, emphasizing the need for innovative business models that extend product life cycles, minimize resource consumption, and maximize economic and environmental value. This study examines the multidimensional integration of circular business model innovation, product design strategies, and digital capabilities, with particular attention to institutional and organizational factors shaping adoption. Drawing on a comprehensive review of literature spanning circular economy frameworks, sustainable business model archetypes, digital business strategy, and resource management, this research identifies critical enablers, barriers, and mechanisms for implementing circular business models. Methodologically, this paper employs a qualitative synthesis approach, combining theoretical insights with empirical evidence from case studies and prior analyses. The findings reveal that successful circular business models require alignment between product design, organizational capabilities, stakeholder collaboration, and regulatory support, mediated by technological innovations such as big data analytics, smart systems, and digital platforms. Furthermore, institutional pressures, legitimacy strategies, and consumption policies significantly influence the uptake and diffusion of circular practices. The study highlights the necessity of viewing circular business models not only as economic instruments but as socio-technical and institutional innovations capable of fostering systemic sustainability transitions. By elucidating these linkages, this research offers both theoretical and practical guidance for corporations, policymakers, and academics aiming to advance circular economy principles. Implications for future research include the need for longitudinal studies to assess dynamic interactions among design, technology, and institutional factors, as well as the development of integrative evaluation frameworks for measuring circular performance.

Keywords: Circular economy, business model innovation, product design, digital strategy, sustainability, institutional theory, resource management.

INTERNATIONAL JOURNAL OF COMPUTER SCIENCE & INFORMATION SYSTEM

Volume10 Issue11, November-2025, pg. 59-65

Published Date: - 30-11-2025

E-ISSN: 2536-7919
P-ISSN: 2536-7900
SJIF 2019: 4.58 2020: 5.046 2021: 5.328

INTRODUCTION

The contemporary discourse on sustainability has witnessed a paradigmatic shift toward circular economy (CE) frameworks, emphasizing regenerative resource cycles, value retention, and environmental stewardship (Reike, Vermeulen & Witjes, 2018; The Ellen MacArthur Foundation, 2013). Traditional linear models of production and consumption—characterized by "take, make, dispose" logic—have been increasingly criticized for their ecological inefficiency, resource depletion, and contribution to environmental degradation (Allwood, 2014). Consequently, scholars and practitioners have explored mechanisms for embedding circular principles into business operations, with circular business models (CBMs) emerging as pivotal instruments in operationalizing CE objectives (Geissdoerfer et al., 2020).

The conceptual evolution of CBMs integrates diverse theoretical lenses, including product design, organizational innovation, digital capabilities, and institutional theory. Product design strategies, for instance, play a critical role in determining the circular potential of products through modularity, durability, reparability, and material recyclability (Bocken, de Pauw, Bakker & van der Grinten, 2016; de Kwant, Rahi & Laurenti, 2021). Simultaneously, digitalization, particularly the deployment of big data analytics, smart systems, and IoT-enabled tracking mechanisms, enables enhanced resource efficiency, predictive maintenance, and usage-focused service models (Akter et al., 2016; Bressanelli et al., 2018). These technological affordances are complemented by institutional frameworks, which shape legitimacy, regulatory compliance, and stakeholder engagement, thereby influencing the diffusion and scalability of circular practices (Arranz & Arroyabe, 2023; Alpsahin Cullen, 2023).

Despite the growing scholarship on CBMs, several gaps remain. First, while existing studies often emphasize technological or product-centric dimensions, the interplay between design, digital capabilities, and institutional influences is underexplored. Second, empirical analyses frequently focus on discrete industries or regional contexts, limiting the generalizability of findings. Third, there is a need to reconcile theoretical perspectives from business model innovation, organizational strategy, and sustainability transitions to provide an integrative understanding of CBM implementation (Bidmon & Knab, 2018; Bocken, Boons & Baldassarre, 2019).

This study addresses these gaps by offering a holistic synthesis of CBM literature, emphasizing the integration of product design, digital technologies, and institutional factors in promoting sustainable value creation. The research interrogates the following questions: How do product design strategies influence CBM effectiveness? In what ways can digital capabilities enhance circular operations and stakeholder engagement? What institutional mechanisms facilitate or hinder the adoption of circular practices? By answering these questions, the paper contributes to both theoretical refinement and practical guidance for CE transitions.

METHODOLOGY

INTERNATIONAL JOURNAL OF COMPUTER SCIENCE & INFORMATION SYSTEM

Volume10 Issue11, November-2025, pg. 59-65

Published Date: - 30-11-2025

E-ISSN: 2536-7919
P-ISSN: 2536-7900
SJIF 2019: 4.58 2020: 5.046 2021: 5.328

This research adopts a qualitative, literature-based methodology, employing systematic synthesis techniques to integrate insights from diverse scholarly contributions on CBMs, circular economy frameworks, and organizational strategy. The study draws on more than fifty peer-reviewed articles, industry reports, and authoritative conceptual frameworks spanning the fields of sustainability, management information systems, industrial engineering, and institutional theory. Sources were selected based on relevance, citation impact, and contribution to theoretical and practical discourse on CBMs (Alcayaga, Wiener & Hansen, 2019; Geissdoerfer et al., 2020).

The analytical approach comprised three sequential phases. First, a comprehensive thematic extraction was conducted, categorizing content into four primary domains: (i) circular product design strategies, (ii) digital and data-driven capabilities, (iii) organizational and business model innovation, and (iv) institutional and regulatory influences. Second, cross-thematic integration was undertaken to identify interdependencies, synergies, and tensions among these domains. For instance, the analysis examined how digital capabilities facilitate usage-based business models, which, in turn, depend on modular and durable product designs (Bressanelli et al., 2018; de Mattos & de Albuquerque, 2018). Third, the synthesis incorporated critical discourse and comparative analysis techniques, evaluating the conceptual robustness, empirical evidence, and applicability of CBM strategies across different industrial and geographical contexts (Al-Debei & Avison, 2010; Reike et al., 2018).

A key feature of the methodology is the emphasis on descriptive and interpretive analysis rather than quantitative aggregation, reflecting the complex, multidimensional nature of CBM phenomena. By prioritizing theoretical integration and explanatory depth, this study aims to provide a nuanced understanding of mechanisms, enablers, and barriers, offering insights that can guide both scholarly inquiry and managerial practice.

RESULTS

The synthesis of the literature reveals several critical findings concerning CBM design, implementation, and institutional embedding.

Circular Product Design as a Strategic Lever

Product design emerged as a foundational determinant of CBM success, shaping the feasibility and efficiency of circular strategies such as remanufacturing, refurbishment, and closed-loop recycling (Bocken et al., 2016; de Kwant et al., 2021). Modular architectures enable easier repair, component substitution, and upgradability, thereby extending product lifespans and facilitating secondary markets. Material selection and eco-effective design principles, including low-carbon, recyclable, or bio-based inputs, further support resource retention and environmental impact reduction (Dahmani et al., 2021; Allwood, 2014). Importantly, product design is not merely a technical exercise but also a strategic and organizational activity, requiring alignment with business models, supply chain capabilities, and consumer behavior patterns (Bocken et al., 2014; de Mattos & de Albuquerque, 2018).

INTERNATIONAL JOURNAL OF COMPUTER SCIENCE & INFORMATION SYSTEM

Volume10 Issue11, November-2025, pg. 59-65

Published Date: - 30-11-2025

E-ISSN: 2536-7919
P-ISSN: 2536-7900
SJIF 2019: 4.58 2020: 5.046 2021: 5.328

Digitalization and Big Data as Enablers of Circularity

Digital technologies, particularly big data analytics, IoT, and smart systems, provide critical support for operationalizing CBMs. Data-driven insights enable predictive maintenance, optimize resource flows, and facilitate usage-based service models, transforming traditional ownership models into service-oriented arrangements (Akter et al., 2016; Bressanelli et al., 2018; Chen, Preston & Swink, 2015). Moreover, digital platforms enhance transparency, traceability, and stakeholder engagement, fostering consumer trust and supporting institutional legitimacy (Bharadwaj et al., 2013; Brown, 2019). The literature emphasizes that the value derived from digitalization is contingent upon integration with organizational strategy, highlighting the need for alignment between technological investment and business objectives (Buhl et al., 2013).

Institutional Context and Legitimacy Mechanisms

Institutional forces, including regulatory policies, consumption norms, and legitimacy pressures, significantly influence the adoption and diffusion of CBMs (Arranz & Arroyabe, 2023; Alpsahin Cullen, 2023; Bocken & Coffay, 2024). Legitimacy strategies, such as sustainability reporting, collaborative initiatives, and stakeholder engagement, enable firms to navigate institutional expectations and foster social acceptance. Institutional theory underscores that organizational adaptation to environmental demands is not solely voluntary but often shaped by coercive, normative, and mimetic pressures (Aldrich, 1999; Bidmon & Knab, 2018). Evidence from European and Asian contexts indicates that policies promoting circular procurement, waste reduction, and extended producer responsibility accelerate CBM implementation, while weak institutional support can constrain innovation and adoption (Chun et al., 2022; Kanther, 2025).

Integration Across Design, Technology, and Institutions

The findings indicate that CBM effectiveness is maximized when product design, digital capabilities, and institutional alignment are synergistically integrated. For example, usage-focused business models rely on modular design to facilitate product returns and refurbishment, while digital monitoring systems provide data for operational optimization and customer engagement (Bressanelli et al., 2018; de Kwant et al., 2021). Simultaneously, institutional support in the form of favorable regulations, incentives, and legitimacy channels ensures scalability and societal acceptance. Failure to achieve such integration can result in fragmented efforts, operational inefficiencies, and limited environmental impact (Reike et al., 2018; Bocken et al., 2019).

DISCUSSION

The integrative perspective presented in this study offers several theoretical and practical implications.

Theoretical Implications

Volume10 Issue11, November-2025, pg. 59-65

Published Date: - 30-11-2025

E-ISSN: 2536-7919
P-ISSN: 2536-7900
SJIF 2019: 4.58 2020: 5.046 2021: 5.328

First, the synthesis underscores the multidimensional nature of CBMs, extending beyond product design or technological solutions to encompass organizational, strategic, and institutional dimensions. By conceptualizing CBMs as socio-technical innovations, this research contributes to a more holistic understanding of sustainability transitions (Boons, 2009; Boons & Bocken, 2018). Second, the alignment of product design and digitalization demonstrates the interdependence of physical and informational resource flows, emphasizing the necessity of coordinated strategy and capability development (Akter et al., 2016; Chen et al., 2015). Third, the integration of institutional theory provides insights into how legitimacy, policy frameworks, and social norms shape adoption trajectories, bridging gaps between micro-level business practices and macro-level systemic change (Arranz & Arroyabe, 2023; Alpsahin Cullen, 2023).

Managerial Implications

For practitioners, the findings highlight the importance of cross-functional collaboration and strategic alignment in CBM implementation. Firms must invest in modular and durable product architectures, embed digital tracking and analytics capabilities, and engage proactively with institutional actors to secure regulatory compliance and social acceptance (Bocken et al., 2016; Bressanelli et al., 2018). Furthermore, organizations should recognize the potential for CBMs to generate competitive advantage through differentiated value propositions, enhanced customer loyalty, and resource efficiency. Importantly, managers must navigate trade-offs between upfront investment in design and technology and long-term sustainability and profitability benefits (Bocken et al., 2014; Reike et al., 2018).

Limitations and Future Research

Despite its comprehensive scope, this study has limitations. The reliance on secondary literature and qualitative synthesis precludes quantitative generalization and may be subject to interpretive bias. Moreover, industry-specific contextual factors may influence the applicability of findings across sectors and geographies. Future research should employ longitudinal and empirical studies to examine dynamic interactions among design, technology, and institutional factors. Additionally, developing integrative evaluation frameworks and performance metrics for CBMs can enhance measurement rigor and support evidence-based policy and managerial decision-making. Investigating the role of consumer behavior, social innovation, and circular finance mechanisms also represents promising avenues for extending understanding of CBM efficacy.

CONCLUSION

The adoption of circular business models represents a strategic and socio-technical pathway toward sustainable value creation, integrating product design, digital capabilities, and institutional alignment. Product design provides the foundational architecture for resource efficiency and product lifecycle extension, while digital technologies enable operational optimization, usage-based models, and stakeholder engagement. Institutional mechanisms, including regulatory frameworks, legitimacy

Volume10 Issue11, November-2025, pg. 59-65

Published Date: - 30-11-2025

E-ISSN: 2536-7919
P-ISSN: 2536-7900
SJIF 2019: 4.58 2020: 5.046 2021: 5.328

pressures, and consumption policies, further shape adoption trajectories and systemic impact. The integrative analysis presented here demonstrates that CBMs are not isolated interventions but require coordinated action across design, technology, and institutional domains. By elucidating these interdependencies, this research contributes to theoretical advancement, managerial guidance, and policy formulation, advancing the broader agenda of circular economy transitions and sustainable business practice.

REFERENCES

1. Ackoff, R. (1989). From data to wisdom. Journal of Applied Systems Analysis, 16, 3–9.
2. Aid, G., Eklund, M., Anderberg, S., & Baas, L. (2017). Expanding roles for the Swedish waste management sector in inter-organizational resource management. Resources, Conservation and Recycling, 124, 85–97.
3. Akter, S., Wamba, S. F., Gunasekaran, A., Dubey, R., & Childe, S. J. (2016). How to improve firm performance using big data analytics capability and business strategy alignment? International Journal of Production Economics, 182, 113–131.
4. Al-Debei, M. M., & Avison, D. (2010). Developing a unified framework of the business model concept. European Journal of Information Systems, 19(3), 359–376.
5. Alcayaga, A., Wiener, M., & Hansen, E. G. (2019). Towards a framework of smart-circular systems: An integrative literature review. Journal of Cleaner Production, 221, 622–634.
6. Aldrich, H. (1999). Organizations Evolving. London: Sage Publications Ltd.
7. Alpsahin Cullen, U. (2023). Exploring a circular business model: insights from the institutional theory perspective and the business model lens. International Journal of Entrepreneurship and Innovation, 24(1), 58–69.
8. Arranz, C. F. A., & Arroyabe, M. F. (2023). Institutional theory and circular economy business models: the case of the European Union and the role of consumption policies. Journal of Environmental Management, 340, 117906.
9. Bharadwaj, A., Sawy, O., Pavlou, P., & Venkatraman, N. (2013). Digital business strategy: toward a next generation of insights. MIS Quarterly, 37(2), 471–482.
10. Bocken, N., de Pauw, I., Bakker, C., & van der Grinten, B. (2016). Product design and business model strategies for a circular economy. Journal of Industrial and Production Engineering, 33(5), 308–320.
11. Bocken, N., Short, S. W., Rana, P., & Evans, S. (2014). A literature and practice review to develop sustainable business model archetypes. Journal of Cleaner Production, 65, 42–56.
12. Bocken, N., Boons, F., & Baldassarre, B. (2019). Sustainable business model experimentation by understanding ecologies of business models. Journal of Cleaner Production, 208, 1498–1512.
13. Bocken, N., Coffay, M. (2024). Circular business model innovation in the U.S. - an institutional perspective. Proceedings of the 9th International Conference on New Business Models, Donostia/San Sebastian, 3–5 July 2024.

Volume10 Issue11, November-2025, pg. 59-65

Published Date: - 30-11-2025

E-ISSN: 2536-7919
P-ISSN: 2536-7900
SJIF 2019: 4.58 2020: 5.046 2021: 5.328

14. Bocken, N., Konietzko, J. (2022). Circular business model innovation in consumer-facing corporations. Technological Forecasting and Social Change, 185, 12207.
15. Boons, F. (2009). Creating Ecological Value: An Evolutionary Approach to Business Strategies and the Natural Environment. Cheltenham, UK: Edward Elgar Publishing.
16. Boons, F., & Bocken, N. (2018). Towards a sharing economy–innovating ecologies of business models. Technological Forecasting and Social Change, 137, 40–52.
17. Bressanelli, G., Adrodegari, F., Perona, M., & Saccani, N. (2018). Exploring how usage-focused business models enable circular economy through digital technologies. Sustainability, 10(3).
18. Brown, P. (2019). Why do companies pursue collaborative circular oriented innovation? Sustainability, 11(3).
19. Buhl, H., Röglinger, M., Moser, F., & Heidemann, J. (2013). Big Data. Business & Information Systems Engineering, 5(2), 65–69.
20. Chen, D., Preston, D., & Swink, M. (2015). How the use of big data analytics affects value creation in supply chain management. Journal of Management Information Systems, 32(4), 4–39.
21. Chun, Y.-Y., Matsumoto, M., Chinen, K., Endo, H., Gan, S.-S., & Tahara, K. (2022). What will lead Asian consumers into circular consumption? An empirical study of purchasing refurbished smartphones in Japan and Indonesia. Sustainable Production and Consumption, 33, 158–167.
22. Kanther, S. D. (2025). Integrating circular business models in construction: A framework for design and planning to enhance sustainability. International Journal of Sustainability and Innovation in Engineering, 3, 26–33. https://doi.org/10.56830/IJSIE202502
23. Dahmani, N., Benhida, K., Belhadi, A., Kamble, S., Elfezazi, S., & Jauhar, S. K. (2021). Smart circular product design strategies towards eco-effective production systems: a lean eco-design industry 4.0 framework. Journal of Cleaner Production, 320, 128847.
24. D'Amato, D., Droste, N., Allen, B., Kettunen, M., Korhonen, J., Lähtinen, K., Leskinen, P., Matthies, B., & Toppinen, A. (2017). Green, circular, bio economy: A comparative analysis of sustainability avenues. Journal of Cleaner Production, 168(C), 716–734.
25. de Kwant, C., Rahi, A., & Laurenti, R. (2021). The role of product design in circular business models: An analysis of challenges and opportunities for electric vehicles and white goods. Sustainable Production and Consumption, 27, 1728–1742.
26. de Mattos, C., & de Albuquerque, T. (2018). Enabling factors and strategies for the transition toward a circular economy (CE). Sustainability, 10(12).
27. Ellen MacArthur Foundation. (2013). Towards the circular economy Vol. 1: an economic and business rationale for an accelerated transition.
28. Geissdoerfer, M., Pieroni, M. P. P., Pigosso, D. C. A., & Soufani, K. (2020). Circular business models: A review. Journal of Cleaner Production, 277, 123741.
29. Osterwalder, A., & Pigneur, Y. (2010). Business model generation: a handbook for visionaries, game changers, and challengers. Wiley.
30. Potting, J., Hekkert, M