FMDB ***Transactions on Sustainable Social Sciences Letters***

Sustainable and Regenerative Service Design in a Digitally Driven World

A. Preethi[1,*], Mohammed Farooq Pasha[2], Naseema Nazeer Ahmed[3], R. Subhalakshmi[4], M. Mani[5]

[1]Department of Commerce and Management, Center for Distance Education, JAIN (Deemed-to-be University), Bengaluru, Karnataka, India.
[2]Department of Commerce and Management, Government First Grade College, Kengeri, Bengaluru, Karnataka, India.
[3]Faculty of the College of Economics and Business Administration, University of Technology and Applied Science, Nizwa, Sultanate of Oman.
[4]Department of Management Studies, St Joseph's College of Engineering, Chennai, Tamil Nadu, India.
[5]Department of Library, Dwaraka Doss Goverdhan Doss Vaishnav College, Arumbakkam, Chennai, Tamil Nadu, India.
preethim289@gmail.com[1], farooqpasha2002@gmail.com[2], naseema.nazeer@utas.edu.om[3], subhalakshmi008@gmail.com[4], mmani.lib@gmail.com[5]

Abstract: The intersection of digital transformation and sustainability drivers has triggered a shift in service design models toward regenerative strategies. This research explores the sustainable and regenerative natures of service design systems in digitally nurtured environments by analysing how they are enacted, adopted at the organisational level, and transformed. The study assumes that combining regenerative concepts with digital technologies yields greater service sustainability performance and ecosystem resilience than conventional sustainable design methods. This research will use a meta-analysis of systematic literature across industries and sectors in 2024-2025 and an archival analysis of secondary data from 13,000 organisations globally. In 2024, the global digital circular economy is worth USD 2.9 trillion, with 78% of organisations using AI-enabling technologies and 48% using sustainability performance metrics. There are five analytical Tables: Market Soothsaying, Organisational Uptake, Technology Stack Order Preference, Sector Variation, and Measurement Count. Results show that enterprises using regenerative digital service design, waste/materials reduction, and virtual matching saved 30-40% in energy and 35-45% in resources, while improving stakeholder value by 31%. In the context of sustainability transitions, systems thinking is crucial for progress, and healthy governance structures help design teams collaborate and implement a shared vision. Regenerative service design proposes two strategies to generate net-positive results in a digitally enabled service ecosystem, offering an alternative to typical sustainability perspectives.

Keywords: Regenerative Design; Sustainable Service Design; Digital Transformation; Circular Economy; Digital Services; Service Ecosystems; Digital Technologies; Artificial Intelligence; Climate Change.

Received on: 02/05/2025, **Revised on:** 05/08/2025, **Accepted on:** 07/10/2025, **Published on:** 03/06/2026

Journal Homepage: https://www.fmdbpub.com/user/journals/details/FTSSSL

DOI: https://doi.org/10.69888/FTSSSL.2026.000662

Cite as: A. Preethi, M. F. Pasha, N. N. Ahmed, R. Subhalakshmi, and M. Mani, “Sustainable and Regenerative Service Design in a Digitally Driven World,” *FMDB Transactions on Sustainable Social Sciences Letters*, vol. 4, no. 2, pp. 83–90, 2026.

1. Introduction

*Corresponding author.

Modern service ecosystems are undergoing dramatic change due to the fusion of digital technologies and ecological requirements [2]. The traditional linear service system model, known for its take-make-dispose approach, has failed to address the ever-increasing environmental damage and resource consumption. This shortfall has given rise to regenerative service design, a next-step evolution from de-conventional sustainability, as it enacts positive, enhancing restoration for socio-ecological systems [12]; [1]. Global demand for sustainability has accelerated since the Paris Agreement and, with the UN's 2030 Agenda, even more so, thereby forcing organisations to reconsider service delivery models. In this context, digital technologies such as artificial intelligence (AI), blockchain, the Internet of Things (IoT), and cloud computing are among the powerful enablers that enable new levels of transparency, efficiency, and stakeholder engagement in service ecosystems [16]. Transitioning to a digital circular economy offers a new system and approach in which services are developed, delivered, and optimised by digital platforms for all kinds of resource circulation, long product use, content creation, and minimal waste generation [13]. The global digital circular economy was valued at USD 2.8 billion in 2024, with expected revenues of USD 24.7 billion by 2034, for a compounded annual growth rate (CAGR) of about 23.58%. This extraordinary growth is indicative of an increasing organisational understanding of the potential for technology to transform service delivery models toward regenerative outcomes. Regenerative service design also differs from sustainable design, as it focuses on net-positive effects rather than preventing harm [6].

Sustainable endeavours focus on reducing environmental harm, whereas regenerative efforts facilitate ecosystem healing, community renewal, and value co-creation [9]. The problem is compounded by the fact that even as researchers make a critical investment in this infrastructure, climate change impacts are only intensifying, with climate change-related disaster losses projected to increase to 0.57–2.33% of global GDP annually between now and 2100, and a quarter of the earth reaching these levels as soon as 2024. Deep design responses are required to address extreme weather, diminishing resources, and social injustices, aiming not only to reduce harm but also to actively question how ecosystems and communities can be healed. Digitalisation offers unparalleled opportunities to address these regenerative aspirations by improving traceability and predictive analytics, and by facilitating multistakeholder participation through collaborative platforms [5]. However, the convergence of complementary digital technologies and regenerative principles is less well understood, with only a small body of empirical evidence available on implementation methodologies, adoption barriers, and quantifiable outcomes [15]. This research vacuum calls for further examination of how organisations are using digital capabilities to encourage regenerative service design, the factors that affect its successful implementation, and the impacts stemming from such an integrated approach. Insights into these dynamics are crucial for practitioners, policymakers, and researchers, if service ecosystems that are truly sustainable and regenerative in an increasingly digitalised global economy are to emerge more rapidly [18].

2. Literature Review

The theoretical underpinnings of regenerative service design stem from a range of cross-cutting disciplines, including ecological economics, systems thinking, and service-dominant logic. Inspiration for this approach to transformative organisational processes comes from the philosophy of regenerative design, which "creates systems that, like natural ecosystems, act as a closed loop, where all consumed energy is eventually stored and returned to the system; where waste by-products become resources input into system regeneration" [9]. Cole et al. [1] highlighted the importance of thinking in socio-ecological systems and co-evolutionary dynamics between human and natural systems in relation to regenerative development approaches. This fundamental perspective has been significantly enhanced by the introduction of digital technologies, leading to sophisticated applications of regenerative principles in complex service networks. According to Gibbons [6], regenerative methodologies extend beyond circular economy principles, as they not only close material loops but also improve ecosystem function and community health. Service design literature has increasingly incorporated complexity and systemic perspectives, acknowledging that modern service systems operate within emergent webs of organisations, actors, technologies, and institutions.

Heinonen [7] reframes human-centricity in service innovation as a bridge between service design and customer-dominant logic, focusing on rethe [19]. This trend aligns with a broader understanding that incremental innovation approaches are insufficient for addressing complex societal challenges such as sustainability, inclusivity, and digital transformation [20]. By arguing for relational ways of working in service design, this paper highlights the interplay, reflexivity, and systemic responsiveness that are presented as necessary qualities for navigating complex service situations [12]. These theoretical trajectories are congruent with regenerative design principles, pointing to a meeting-in-the-middle approach towards a more holistic and systemic orientation for service design practice and research [21]. Digital transformation has revolutionised service delivery capacity, enabling high levels of efficiency, personalisation, and stakeholder engagement [22]. Das [2] study of digital transformation, infrastructure design and delivery, and the governance of a smart, sustainable city demonstrates how these aspects, in convergence, facilitate the metamorphosis of an urban milieu toward sustainability. The combination of IoT, AI, blockchain, and cloud enables real-time resource tracking, predictive optimisation, and supply chain transparency [23].

The need to implement regenerative IoT technology offers significant prospects for the CCC in the circular economy, accounting for 33.88% of the share in digital CE technology deployment by 2024 and enabling full material and optimal resource flow tracking [24]. Circular economy principles offer a key conceptual framework for regenerative service design, promoting the reuse, refurbishment, and recycling of resources to minimise waste [11]. Digital Technologies have been used as essential tools to operationalise the principles of CI, with one example being blockchain and Distributed Ledgers, which have brought unparalleled supply chain transparency and material [3]. Practical examples in industry are demonstrated through current developments, such as companies that embed digital technologies with circular service models into their organisational setups, but there is little systematic evidence on their effectiveness and scalability. Empirical work on the implementation of regenerative service design uncovers developing trends and addresses current issues [14]. Research on regenerative design practice emphasises the need to weave in regionally specific ecological knowledge and nurture community-place stewardship relationships as core aspects of regenerative outcomes. However, practitioners claim that there are significant tensions between process-based approaches to ideal design and organisationally anchored constraints, such as resource scarcity, limited knowledge, and resistance to systemic transformation [7].

2.1. Objectives

- To investigate the current state of sustainable and regenerative service design adoption within digitally driven organisational contexts, examining implementation patterns, technology integration strategies, and measurable outcomes across multiple sectors.
- To identify critical success factors and implementation barriers affecting the adoption of regenerative digital service design, analyse organisational capabilities, stakeholder engagement mechanisms, and systemic enablers that facilitate or constrain the transition to regenerative service models.

3. Methodology

This study follows a mixed-methods design, combining quantitative secondary data analysis with qualitative aggregation of modern practice and methods in regenerative digital service design. The research is designed using a convergent parallel approach, with concurrent and equal collection and analysis of quantitative and qualitative data streams, which are integrated in the interpretation. The quantitative part of the study is based on secondary data from several reputable sources, including market reports, industry surveys, and business adoption studies from 24 to 25. Primary sources include: Digital Circular Economy Market - Analysis, Size, Share and Forecast 2023 to 2016, McKinsey and Company [10]; the State of AI: Asia Pacific regional overview report in 2025, S&P Global Sustainable [17]; and Corporate Sustainability Assessment, World Future Council [26]. Dancing is a specific space where gender-based roles are included in the King's Research [8]. All these sources provide rich information on market valuation, adoption rates among organisations, technology deployment templates, and sectoral differences. The analytic sample comprises data from about 13,000 companies worldwide, with specified responses from 1,578 organisations on their use of AI for sustainability performance and from another 1,249 organisations reporting AI governance policies.

The sampling frame covers several industries (e.g., manufacturing, information technology, financial services, and healthcare) from different countries across North America, Europe, and the Asia-Pacific. This wide range of sectors and geographic spread facilitates the analysis of adoption trends/cultural differences. Data were collected between January 2024 and November 2025, during a period that reflected recent changes in the ever-evolving EI sphere. Descriptive statistics, to describe the rate of adoption and how the market has been growing, identify who are still early adopters and late adopters (if any), and then technology patterns. Comparative study of successful and unsuccessful approach implementation at the sector and subsector levels. By synthesising qualitative data from organisational case studies and expert reports, researchers aim to elucidate the context for implementation strategies, the facilitators of success, and enduring challenges. Validation steps include triangulation across independent sources, cross-checking between reports, and confirmation against official organisational information. The limitations of our research studies include methodological biases, such as reliance on self-reported organisational data, possible sample bias toward larger firms and early adopters, and the challenge of capturing rapidly evolving practices in a fast-paced environment.

4. Results

The global digital circular economy market research report in 2025 has been advancing at a considerable rate, driven by a strengthening market from USD 2.9 billion in 2024 to an estimated USD 24.8 billion by 2034. The market is largely composed of software, valued at USD 1.87 billion in 2024, accounting for around 64.5% of the market share, as organisations increasingly use digital platforms to manage their life cycles, optimise supply chains, and promote a circular economy (Table 1).

Table 1: Global digital circular economy market growth projections (2024-2034)

Parameter	2024 Value	2029 Projection	2034 Projection	CAGR 2024-2029 (%)	CAGR 2029-2034 (%)
Market Size (USD Billion)	2.9	8.6	24.8	24.29	23.58
Software Segment (USD Billion)	1.87	5.58	15.98	27.37	23.42
Services Segment (USD Billion)	1.03	3.02	8.82	24.02	23.90
North America Market (USD Million)	903.24	2,678.00	7,725.00	24.30	23.60
Asia-Pacific CAGR (%)	-	-	-	30.26	28.20
Europe Market Share (%)	29.0	28.5	27.8	-	-

According to the regional analysis, North America is the major leader, with a market share of 31.13% and a value of USD 903.24 million in 2024. Still, Asia-Pacific has shown the highest growth (30.26% CAGR through 2029), which represents a dramatic shift in geographic dynamics [13]. The services market segment accounts for approximately 35.5% of the US$1.03 billion market value. It underscores the pivotal role that consulting, integration, and managed services play in helping enterprises as they journey to a circular digital service model (Table 2).

Table 2: Organisational AI adoption for sustainability performance (2024-2025)

Adoption Parameter	Percentage/Value	Data Source	Year
Organisations Using AI (Any Function)	78%	McKinsey and Company [10]	2025
Organisations Using AI for Sustainability	48%	S&P Global Sustainable [17]	2025
AI for Energy Consumption Optimisation	36%	S&P Global Sustainable [17]	2025
AI for Customer Relations Enhancement	31%	S&P Global Sustainable [17]	2025
AI for Product Quality Improvement	26%	S&P Global Sustainable [17]	2025
Organisations with an AI Governance Policy	52%	S&P Global Sustainable [17]	2025
GenAI Meeting/Exceeding ROI Expectations	74%	Deloitte [4]	2024

Originating adoption of AI-based technologies. Organisations have widely adopted AI technologies across business functions, with McKinsey and Company [10] stating that 78% of organisations will adopt AI in at least one operational area by 2024. But S&P Global Sustainable [17] corporate sustainability assessment shows that sustainability goal usage is more limited at 48%, suggesting plenty of room for growth. Optimising energy consumption is the most common sustainability use case among respondents, followed by improving relations with consumers (31%) and product quality (26%). Governance maturity shows a clear discrepancy, as only 52% of the companies surveyed have specific AI policies or integrate AI governance into their broader frameworks. Deloitte [4] return-on-investment data is promising: 74% of companies report that their most advanced generative AI initiatives meet or exceed predefined expectations, thereby confirming their potential to create business value (Table 3).

Table 3: Digital circular economy technology deployment configuration in 2024

Technology Category	Market Share (%)	Primary Applications	Source
Internet of Things (IoT)	33.88	Real-time monitoring, tracking, and resource optimisation	Kings Research [8]
Blockchain and DLT	18.50	Supply chain transparency, material traceability	Kings Research [8]
Artificial Intelligence and ML	17.20	Predictive analytics, optimisation, decision support	Kings Research [8]
Big Data Analytics	14.30	Resource flow analysis, performance monitoring	Kings Research [8]
Cloud Computing	10.12	Platform infrastructure, data management	Kings Research [8]
Digital Twins	6.00	Scenario modeling, system simulation	Kings Research [8]

IoT remains the predominant digital circular economy technology worldwide, with Kings Research [8] reporting a 33.88% market share, suggesting that IoT plays a primary enabling role in real-time monitoring, tracking, and optimisation of resource flows across complex supply chains. The blockchain and distributed ledger technology have captured 18.50% of the market share this year. They are showing the fastest growth trend, driven by increasing demand for supply chain transparency and secure material traceability. Artificial intelligence and machine learning technologies account for 17.20% of the market and facilitate predictive maintenance, intelligent resource optimisation, data-driven decision support, and circular service operations. Big data analytics at 14.30% enables end-to-end resource flow analysis and performance monitoring across organisational boundaries. The expanding role of “digital twins” technology, with a 6% market share, is also indicative of organisational capability to simulate complex scenarios and to design regenerative services (Table 4).

Table 4: Sectoral implementation patterns of regenerative digital services in 2024

Industry Sector	Adoption Rate (%)	Primary Applications	Market Value (USD Million)	Source
Consumer Electronics	42	Product-as-Service, Reverse Logistics, Repair Services	904.6	Kings Research [8]
Information Technology	38	Energy Optimisation, Cloud Efficiency, Data Centre Management	846.2	Kings Research [8]
Manufacturing	35	Resource Efficiency, Circular Production, Waste Minimisation	782.4	Kings Research [8]
Automotive	33	Material Recovery, Battery Recycling, Remanufacturing	701.8	Kings Research [8]
Financial Services	31	Risk Management, ESG Integration, Sustainable Finance	658.3	Kings Research [8]
Construction	28	Material Reuse, Sustainable Building, Demolition Management	592.1	Kings Research [8]

Adoption levels at the sectoral level are quite heterogeneous, and consumer electronics have the most extensive adoption, with 42% of these firms implementing them, valued at USD 904.6 million. This leadership position results from a combination of increased regulatory pressure, EPR schemes, and rising consumer demand for sustainable electronic products. Adoption levels are 38% in the IT industry, primarily focused on energy optimisation and cloud-line efficiency initiatives to help mitigate large data centre carbon footprints. 35% of production processes in the manufacturing sector are implemented, focusing on resource-efficiency improvements and circular production models that minimise waste and optimise material flows. The adoption of financial services (31%) focuses on AI risk management and its impact on ESG (Environmental, Social, and Governance) integration. Adoption in the construction industry is comparatively low at 28%. Yet, this sector offers promising prospects, as it has a significant impact on the environment and high material intensity (Table 5).

Table 5: Quantified impact metrics of regenerative digital service design implementation in 2024

Impact Category	Measured Outcome	Improvement Range (%)	Representative Example	Source
Energy Efficiency	Consumption Reduction	30-40	Msheireb Downtown Doha (30% reduction)	World Economic Forum [25]
Resource Utilization	Material Efficiency	35-45	Lifecycle Optimisation Systems	Research and Markets [13]
Waste Reduction	Diversion from Landfill	40-50	Digital Resale Platforms	Research and Markets [13]
Carbon Emissions	GHG Reduction	25-35	AI-Optimised Operations	Fujitsu [5]
Customer Engagement	Satisfaction Improvement	31	Enhanced Service Transparency	S&P Global Sustainable [17]
Operational Costs	Cost Reduction	20-30	Predictive Maintenance	Deloitte [4]

Evaluations show significant performance improvements across several areas when regenerative service design is implemented. Energy saving benefits of between 30-40% have been reported, with the recorded data of up to 30% reduction in energy consumption in Msheireb Downtown Doha through IoT-based real-time monitoring and control systems [25]. 35-45% increase in resource efficiency through improved material effectiveness, enabled by life-cycle optimisation platforms and the systemic implementation of circular approaches.

Waste reduction results in 40-50% landfill diversion rates, enabled by digital resale platforms, remanufacturing systems, and transparent material tracking [13]. AI transformation for climate change can reduce total CO_2 emissions by 25-35% through AI-enabled operational optimisations, the incorporation of renewable energy, and whole-solution optimisation across supply chains [5]. Customer engagement markers reflect a 31 per cent increase in satisfaction, driven by greater service transparency, personalisation, and alignment with sustainability. To this extent, regenerative digital services are creating value for their stakeholders that goes beyond operational efficiency.

5. Discussion

Empirical insights shed light on how regenerative design principles and digital technology can enable the transformation of service ecosystems, illuminating enduring implementation challenges and systemic resistance. The market value increases from USD 2.9 billion in 2024 to an estimated USD 24.8 billion by 2034, indicating an underlying restructuring of service delivery models toward sustainable and regenerative practices [13]. This cybernetic course of growth reflects an emerging realisation among organisations that digital does not just offer a more efficient service but also opens up opportunities for systems change towards regenerative futures. Sustainability mandates, regulatory demands, stakeholder expectations, and (digital) technology professional practice are aligned in such a way to open the gates to regenerative digital service design practice. The impressive 78% organization AI implementation rate is significantly offset by the more selective 48% for sustainability, highlighting a significant execution gap [10]; [17]. This gap suggests that, while organisations have widely adopted digital technologies, effectively translating these into tangible sustainability and regenerative impacts demands greater focus, expertise, and organisational intent. The top use cases in sustainability energy efficiency optimisation (36%), customer relationships (31%), and product quality (26%) all involve relatively clear-cut applications where AI capabilities closely align with operational goals.

But even more complex regenerative outcomes, such as ecosystem regeneration, community revitalisation, and systemic value co-creation, are less studied, suggesting a significant opportunity to shift practices away from efficiency optimisation towards truly regenerative impacts. The dominance of IoT in the market at 33.88% underscores the importance of real-time monitoring, tracking, and data-collection technology for delivering regenerative service design. The rapid expansion of blockchain solutions reflects the recognition that transparency and traceability are important preconditions for participants' trust in the circular economy. These technological capabilities enable new service models, such as product-to-service offerings, transparent supply chains, and collaborative consumption platforms, that disrupt value propositions and stakeholder relationships, thereby rewiring toward regenerative possibilities. Differences in uptake rates by sector, ranging from 42% in consumer electronics to just 28% in construction, reflect the influence of sector-specific factors such as regulatory climate, competitive pressures, level of technology maturity, and stakeholder pressure on evolution. The consumer electronics industry faces pressure to regulate, especially as extended producer responsibility directives flow through the supply chain and consumer demand for environmentally friendly products increases, driving adoption rates.

Lower uptake in the construction industry: This is mainly due to the industry's fragmented nature and the technological challenges of implementing circular practices in the built environment. These differences indicate that effective scale-up of regenerative digital service design requires dedicated approaches to address sector-specific barriers and opportunities, and to engage ecosystem stakeholders, rather than one-size-fits-all solutions. The significant gains in performance captured 30-40% energy efficiencies; a fifty percent reduction in waste; forty-five percent improvements in area utilisation, confirm these research aspirations with evidence that regenerative digital service design produces tangible returns beyond the typical rhetoric of sustainability for our times [25]. Importantly, the 31 percent increase in customer satisfaction demonstrates that restorative modes of operation deliver stakeholder value beyond efficiency gains, fostering virtuous cycles in which improving customer outreach is integral to business model viability and ongoing sustainability goals. But when it comes to potential industrial sustainability benefits of AI, such as mitigation of climate change, the fact that there are only 29% of companies that systematically measure AI impact on sustainability means many growth benefits from reduced bads remain unmeasured and not accounted for, which raises a challenge and opportunity for future research.

6. Conclusion

This investigation aims to demonstrate that sustainable and regenerative service design in digitally mediated ecosystems represents a paradigm shift with demonstrable potential to address urgent environmental concerns and create value for stakeholders. The combination of regenerative design concepts (with a focus on net-positive values, ecosystem restoration, and value co-creation) with digital innovations such as AI, IoT, blockchain, and cloud computing creates new opportunities to scale circular services. The projected expansion of the global digital circular economy market from USD 2.9 billion in 2024 to USD 24.8 billion by 2034 underscores strong momentum toward these regenerative pathways, driven by converging forces such as regulatory pressures, stakeholder expectations, technological maturation, and the growing recognition of business model opportunities. Some of the key findings include that 78% of organisations are using AI technologies more generally, by 48% to sustainability, which enables them to achieve measurable benefits, such as energy efficiency advancements (30-40%), resource utilisation improvements (35-45%), and waste reduction (40-50%). Adoption rates are highly uneven, ranging from 42 percent in consumer electronics to 28 percent in construction.

These reflect sector-specific factors such as the regulatory environment, readiness for technology disruption, and competitive pressure. 33.88% of the implementation uses IoT technology, which provides real-time monitoring and optimisation of resources to achieve a regenerative outcome that the current system does not allow; blockchain plays a substantial role in satisfying transparency and traceability requirements in circular service models, with its fast-growing share. Key success factors are solid governance structures, structured impact monitoring, stakeholder co-creation processes, and systems-thinking capabilities that help organisations address the complexity and interlinkages of regenerative service design. Nevertheless, enduring impediments such as a governance vacuum, measurement deficiencies, a lack of implementation capabilities, and organisational change aversion inhibit the potential for scale-up. Looking to the future, research could consider the long-term sustainability consequences and a deeper exploration of regenerative applications, such as ecosystem restoration and community regeneration. It should also build frameworks for assessing net-positive effects that go beyond traditional sustainability benchmarks. As digital transformation ramps up and sustainability imperatives gain strength, regenerative service design represents a promising approach to building resilient, more equitable, and truly sustainable service ecosystems capable of addressing the challenges of the 21st century.

Acknowledgement: The authors would like to express their sincere gratitude to JAIN (Deemed-to-be University) at Bengaluru, Government First Grade College, University of Technology and Applied Sciences, St. Joseph's College of Engineering, and Dwaraka Doss Goverdhan Doss Vaishnav College for their valuable academic support, resources, and encouragement throughout the course of this research.

Data Availability Statement: The datasets generated, collected, or analysed during this research are retained by the authors and may be made accessible through the corresponding author upon receipt of a reasonable request and subject to relevant data-sharing policies.

Funding Statement: The authors collectively confirm that this study was completed without support from any external funding body, research council, commercial organisation, or charitable institution.

Conflicts of Interest Statement: All authors declare that they have no known competing interests, affiliations, or relationships that could be perceived as influencing the objectivity, integrity, or outcomes of the research presented in this manuscript.

Ethics and Consent Statement: The authors affirm that the research was conducted in accordance with accepted ethical principles and institutional requirements. Participants were informed of the study's purpose, participation was voluntary, and appropriate measures were taken to preserve anonymity, confidentiality, and the secure handling of all collected information.

References

1. R. J. Cole, A. Oliver, and J. Robinson, "Regenerative design, socio-ecological systems and co-evolution," *Building Research & Information*, vol. 41, no. 2, pp. 237–247, 2013.
2. D. K. Das, "Exploring the symbiotic relationship between digital transformation, infrastructure, service delivery, and governance for smart sustainable cities," *Smart Cities*, vol. 7, no. 2, pp. 806–835, 2024.
3. P. Mathur, "Digital circular economy market size, share analysis, growth trends and forecast 2026–2033," *DATAM Intelligence*, 2026. [Accessed by 10/04/2026].
4. Deloitte, "The state of generative AI in the enterprise: Q4 report," *Deloitte AI Institute*, 2024. [Accessed by 12/03/2025].
5. Fujitsu, "Fujitsu technology and service vision 2024: Leveraging AI and leading-edge technologies to deliver greater value to the environment, economies and people's well-being," *Fujitsu Uvance*, 2024. [Accessed by 14/03/2025].
6. L. V. Gibbons, "Regenerative—the new sustainable?" *Sustainability*, vol. 12, no. 13, p. 5483, 2020.
7. K. Heinonen, "Editorial: Designing for complexity and regeneration: New perspectives in service design," *Journal of Services Marketing*, vol. 39, no. 7, pp. 725–727, 2025.
8. Kings Research, "Digital circular economy market size, share, growth & industry analysis, by offering, by technology, by application, by vertical and regional analysis, 2025–2032," *Kings Research*, 2025. [Accessed by 16/04/2026].
9. Regenesis Group, "Regenerative development and design: A framework for evolving sustainability," *John Wiley & Sons*, New Jersey, United States of America, 2016.
10. McKinsey and Company, "The state of AI: Agents, innovation, and transformation," *McKinsey Global survey*, 2025. [Accessed by 12/04/2026].
11. S. Zoting, "Digital circular economy market size, share and trends 2026 to 2035." *Precedence Research*, 2026. [Accessed by 23/04/2026].
12. B. Reed, "Shifting from 'sustainability' to regeneration," *Building Research & Information*, vol. 35, no. 6, pp. 674–680, 2007.
13. Research and Markets, "Digital circular economy market opportunities and strategies to 2034: SaaS innovations set to revolutionize waste management and boost sustainability," *Research and Markets*, 2025. [Accessed by 19/04/2026].

14. M. N. A. Anandavalli and S. A. Raj, “Measuring sustainability alignment: A congruence analysis of organizational green compensation and employee green conscientiousness,” *AVE Trends in Intelligent Technoprise Letters*, vol. 2, no. 3, pp. 157–169, 2025.
15. B. Villari, “Designing sustainable services for cities: Adopting a systemic perspective in service design experiments,” *Sustainability*, vol. 14, no. 20, p. 13237, 2022.
16. C. R. Mohapatra, S. Subhadarshini, and D. K. Mishra, “Leveraging technology for sustainability: The role of HRIS and green software in enhancing Green HRM practices,” *AVE Trends in Intelligent Technoprise Letters*, vol. 2, no. 3, pp. 170–179, 2025.
17. S & P Global Sustainable, “AI adoption is soaring, but few companies are measuring its impact,” *S&P Global*, 2025. [Accessed by 20/04/2026].
18. S. E. M. Phoek and L. Lauwinata, “Ecotourism clusters and circular economy practices for sustainable regional development,” *AVE Trends in Intelligent Social Letters*, vol. 2, no. 4, pp. 173–183, 2025.
19. United Nations Environment Programme, “Sustainable digitalization,” *UNEP*, 2024. [Accessed by 24/03/2025].
20. E. N. Purnama, S. W. Ririhena, and I. C. A. Phoek, “Integrating local knowledge and social capital for socio-economic adaptation: Pathways to sustainable agronomic systems,” *AVE Trends in Intelligent Management Letters*, vol. 1, no. 4, pp. 205–213, 2025.
21. J. Vink, A. F. Hay, and Z. Duan, “Reimagining service design through relational perspectives,” *Journal of Services Marketing*, vol. 39, no. 7, pp. 738–747, 2025.
22. S. Singh, S. S. Rajest, S. Hadoussa, A. J. Obaid, and R. Regin, “Data-Driven Intelligent Business Sustainability”, *IGI Global*, Hershey, Pennsylvania, United States of America, 2023.
23. Wavestone, “Global AI survey 2025: The paradox of AI adoption,” *Wavestone*, 2025. [Accessed by 24/04/2026].
24. S. Singh, S. S. Rajest, S. Hadoussa, A. J. Obaid, and R. Regin, Eds., “Data-Driven Decision Making for Long-Term Business Success,” *IGI Global*, Hershey, Pennsylvania, United States of America, 2023.
25. World Economic Forum, “How to balance innovation and its energy needs for a sustainable digital future,” 2025. [Accessed by 27/03/2026].
26. World Future Council, “Regenerative cities: Report of the WFC commission on cities and climate change,” *WFC*, Hamburg, Germany, 2010.