

Application Obstacles and Countermeasures of Circular Supply Chain in Enterprises —— Taking Mobile Phone Industry as an Example

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Abstract:

Against the backdrop of increasing global resource consumption rates and growing environmental pressures, the limitations of the traditional linear economic model in advancing sustainable development have become increasingly apparent. In view of this, this study focuses on the mobile phone industry, thoroughly analyses the key obstacles faced in the practice of the circular supply chain in this industry, and explores the corresponding solutions. This study employs a mixed-method approach combining literature review and case analysis, and after careful exploration, identifies four core challenges in the process of building a circular supply chain for mobile communication equipment, namely, technical bottlenecks, economic challenges, consumer barriers and institutional environment constraints. In response to these challenges, this study puts forward highly operable suggestions from four key dimensions: technological innovation, business model innovation, consumer incentive and policy coordination. These suggestions aim to provide a reference framework with both theoretical depth and practical significance for the green transformation of enterprises.

Keywords: Circular supply chain, Mobile phone industry, Sustainable development, Reverse logistics

1. Introduction

1.1 Research Background

The global total amount of electronic waste is increasing, which increasingly highlights the problems existing in the traditional linear economic develop-

ment model in resource utilization and environmental protection. In the field of resource-intensive industries, the mobile phone industry is quite typical-its product iteration speed is extremely fast, the structure of parts is highly integrated, and consumers change machines frequently, which makes it difficult for the existing recycling system to deal with it effectively,

and then produces a lot of electronic waste. In this case, the circular supply chain provides a key solution to resolve the contradiction between environmental constraints and industrial development by building a closed-loop system of “design-production-recovery-regeneration”.

1.2 Research Significance

This study focuses on the mobile phone industry, systematically analyses the key obstacles in the practice of the circular supply chain and puts forward operational schemes to provide theoretical and practical reference for the sustainable development of the industry. In industrial practice, building an efficient reverse logistics system and adopting modular product design can reduce the cost of raw materials, solve the problem of electronic waste disposal and promote the recycling of resources. On the policy level, under the strategy of promoting circular economy in various countries, the implementation of the circular supply chain by mobile phone enterprises is a response to the extended producer responsibility system, which can get policy support and achieve sustainable development, and institutional arrangements provide external driving force for enterprise transformation. Theoretically, the existing literature pays more attention to macro-policy or specific technological innovation, and lacks analysis of systemic obstacles in manufacturing industry. This study focuses on the mobile phone industry to explore the challenges and paths of the circular supply chain construction, expands the theoretical application of the circular supply chain, and provides an analytical framework for other electronic product manufacturing.

2. Literature Review

2.1 The Difference and Connection between Circular Supply Chain and Traditional Supply Chain Management

Traditional supply chain management focuses on optimizing the forward logistics process from raw material procurement to terminal consumption, and its core goal is to improve operational efficiency and control costs. The circular supply chain system constructs a more complex life cycle management system, which integrates reverse logistics links such as product recycling and remanufacturing to form a complete closed loop on the basis of retaining the traditional supply chain elements. Werner Jammerneegg et al. (2018) pointed out that the essence of this model is to integrate the concept of circular economy into the supply chain strategy and break the linear operation to achieve sustainable development. R. De Angelis et al. (2018) further explained that the circular supply chain conforms to the principle of circular economy, and its

characteristics are as follows: the supply chain relationship has changed from the traditional product ownership model to the service leasing model, and the operation structure pays more attention to flexibility, providing development space for start-ups in regional circular networks.

2.2 The Role and Position of Circular Supply Chain in Circular Economy

Circular economy is the inevitable path of social sustainable development. It emphasizes high efficiency and recycling of resources to reduce dependence on natural resources and environmental damage. Zhang (2007) pointed out that circular economy puts forward new requirements for supply chain, and it is necessary to attach importance to the construction of reverse supply chain to form a closed loop and strengthen the green research and development of supply chain. Circular supply chain is a practical form to meet these requirements. It integrates product recovery, reuse and remanufacturing to realize the circular flow of resources, which conforms to the principle of “reduction, reuse and recycling” of circular economy. R. De Angelis et al. (2018) believe that the open and closed material circulation in the circular supply chain plays a key role in technology and biological cycle, and the close cooperation of all links in the supply chain and the application of public and private procurement in service industry will help promote the development of circular economy business model.

2.3 Research Status of Circular Supply Chain in Mobile Phone Industry

Scholars at home and abroad have carried out relevant research on the circular supply chain of mobile phone industry. Wu et al. (2023) focused on the reverse supply chain of China mobile phone industry, developed a simulation model and analysed the effects of trade-in plan and government subsidies on system behaviour. They use system dynamics to model and determine the key factors and relationships through literature review and observation. The research shows that when recyclers compete with different acquisition and recycling strategies, the trade-in plan and government subsidies have different effects on the system behaviour. The trade-in plan has a significant positive impact on the economic performance of the formal recycling industry, and government subsidies play a key role in alleviating the uncontrollable disposal problem. Xinyi Hu et al. (2022) built a dynamic game model of dual-channel green supply chain with retailers and e-commerce platforms as the main body of mobile phone recycling, and explored the influence of trade-in strategy on the integration of green supply chain. The results show that the offset price, recovery price and recovery quantity are positively

correlated with the corresponding channel income, and the transfer payment price is positively correlated with the income of the two channels. Trade-in strategy can improve offset price, recovery price and manufacturer's profit, but the profit of retailers and e-commerce platforms is affected by channel substitution coefficient and recovery price sensitivity.

3. Application Analysis of Circular Supply Chain in Mobile Phone Enterprises

3.1 Analysis of the Particularity of the Mobile Phone Industry

The mobile phone industry has the characteristics of short product iteration period, high integration of parts and components, and frequent machine change by consumers, which make it difficult for the traditional recycling system to operate effectively. The contradiction between short iteration period and rapid technology elimination makes mobile phone products lose market value in a short time, which increases the difficulty of recycling. The complexity of materials requires a high degree of professionalism and technology in the recycling process to ensure the effective reuse of recycled materials.

3.2 Analysis of Obstacles in the Application of Circular Supply Chain in Mobile Phone Enterprises

Technical Bottleneck.

In the mobile phone industry, the implementation of the circular supply chain is facing key technical challenges, mainly reflected in the complex modular design of products and imperfect recycling technology. From the perspective of product life cycle, to realize effective modular design requires manufacturers to consider recycling elements such as disassembly and material compatibility at the initial stage of research and development, which puts forward systematic requirements for enterprise product design ability. In the back-end processing, the existing recycling technology is difficult to ensure the quality stability of recycled materials, which directly limits the economic benefits and industrial development of resource recycling.

3.2.2 Economic Challenges

When enterprises carry out the circular supply chain model, the balance of cost and benefit is the core problem to be solved urgently. This challenge is mainly reflected in three aspects: first, the cost optimization of reverse logistics needs to establish an accurate accounting system; Second, the market value evaluation mechanism of recycled prod-

ucts needs to be improved; Third, the cost control technology of remanufacturing link needs to be broken through. It is worth noting that the implementation of this model requires enterprises to continue to invest in technology research and development and equipment upgrading, which poses a severe test for the financial strength and financial management ability of enterprises.

3.2.3 Consumer Barriers

Consumers' cognition and acceptance of the circular supply chain is the key factor affecting its wide application in mobile phone industry. Some consumers lack understanding of the recycling value of used mobile phones, and their enthusiasm for participating in recycling is not high. In addition, some irregular recycling behaviours in the market have harmed consumers' interests and further weakened their willingness to participate.

3.2.4 Institutional Environment Constraints

The institutional environment such as policies and regulations also has an important impact on the implementation of the circular supply chain. At present, although some countries and regions have issued relevant policies to promote the development of circular economy, there are still policy gaps and insufficient enforcement in the specific implementation of the circular supply chain in mobile phone industry. In addition, the policy differences between different regions also increase the difficulty and cost of enterprises to implement the circular supply chain.

4. Case Analysis

4.1 Successful Cases

4.1.1 Apple's Closed-loop Supply Chain Practice

By building a closed-loop supply chain, Apple has realized the efficient recycling and reuse of used mobile phones. Apple has launched a trade-in program to encourage consumers to return used mobile phones to Apple for recycling. At the same time, they also invested a lot of money in technology research and development, which improved the quality and reuse efficiency of recycled materials. This practice not only helps Apple reduce the cost of purchasing raw materials, but also enhances its brand image and market competitiveness. Apple's closed-loop supply chain system covers product design, production, recycling, reuse and other links. Through strict quality control and efficient logistics system, the reuse value of recycled materials is ensured.

4.1.2 Huawei Green Supply Chain Innovation

Huawei is actively exploring and innovating in the field of green supply chain. By optimizing product design and upgrading recycling technology, Huawei has achieved

efficient recycling and reuse of used mobile phones. In addition, Huawei also actively cooperates with government departments to win policy support and promote the popularization and application of the circular supply chain in the mobile phone industry. Its green supply chain innovation covers many dimensions, such as adopting environmental protection materials, popularizing energy-saving technologies and building recycling systems. These measures not only help to reduce environmental pollution, but also enhance Huawei's market competitiveness and social responsibility.

4.1.3 Enlightenment from Successful Cases

As the leading enterprises in the global smart phone industry, the practical experience of Apple and Huawei in the construction of the circular supply chain is of great reference significance. By analysing the successful cases of the two companies, the following key paths can be summarized: on the technical level, enterprises need to continuously increase R&D investment and improve the dismantling process and material recovery rate of waste equipment, which is the basic guarantee; On the policy level, enterprises should actively carry out strategic cooperation with regulatory agencies to build a policy system conducive to industrial development; At the market level, the government can carry out systematic environmental education for end users, which can effectively stimulate the participation of circular economy. The three dimensions of technology, policy and market cooperate to form the solution of the circular supply chain in mobile phone industry.

4.2 Failure Cases

4.2.1 Modular Design Dilemma of Fairphone

As an early explorer of modular design, Fairphone has carried out forward-looking practice in the field of smart phones. However, it faces multiple challenges in the process of promotion: on the one hand, although the modular architecture significantly enhances the maintainability and upgrading potential of the equipment, it also leads to an increase in manufacturing costs and a complicated recycling process; On the other hand, the market's limited recognition and acceptance of the concept of modularity has become an important factor restricting the development of enterprises. From the practical effect, although this innovative design concept is breakthrough, it is constrained by the market environment and cost pressure, and finally failed to achieve the expected commercialization results.

4.2.2 Samsung Galaxy Note 7 Battery Explosion Recovery Event

The Samsung Galaxy Note 7 battery explosion profoundly impacted the brand image and market position of

Samsung Electronics. Although the company started the product recall quickly, the defects of its supply chain management were exposed in the specific implementation: the slow construction of recycling channels and unreasonable compensation mechanism seriously affected the recall efficiency. This crisis highlights Samsung's shortcomings in the construction of reverse logistics system, especially in the design and implementation of emergency response mechanism. Due to the failure to build a sound recycling network and scientific pricing system in time, a large number of defective equipment are stranded in the market, which not only aggravates the security risks, but also puts forward a severe test for enterprises' ability to fulfil their environmental responsibilities.

4.2.3 Enlightenment from Failure Cases

In the process of promoting the practice of the circular supply chain, the failure cases of Fairphone and Samsung have profound warning significance. These cases reveal three key implementation points: first, enterprises must carefully evaluate the economic feasibility and market acceptance of modular design schemes; Secondly, when there are product quality problems, it is necessary to establish a systematic recycling network and processing mechanism; Finally, the continuous construction of consumer communication and participation mechanism is very important to improve user stickiness and satisfaction.

5. Conclusions and Countermeasures

5.1 Conclusion

The implementation of the circular supply chain in the mobile phone industry faces multiple obstacles and urgently requires systematic solutions. Based on the case study of smart phone industry, this paper identifies four key factors that restrict the development of the circular supply chain: technical bottleneck, economic challenge, consumer obstacles and institutional environment constraints. In view of these problems, this study puts forward the four-in-one coping strategies of technological innovation, business model innovation, consumer incentive and policy coordination.

5.2 Countermeasures and Suggestions

Technical Innovation.

Enterprises should increase investment in scientific research to promote R&D and application of the circular supply chain technology. Enterprises need to strengthen technical cooperation and resource sharing, and work together to overcome technical bottlenecks. For example, advanced recycling technology and equipment can be jointly developed to improve the quality and recycling efficiency of recycled materials. In addition, the government

should provide policy and financial support to encourage enterprises to carry out technological innovation and transformation and upgrading.

5.2.2 Business Model Innovation

Enterprises should explore diversified profit models to alleviate the cost pressure in the implementation of the circular supply chain. By establishing long-term cooperation with recyclers and remanufacturers, enterprises can realize resource sharing and mutual benefits. For example, we can jointly invest in the construction of recycling facilities to reduce related costs, or enhance market competitiveness by sharing sales channels and customer resources. At the same time, enterprises should strengthen cost control and management to improve the economic benefits of the circular supply chain.

5.2.3 Consumer Incentives

Enterprises should enhance consumers' awareness of environmental protection and their awareness of circular economy through publicity and education. Enterprises can build an incentive mechanism to encourage consumers to actively participate in the recycling and reuse of used mobile phones. For example, take incentives such as trade-in concessions and redemption of points to improve consumer participation and satisfaction. At the same time, enterprises should strengthen communication and interaction with consumers, grasp their needs and feedback in time, and continuously optimize the implementation plan of the circular supply chain.

5.2.4 Policy Coordination

The government should improve the system of policies and regulations to provide legal support for the implementation of the circular supply chain. The government needs

to build a standardized market access and management mechanism to maintain the market order of the circular supply chain. For example, strict recycling standards and regulatory measures can be formulated to ensure that the process conforms to environmental protection norms; Or encourage enterprises to adopt the circular supply chain model through tax incentives, financial subsidies and other policies. At the same time, the government should strengthen policy guidance and support to promote the popularization and sustainable development of the circular supply chain in the mobile phone industry.

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