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# Innovative Development Path of Shaoguan Bamboo Industry from the Perspective of Ecological, Production, and Life Integration

**Nanjing Chen, Ruikang Li, Xudong Chen, Jiachun Lin, Zhenfeng Zhu***

Guangdong University of Science and Technology, Dongguan 523083, Guangdong, China

**Author to whom correspondence should be addressed.*

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**Abstract:** In the context of the development of "replacing plastic with bamboo" and "integrating the three industries", the bamboo industry in Shaoguan City boasts certain advantages, including abundant resources. However, the industry faces significant challenges, such as low utilization efficiency and a shortage of skilled labor. The present article employs a comprehensive analysis of bamboo resources and industry status, leveraging SWOT analysis to elucidate the strengths, weaknesses, opportunities, and challenges pertinent to the subject. The article further proposes an innovative development path for the bamboo industry. The objective of this initiative is to promote resource-intensive management, strengthen technical and talent support, expand diversified marketing channels, and deepen the integrated development of the bamboo industry. The overarching ambition is to achieve a rich and beautiful bamboo industry ecology, abundant production, and prosperous life in Shaoguan, thereby providing invaluable experience and reference for the development of China's bamboo industry as a whole.

**Keywords:** Bamboo as a substitute for plastic; Three integrations; Common prosperity; Bamboo industry; Northern Guangdong mountainous area

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## 1. Introduction

The ongoing enhancement of environmental awareness in various countries and regions worldwide has led to a growing focus on bamboo, a natural renewable resource, among the public [1]. In the context of China's initiative to substitute plastic with bamboo, bamboo resources have emerged as a pivotal element in promoting high-quality socio-economic development. This initiative is part of a broader strategy aimed at revitalizing rural areas, achieving the "dual carbon" goals, and advancing the construction of ecological civilization [2]. A case study of China's recent initiatives to substitute plastic with bamboo reveals several key benefits of bamboo resources. These benefits include the support of bamboo production and processing enterprises, promotion of bamboo industry

agglomeration, enhancement of regional ecological environment and carbon sequestration capacity, and increased farmer income in bamboo production areas. These benefits extend across three primary domains: ecology, production, and life. Consequently, scholars have conducted continuous research on the integration of bamboo resources into the "three lives" in recent years. Furthermore, they have proposed innovative development ideas for the bamboo industry in the context of ecological, production, and life integration. This paradigm has emerged as the foundational framework for examining the synergistic evolution of regional economies and societies within the bamboo industry.

Bamboo, a natural renewable resource, possesses significant ecological, cultural, and economic value. Due to its distinctive benefits, it has progressively evolved into a pivotal pragmatic approach for bamboo-resource-abundant regions to encourage collaborative regional advancement and collective well-being [3]. Among them, Shaoguan City, which is renowned for its substantial bamboo resources in Guangdong Province, boasts an expanse of bamboo forest covering 2.278 million mu. The city's abundant bamboo resources have established a substantial material foundation for the development and operation of the bamboo industry. However, the city of Shaoguan is located in the northern Guangdong region and is primarily composed of mountainous counties, which pose practical challenges for the development and utilization of local bamboo resources. A decline in operating profits has been observed among certain bamboo enterprises in Shaoguan City, indicating constraints in bamboo industry development. These constraints include insufficient utilization of bamboo resources, inadequate equipment intelligence, insufficient supply of high-end products, and limited innovation in development models. In order to address the practical challenges faced by the development of the bamboo industry in Shaoguan City, a development concept will be integrated into the industry's development process. This concept will integrate the three elements of bamboo resources, providing support for the acceleration of a virtuous cycle of "using bamboo to promote development, enrich the people, and beautify the environment" in Shaoguan City. This cycle will promote urban green transformation.

## 2. The present state of bamboo resources and the evolution of the bamboo industry in Shaoguan City

### 2.1. The following section will provide an overview of bamboo resources in Shaoguan City

The total area of Shaoguan City is 18,400 square kilometers, with abundant forest resources and a total area of 19.18 million acres. Of these, the bamboo forest covers an area of 2.278 million mu, accounting for 11.9% of the total forest area, and thus ranking first in Guangdong Province. With respect to bamboo forest area, Shaoguan City boasts a substantial expanse of bamboo forests, predominantly situated in counties (cities) such as Nanxiong, Renhua, Shixing, and Xinfeng. The municipality of Nanxiong and the district of Renhua contain the most extensive bamboo forest areas, with a combined total area exceeding 900,000 acres, accounting for over 40% of the city's total area. In recent years, the overall bamboo forest area in Shaoguan City has exhibited a relatively stable trend, with certain areas demonstrating an increase in bamboo forest area through artificial nurturing and scientific planting. The bamboo forest area's stable situation provides a solid material foundation for the sustainable development of the bamboo industry. Shaoguan City is situated in the northern region of Guangdong Province, occupying a territory that extends from the southern foothills of the Nanling Mountains to the middle and upper reaches of the Beijiang River. The region's distinctive geographical characteristics foster optimal conditions for bamboo cultivation. From the perspective of bamboo forest types, the Shaoguan area boasts a rich

and diverse variety of bamboo forest types, including more than 120 species such as moso bamboo, mugwort bamboo, pink bamboo, and hemp bamboo. The bamboo resource system in Shaoguan is distinguished by the presence of diverse bamboo species, which collectively serve as a foundation for regional economic and ecological development.

### 2.2. Development status of bamboo industry in Shaoguan City

As of the conclusion of 2024, Shaoguan City has 144 bamboo processing and operation entities, including three national forestry leading bamboo and wood enterprises and four provincial leading enterprises. These leading enterprises have played a pioneering and exemplary role in the industry, helping to enhance the development level and market competitiveness of the entire bamboo industry. Concurrently, Shaoguan City boasts four bamboo industry enterprises with an annual output value exceeding 100 million yuan, thereby underscoring the fact that a number of bamboo enterprises in the region have attained a certain scale and economic strength [4]. The bamboo industry in Shaoguan City encompasses a diverse array of products, including those utilized in catering, home furnishings, and building materials. This industry boasts a wide variety of product types. These products are designed to address the diverse requirements of various market segments, thereby showcasing the Shaoguan bamboo industry's commitment to innovation and its capacity to meet the highest standards of professionalism in product development. Shaoguan City has developed a unique "bamboo+tourism" model, leveraging the region's abundant bamboo resources. This initiative aims to enhance the added value of the bamboo industry and promote its coordinated development. The "bamboo+tourism" model has also led to substantial improvements in the sales channels and sales volume of bamboo handicrafts. Furthermore, brand exposure has been significantly increased through promotional channels such as online media and tourism exhibitions. This has established a substantial foundation for the long-term development of the bamboo industry, thereby further enhancing its added value.

## 3. SWOT analysis of bamboo industry development in Shaoguan City

### 3.1. Advantages of bamboo industry development

The bamboo industry is characterized by a substantial abundance of resources. Shaoguan City boasts the largest bamboo forest resources in Guangdong Province, particularly in the border regions of Nanxiong, Renhua, and Shixing, where over 1 million acres of concentrated bamboo resources have been established, paving the way for substantial development prospects. Secondly, the foundation of the industrial chain is well-established. Following years of development, Shaoguan City has established an industrial chain system of "full bamboo utilization" in the bamboo industry. As of the conclusion of 2024, 140 bamboo processing enterprises of various types are located in Shaoguan City, and the spatial agglomeration effect of the industrial chain is significant. Thirdly, government policies provide comprehensive support. The municipal government of Shaoguan City has demonstrated a notable commitment to the advancement of the bamboo industry. In 2024, the Shaoguan Municipal Government issued the Action Plan for Promoting the High Quality Development of the Bamboo Industry (2024–2026), which created positive conditions and provided high-level promotion for the development of the bamboo industry [5].

### 3.2. Disadvantages of bamboo industry development

Firstly, the efficiency of resource utilization is suboptimal. The bamboo forest resources in Shaoguan are primarily managed by a dispersed network of farmers, exhibiting a low degree of intensification in management practices. The proportion of bamboo forests managed on a large scale through the "leading enterprise+cooperative+base+

farmers" model is insufficient. This fragmented management approach has resulted in extensive bamboo forest management, a lack of scientific nurturing, and subsequent degradation of bamboo forests, low yield, and high harvesting costs, which have collectively undermined industrial competitiveness [6]. Secondly, there is a shortage of infrastructure and technical personnel. Infrastructure in forest areas, including roads and irrigation facilities, is deficient. With respect to the professional talent team, there is a dual shortage of high-end R&D talents and skilled craftsmen. Furthermore, Shaoguan's economic development is relatively lagging behind, especially in rural areas. The underdeveloped infrastructure and comparatively limited educational attainment within these regions have collectively resulted in a paucity of talent cultivation, thereby impeding the fulfillment of rural economic development needs [7]. Thirdly, an established market mechanism for high-quality and high-price products does not currently exist. The market mechanism for high-quality and cost-effective bamboo resources has yet to be established, creating challenges for bamboo farmers in sharing the value-added benefits of processing.

### 3.3. Opportunities for the development of the bamboo industry

Firstly, there is a necessity for robust support from national policies. The national government has issued a three-year action plan to accelerate the development of "replacing plastic with bamboo." This plan includes the incorporation of bamboo products into the green product certification system and the promotion of bamboo substitution in daily necessities, building materials, and other fields. Secondly, there has been an explosive growth in market demand. In recent years, there has been a notable trend in China of "replacing plastic with bamboo" in various sectors. This shift has led to the emergence of a substitute market with significant economic value, estimated at billions of yuan. The adoption of bamboo-based materials has seen a substantial increase in various applications, including packaging, construction, and daily necessities, among others [8]. Thirdly, advanced technology is a prerequisite. The high-value utilization technology of bamboo in some bamboo processing enterprises in Shaoguan City continues to make significant advancements while actively integrating industry, academia, and research practices. This integration is expected to facilitate the successful implementation of major industrial projects.

### 3.4. Challenges in the development of the bamboo industry

Firstly, the bamboo forests in Shaoguan City have been severely degraded. Most bamboo forests in Shaoguan City continue to adhere to the extensive management model, characterized by placing logging above management for a long time. Secondly, the financial burden of collection and transportation is significant, and there is a shortage of labor. The bamboo harvesting and transportation industry in Shaoguan City is mainly characterized by manual handling, which results in significant intermediate losses and is accompanied by low costs and high efficiency. At the same time, the average age of bamboo cutting tools is relatively high, and the number of young people engaged in the bamboo industry is relatively small, leading to a shortage of labor. Thirdly, marketing channels are not optimal. At present, the bamboo industry in Shaoguan City continues to mainly adhere to the traditional offline sales model, and the overall market expansion model still relies heavily on traditional methods.

## 4. Innovative development path of the bamboo industry in Shaoguan City

### 4.1. Accelerate the intensive management of bamboo resources

In addressing the challenges posed by the fragmented management and suboptimal utilization of bamboo forests in Shaoguan, the government must implement comprehensive policy measures. These measures should include

the following. First, the government must provide stronger guidance to farmers, encouraging them to invest in land and bamboo forest resources through policy support. Second, the government must expand the coverage of the "leading enterprise+cooperative+base+farmers" model. Third, the government must increase the proportion of intensive management of bamboo forests. Concurrently, a scientific nurturing system for bamboo forests must be established, and a professional technical guidance team must be constituted. Moreover, training on bamboo forest management and protection must be provided to farmers on a regular basis, and efforts must be made to improve the quality and yield level of bamboo forests. Furthermore, the enhancement of infrastructure within forest areas, including roads and transportation networks, is imperative. This initiative should be accompanied by a reduction in the cost of bamboo harvesting and transportation, thereby ensuring cost-effectiveness. Additionally, measures must be undertaken to enhance industrial competitiveness.

## 4.2. Continuously strengthening technological innovation and talent support

It is imperative to augment investment in the domain of bamboo industry technology research and development. Moreover, the establishment of cooperative research platforms between industry and universities, as well as research institutions, is of paramount importance. A concerted effort must be made to prioritize technological breakthroughs in high-value-added fields, such as bamboo-based new materials and biomass extraction. The establishment of a special talent fund, in conjunction with the formulation of preferential policies, is imperative for the purpose of attracting high-end R&D talents and skilled craftsmen to the bamboo industry in Shaoguan. Concurrently, the local vocational colleges are being utilized to offer bamboo industry-related majors, with the objective of providing targeted training to professional talents and thereby ensuring continuous intellectual support for the industry's development. Furthermore, the integration of intelligent production equipment into bamboo processing enterprises has been demonstrated to enhance automation and intelligence levels, thereby reducing labor costs.

## 4.3. Expanding diversified marketing channels

It is imperative to encourage bamboo enterprises to proactively adopt digital transformation, fostering collaboration with prominent e-commerce platforms. This entails the strategic implementation of online stores, such as those found on TikTok and Amazon, in addition to the augmentation of sales channels through the integration of emerging models, including live streaming and cross-border e-commerce. Concurrently, a market mechanism for high-quality and low-priced bamboo should be established. The market premium ability of high-quality bamboo should be enhanced through quality certification, brand building, and other methods. Furthermore, bamboo farmers should be enabled to fully share the value-added benefits of processing. An exploration of the development of bamboo forest carbon sequestration projects is warranted, as is an improvement of ecological value accounting and compensation mechanisms. Furthermore, it is essential to transform ecological advantages into economic advantages.

## 4.4. Exploring the development model of multi-industry integration

The present study will build upon the existing "bamboo+tourism" model to further explore the connotation of bamboo culture. The objective is to develop diversified cultural and tourism products, such as bamboo culture-themed homestays, bamboo art experience workshops, and bamboo culture research and learning. The final aim is to create an immersive bamboo culture tourism experience. It is imperative to fortify the collaborative relationships

with proximate tourist attractions, conceptualize bamboo-themed tourism pathways, and augment the brand influence of "Yangtze River Bamboo Sea" and analogous brands. Integration of culture and tourism, extension of the bamboo industry chain, driving the development of related industries such as bamboo handicrafts and bamboo food, and achievement of deep integration of ecology, production, and life are the objectives of the aforementioned initiative.

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## Disclosure statement

The authors declare no conflict of interest.

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