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Features of implementing business models based on sustainable development

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Abstract

The article examines the features of implementing business models oriented toward the principles of sustainable development. It focuses on the integration of environmental, social, and economic factors into strategic management processes. The objective of the study is to identify methodological approaches, tools, and factors influencing the implementation of sustainable models across various industries and regions.

The methodology is based on an analysis of scientific literature and empirical data, which enabled the identification of effective practices and the recognition of gaps in existing approaches. Sources include scientific articles by international authors available in open access, as well as materials found online, allowing for a comprehensive examination of the topic. Among the tools highlighted are digital platforms, monitoring systems, lifecycle assessment methods, and blockchain technologies, all of which enhance the transparency of supply chains.

The results indicate that the successful adaptation of sustainable business models depends on the interplay of technological innovations, social responsibility, and local adaptation. Barriers to implementing such models include limited resources, cultural differences, and the absence of universal standards for evaluating their effectiveness.

The conclusion emphasizes the importance of an interdisciplinary approach in developing sustainable development strategies, which is particularly relevant for organizations seeking to maintain long-term competitiveness. The study will be of interest to company executives, researchers, and consultants working on sustainable development issues.

Keywords: Sustainable development; Business models; Innovations; Circular economy; Corporate social responsibility; Technological solutions

1. Introduction

Global challenges such as climate change, depletion of natural resources, and social inequality necessitate a reevaluation of traditional business practices. Sustainable models incorporate environmental responsibility, economic efficiency, and social equity, contributing to a reduction in negative environmental impacts. The study of these processes is essential due to the significance of sustainable development for corporate competitiveness. Increasing consumer attention to environmentally friendly products, stricter regulatory requirements and the drive to adapt to the circular economy encourage companies to reassess their approaches. However, the practical implementation of such models is associated with numerous challenges, including limited resources, low awareness, and resistance to change within corporate culture.

Analyzing the specifics of implementing sustainable business models is a key component in developing a comprehensive approach to addressing these issues. Examining theoretical models, practical methods, and factors that determine the

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success of these initiatives helps formulate strategies for integrating sustainable practices into business processes and provides recommendations for various industries and regions.

The purpose of this study is to examine the aspects of implementing sustainable business models and to develop recommendations for their application in the context of modern economic realities.

2. Materials and Methods

The literature on sustainable business models encompasses diverse approaches, methods, and concepts that address various theoretical and practical aspects. An analysis of scientific studies highlights key areas of interest to researchers and practitioners.

One significant area is the development of frameworks for sustainable business models. In 2020, Goni F. A. et al. [1] introduced a conceptual model emphasizing the integration of information technologies, circular economy principles, and performance management. The study highlights the role of information technologies as catalysts for sustainability and the adoption of closed-loop systems to minimize waste. That same year, Bradley P., Parry G., and O'Regan N. [12] proposed a model focusing on innovative practices. These studies demonstrate methods for integrating innovations into business processes to achieve sustainable development goals, identifying key intersections of environmental and economic interests.

Another important area is the application of sustainable models in specific industries and regions. In 2023, Strapchuk S. [6] studied the agricultural sector, proposing a methodology that considers the specifics of agricultural production, dependence on natural resources, and seasonal variations. In 2024, Mazur B., Walczyna A., and Wilczewska W. [2] examined the implementation of sustainable models in Polish enterprises, emphasizing the "green economy" and corporate social responsibility. Their studies argue that the success of sustainable models depends on the cultural and institutional characteristics of the region.

The circular economy represents a significant area of research. In 2021, Ziolo M., Filipiak B. Z., and Tundys B. [3] focused on the principles of circularity and the factors determining the success of such models. Key elements identified include stakeholder engagement, the adoption of innovative technologies, and resource management. In the same year, Boffa E. and Maffei A. [8] classified circular business models and analyzed their contribution to sustainable development. These studies provide valuable recommendations for companies seeking to incorporate circular approaches into their operations.

Stadtländer M., Schoormann T., and Knackstedt R. [10] in 2021 described a range of tools, including digital platforms for modeling and prototyping, which accelerate the development and adaptation of models. In 2020, Baldassarre B. et al. [4,11] proposed a prototyping methodology that bridges the gap between designing and implementing models. This approach has proven effective in testing hypotheses and quickly adapting to changing conditions.

Trollman H. and Colwill J. [5] assert that sustainable development should form the foundation of strategic planning. Their research emphasizes the necessity of considering global environmental challenges and long-term objectives in strategy formulation. Ibrahim F. [9], in 2023, expanded on this topic by examining the interplay of social, economic, and environmental factors. This approach facilitates the development of comprehensive and effective strategies for sustainable business.

Kabalska A. [7] highlights that achieving sustainability requires not only reducing costs and optimizing processes but also considering societal and environmental interests by adopting new technologies and revisiting traditional business practices. In this context, creating value for all stakeholders is deemed a critical component.

Practical examples of companies implementing sustainability-based business models are provided in source [13], with information available on networking.camp website.

An analysis of existing scientific studies reveals several gaps. First, inconsistencies in approaches to the classification and structuring of sustainable models are evident. While some researchers advocate for standardization, others focus on industry-specific features. Second, despite the availability of numerous tools for model development, methods for quantitatively evaluating their effectiveness remain underdeveloped. Third, much of the attention is directed at large corporations and developed markets, whereas small businesses and emerging economies are often overlooked in research.

Additionally, unresolved issues persist regarding the overcoming of barriers to sustainability implementation. Challenges such as a lack of funding, insufficient awareness, and resistance to change require more in-depth examination. Future research could focus on developing universal metrics for evaluating sustainability, studying the specific needs of small and medium-sized enterprises in local contexts, and creating recommendations for their integration into global supply chains.

The methodology is based on an analysis of scientific studies and empirical data, enabling the identification of effective practices and gaps in existing approaches.

3. Results and Discussion

The implementation of sustainable development principles in the corporate sector is a multifaceted process that requires careful integration of environmental, economic, and social factors. Contemporary challenges, such as climate change, ecosystem degradation, and the threat of increasing social inequality, necessitate a reevaluation of conventional business practices. Organizations focused on long-term outcomes are adopting models that combine sustainability with efficiency while facing methodological and organizational difficulties [10]. The key features of implementing business models based on sustainable development are outlined in Table 1 below:

Table 1 Features of the implementation of business models based on sustainable development [1,6,2].

Feature	Description
Integration of sustainability principles	Sustainability must be integrated into the core business strategy, requiring a revision of goals.
Focus on long-term goals	Sustainable development principles demand a long-term perspective rather than short-term gains.
Stakeholder focus	The interests of all stakeholders—employees, customers, and investors—must be considered.
Use of modern technologies	The adoption of sustainable business models is linked to the use of advanced technological solutions.
Reporting system	Companies must develop reporting systems to assess the progress of sustainable practices.
Supply chain adaptation	Implementing sustainability requires rethinking the entire supply chain to meet environmental standards.
Employee engagement	The introduction of sustainable practices necessitates employee training and changes in corporate culture.
Transition to clean technologies	Investments in energy-efficient technologies, renewable energy sources, waste minimization, and eco-friendly materials are key aspects of sustainable business.
Social responsibility	Business models must address not only environmental but also social sustainability.

The concept of sustainable business models is based on creating value that encompasses various aspects of business activities. Sustainability is integrated with social responsibility and economic efficiency, forming a new foundation for strategic planning. Unlike traditional approaches focused on financial indicators, sustainable models incorporate intangible assets, such as natural resources, social capital, and innovative practices.

The development of these models relies on interdisciplinary methods, including systems analysis, game theory, and elements of behavioral economics. For instance, environmental impact assessments use forecasts that consider the comprehensive effects of production processes on ecosystems. Social aspects are analyzed through evaluations of their impact on local communities and working conditions for employees.

Implementing business models based on the principles of sustainable development requires a set of measures aimed at reducing environmental impact, rationalizing resource use, and enhancing social responsibility. The technical aspect plays a significant role in executing these strategies, as it enables the application of innovative solutions, automated

systems, digital technologies, and methods that contribute to achieving environmental, economic, and social goals [4,5]. Below, Figure 1 outlines the stages of implementing business models based on sustainable development.

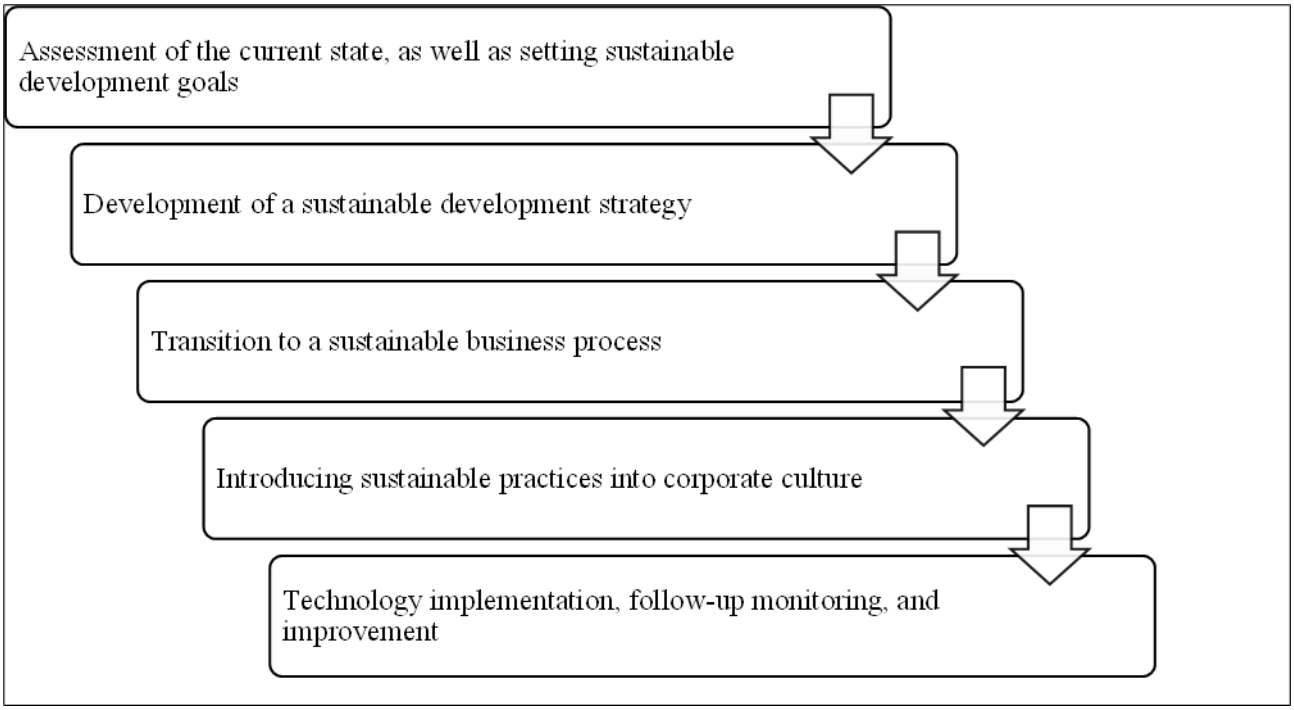

Figure 1 Stages of implementation of business models based on sustainable development [4,5,10,11]

One key component is the establishment of monitoring systems. Modern digital technologies, including the Internet of Things, enable the tracking of resource consumption, greenhouse gas emissions, waste levels, and other necessary indicators. The integration of data analysis platforms facilitates data collection and analysis, forming the basis for informed decision-making. A crucial task involves accounting for negative factors, which includes calculating an organization's carbon footprint and analyzing it across supply chains.

Energy optimization represents a direction for technical modernization. The adoption of renewable energy sources, such as solar panels, wind turbines, and biogas plants, reduces dependency on traditional hydrocarbon-based energy sources. The use of energy-efficient technologies, including lighting management systems, building automation, and heating, ventilation, and air conditioning (HVAC) systems, decreases energy consumption. Energy storage systems help mitigate fluctuations in energy supply, enhancing the resilience of the energy infrastructure.

For sustainable production and the transformation of supply chains, the implementation of environmentally safe technologies is required. This includes the use of recycled and biodegradable materials, as well as minimizing the consumption of hazardous chemicals. The digitalization of supply chains through blockchain technologies enhances process transparency, ensuring compliance with sustainable development standards. The transition to a circular economy necessitates the creation of infrastructure for collecting, recycling, and reusing materials within production cycles [3,8].

Information technologies and the automation of production processes facilitate the adoption of sustainable development principles. Software solutions for lifecycle assessment enable modeling and evaluating the environmental impact of products at various stages of their lifecycle. Robotics and the automation of production processes reduce waste and increase productivity. Cloud platforms for data management optimize internal business processes.

Waste management requires technologies for sorting, recycling, and disposal. Modern water recycling systems utilizing biological and chemical purification methods ensure the reuse of water in production cycles. Biotechnologies, such as bioreactors, convert organic waste into useful products, such as fertilizers or biogas. Zero-waste strategies contribute to minimizing environmental impact.

Ecological product design includes the development of items suitable for recycling and the use of materials with minimal carbon footprints. Modular product designs allow for the replacement of worn-out components, thereby extending the product's lifecycle. Water-saving measures, including rainwater harvesting systems and automated water supply control systems, help efficiently utilize water resources.

The use of artificial intelligence and machine learning increases process efficiency. These technologies enable the forecasting of resource demand, optimization of logistics, and identification of inefficiencies in operational processes. Their implementation enhances operational efficiency and reduces costs.

Supporting these changes requires training employees in new technologies. The development of educational programs improves workforce qualifications. The use of resource management systems and customer interaction platforms ensures coordination during the implementation of changes. Environmental performance is evaluated using software that enables the preparation of reports by international sustainability standards.

Innovations in customer interaction include the development of platforms that inform consumers about product compliance with sustainability principles. The introduction of "smart" products capable of tracking environmental impact increases user awareness and encourages environmentally responsible practices.

The technical aspect of implementing sustainable business models encompasses a wide range of activities that require a comprehensive approach and coordination at all organizational levels.

The adoption of sustainability principles faces several obstacles that necessitate a strategic approach. One of the primary challenges is the lack of financial resources for implementing projects such as transitioning to renewable energy sources and modernizing production facilities. This issue is particularly evident in companies with low profitability.

Another significant challenge is the limitation of data and analytical tools. For instance, accurately assessing carbon footprints or biodiversity in supply chains is hindered by fragmented information and the absence of a unified methodology. Inconsistent legislation across different countries increases risks and complicates the standardization of processes [7,12].

Cultural barriers also exert an influence. Insufficient engagement from management and employee passivity slow down the process of change. Motivational programs aimed at fostering environmental awareness must be supported by specific organizational measures.

Technology plays a crucial role in shaping sustainable business models. Big data analytics and machine learning algorithms help predict environmental and social risks and develop strategies to minimize costs. Blockchain technology ensures supply chain transparency and validates the environmental integrity of products.

Additionally, the potential of the circular economy must be taken into account. The use of recycled materials and secondary resources reduces waste, promotes cost savings, and decreases reliance on primary resources. These approaches are particularly important for industries with high production costs and significant environmental impact.

Rethinking communication strategies with stakeholders is a vital element of sustainable development. For investors, it is essential to provide evidence of the feasibility of sustainable initiatives through the disclosure of environmental and social performance indicators. Engagement with local communities strengthens brand reputation. Employee training programs focused on developing environmental literacy help foster a corporate culture aligned with sustainability principles [9]. Below, Table 2 outlines the advantages and disadvantages of implementing business models based on sustainable development.

Table 2 Advantages and disadvantages of implementing business models based on sustainable development (compiled by the author)

Advantages	**Disadvantages**
Increased competitiveness. Companies focused on sustainability can differentiate themselves from competitors by attracting environmentally conscious consumers.	High initial costs. Implementing sustainable practices requires significant investment.
Brand strengthening. Sustainability initiatives can enhance a company's reputation and increase customer loyalty.	Challenges in assessing sustainability. Assessment is complex and requires the adoption of new standards and tools.
Access to new markets. Sustainable practices open opportunities to enter new markets.	The need for changes in corporate culture. Implementing sustainability requires cultural shifts and employee training.
Long-term savings. Energy-efficient technologies reduce operating costs.	Uncertainty in long-term outcomes.
Attracting investments.	Diverse reporting standards complicate processes.
Risk reduction. Sustainability helps mitigate risks related to environmental disasters, climate change, or social instability.	The necessity of long-term changes. Transitioning to a sustainable business model requires time and faces resistance to change.

Practical examples of companies implementing sustainable business models include:

Unilever implements a sustainability strategy aimed at reducing the environmental impact of its production activities. The goal is to transform the organization into an active participant in ecosystem restoration and mitigate the consequences of industrial resource exploitation. Key efforts focus on minimizing carbon emissions, improving social conditions within the company, and developing products that meet environmental standards.

Tesla introduces sustainable solutions in high-tech industries, focusing on producing electric vehicles that help reduce carbon emissions. The company actively works in the fields of renewable energy and efficient energy storage systems, reducing reliance on hydrocarbon resources.

Patagonia integrates sustainability principles across all stages of its production process. The company uses recycled materials in its products and supports ecological initiatives aimed at preserving nature. Patagonia promotes responsible consumption, encouraging customers to choose eco-friendly products and minimize their environmental footprint.

IKEA incorporates sustainability principles at all levels of its operations. The company has developed measures to reduce carbon emissions, increase the use of renewable materials in production processes, and foster rational consumer habits. Additionally, IKEA develops solutions to enhance product energy efficiency and reduce environmental impact.

In conclusion, the transition to business models based on sustainable development principles requires a comprehensive approach that includes technological innovations, stakeholder engagement, and the adoption of new management methods. Implementing such models allows companies to minimize risks, create long-term competitive advantages, and successfully adapt to changes in the economic system.

4. Conclusion

The described models, encompassing ecological, economic, and social aspects, serve not only as a means of minimizing environmental impact but also as a way to strengthen companies' market positions. The use of technologies such as digital platforms, blockchain, and lifecycle assessment methods creates opportunities to enhance operational transparency and optimize resource utilization.

However, several barriers persist, including limited available resources, a lack of standardized evaluation methods, and resistance to change within corporate culture. Overcoming these challenges is possible through the development of universal metrics that allow for objective performance assessment while being adaptable to local conditions and specific

needs. Additionally, tailoring models to local contexts and increasing awareness among employees and management are critical steps in addressing these obstacles.

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