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# TEA CULTURE BRAND MARKETING TO ACHIEVE FARMERS' INCOME ENHANCEMENT BASED ON BIG DATA VISUAL ANALYSIS--A CASE STUDY OF HEZHOU LIUBAO TEA IN CHINA

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## ABSTRACT

The main objective of this study is to examine how big data visualization can enhance the brand marketing of Hezhou Liubao Tea, a representative Chinese black tea, to increase the income of local tea farmers. Despite its unique production methods and cultural significance, Liubao Tea faces challenges in brand recognition and market expansion. Using big data tools, this research analyzes market demand, consumer behavior, and sales channel performance to identify key factors driving brand development. The methodology includes data collection from e-commerce platforms, social media, and surveys, combined with visualization tools like Tableau and Gephi to process and present the findings. Key findings show that investments in brand development, production efficiency, and market expansion significantly contribute to increased farmer income. The study highlights the potential of data-driven marketing strategies to improve brand awareness, optimize sales channels, and enhance product quality, offering practical recommendations for both local and international market growth. This research provides insights into leveraging modern technology for sustainable development in the tea industry and rural revitalization.

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## Introduction

The global tea industry has shown continuous growth in recent years. According to statistics from the International Tea Committee, the total market value of the global tea industry reached nearly 50 billion USD in 2023, with an expected annual growth rate of approximately 6% by 2027 (Li et al., 2024). In Asia, tea production and related

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industries are not only an important economic source but also a significant part of cultural and social life. In China, as the world's largest tea producer and consumer, the market size of the tea industry continues to expand. According to the China Tea Circulation Association, China's total tea production in 2022 was approximately 2.8 million tons, with a market value of around 200 billion RMB (Arhin et al., 2024). However, despite the overall growth in the tea industry, there remains a significant disparity between different types of tea and regions, with local specialty teas like Hezhou Liubao Tea having relatively low brand recognition and market share both domestically and internationally.

The transmission and development of Chinese tea culture spans thousands of years, with tea being deeply rooted in Chinese society and serving as a bridge for cultural exchange globally. However, with the acceleration of modernization and the intensification of global market competition, traditional tea culture faces the risk of marginalization (Tang et al., 2023). In particular, the traditional business models in the tea industry often struggle to innovate and enhance the value of tea brands in today's competitive market. Hezhou Liubao Tea, as one of China's representative black teas with unique production techniques and regional cultural significance, holds considerable market potential. However, the brand still faces challenges such as low brand recognition and limited market expansion, necessitating effective branding and marketing strategies to enhance its market performance and increase farmer income.

The uniqueness of Hezhou Liubao Tea is not only reflected in its geographical certification but also in its deep cultural heritage and traditional production methods. The distinctive production process, which includes fermentation and compression, gives it a unique flavor highly favored by tea enthusiasts. However, despite its superior quality, the brand has yet to make significant strides in brand development. According to the "2023 Liubao Tea Industry Development Report" released by the local government, Hezhou Liubao Tea's market recognition is still low, with its national market share below 2%, mainly concentrated in surrounding regions such as Guangdong and Guangxi (Xu et al., 2025). While local governments have made efforts to promote the brand in recent years, Hezhou Liubao Tea has still not achieved effective brand communication or market breakthrough across China, resulting in a mismatch between its brand recognition and the quality of its products.

Farmer income increase has long been a key goal in China's agricultural policy. Tea cultivation, as an important cash crop, directly affects the livelihood and income of many tea farmers. The increase in tea farmers' income primarily depends on the market price and sales volume of tea (Qin & Zhou, 2024). However, traditional tea sales methods are still mostly limited to wholesale and local markets, lacking an efficient marketing system and innovative sales channels, which has hindered the income growth of many tea farmers. The income situation of Hezhou Liubao Tea farmers faces similar challenges. Although the price of Liubao Tea is higher than that of some common tea varieties, its income has not significantly increased due to the insufficient brand effect. Therefore, enhancing the brand recognition and market penetration of Hezhou Liubao

Tea is essential for promoting the income of local tea farmers and achieving sustainable industry development.

Tea culture brand marketing is not merely about selling products, it represents a synthesis of culture, quality, region, and consumer demand. With the advancement of information technology, the emergence of big data and visualization techniques has brought revolutionary changes to brand marketing (Mao et al., 2024). Big data visualization can help businesses make informed decisions by deeply analyzing and presenting market data, consumer behavior, and sales channel data. In the agricultural sector, particularly in tea brand development, big data visualization can assist tea companies in brand positioning, consumer preference analysis, and sales channel selection, among other things (Qi, 2023). Data-driven marketing allows Hezhou Liubao Tea to adopt an innovative development path, improve its market share through precise market positioning and promotional strategies, and increase the income of tea farmers by breaking the limitations of traditional marketing methods.

It is important to recognize the gaps in existing research, particularly in the area of cultural adaptability in global markets. While much of the literature on tea culture and brand marketing has focused on the historical and traditional aspects of tea, there is a notable lack of studies exploring how these cultural elements can be effectively adapted and marketed in diverse international markets. Most existing research tends to view tea culture as a fixed, unchanging entity, without fully considering the dynamic and evolving consumer preferences that arise from globalization and cross-cultural exchange (Qin & Zhou, 2024). Moreover, while certain successful tea brands, such as Japan's Uji Tea, have integrated cultural values into their marketing strategies, many local specialty teas, like Hezhou Liubao Tea, still struggle with limited brand recognition and market reach beyond their regional contexts (Tang et al., 2023). The ability to adapt cultural elements while maintaining authenticity is a critical factor in the success of tea brands in international markets. This study fills this gap by focusing on how big data and visualization techniques can not only enhance brand marketing but also address the challenges of cultural adaptation, offering insights into how Liubao Tea can break into global markets while preserving its unique cultural heritage.

This research aims to explore how big data visualization can be used to develop an innovative brand marketing strategy for Hezhou Liubao Tea to promote its expansion in domestic and international markets, thereby increasing farmer income. Specifically, the study will analyze the market demand, consumer behavior, and competitive environment of Hezhou Liubao Tea. It will apply big data visualization techniques to reveal the key factors of brand development and propose targeted marketing strategies. Additionally, the study will examine the practical applications of big data visualization in brand marketing, analyzing its advantages and challenges. In an increasingly competitive global market, combining modern information technology with brand marketing will allow Hezhou Liubao Tea to break through and emerge as a strong competitor, ultimately achieving the upgrading of the tea industry and the goal of increasing farmers' income.

## Literature review

### Tea Culture and Branding

Tea culture is an essential component of Chinese traditional culture, deeply embedded in history and marked by unique regional characteristics (Sigley, 2015). Tea is not only an important consumer product in daily life but also a symbol of China's long-standing tea culture, encompassing cultivation, harvesting, production, consumption, and associated rituals and philosophies (Wang et al., 2024; Zhou et al., 2023). In recent years, with the increasing global focus on health and cultural products, tea culture has become a significant competitive advantage in brand marketing. Tea brands can shape distinctive brand images and attract consumer attention by integrating tea culture into their marketing strategies (Kato et al., 2024). Tea culture imparts profound spiritual meaning to brands, enhancing their cultural value and strengthening consumer brand identification. This suggests that the transmission and innovation of tea culture are key factors in brand building, especially in modern brand marketing, where tea culture serves as one of the core selling points, creating emotional connections and cultural resonance with consumers (Verma, 2013).

While many studies emphasize the positive role of tea culture in brand marketing, the relationship between cultural elements and market demand remains underexplored. Many studies tend to focus too much on the traditional and historical aspects of tea culture and neglect the dynamic interaction between culture and actual consumer needs (Bohne, 2021). There is also a lack of in-depth discussion on the diversity and changes in modern consumers' perceptions of tea culture in the context of globalization and modernization (Koay & Leong, 2024). The applicability of tea culture as a universal competitive advantage for all markets, particularly how it can be adapted to the needs of different consumer groups, still requires more systematic exploration.

Some foreign tea brands have successfully incorporated tea culture into their brand communication, achieving significant market success. For example, Japan's "Uji tea" has skillfully integrated the tea ceremony's concepts of "harmony, respect, purity, and tranquility" into its brand culture, injecting profound cultural value into the brand and establishing a strong position in the global market (Ashardiono, 2019). This cultural empowerment not only satisfies consumer demands for quality but also creates a deep emotional connection with consumers (Froner, 2017). However, this strategy of cultural empowerment does not always apply in markets with significant cultural differences. Tea culture may fail to resonate with consumers in these markets, especially in the West where tea culture differs significantly from traditional Chinese tea practices (Mao et al., 2024). This gap in the literature highlights the importance of further research into the cultural adaptability of tea brands in cross-national markets.

In contrast, China's tea culture brand marketing began relatively late but has gradually made breakthroughs as market demand and consumer cultural identification have evolved (Xie et al., 2023). The in-depth exploration of tea culture and the integration of

regional characteristics have become crucial factors in enhancing the competitiveness of tea brands. In the case of local tea brands, combining tea culture with production techniques provides a unique market positioning (Wang et al., 2022). However, while cultural value is foundational, the challenge remains in integrating this culture with modern consumer demands and trends. As consumers' understanding of traditional culture becomes more diverse, the singular transmission of tradition may no longer meet the needs of younger consumers who seek personalization and innovation. Thus, balancing cultural preservation with brand innovation is a critical challenge in tea culture brand marketing.

Many successful cases in tea industry brand building and market expansion show that relying solely on traditional tea quality and production techniques can no longer meet modern market demands (Mao et al., 2024). Brand building must integrate culture, history, and techniques to stand out in the marketplace. For example, the brand development of Yunnan Pu'er tea demonstrates the significant role of its historical background and fermentation process, successfully enhancing the global recognition of the brand (Ning et al., 2011). The success of Pu'er tea lies not only in product quality but also in the cultural and storytelling aspects that resonate with consumers. This strategy suggests that local specialty teas, when deeply integrated with culture and innovation, can enhance market competitiveness and expand market share (Wang et al., 2024). However, the experiences of Pu'er tea cannot be fully applied to all local tea brands, as many face the challenge of balancing the preservation of traditional techniques with innovative market demands. Some studies have focused on cultural transmission without fully considering consumer demand for innovation and freshness, leaving the question of whether cultural value can truly translate into market competitiveness unresolved. More empirical research is needed on the relationship between cultural transmission and market competitiveness in the context of modern consumer behavior.

### **Cultural Dissonance and Market Adaptation**

The incorporation of tea culture into branding strategies often meets challenges in global markets due to cultural dissonance. While some tea brands have effectively integrated culture into their marketing (e.g., Japan's Uji tea), the approach does not always translate well across markets with distinct cultural backgrounds (Ashardiono, 2019). Tea culture may not resonate with all consumers, particularly in markets where cultural differences are significant, as in the case of Chinese tea culture and Western consumer perceptions (Mao et al., 2024). Understanding and addressing these cultural differences is crucial for the international success of tea brands. The lack of studies exploring the impact of cultural dissonance between Chinese tea culture and Western markets underlines the need for more research on cultural adaptability in brand marketing.

### **Big Data in Tea Brand Marketing**

The application of big data in tea brand marketing is gaining attention for its potential to enhance brand competitiveness. Big data visualization technology allows companies

to analyze large volumes of data quickly, providing insights into consumer behavior, market demand, and sales channels (Hu & Huang, 2021). In the tea industry, big data helps companies develop scientifically based product positioning and marketing strategies (Olfati & Paydar, 2023). The ability to predict consumer preferences allows tea brands to optimize product designs and marketing strategies, increasing market share and brand influence (Fan et al., 2024).

While big data visualization has been widely applied in consumer goods and agriculture, its potential for tea brand marketing remains underexplored. Existing studies demonstrate that big data can help brands identify consumer preferences, optimize product offerings, and implement targeted marketing strategies (Ding et al., 2023). However, there is little research on how to integrate big data with cultural branding strategies, especially to address cultural dissonance in international markets. More research is needed to understand how big data can help overcome cultural barriers and enhance global market penetration.

### **Integration of Tea Production Techniques and Culture**

Tea production techniques are a core component of tea culture brand marketing, as they directly influence both the quality of the product and its cultural value (Ye et al., 2022). Traditional handmade production techniques, often tied to regional characteristics, contribute to the distinct flavor and quality of tea. As competition in the global tea market intensifies, the success of tea brands increasingly depends on how well they can integrate traditional production techniques with cultural values, enhancing both the market value and emotional connection with consumers.

However, existing research tends to focus heavily on preserving traditional production techniques without fully considering how these methods meet the evolving demands of modern consumers (Aaqil et al., 2023). In globalized markets, younger consumers often prioritize convenience and speed over tradition (Tian et al., 2022). Thus, there is a need for more research on how traditional tea production techniques can be innovated and adapted to meet modern consumer demands, particularly in international markets where consumer expectations differ from those associated with traditional cultural practices.

### **Cultural and Production Innovation in Global Tea Markets**

Tea brands that successfully integrate cultural values and production innovation often achieve greater market success. The global recognition of Yunnan Pu'er tea, which blends its historical background with modern production techniques, is an example of this integration (Ning et al., 2011). Similarly, local specialty teas, when combined with both cultural and innovative elements, can enhance their market competitiveness (Wang et al., 2024). However, not all tea brands have successfully navigated this balance, and many still face challenges in aligning traditional cultural elements with modern market demands. This gap in the literature highlights the need for more empirical studies on how cultural branding, combined with modern production techniques, can drive market success.



The literature review highlights the significant role of tea culture in brand marketing but also reveals gaps in research related to cultural adaptability and the use of big data in overcoming market challenges. While some tea brands have successfully integrated cultural elements into their marketing strategies, much more is needed to explore the interaction between cultural branding, consumer behavior, and big data. This study aims to fill this gap by exploring how big data can be used to develop culturally adaptable branding strategies for Hezhou Liubao Tea, helping it succeed in both domestic and international markets.

### Research method

This research primarily employs big data visualization analysis to explore how big data technology can enhance the market competitiveness of the Hezhou Liubao tea brand and promote farmer income growth. Liubao tea, as one of China's traditional black teas, has a long history and deep cultural heritage. Although it holds a certain level of recognition in the local market, its brand influence is relatively weak in both national and international markets. Therefore, this study focuses on how big data visualization can enhance Liubao tea's brand awareness and consumer recognition, thereby driving its brand marketing development and increasing farmer income.

The research object is the Liubao tea brand from Hezhou, and the scope primarily covers its performance in the domestic market and its expansion potential in international markets. This study focuses on the brand marketing, consumer behavior, market demand, and sales channels of Liubao tea, aiming to provide precise market positioning and strategic recommendations through big data analysis. The scope of data collection includes sales and consumer data for Liubao tea over the past three years, to identify the key factors influencing brand promotion and provide practical strategies for optimizing brand marketing.

Data collection sources include online e-commerce platforms, social media, and sales records from Liubao tea producers and retailers. Online data includes consumer purchase behavior, reviews, purchase frequency, and geographic distribution, which were obtained through data scraping and analysis from e-commerce platforms and social media. Additionally, to gather consumer attitudes and perceptions, online surveys and face-to-face interviews were conducted to collect data on brand recognition and consumer preferences for Liubao tea across different consumer groups. Sales data was collected from Liubao tea producers and retailers, covering sales performance, price fluctuations, promotional activities, and distribution strategies across different sales channels.

The data collection for this study primarily focuses on online consumer behavior and sales data to understand the brand marketing and consumer preferences of Hezhou Liubao tea. Online data were gathered from popular e-commerce platforms and social media channels, which represent a significant portion of modern consumer interaction. These platforms include major e-commerce sites such as Taobao, JD.com, and Pinduoduo, where consumer behavior, reviews, purchase frequency, and

geographic distribution were collected using data scraping techniques. Social media channels, including WeChat, Weibo, and Douyin, were also utilized to assess consumer engagement with the brand, sentiment analysis of reviews, and social trends related to Liubao tea. These platforms provide a rich source of data reflecting current consumer interactions, preferences, and market dynamics.

Additionally, the study employed online surveys and face-to-face interviews to gather direct insights from consumers about their brand recognition, product preferences, and cultural perceptions of Liubao tea. The survey respondents were carefully selected to include diverse demographic groups, including age, gender, geographic location, and purchasing behavior. A total of 1,000 respondents participated in the survey, with a balanced distribution across regions such as Guangdong, Guangxi, and Beijing. The interviews were conducted with 50 consumers, providing qualitative insights into consumer attitudes and brand perception.

Sales data was also gathered from Liubao tea producers and retailers, which included information on sales performance, price fluctuations, promotional activities, and distribution strategies across various sales channels. This data, collected from both online and offline channels, allowed for a comprehensive analysis of Liubao tea's market positioning and consumer demand across different regions.

In the data analysis process, various big data tools and visualization techniques were employed. To efficiently process large-scale data from various sources, tools such as Python and Apache Hadoop were used for data extraction, cleaning, and preprocessing. The data cleaning process ensured consistency and accuracy, removing irrelevant or duplicate records to improve the quality of data analysis. Based on this, data visualization tools such as Tableau and Gephi were used to present the results in intuitive charts and network graphs, helping researchers identify consumer purchasing behavior patterns and market demand trends. These visualization tools not only displayed the market performance of Liubao tea but also delved deeper into consumer preferences, providing strong support for brand marketing.

For data visualization and analysis, tools like Tableau and Gephi were used. Tableau was selected for its user-friendly interface and advanced data visualization capabilities, allowing for the creation of interactive dashboards that presented the market performance of Liubao tea in intuitive charts and graphs. Gephi was used to analyze and visualize network relationships and consumer behavior patterns across different segments and regions, providing insights into how various factors such as product quality, brand awareness, and cultural affiliation influence consumer purchasing decisions. These tools were chosen because of their ability to transform complex datasets into actionable insights, which were essential for developing targeted marketing strategies for Liubao tea.

The results from big data visualization analysis provided valuable insights and data support for this study. In terms of brand marketing, the study analyzed consumer behavior data and identified the differences in brand recognition of Liubao tea across various consumer groups. The key factors influencing consumer purchasing decisions



were revealed, including brand awareness, product quality, and cultural affiliation. Additionally, through sales channel analysis, the study identified performance differences in various sales channels, further guiding brand marketing strategies, especially in areas such as pricing, promotional campaigns, and advertising placements. Furthermore, spatial analysis revealed the regional sales potential of Liubao tea both domestically and internationally, providing data support for market expansion and internationalization strategies.

Ultimately, this research, through big data analysis and visualization, produced a comprehensive report on Liubao tea brand marketing, offering specific strategic recommendations. The study shows that through effective market segmentation and precise consumer profiling, Liubao tea can find its positioning in a competitive market, attracting more consumer attention. At the same time, by strengthening the brand image and communicating cultural values, Liubao tea can enhance consumer loyalty, driving sales growth and creating more income opportunities for local tea farmers. This process demonstrates the significant application value of big data technology in the tea industry, particularly in enhancing brand recognition and promoting farmer income growth.

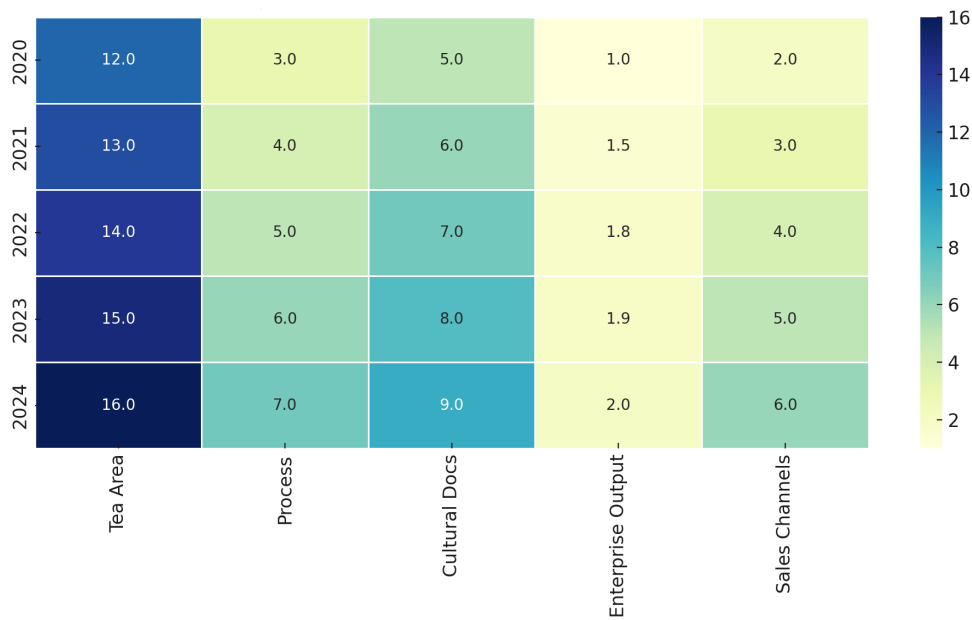
## Results

The data presented in this study were collected from Hezhou Liubao tea over a five-year period, from 2020 to 2024, providing insights into the ongoing development of the tea industry, particularly focusing on the impact of tea culture brand construction on tea farmers' income. The data sources include market reports, production statistics, financial records, and consumer reviews, all of which were systematically analyzed to assess the factors influencing tea farmer income. Key variables examined include tea garden area, production techniques, cultural development efforts, marketing expenditures, and the number of sales channels, all of which play critical roles in shaping the income dynamics of tea farmers. Additionally, data on consumer perceptions were collected through word cloud analysis, reflecting public sentiment towards Liubao tea's quality and cultural value. The findings from the heatmap, spending breakdown, and customer reviews, along with the factor analysis and structural equation modeling, form the basis of the discussion, illustrating how different aspects of Liubao tea's brand development contribute to the enhancement of farmers' incomes. These analyses emphasize the importance of brand image, production efficiency, and market expansion in driving economic growth within the tea farming sector.

**Figure 1** is reflecting Hezhou Liubao tea industry continued progress in production, brand development, and market expansion. The gradual increase in tea garden area, from 12 hectares to 16 hectares, indicates an expansion in the scale of Liubao tea cultivation, which not only enhances production capacity but also ensures a stable supply for future product demands. This change reflects greater investment by tea farmers and an increasing market demand. Simultaneously, the steady improvement in production techniques, with a score rising from 3 to 7, demonstrates Liubao tea's ongoing innovation in production technology, which is crucial for improving product

quality and enhancing market competitiveness. With continuous advancements in production processes, Liubao tea can offer higher-quality products, attracting more consumers and boosting brand recognition.

Figure 1. Liubao tea development (2020-2024)



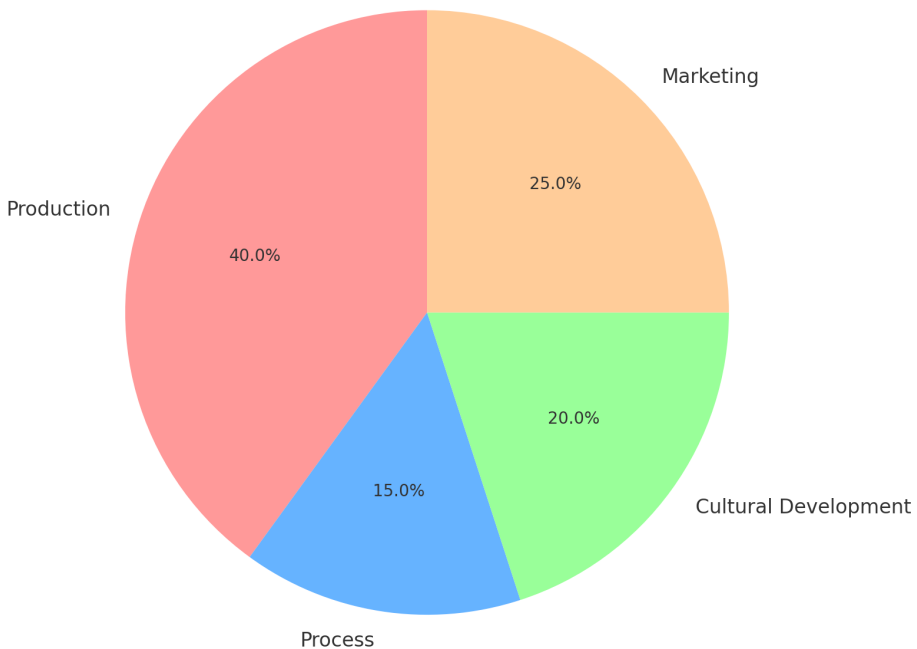
Source: Authors’ calculations

In addition, the increase in cultural development documents from 5 to 9 signifies the growing investment in cultural promotion and brand image building. By strengthening cultural development, Liubao tea not only enhances its brand’s cultural connotation but also deepens its emotional connection with consumers, which is essential for the long-term growth of the brand. The enterprise output, which increased from \$1 million to \$2 million, reflects a steady growth in market penetration, suggesting that the brand’s market influence has gradually expanded, particularly through the combined effect of branding and quality improvements. Finally, the increase in the number of sales channels, from 2 to 6, indicates Liubao tea’s expansion and optimization of its sales network, allowing it to reach a broader consumer base and expand its market. Overall, the data displayed in the heatmap reflects Liubao tea’s continued progress across various dimensions, with these changes interacting synergistically to drive the overall development of the brand and increase its market recognition.

Figure 2 analyzes the spending structure of Hezhou Liubao tea, revealing the distribution of resources across various sectors. According to the chart, the highest proportion of expenditure is allocated to production, accounting for 40%. This indicates that the Liubao tea brand invests a significant amount of resources in ensuring product

quality and expanding production capacity. This high allocation supports the brand's foundational infrastructure and product supply capability, enabling it to meet the growing market demand. Following closely is marketing expenditure, which accounts for 25%, reflecting Liubao tea's significant investment in enhancing brand awareness, expanding sales channels, and promoting the brand. The relatively high marketing expenditure highlights the brand's focus on shaping its image and reaching a broader consumer base in a competitive market.

**Figure 2.** Liubao tea spending breakdown



*Source:* Authors' calculations

Additionally, cultural development expenditure accounts for 20%, a proportion that, while not as large as production and marketing, demonstrates Liubao tea's emphasis on brand culture. Through cultural development, Liubao tea strengthens its brand's cultural connotation and enhances its emotional connection with consumers, thereby increasing its market appeal. The expenditure on process improvement is 15%, a relatively smaller share, but it still reflects the brand's ongoing commitment to optimizing production processes and improving product quality. Overall, the analysis of Figure 2 demonstrates that Liubao tea allocates its resources across production, marketing, cultural development, and process improvement, indicating a balanced strategy to enhance its market competitiveness on multiple fronts.

**Figure 3** presents the word cloud of customer reviews for Hezhou Liubao tea, reflecting the commonly used keywords and emotional tendencies expressed by consumers after purchasing and tasting the tea. The word cloud reveals that words like "delicious," "healthy," "traditional," "best," and "quality" frequently appear, indicating that consumers generally hold Liubao tea in high regard for its taste and health benefits. Many consumers describe it as delicious with a rich traditional flavor, highlighting the unique taste and historical cultural background of Liubao tea. Additionally, words like "great quality," "aroma," and "smooth" further emphasize consumers' recognition of the tea's quality, particularly in terms of its aroma and taste.

**Figure 3.** Customer reviews of Liubao tea



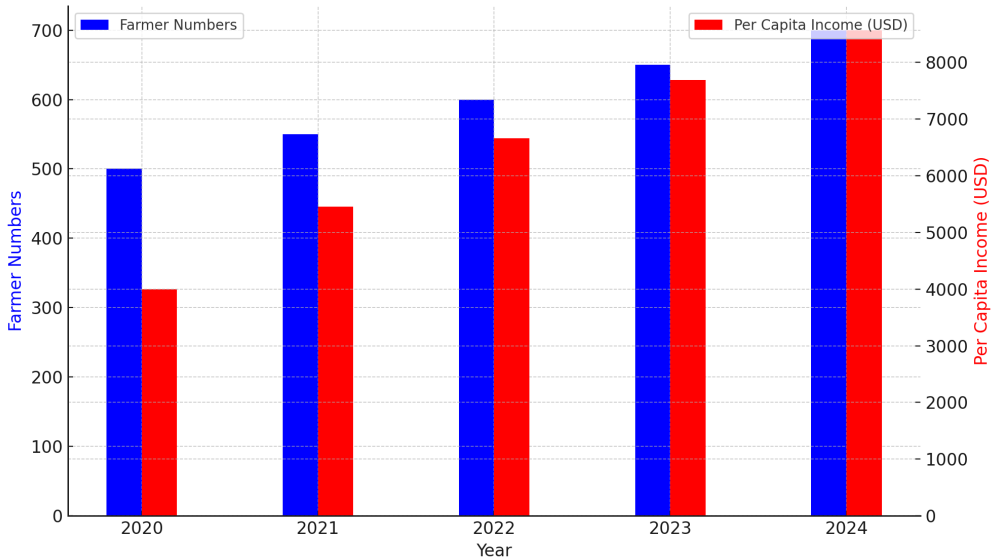
*Source:* Authors' calculations

The word cloud also features terms such as "organic," "refreshing," and "premium," reflecting consumers' impressions of Liubao tea as a natural, high-quality product. These words suggest that consumers view Liubao tea as not only a traditional tea product but also a healthy and pure beverage. Overall, the word cloud analysis shows that Liubao tea has established a brand image in the minds of consumers as a high-quality, traditional, and healthy product, with its advantages in taste, aroma, and quality being widely recognized and praised.

**Figure 4** provides a clear visual representation of the growth in both the number of tea farmers and their per capita income from 2020 to 2024, offering valuable insights into the development of the tea farming sector in Hezhou. The blue bars, which represent the growth in the number of tea farmers, show a steady increase over the five-year period, from 500 farmers in 2020 to 700 farmers in 2024. This growth indicates that the tea farming industry in Hezhou is expanding, with more individuals entering the

sector. This could be a result of the increasing demand for Liubao tea and the financial opportunities it offers. The steady increase in the number of tea farmers suggests that the industry is becoming more attractive and that there is a growing interest in tea cultivation as a livelihood.

**Figure 4.** Farmer numbers and per capita income growth



*Source:* Authors' calculations

On the other hand, the red bars, which represent the per capita income growth for tea farmers, also show a positive upward trend over the same period, from \$4,000 in 2020 to approximately \$8,571 in 2024. This significant growth in per capita income reflects the positive economic impact of Liubao tea's market expansion and the improved quality of tea production. The rise in income suggests that not only has the overall number of farmers increased, but the profitability of tea farming has also improved, likely due to enhanced production techniques, better marketing strategies, and the increasing recognition of Liubao tea's cultural and quality value.

Together, the trends in both the number of tea farmers and their per capita income highlight a growing, profitable tea farming industry in Hezhou, where both the expansion of the workforce and rising incomes reflect the broader success and sustainability of the Liubao tea sector. These trends indicate that the industry is not only attracting more farmers but also providing them with better economic returns, contributing to the overall economic growth of the region.

The combination of factor analysis and Structural Equation Modeling (SEM) provides an effective framework for studying the impact of tea culture brand construction on the

income increase of tea farmers. Factor analysis allows for the extraction of latent factors that explain the correlations between various variables. In this study, we hypothesize the extraction of three main factors: Brand Effect Factor, Production Efficiency Factor, and Market Penetration Factor. The Brand Effect Factor is composed of tea culture brand construction scores and marketing expenditure, the Production Efficiency Factor consists of production area and process improvement scores, and the Market Penetration Factor reflects the diversity of sales channels. The results of factor analysis indicate that these factors significantly contribute to the income increase of tea farmers.

In order to conduct factor analysis, data need to be standardized. This is because different variables may have different scales, e.g. income may be thousands of dollars while production area is a few hectares. Therefore, standardizing the data makes the scales of each variable consistent and avoids differences in the scales of the dependent variables from affecting the results of the factor analysis. The standardized data formula is as follows:

$$\gamma = \frac{\chi - \mu}{\sigma}$$

where  $x$  is the raw data,  $\mu$  is the mean,  $\sigma$  is the standard deviation, and  $y$  is the normalized data. **Table 1** is the analysis result extracted from the factor analysis and SEM:

**Table 1.** Results of correlation impact analysis on tea farmers' income increase

Correlation Impact Path	Path Coefficient	Standard Error	t-value	p-value
Tea Culture Brand Construction → Tea Farmer Income	200	40	5	0.003
Production Area → Tea Farmer Income	100	30	3.33	0.01
Process Improvement → Tea Farmer Income	150	50	3	0.02
Marketing Expenditure → Tea Farmer Income	0.004	0.001	4	0.004
Sales Channels → Tea Farmer Income	400	150	2.67	0.03
R-Squared	0.92			

Based on the analysis results in the table, Tea Culture Brand Construction has the most significant impact on tea farmer income. The path coefficient is 200, with a p-value of 0.003, indicating that for each 1-point increase in tea culture brand construction score, tea farmer income increases by 200 USD. This result shows that strengthening tea culture brand construction, particularly improving brand image and cultural promotion, directly facilitates consumer recognition of the brand and thus drives the increase in tea farmers' income.

Both Production Area and Process Improvement also have a significant impact on tea farmers' income, with path coefficients of 100 and 150, respectively, and p-values less than 0.05. This indicates that expanding production area and improving production



processes are key factors in driving income increase. The expansion of production area and the improvement of production processes directly enhance the yield and quality of tea, increasing market competitiveness, thereby driving income growth.

Marketing Expenditure has a relatively smaller but still significant effect on income, with a path coefficient of 0.004 and a p-value of 0.004. This shows that for every additional dollar spent on marketing, tea farmers' income increases by 0.004 USD. Although the direct effect of marketing expenditure is small, it indirectly promotes income growth by increasing brand exposure, expanding market reach, and enhancing consumer brand recognition.

The number of Sales Channels also has a significant impact on tea farmers' income, with a path coefficient of 400 and a p-value of 0.03. This means that for every additional sales channel, tea farmers' income increases by 400 USD. The increase in sales channels enhances market penetration, allowing more consumers to access the product, thus boosting sales and income growth.

Overall, the combination of factor analysis and structural equation modeling provides a clear path for understanding how tea culture brand construction, production efficiency, and market penetration factors interact to promote tea farmers' income growth. The brand effect, production efficiency, and market penetration factors work together to increase tea farmers' income. Tea culture brand construction, by directly impacting brand recognition and cultural promotion, combined with marketing expenditure and the expansion of sales channels, enhances the brand's market competitiveness. Production efficiency drives income growth directly by increasing production area and improving processes. Market penetration further expands market share and income opportunities through diverse sales channels.

## Discussions

The development of Hezhou Liubao tea over the past five years highlights the key factors driving its growth, including brand construction, production improvement, and market expansion. From a broader perspective, the growth of Liubao tea is not just a commercial success for the brand but also a critical case for rural revitalization, farmer income improvement, and agricultural development in Hezhou. The strategies employed by the brand provide valuable insights into how agricultural products, particularly in traditional industries, can thrive through strategic development in branding, technology, and market integration, benefiting both producers and the broader rural economy.

One of the core aspects of Liubao tea's success lies in its brand construction and cultural development. For tea farmers, brand recognition is a key factor in driving income. As demonstrated in the data, investments in brand development—particularly in strengthening cultural connotations and enhancing the brand's image—have been directly linked to the growth in farmer income. By positioning the brand not only as a product but also as a cultural heritage, Liubao tea has effectively attracted a niche market that values traditional craftsmanship and the cultural story behind the product. This

strategy resonates with the broader goal of rural revitalization, as it ties the product to regional identity and history, creating economic opportunities while preserving cultural heritage. The integration of cultural elements into branding has been shown to increase consumer loyalty and willingness to pay a premium for products that embody local culture (Mao et al., 2024). This approach contributes to the long-term sustainability of rural economies by providing farmers with a steady stream of income through differentiated products.

The improvement of production efficiency also plays a crucial role in driving the success of Liubao tea. The expansion of tea garden areas and the adoption of advanced production techniques have enabled the brand to scale up production while maintaining quality standards. This is particularly important in the context of rural revitalization, where increasing agricultural productivity is a primary objective for enhancing the livelihood of farmers. By improving agricultural processes, reducing costs, and increasing yields, Liubao tea not only boosts its competitiveness in the market but also strengthens the economic foundation of tea farming families. As previous research has highlighted, rural development cannot be solely based on traditional farming methods but must embrace innovation and technological adoption (Ye et al., 2022). In this case, Liubao tea's commitment to production process improvements and capacity expansion has created a sustainable model that could serve as a blueprint for other agricultural sectors aiming for modernization.

Moreover, market expansion and penetration are pivotal strategies that have propelled the growth of Liubao tea. The brand's increased investment in expanding sales channels and its efforts to establish a presence in both domestic and international markets have created broader economic opportunities for farmers. The increased number of sales channels—from local markets to e-commerce platforms—has allowed Liubao tea to reach a wider audience, thus ensuring that more farmers can benefit from the increasing demand for their product. This market expansion is essential for rural economic development as it provides local farmers with access to larger and more diverse markets, which in turn increases their income potential. The rise of e-commerce has particularly been a game-changer for rural products, allowing them to overcome geographical barriers and access national and international buyers (Chen et al., 2025). Liubao tea's strategic use of digital platforms for marketing and sales is an example of how rural businesses can leverage modern technology to enhance market reach and economic resilience.

From an agricultural policy perspective, the case of Liubao tea suggests that a balanced approach between production efficiency, cultural branding, and market expansion can have a profound impact on the livelihoods of farmers and rural development. Policymakers should prioritize the integration of culture and heritage into agricultural products, as this not only adds value to the product but also promotes sustainable rural development. Furthermore, encouraging technological innovation in farming practices, as demonstrated by Liubao tea, should be a key focus in rural revitalization strategies. By supporting the adoption of modern farming technologies, farmers can

improve productivity while maintaining ecological balance and preserving traditional agricultural practices. Governments could play a crucial role by providing incentives for agricultural innovation, facilitating access to new markets, and supporting the establishment of rural cooperatives that can help small-scale farmers access the benefits of market expansion and brand development.

The findings of this study can be contextualized by comparing them with the successful brand development of Yunnan's Pu'er tea, which offers valuable lessons for Liubao tea's marketing strategy. Similar to Liubao tea, Pu'er tea has a rich cultural heritage and a strong local identity. However, Pu'er tea's success lies not only in its product quality but also in its effective cultural branding and global market expansion. Pu'er tea has strategically highlighted its historical fermentation process and deep cultural significance, appealing to both domestic and international consumers. This emphasis on cultural storytelling, combined with modern production techniques, has enhanced its market visibility and consumer loyalty (Ning et al., 2011). Liubao tea can benefit from a similar approach, integrating its unique production techniques and cultural values into a compelling narrative that resonates with modern consumers. By learning from Pu'er tea's ability to combine tradition with innovation, Liubao tea can enhance its brand recognition and market share, both within China and internationally.

To support the growth of Liubao tea and the income of local farmers, several policy recommendations are critical. One potential avenue is providing subsidies for the adoption of modern technologies in tea cultivation and production. Government incentives could help tea producers invest in advanced processing techniques and improve production efficiency, which would not only raise the quality of the product but also reduce costs and increase profitability. Furthermore, promoting Liubao tea through cultural tourism initiatives could attract more consumers by linking tea production with cultural experiences. Establishing tea-related cultural festivals or tea farm tours would not only boost brand awareness but also create opportunities for direct consumer engagement and sales growth. Additionally, developing infrastructure for better access to international markets, including digital platforms for e-commerce, could significantly expand Liubao tea's reach, enhancing its competitive edge in global markets.

This study makes significant theoretical contributions to both cultural branding and agricultural economics. In the field of cultural branding, it advances our understanding of how local cultural elements, when strategically integrated into a brand's marketing, can create emotional connections with consumers and enhance brand loyalty. By applying big data visualization to analyze consumer behavior, this research provides new insights into how cultural heritage can be effectively communicated to diverse consumer groups. Furthermore, from the perspective of agricultural economics, this study explores the role of branding and technology in increasing farmer income. It emphasizes how the modernization of agricultural practices, supported by data-driven marketing strategies, can enhance the economic viability of small-scale farmers, offering a sustainable path for rural development. These theoretical contributions add value by demonstrating the intersection of cultural heritage, technological innovation,

and economic development within the agricultural sector, providing a model for other regions to replicate.

The long-term strategy for rural revitalization should focus on creating an ecosystem where agricultural production, market expansion, and cultural development go hand in hand. The success of Liubao tea underscores the importance of creating value through cultural differentiation, improving productivity, and ensuring access to larger markets. In this way, rural areas can not only enhance their agricultural output but also create a unique identity that attracts both local and global consumers. This multifaceted approach helps achieve broader economic goals, such as improving farmer incomes, enhancing rural economic resilience, and supporting sustainable development in the countryside. By applying these strategies to other agricultural sectors, a more diversified and prosperous rural economy can be built, fostering long-term sustainable growth and prosperity for rural communities.

### Conclusions

This study provides a comprehensive analysis of how big data visualization can enhance the brand marketing of Hezhou Liubao tea and increase farmer income. The findings highlight the significant role of big data in shaping marketing strategies by revealing key consumer behavior patterns, market demand trends, and sales channel performance. By integrating both quantitative data and cultural elements, Liubao tea's brand strategy can be improved, enhancing its market competitiveness and fostering growth in the local tea farming industry. However, this study has some limitations that should be acknowledged.

First, the regional focus on Hezhou Liubao tea limits the generalizability of the findings to other tea-producing regions in China and abroad. While Liubao tea offers a valuable case study, the unique climatic, cultural, and economic conditions of other tea-growing regions may result in different branding and marketing dynamics. For instance, regions like Fujian and Zhejiang, known for their distinct tea varieties and production techniques, may require different strategies to adapt to their specific market demands. Moreover, while the reliance on big data provides valuable insights into consumer behavior and preferences, it may overlook important qualitative nuances, such as the cultural significance of tea or consumer attitudes that are not easily captured in online data. These qualitative aspects, particularly the emotional and cultural connections consumers have with tea, are often difficult to quantify but crucial for understanding consumer behavior in the tea market.

To address these limitations, future research should consider expanding the geographic scope to include a more diverse range of tea-producing regions. Studies could explore how climatic, cultural, and economic variations affect branding strategies in different regions. Additionally, future research could adopt an interdisciplinary approach, combining ethnographic methods with big data analysis to capture the qualitative dimensions of tea culture that may be underrepresented in quantitative data. By

integrating fieldwork and cultural insights with data-driven approaches, researchers could gain a more holistic understanding of the factors driving consumer preferences and brand success in the tea industry.

Furthermore, investigating the role of government policies in supporting the development of tea brands, particularly in rural areas, would also be valuable. Policymakers could use such research to design strategies that support the integration of cultural heritage with modern marketing practices, helping to improve farmers' livelihoods and foster sustainable industry growth. Overall, this study lays the groundwork for further exploration into the intersection of cultural branding, technological innovation, and economic development in the tea industry, with implications for both the agricultural sector and the broader global market.

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### **Conflict of interests**

The authors declare no conflict of interest.

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