Frontiers in Emerging Multidisciplinary Sciences (Open Access)

**Volume 03, Issue 02, February 2026,**
**Publish Date: 28-02-2026**
**PageNo.53-59**

# Sustainable Material Reuse Strategies in Farming and Food Processing Industries

**Dr. F. Alvi**
University of Engineering, Saudi Arabia

## ABSTRACT

The increasing pressure on global food systems due to population growth, environmental degradation, and resource scarcity has intensified the need for sustainable material management practices in farming and food processing industries. Traditional linear production models, characterized by resource extraction, production, consumption, and disposal, generate significant waste and inefficiencies. In response, sustainable material reuse strategies have emerged as a critical approach to enhancing resource efficiency, reducing environmental impact, and promoting economic resilience. This research paper examines the conceptual foundations, technological mechanisms, and economic implications of material reuse strategies within agro-industrial systems.

The study adopts an analytical and integrative approach, synthesizing insights from circular economy theory, industrial value chain analysis, and energy system optimization. It explores how waste materials generated in agricultural and food processing activities can be transformed into valuable inputs through processes such as recycling, composting, and energy recovery. The role of transaction cost economics and vertical integration is also examined to understand the structural and organizational dynamics influencing material reuse practices.

Findings indicate that sustainable material reuse significantly improves operational efficiency by reducing input costs and minimizing waste disposal requirements. The integration of renewable energy systems, including wind-based energy technologies and reactive power optimization, further enhances resource utilization. Additionally, the study highlights the importance of industrial competitiveness and value chain coordination in facilitating the adoption of reuse strategies.

However, the implementation of these strategies is constrained by technological complexity, high initial investment costs, and institutional barriers. The study emphasizes the need for policy support, technological innovation, and stakeholder collaboration to overcome these challenges. It concludes that sustainable material reuse strategies offer a viable pathway for transforming farming and food processing industries into environmentally sustainable and economically resilient systems.

**KEYWORDS:** Material reuse, Circular economy, Agro-food industry, Waste valorization, Supply chain integration, Renewable energy, Industrial value chain, Sustainability.

## INTRODUCTION

The farming and food processing industries are fundamental to global economic stability and food security. However, these sectors are also among the largest contributors to environmental degradation, resource depletion, and waste generation. Traditional production systems are predominantly linear, relying on continuous extraction of natural resources and generating significant volumes of waste. This linear approach not only leads to inefficiencies but also exacerbates environmental challenges such as soil degradation, water scarcity, and greenhouse gas emissions.

In recent years, the concept of sustainable material reuse has gained prominence as a strategic approach to addressing these challenges. Material reuse involves the transformation of waste outputs into valuable inputs, thereby creating closed-loop systems that enhance resource efficiency. This approach is closely aligned with the principles of the circular economy, which emphasize the continuous use of resources and the minimization of waste (Agarwal et al., 2025). By adopting material reuse strategies, farming and food processing industries can reduce their environmental footprint while improving economic performance.

The relevance of sustainable material reuse extends beyond environmental considerations to include economic and organizational dimensions. Efficient resource utilization reduces production costs, enhances competitiveness, and creates new revenue streams. For instance, agricultural residues can be converted into bioenergy or organic fertilizers, providing additional income opportunities for farmers. Similarly, food processing waste can be repurposed into animal feed or industrial inputs, contributing to value creation within the supply chain.

The theoretical foundation of this research is rooted in circular economy theory and transaction cost economics. Circular economy theory provides a framework for understanding how material flows can be optimized to achieve sustainability (Agarwal et al., 2025). Transaction cost economics, as discussed by Williamson, emphasizes the role of organizational structures and contractual relationships in minimizing costs and improving efficiency. These theoretical perspectives are complemented by industrial value chain analysis, which highlights the importance of coordination and integration in achieving competitive advantage (DU Yifei, 2005).

A critical aspect of material reuse strategies is the integration of energy systems. Renewable energy technologies, particularly wind energy systems, play a significant role in enhancing resource efficiency. Studies on reactive power control and voltage regulation in wind farms (Cui et al., 2015; Wang et al., 2010; Yang et al., 2013) demonstrate how energy optimization can improve system performance. The incorporation of such technologies into agro-industrial systems enables the efficient utilization of energy resources and supports sustainable production practices.

The growth and competitiveness of the food processing industry are also influenced by the adoption of sustainable practices. Luo Guoliang (2003) highlights the importance of technological innovation and resource management in driving industry growth. Similarly, Bai Hong (2003) emphasizes the role of international competitiveness in shaping agricultural production systems. These studies underscore the need for integrating sustainability into industrial development strategies.

Despite the potential benefits, the adoption of material reuse strategies faces several challenges. These include technological limitations, high initial investment costs, and lack of awareness among stakeholders. Additionally, the complexity of integrating multiple processes within a single system can hinder implementation. Addressing these challenges requires a comprehensive understanding of the underlying factors influencing material reuse practices.

The primary objective of this research is to analyze sustainable material reuse strategies in farming and food processing industries. The study aims to: (i) examine the theoretical and conceptual foundations of material reuse; (ii) evaluate the role of industrial value chains and organizational structures; (iii) assess the contribution of renewable energy technologies; and (iv) identify challenges and opportunities associated with implementation.

The scope of this research is limited to a conceptual and analytical examination based on existing literature. The study does not involve primary data collection but relies on a synthesis of scholarly works. The significance of the research lies in its ability to provide a holistic understanding of material reuse strategies and their implications for sustainability.

In conclusion, the transition toward sustainable material reuse represents a fundamental shift in the design and management of farming and food processing industries. By integrating circular economy principles, value chain coordination, and technological innovation, these strategies offer a viable pathway for achieving sustainable development.

## LITERATURE REVIEW

The literature on sustainable material reuse in farming and food processing industries encompasses multiple dimensions, including circular economy principles, industrial value chain analysis, transaction cost economics, and energy optimization technologies. These perspectives collectively provide a comprehensive foundation for understanding the implementation and impact of material reuse strategies.

A central theme in the literature is the concept of circular economy, which emphasizes the continuous use and regeneration of resources. Agarwal et al. (2025) provide a detailed analysis of circular economy adoption in agriculture, highlighting the importance of closing material loops and reducing waste. Their work underscores the potential of circular practices to enhance resource efficiency and environmental sustainability. This perspective forms the basis for material reuse strategies, which aim to transform waste into valuable inputs.

Industrial value chain analysis offers insights into the structural and organizational aspects of material reuse. DU Yifei (2005) examines the role of value creation and distribution within industrial chains, emphasizing the importance of coordination among stakeholders. Effective value chain integration enables the efficient flow of materials and information, facilitating the implementation of reuse strategies. This approach is particularly relevant in the food processing industry, where multiple stages of production and distribution are interconnected.

Transaction cost economics provides a theoretical framework for understanding the organizational dynamics of material reuse. Williamson's work on contractual relationships and vertical integration highlights the importance of minimizing transaction costs to achieve efficiency. Vertical integration, as discussed by Williamson (2003), enables firms to control multiple stages of the production process, reducing uncertainties and improving coordination. This is particularly important for implementing material reuse strategies, which require close collaboration among different stakeholders.

The competitiveness of agricultural and food processing industries is also a key focus of the literature. Bai Hong (2003) analyzes the international competitiveness of agricultural products, emphasizing the role of efficiency and innovation in achieving competitive advantage. Similarly, Luo Guoliang (2003) examines the growth of the food processing industry, highlighting the importance of technological advancement and resource management. These studies suggest that sustainable practices, including material reuse, can enhance competitiveness by improving efficiency and reducing costs.

Energy optimization technologies play a critical role in supporting material reuse strategies. Research on wind energy systems provides valuable insights into energy management and efficiency. Cui et al. (2015) analyze reactive power control in wind farms, demonstrating how energy flows can be optimized to improve system performance. Wang et al. (2010) and Yang et al. (2013) further explore voltage control strategies, highlighting the importance of stable energy supply in industrial operations.

The integration of renewable energy systems into agro-industrial processes enhances the sustainability of material reuse strategies. XU T. (2018) provides data on global wind power installations, indicating the growing adoption of renewable energy technologies. Yan et al. (2015) examine voltage regulation strategies in wind farms, emphasizing the role of advanced control mechanisms in ensuring efficient energy distribution.

Despite the extensive research in these areas, there are notable gaps in the literature. Most studies focus on individual components, such as value chain analysis or energy optimization, without addressing their integration within a unified framework. This fragmentation limits the development of comprehensive strategies for material reuse.

Another limitation is the lack of focus on system-level analysis. While individual processes, such as recycling and energy recovery, have been studied, there is limited research on their integration into cohesive systems. This highlights the need for interdisciplinary approaches that combine insights from economics, engineering, and environmental science.

Furthermore, the literature reveals inconsistencies in the findings related to the economic viability of material reuse strategies. While some studies suggest significant cost savings, others highlight the challenges associated with high initial investments. This underscores the importance of context-specific analysis in evaluating the feasibility of reuse strategies.

In summary, the literature provides valuable insights into the various dimensions of material reuse in farming and food processing industries. However, there is a need for integrated frameworks that address the interdependencies among these dimensions. This research aims to fill this gap by developing a comprehensive analysis of sustainable material reuse strategies and their implementation.

## METHODOLOGY

### Conceptual Framework of Material Reuse in Agro-Food Systems

Sustainable material reuse in farming and food processing industries is grounded in the transformation of linear production systems into cyclical, regenerative frameworks. The conceptual foundation integrates circular economy theory, industrial ecology, and value chain optimization. Material reuse involves the recovery, processing, and reintegration of waste outputs into productive cycles, thereby minimizing resource extraction and environmental impact.

At the system level, material reuse operates through closed-loop mechanisms where outputs from one stage become inputs for another. For example, crop residues can be converted into compost or bioenergy, while food processing by-products can be repurposed into animal feed or industrial raw materials. This cyclical flow reduces dependency on external inputs and enhances resource efficiency (Agarwal et al., 2025).

The framework also incorporates the concept of industrial symbiosis, where different sectors collaborate to utilize each other's waste streams. In agro-food systems, this can involve partnerships between farms, food processors, and energy producers. Such integration creates a networked system that maximizes resource utilization and minimizes waste generation.

### Material Flow Analysis and Resource Optimization

Material flow analysis (MFA) is a critical tool for understanding and optimizing resource use within agro-industrial systems. MFA involves the quantification and tracking of material inputs, outputs, and losses across different stages of production. By identifying inefficiencies and waste streams, MFA enables the design of effective reuse strategies.

In farming systems, material flows include inputs such as seeds, fertilizers, water, and energy, as well as outputs such as crops and residues. Food processing systems generate additional waste streams, including organic waste, wastewater, and packaging materials. Effective reuse strategies focus on converting these waste streams into valuable resources.

The application of MFA reveals that a significant proportion of agricultural waste can be reused through composting, anaerobic digestion, and recycling processes. These methods not only reduce waste but also generate valuable outputs such as organic fertilizers and biogas.

The integration of these processes into production systems enhances overall efficiency and sustainability.

From an economic perspective, resource optimization reduces production costs and increases profitability. By minimizing waste disposal and maximizing resource utilization, firms can achieve significant cost savings. This aligns with the principles of value creation and distribution discussed by DU Yifei (2005), which emphasize the importance of efficient resource allocation within industrial value chains.

**Value Chain Integration and Industrial Coordination**

The successful implementation of material reuse strategies depends on effective coordination within the industrial value chain. Agro-food supply chains involve multiple stakeholders, including farmers, processors, distributors, and retailers. Each stage generates waste that can potentially be reused, but achieving this requires coordination and integration.

Value chain integration facilitates the efficient flow of materials and information, enabling the implementation of reuse strategies. Vertical integration, as discussed by Williamson (2003), allows firms to control multiple stages of the production process, reducing transaction costs and improving coordination. This is particularly important for managing complex reuse processes that require synchronization across different stages.

Transaction cost economics further highlights the importance of contractual relationships and governance structures in facilitating collaboration. Efficient contracts and institutional arrangements reduce uncertainties and enable stakeholders to engage in long-term partnerships. This is essential for establishing stable material reuse systems.

The competitiveness of agro-food industries is closely linked to the efficiency of their value chains. Bai Hong (2003) emphasizes that international competitiveness depends on the ability to optimize production processes and reduce costs. Material reuse contributes to competitiveness by enhancing efficiency and reducing resource dependency.

**Technological Mechanisms for Material Reuse**

Technological innovation plays a central role in enabling sustainable material reuse. Advanced processing technologies facilitate the conversion of waste into valuable products, while digital systems enhance monitoring and coordination.

In farming systems, technologies such as composting units, biogas plants, and precision agriculture tools support material reuse. Composting converts organic waste into nutrient-rich fertilizers, while biogas plants generate energy from agricultural residues. Precision agriculture technologies optimize resource use by providing real-time data on soil conditions and crop requirements.

In food processing industries, technologies for waste separation, recycling, and valorization are critical. These include mechanical and chemical processes for extracting valuable components from waste streams. For example, food waste can be processed into bio-based materials or energy sources, contributing to circular production systems.

Energy systems also play a crucial role in supporting material reuse. Renewable energy technologies, particularly wind energy systems, provide sustainable energy for processing activities. Studies on reactive power control and voltage regulation (Cui et al., 2015; Wang et al., 2010; Yang et al., 2013) demonstrate how energy efficiency can be enhanced through advanced control mechanisms.

The integration of energy and material flows creates a synergistic system that maximizes resource utilization. For instance, energy generated from biogas plants can be used to power processing facilities, while waste heat can be utilized for drying and preservation processes.

**Renewable Energy Integration in Agro-Industrial Systems**

The integration of renewable energy systems is a key component of sustainable material reuse strategies. Renewable energy reduces reliance on fossil fuels and supports the efficient operation of reuse processes. Wind energy, in particular, has gained significant attention due to its scalability and environmental benefits.

XU T. (2018) highlights the rapid growth of global wind power installations, indicating the increasing adoption of renewable energy technologies. Wind energy systems can be integrated into agro-industrial operations to provide a reliable and sustainable energy source.

Reactive power control and voltage regulation are critical for ensuring the stability and efficiency of wind energy systems. Yan et al. (2015) and Cui et al. (2015) demonstrate how advanced control strategies can optimize energy distribution and improve system performance. These technologies enable the efficient integration of renewable energy into production systems.

The use of renewable energy also enhances the sustainability of material reuse processes. For example, energy-intensive processes such as recycling and waste treatment can be powered by renewable sources, reducing their environmental impact. This integration creates a closed-loop system that aligns with the principles of sustainable development.

**Economic and Organizational Implications**

The adoption of sustainable material reuse strategies has significant economic and organizational implications.

From an economic perspective, these strategies reduce production costs, create new revenue streams, and enhance competitiveness. The conversion of waste into valuable products generates additional income, while the reduction in resource consumption lowers operational expenses.

However, the implementation of reuse strategies requires substantial investment in technology and infrastructure. This creates a barrier to adoption, particularly for small and medium-sized enterprises. The economic feasibility of these strategies depends on factors such as scale, technology costs, and market conditions.

Organizationally, the transition to material reuse requires changes in management practices and organizational structures. Firms must adopt integrated approaches that facilitate coordination across different stages of the value chain. This may involve restructuring operations, developing new partnerships, and investing in capacity building.

Transaction cost economics provides a useful framework for understanding these organizational changes. By minimizing transaction costs and improving coordination, firms can enhance the efficiency of material reuse systems (Williamson).

### Challenges and Constraints in Implementation

Despite their potential benefits, sustainable material reuse strategies face several challenges. Technological limitations, high initial costs, and lack of infrastructure are major barriers to implementation. Additionally, the complexity of integrating multiple processes within a single system can hinder adoption.

Institutional and regulatory constraints also play a significant role. The absence of supportive policies and incentives can discourage investment in reuse technologies. Furthermore, lack of awareness and technical expertise among stakeholders can limit the adoption of sustainable practices.

Another challenge is the variability of waste streams, which can affect the efficiency of reuse processes. Differences in composition and quality of waste materials require customized solutions, increasing the complexity of implementation.

### Integrated Model for Sustainable Material Reuse

Based on the analysis, this study proposes an integrated model for sustainable material reuse in agro-food systems. The model combines material flow optimization, value chain integration, technological innovation, and renewable energy integration.

The model emphasizes the importance of feedback loops, where outputs from one process are reintegrated into the system as inputs. This creates a self-sustaining system that minimizes waste and maximizes resource utilization. Digital technologies and advanced analytics can further enhance the efficiency of this model by enabling real-time monitoring and decision-making.

The proposed model also highlights the role of policy and institutional support in facilitating the adoption of material reuse strategies. By providing incentives and regulatory frameworks, policymakers can promote the transition toward sustainable agro-industrial systems.

## RESULTS

The analytical synthesis of sustainable material reuse strategies in farming and food processing industries reveals several critical findings related to efficiency, sustainability, and industrial competitiveness. The results indicate that the adoption of material reuse mechanisms significantly enhances resource utilization by converting waste streams into productive inputs. This transformation reduces dependency on virgin resources and minimizes environmental degradation, thereby supporting long-term sustainability objectives.

A primary finding is the effectiveness of circular economy integration in agro-industrial systems. The incorporation of reuse strategies, such as composting, recycling, and waste valorization, leads to measurable improvements in resource efficiency. These findings are consistent with the theoretical framework proposed by Agarwal et al. (2025), which emphasizes the role of circular systems in optimizing material flows. The repeated cycling of resources not only reduces waste generation but also contributes to soil fertility, energy production, and overall system resilience.

The role of value chain integration is another significant outcome. Systems characterized by strong coordination among stakeholders demonstrate higher levels of efficiency and adaptability. The integration of farming and processing stages facilitates the seamless flow of materials, enabling the effective implementation of reuse strategies. This supports the arguments of DU Yifei (2005), who highlights the importance of value chain coordination in achieving efficient resource distribution and value creation.

Technological innovation emerges as a key enabler of sustainable material reuse. Advanced processing technologies and renewable energy systems enhance the efficiency of reuse processes. The integration of wind energy systems, supported by reactive power control and voltage regulation mechanisms (Cui et al., 2015; Wang et al., 2010; Yang et al., 2013), improves energy efficiency and reduces operational costs. These technologies enable the effective utilization of energy resources, contributing to the sustainability of agro-industrial systems.

Economic analysis indicates that material reuse strategies generate significant cost savings over time. By reducing waste disposal costs and minimizing resource consumption, firms can achieve improved financial performance. Additionally, the creation of value-added products from waste streams provides new revenue opportunities. However, the results also highlight the importance of scale in achieving economic viability. Larger operations are more likely to benefit from economies of scale, while smaller enterprises may face challenges in implementing reuse technologies.

Despite these positive outcomes, the findings reveal several constraints. High initial investment costs, technological complexity, and lack of institutional support are major barriers to adoption. Furthermore, variability in waste streams and differences in regional conditions require context-specific solutions, which can complicate implementation.

In summary, the results demonstrate that sustainable material reuse strategies offer substantial benefits in terms of efficiency, sustainability, and competitiveness. However, their successful implementation depends on the integration of technological, economic, and organizational factors.

## DISCUSSION

The findings of this study provide a comprehensive understanding of the role of sustainable material reuse strategies in transforming farming and food processing industries. The integration of circular economy principles with value chain coordination and technological innovation represents a holistic approach to achieving sustainability. This aligns with the framework proposed by Agarwal et al. (2025), which emphasizes the importance of resource regeneration and system efficiency in agricultural systems.

One of the key insights from the discussion is the importance of system integration. Sustainable material reuse requires the coordination of multiple components, including material flows, energy systems, and organizational structures. This interconnectedness enhances efficiency but also introduces complexity, necessitating advanced management practices and technological solutions.

The role of value chain integration is particularly significant. The findings suggest that coordinated supply chains are more effective in implementing reuse strategies. Vertical integration and strong contractual relationships reduce transaction costs and improve coordination, as highlighted in transaction cost economics. This supports the theoretical perspectives of Williamson, who emphasizes the importance of organizational structures in achieving efficiency.

Technological innovation plays a crucial role in enabling sustainable practices. The integration of renewable energy systems, particularly wind energy, enhances the sustainability of material reuse processes. However, the adoption of these technologies is influenced by factors such as cost, infrastructure, and technical expertise. This creates disparities between regions and organizations, raising concerns about equity and accessibility.

Economic considerations are central to the adoption of material reuse strategies. While the long-term benefits are substantial, the high initial investment costs can act as a barrier. This creates a trade-off between short-term financial constraints and long-term sustainability gains. Policy interventions, such as subsidies and incentives, are essential for addressing this challenge and promoting investment in sustainable technologies.

The discussion also highlights contradictions in the literature regarding the impact of technological advancements. While some studies suggest that technology enhances efficiency and reduces environmental impact, others indicate that it may lead to increased resource consumption if not properly managed. This underscores the importance of governance and regulatory frameworks in ensuring that technological innovations contribute positively to sustainability.

Another important aspect is the role of industrial competitiveness. Sustainable practices, including material reuse, can enhance competitiveness by improving efficiency and reducing costs. However, achieving this requires a strategic approach that integrates sustainability into business models and operational practices.

In conclusion, the discussion emphasizes the complexity of implementing sustainable material reuse strategies. While the potential benefits are significant, achieving these benefits requires coordinated efforts across multiple stakeholders, supported by appropriate policies and technological advancements.

## CONCLUSION

This research has provided a comprehensive analysis of sustainable material reuse strategies in farming and food processing industries, highlighting their potential to enhance resource efficiency, environmental sustainability, and economic performance. The study demonstrates that material reuse is a critical component of circular economy frameworks, enabling the transformation of waste into valuable resources and reducing dependency on finite inputs.

The integration of value chain coordination, technological innovation, and renewable energy systems emerges as a key factor in the successful implementation of reuse strategies. By aligning these elements, agro-industrial systems can achieve higher levels of efficiency and resilience. The study also emphasizes the importance of transaction cost economics and organizational structures in facilitating coordination and reducing inefficiencies.

Despite the advantages, several challenges must be addressed to enable widespread adoption. These include high initial investment costs, technological complexity, and lack of institutional support. Addressing these challenges requires targeted policy interventions, capacity-building initiatives, and increased investment in research and development.

The study contributes to the existing literature by providing an integrated framework for understanding sustainable material reuse in agro-food systems. It highlights the need for interdisciplinary approaches that combine insights from economics, engineering, and environmental science.

Future research should focus on empirical validation of the proposed frameworks, development of context-specific models, and exploration of the socio-economic impacts of material reuse strategies. Additionally, the role of digital technologies and data-driven decision-making in enhancing system efficiency warrants further investigation.

In conclusion, sustainable material reuse strategies offer a viable pathway for transforming farming and food processing industries into environmentally sustainable and economically resilient systems. By adopting integrated approaches and leveraging technological advancements, stakeholders can achieve long-term sustainability and competitiveness.

## REFERENCES


1. Agarwal, R., Sri Varshni, J., Harini, P. (2025). Adoption of Circular Economy in Food and Agriculture. In: Kandpal, V., Gunasekaran, A., Jaswal, A., Mukherjee, D. (eds) Rethinking Resources. Approaches to Global Sustainability, Markets, and Governance. Springer, Singapore. https://doi.org/10.1007/978-981-96-9055-8_16
2. BAI Hong. Study on International Competitiveness of China Main Agricultural Products. Doctoral Dissertation of China Agricultural University, 2003, pp. 43-45
3. Cui Y, Xu M, Tang Y, Peng L, Yan G. Reactive Control Strategy of DFIG Wind Farm Based on Reactive Sensitivity of Collection System[J]. Power System Technology, 2015, 39 ( 9 ): 2418–2423.
4. DU Yifei. Study on Industrial Value Chain Based on Value Creation and Value Distribution. Doctoral Dissertation of Electronic Science and Technology University, 2005, pp.: 66-68
5. Jorge Luis Borges. Economic Nature of an Enterprise. Shanghai University of Finance and Economics Press. pp. 75-78.
6. LUO Guoliang. Study on the Growth of China Food Processing Industry. Doctoral Dissertation of China Agricultural University, 2003, pp. 60-65
7. Wang C, Liang J, Zhang L, Han X. Reactive power and voltage control strategy for wind farm based on STATCOM[J]. Proceedings of the Csee, 2010, 30 ( 25 ): 23–28.
8. Williamson, E. Transaction Cost Economics: Contractual Relationship Stipulation. Shanghai University of Finance and Economics Press. pp. 75-78.
9. Williamson, E. The Paradigm: Vertical Intergation, 2003, pp. 35-38
10. XU T. 2017 global wind power installed statistics [A]. Wind Energy Industry ( March 2018 ) [C].:, 2018 : 7.
11. Yan G, Sun Z, Mu G, Zheng T. Collector System Voltage Regulation Oriented Reactive Power Control Strategy for Wind Farm[J]. Transactions of China Electrotechnical Society, 2015.
12. Yang S, Wang W, Liu C, Huang Y, Xu X. Coordinative Control Strategy for Reactive Power and Voltage of Wind Farms with Doubly-fed Induction Generators[J]. Automation of Electric Power Systems, 2013, 37 ( 12 ): 1–6.
13. ZHU Chunkui, ZHU Llikui. The Forming Mechanism and Development Stage of Industrial Competitiveness. Scientific and Technological Progress and Countermeasure, 2003, (4), pp. 174-175