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Environmental Sustainability Business Model with an Emphasis on Circular Economy in Small and Medium-Sized Technology Enterprises (SMEs)

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Abstract

The increasing environmental challenges associated with resource depletion, waste generation, and climate change have intensified the need for sustainable business practices across industries. Small and medium-sized enterprises (SMEs) in the technology sector face unique sustainability challenges due to rapid technological advancement, resource-intensive operations, and growing environmental expectations from stakeholders. This study aims to develop an environmental sustainability business model with an emphasis on circular economy principles for technology-oriented SMEs. Drawing upon the concepts of sustainable business models and circular economy, a conceptual framework was developed and validated through expert evaluation using a Design Science Research approach. The proposed model integrates four key dimensions: organizational enablers, circular economy practices, environmental sustainability outcomes, and business performance outcomes. The findings indicate that effective implementation of circular economy practices contributes to waste reduction, resource efficiency, energy optimization, and carbon reduction while simultaneously enhancing innovation capability, competitive advantage, organizational resilience, and sustainable growth. The study provides both theoretical and practical contributions by offering an integrated framework that supports the transition of technology SMEs toward environmentally sustainable and economically viable business operations.

Keywords: Environmental Sustainability; Circular Economy; Sustainable Business Model; Technology SMEs; Business Performance

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Introduction

The increasing urgency of environmental challenges, including climate change, resource depletion, electronic waste accumulation, and environmental degradation, has intensified the need for businesses to adopt more sustainable approaches to value creation and resource management. Organizations across industries are facing growing pressure from governments, investors, customers, and society to reduce their environmental footprint while maintaining economic competitiveness (Nosratabadi et al., 2019). In this context, sustainability has evolved from a peripheral corporate responsibility initiative to a strategic imperative that influences long-term organizational success. Small and medium-sized enterprises (SMEs), which constitute a significant proportion of economic activity and employment worldwide, play a critical role in achieving sustainable development goals. However, due to their limited financial, technological, and managerial resources, SMEs often encounter greater challenges than large corporations when implementing sustainability-oriented practices (Bocken et al., 2014).

The technology sector represents one of the most dynamic and rapidly growing segments of the global economy. Technology-based SMEs contribute significantly to innovation, digital transformation, and economic development. Nevertheless, their activities are also associated with various environmental concerns, including high energy consumption, electronic waste generation, intensive use of raw materials, and short product life cycles. As digital technologies continue to expand, the environmental implications of technology production, distribution, usage, and disposal have become increasingly important. Consequently, technology SMEs are expected to adopt innovative business models that balance economic performance with environmental responsibility.

One promising approach for addressing these challenges is the adoption of circular economy principles. The circular economy has emerged as a transformative framework that seeks to replace the traditional linear economic model of “take-make-dispose” with regenerative systems designed to minimize waste, extend product life cycles, and maximize resource efficiency. Circular economy practices emphasize strategies such as reducing material consumption, reusing products and components, repairing and refurbishing equipment, remanufacturing products, and recycling materials. By maintaining the value of products and resources for as long as possible, circular economy approaches can contribute to environmental sustainability while simultaneously creating economic opportunities (Caldera et al., 2021).

In recent years, researchers and practitioners have increasingly recognized the potential of circular economy principles to reshape business models and promote sustainable value creation. Sustainable business models integrate environmental and social considerations into the core mechanisms through which organizations create, deliver, and capture value. Unlike conventional business models that primarily focus on financial performance, sustainable business models seek to generate economic, environmental, and social benefits simultaneously. The integration of circular economy principles into sustainable business models has given rise to circular business models that emphasize resource efficiency, waste reduction, closed-loop systems, and long-term sustainability. Such models have demonstrated considerable potential in improving environmental performance and enhancing organizational resilience (Kuik et al., 2023).

Despite the growing body of literature on sustainable business models and circular economy practices, several research gaps remain. First, much of the existing research has focused on large organizations with substantial resources and established sustainability programs. Comparatively less attention has been devoted to SMEs, particularly those operating in technology-intensive sectors. Second, previous studies

often examine sustainability, circular economy, and business model innovation as separate research streams rather than as interconnected components of an integrated framework. Third, technology SMEs face unique operational and strategic challenges that may influence the implementation of circular economy practices, yet these specific characteristics are insufficiently addressed in current models and frameworks (Riemer et al., 2025).

Given these gaps, there is a need for a comprehensive business model that integrates environmental sustainability principles with circular economy practices while considering the specific characteristics and constraints of technology-oriented SMEs. Such a model can provide practical guidance for managers seeking to improve environmental performance without compromising competitiveness and growth. Furthermore, it can contribute to the academic literature by extending current understanding of how circular economy principles can be systematically embedded within the business models of technology-based SMEs (Brendzel-Skowera et al., 2021).

Therefore, this study aims to develop an environmental sustainability business model with an emphasis on circular economy principles for small and medium-sized technology enterprises. By identifying the key dimensions, components, and relationships necessary for integrating sustainability and circularity into organizational operations, the proposed model seeks to support technology SMEs in their transition toward more sustainable and resilient business practices. The findings of this research are expected to contribute both theoretically and practically to the fields of sustainable business models, circular economy, and SME management.

Literature Review

Environmental sustainability has become a central concern for organizations seeking to balance economic growth with environmental protection. Increasing environmental pressures, resource scarcity, and stakeholder expectations have encouraged businesses to reconsider traditional approaches to value creation and operational management. As a result, the concept of sustainable business models has gained significant attention in both academic and practical contexts. A sustainable business model extends beyond conventional profit-oriented objectives by incorporating environmental and social considerations into the mechanisms through which value is created, delivered, and captured (Caldera et al., 2019).

Unlike traditional business models that primarily focus on economic outcomes, sustainable business models seek to generate long-term benefits for multiple stakeholders while minimizing negative environmental impacts. These models emphasize efficient resource utilization, reduction of environmental burdens, responsible production and consumption practices, and the integration of sustainability objectives into strategic decision-making. By aligning business activities with sustainability principles, organizations can enhance their competitiveness, improve resource efficiency, and strengthen their long-term resilience (Geissdoerfer et al., 2017).

Environmental sustainability within business operations involves reducing waste generation, minimizing greenhouse gas emissions, improving energy efficiency, and promoting the responsible use of natural resources. The adoption of sustainable business models enables organizations to address these objectives while simultaneously maintaining profitability and market competitiveness. Consequently, sustainable business models are increasingly recognized as important tools for supporting the transition toward more sustainable economic systems.

The circular economy has emerged as one of the most influential approaches for achieving environmental sustainability. It represents a fundamental shift from the traditional linear economic model, which is based on the extraction of resources, production, consumption, and disposal. In contrast, the circular economy seeks to maintain the value of products, materials, and resources within the economic system for as long as possible (Saidani et al., 2020).

The core principles of the circular economy include reducing resource consumption, reusing products and components, repairing damaged products, refurbishing and upgrading existing assets, remanufacturing products, and recycling materials at the end of their useful life. These strategies contribute to waste reduction, resource conservation, and environmental protection while simultaneously creating economic value. By extending product life cycles and reducing dependence on virgin materials, organizations can improve resource productivity and decrease operational costs (Abdi et al., 2025).

The circular economy also encourages the development of closed-loop systems in which materials and resources continuously circulate through production and consumption processes. Such systems can reduce environmental pressures associated with resource extraction, manufacturing activities, and waste disposal. Consequently, circular economy principles are increasingly viewed as essential components of sustainable business transformation (Cavallo et al., 2021).

The integration of circular economy principles into business operations has led to the emergence of circular business models. These models focus on creating value through resource optimization, product life extension, material recovery, and sustainable consumption practices. Circular business models differ from traditional approaches by emphasizing the retention of product value throughout multiple usage cycles rather than relying solely on continuous production and sales of new products (Lüdeke-Freund et al., 2019).

Several circular business strategies have been widely adopted across industries. These include product life extension through repair and maintenance services, resource recovery through recycling and material reclamation, product-as-a-service systems that replace ownership with access-based models, and take-back programs that facilitate the return and reuse of products after consumption. Such approaches enable organizations to reduce environmental impacts while creating new revenue opportunities and strengthening customer relationships.

The successful implementation of circular business models often requires organizational innovation, collaboration among supply chain partners, and the development of supportive technological capabilities. As a result, businesses must redesign operational processes and value propositions to effectively incorporate circular economy principles into their activities (Ranta et al., 2018).

Small and medium-sized enterprises operating within the technology sector occupy a unique position in the sustainability landscape. These organizations are recognized as important drivers of innovation, technological advancement, and economic growth. At the same time, they face distinct environmental challenges related to resource consumption, electronic waste generation, energy-intensive operations, and rapid technological obsolescence.

Compared with large organizations, technology SMEs often experience greater constraints in terms of financial resources, specialized expertise, and sustainability-related infrastructure. These limitations can hinder the adoption of environmental management practices and circular economy initiatives. Furthermore,

the fast-paced nature of technological innovation may encourage shorter product life cycles and increased material consumption, creating additional sustainability concerns.

Despite these challenges, technology SMEs possess several characteristics that can facilitate sustainability transitions. Their organizational flexibility, entrepreneurial culture, and capacity for innovation enable them to adapt more rapidly to emerging environmental requirements and market opportunities. By incorporating sustainability and circular economy principles into their business models, technology SMEs can improve operational efficiency, reduce costs, enhance customer value, and strengthen competitive advantage (Pieroni et al., 2019).

Although substantial progress has been made in the fields of environmental sustainability, sustainable business models, and circular economy, important gaps remain within the existing body of knowledge. Much of the available research has focused on large organizations and manufacturing industries, while limited attention has been directed toward technology-oriented SMEs. Furthermore, many studies examine sustainable business models and circular economy practices independently rather than integrating them into a unified framework. Existing models also provide limited guidance regarding how technology SMEs can systematically incorporate circular economy principles into their strategic and operational activities.

Given the increasing importance of sustainability and circularity in the technology sector, there is a clear need for a comprehensive model that combines environmental sustainability objectives with circular economy strategies while addressing the specific characteristics of technology-based SMEs. Therefore, this study seeks to develop and validate an integrated environmental sustainability business model that emphasizes circular economy principles and provides practical guidance for technology SMEs pursuing sustainable growth and long-term competitiveness.

Results and Analysis

The objective of this study was to develop and validate an environmental sustainability business model with an emphasis on circular economy principles for technology-oriented SMEs. Following the literature review and expert validation process, a final model was established that integrates environmental sustainability objectives, circular economy practices, organizational capabilities, and business performance outcomes (Merli et al., 2018). The analysis revealed that the successful implementation of circular economy principles within technology SMEs requires a holistic approach that simultaneously addresses resource efficiency, innovation capabilities, stakeholder engagement, and environmental performance (Kirchherr et al., 2017).

The expert evaluation process demonstrated a strong consensus regarding the importance of integrating circular economy practices into the core business model rather than treating sustainability as a separate organizational function. Experts emphasized that sustainability initiatives generate greater value when they are embedded within strategic planning, operational processes, product design, and customer relationships. This finding supports the view that environmental sustainability should be considered a strategic capability rather than a compliance-oriented activity.

The validated framework consists of four major dimensions: Organizational Enablers, Circular Economy Practices, Environmental Sustainability Outcomes, and Business Performance Outcomes. These dimensions collectively form a dynamic system in which organizational capabilities facilitate the implementation of circular practices, leading to improved environmental and economic performance.

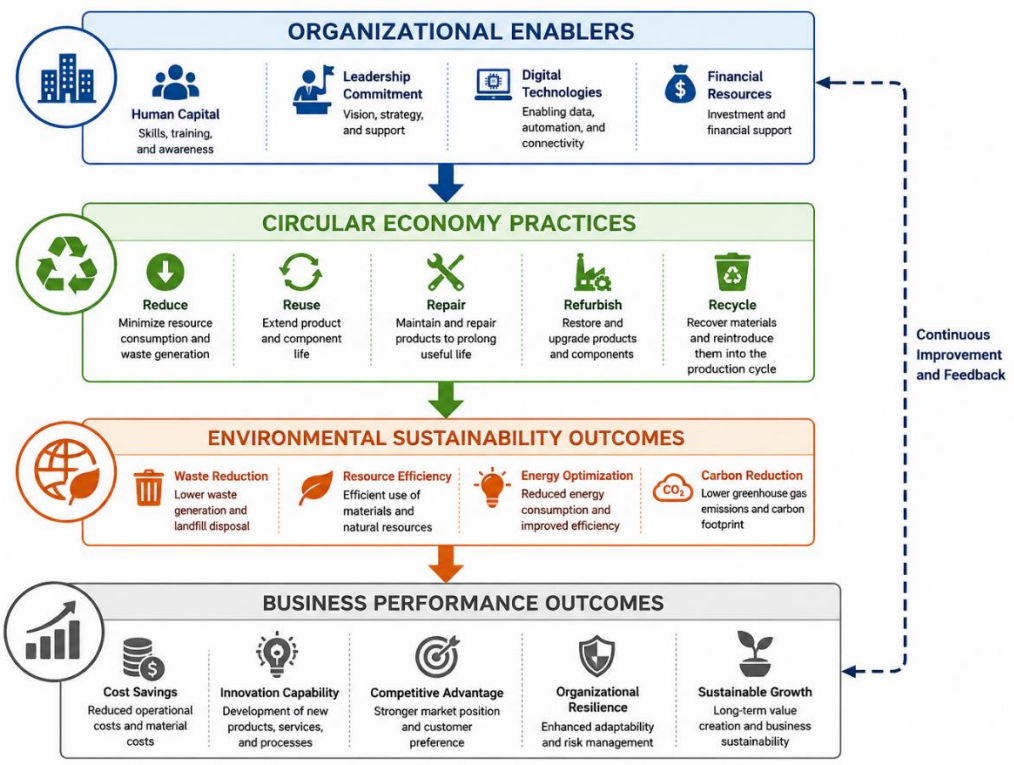

Figure 1. Proposed Environmental Sustainability Business Model Based on Circular Economy Principles for Technology SMEs

As illustrated in Figure 1, organizational enablers act as the foundation of the proposed model. Leadership commitment, employee competencies, technological capabilities, and resource availability create the conditions necessary for the adoption of circular economy practices. These practices subsequently influence environmental outcomes, which in turn contribute to business performance improvements. The model therefore suggests that environmental sustainability and economic competitiveness are not contradictory objectives but rather mutually reinforcing outcomes.

The analysis further identified the most significant components associated with each dimension of the model. Table 1 presents the key dimensions and their corresponding components.

Table 1. Dimensions and Components of the Proposed Model

Dimension	Key Components
Organizational Enablers	Leadership commitment, employee skills, digital technologies, financial support
Circular Economy Practices	Resource reduction, product reuse, repair services, refurbishment, recycling
Environmental Outcomes	Waste minimization, energy efficiency, carbon reduction, resource conservation
Business Outcomes	Cost reduction, innovation capability, market competitiveness, organizational resilience

Table 1 demonstrates that the proposed model extends beyond traditional sustainability initiatives by emphasizing the interdependence of organizational, environmental, and economic factors. The inclusion of organizational enablers highlights the importance of internal capabilities in supporting sustainability transitions. Similarly, the integration of circular economy practices reflects the need for continuous resource circulation rather than linear consumption patterns.

The expert assessment also provided valuable insights into the relative importance of the identified dimensions. Participants consistently emphasized that circular economy practices represent the central mechanism through which environmental and business benefits are generated. However, these practices were considered ineffective in the absence of supportive organizational capabilities. Consequently, organizational readiness emerged as a critical prerequisite for successful implementation.

The level of expert agreement regarding the model dimensions is summarized in Table 2.

Table 2. Expert Evaluation of Model Dimensions

Model Dimension	Mean Importance Score (1–5)
Organizational Enablers	4.62
Circular Economy Practices	4.88
Environmental Sustainability Outcomes	4.71
Business Performance Outcomes	4.65

The results presented in Table 2 indicate a high level of consensus among experts regarding the importance of all four dimensions. Circular Economy Practices received the highest mean score, reflecting the central role of circular strategies in achieving sustainability objectives. Environmental Sustainability Outcomes also received strong support, demonstrating the growing recognition of environmental performance as a key organizational objective within the technology sector.

Furthermore, the findings suggest that technology SMEs possess several characteristics that may facilitate the adoption of circular economy principles. Organizational flexibility, innovative capacity, and the ability to rapidly adapt to changing market conditions were identified as important advantages. These characteristics may enable technology SMEs to implement sustainability-oriented innovations more effectively than larger organizations with more rigid structures. Nevertheless, resource constraints remain a significant challenge and may limit the extent to which circular initiatives can be implemented without external support or strategic partnerships.

Another important finding concerns the relationship between environmental sustainability and business performance. Experts consistently indicated that circular economy practices contribute not only to environmental improvement but also to cost savings, operational efficiency, and enhanced competitiveness. Reduced material consumption, improved resource utilization, and lower waste management costs were identified as key mechanisms through which environmental initiatives generate economic value. These findings support the argument that sustainability investments should be viewed as strategic opportunities rather than operational expenses.

Overall, the analysis confirms that the integration of circular economy principles into the business models of technology SMEs can generate substantial environmental and economic benefits. The proposed model provides a structured framework that links organizational capabilities, circular practices, sustainability outcomes, and business performance within a unified system. By adopting this integrated approach, technology SMEs can strengthen their long-term competitiveness while simultaneously contributing to broader environmental sustainability objectives.

Conclusion

The growing environmental challenges facing modern economies have increased the importance of developing business models that balance economic performance with environmental responsibility. As sustainability concerns continue to influence corporate strategies, organizations are increasingly required to adopt innovative approaches that reduce environmental impacts while maintaining competitiveness and long-term growth. This challenge is particularly significant for small and medium-sized enterprises (SMEs) operating within the technology sector, where rapid innovation cycles, resource-intensive activities, and increasing electronic waste generation create substantial sustainability pressures. Consequently, the development of integrated frameworks capable of supporting sustainable business transformation has become an important area of both academic and practical interest.

This study aimed to develop an environmental sustainability business model with a specific emphasis on circular economy principles for technology-oriented SMEs. By integrating insights from sustainability theory, circular economy practices, and business model innovation literature, the research proposed a comprehensive framework that links organizational capabilities, circular economy activities, environmental sustainability outcomes, and business performance outcomes. The resulting model provides a structured approach for organizations seeking to incorporate sustainability into their core business strategies rather than treating environmental initiatives as isolated operational activities.

The findings of the study indicate that organizational enablers play a fundamental role in facilitating the successful implementation of circular economy practices. Leadership commitment, human capital, technological capabilities, and financial resources were identified as essential factors that support the transition toward more sustainable business operations. Without adequate organizational readiness, the adoption of circular economy initiatives may be limited or ineffective. Therefore, sustainability transformation should begin with the development of internal capabilities that enable organizations to redesign processes, allocate resources efficiently, and foster a culture that supports environmental responsibility.

The study further demonstrates that circular economy practices represent the central mechanism through which environmental and economic value can be generated simultaneously. Activities such as reducing resource consumption, reusing products and components, repairing and refurbishing assets, and recycling materials contribute directly to improved resource efficiency and waste minimization. These practices support the transition from traditional linear production systems toward regenerative and closed-loop business models that maintain the value of products and resources throughout their life cycles. As a result, circular economy principles can significantly contribute to environmental sustainability while also creating opportunities for operational improvements and innovation.

Another important conclusion of this research is the strong relationship between environmental sustainability outcomes and business performance. The findings suggest that sustainability initiatives

should not be viewed solely as compliance requirements or additional costs. Instead, they can function as strategic investments that generate long-term economic benefits. Improvements in resource efficiency, reductions in waste generation, lower energy consumption, and decreased environmental impacts can lead to cost savings, enhanced organizational resilience, increased innovation capacity, and stronger competitive positioning. These outcomes indicate that environmental sustainability and business success are complementary rather than conflicting objectives.

The proposed model also highlights the unique opportunities available to technology SMEs. Although these organizations often face resource constraints and sustainability-related challenges, they possess characteristics such as flexibility, entrepreneurial orientation, and innovative capacity that can facilitate sustainability transitions. By leveraging these strengths, technology SMEs can adopt circular economy strategies more rapidly and effectively than organizations characterized by more rigid structures and complex decision-making processes. Consequently, technology SMEs have the potential to become important contributors to the broader transition toward sustainable and circular economic systems.

From a theoretical perspective, this study contributes to the existing literature by integrating three major research streams that have often been examined independently: environmental sustainability, circular economy, and SME business model innovation. The proposed framework provides a holistic perspective that explains how organizational capabilities enable circular practices, how these practices generate environmental benefits, and how environmental improvements ultimately influence business performance. This integrated approach helps address existing gaps in the literature and provides a foundation for future research in sustainability-oriented business model development.

From a practical perspective, the model offers valuable guidance for managers and decision-makers within technology SMEs. The framework can assist organizations in identifying critical sustainability drivers, prioritizing circular economy initiatives, and designing strategies that simultaneously improve environmental and economic performance. Furthermore, the model may support policymakers, industry associations, and sustainability consultants seeking to promote the adoption of circular economy principles among technology-focused SMEs.

Despite its contributions, this study has several limitations. The proposed framework was developed and validated primarily through theoretical analysis and expert evaluation. Therefore, future research should empirically test the model within different organizational and industrial contexts to further assess its applicability and effectiveness. Additional studies may also explore the influence of external factors such as regulatory policies, market conditions, technological advancements, and stakeholder pressures on the implementation of circular economy business models.

In conclusion, the study demonstrates that the integration of circular economy principles into the business models of technology SMEs can create substantial environmental and economic value. The proposed environmental sustainability business model provides a comprehensive framework that supports sustainable growth, resource efficiency, innovation, and long-term competitiveness. By embracing circular economy practices and embedding sustainability within core business activities, technology SMEs can play a significant role in advancing environmental sustainability while simultaneously strengthening their organizational performance and resilience in an increasingly complex and resource-constrained world.

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