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A Study on the Development History of Agricultural E-commerce in Guizhou Province, 2012-2023

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Abstract: From 2012 to 2023, Guizhou Province leveraged its mountainous agricultural resources and ethnic cultural advantages to actively explore an agriculture e-commerce development path suited to its regional characteristics. During this period, in response to the needs of agricultural modernization, Guizhou proactively addressed key constraints on agricultural e-commerce development: fragmented logistics networks due to karst topography, low levels of agricultural product standardization and branding, and talent shortages caused by a lack of digital skills. To overcome these challenges, Guizhou established a tripartite development framework integrating policy guidance, technological empowerment, and market-driven initiatives. The province integrated county-level logistics nodes to build a smart logistics network, reducing losses during agricultural product distribution; developed a geographical indication certification system and mechanisms for transforming ethnic cultural intellectual property to enhance product value; and innovated a "government-university-enterprise" collaborative talent development model to strengthen endogenous momentum for rural e-commerce growth. By improving infrastructure, activating cultural resources, and enhancing human capital supply, Guizhou has effectively connected smallholder farmers with modern markets through agricultural e-commerce, providing a successful model for e-commerce development in multi-ethnic mountainous regions of western China.

Keywords: Guizhou, agricultural e-commerce, development history

1. Introduction

1.1 Research Background and Significance

Since 2012, domestic e-commerce has accelerated its penetration into county-level and rural areas, and agricultural e-commerce has gradually become an important lever for driving the modernization of agriculture in mountainous areas. The research period is set from 2012 to 2023, because this period represents a complete development stage for agricultural e-commerce in Guizhou Province, from its initial exploration to large-scale promotion and then to quality improvement and transformation. It is typical for conducting historical retrospection. E-commerce platforms have effectively shortened the distance between agricultural producers and consumers, not only reducing the information barriers existing in traditional agricultural transactions, but also expanding the sales channels for agricultural products [1].

This paper takes the period from 2012 to 2023 as the time window for investigation, systematically reviews the development process and stage characteristics of agricultural e-commerce in Guizhou Province, explores the core constraints accumulated during the development process, and then studies the development framework of "policy guidance - technology empowerment - market drive", with the aim of providing a reference practical sample for the high-quality development of agricultural e-commerce in multi-ethnic mountainous areas in the west.

1.2 Current Research Status at Home and Abroad

In terms of domestic research, the field of digital transformation of rural e-commerce focuses on the role of digital technologies in reconfiguring the rural e-commerce ecosystem, and mainly explores the application value and implementation bottlenecks of technologies such as live-streaming e-commerce and big data.

Ouyang Rihui (2022) pointed out in a research published on the National E-commerce Public Service Network that after 2021, rural e-commerce entered a high-quality development stage of "digitalization promoting agriculture", with emerging business models such as short-video e-commerce and live-streaming e-commerce accelerating their popularization, promoting the creation of online brands for agricultural products and the digital transformation of supply chains. However, due to the weak network infrastructure in western mountainous areas, the efficiency of digital technology implementation was significantly lower than that in the eastern regions.[1]

In terms of the research on innovation experiences in different regions, domestic studies have generally summarized the practical models of various places, but they have overlooked the impact of terrain differences on the adaptability of these models.

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The Zhejiang E-commerce Promotion Association and Wu Xiaobo (2023) pointed out in the "White Paper on the Clustered Development of Rural E-commerce in Zhejiang" that the "Taobao Village + Industrial Belt" model in Zhejiang benefits from the advantage of convenient transportation, reducing logistics costs by 30%. However, this model is difficult to replicate in the western mountainous areas with "high mountains and long distances, scattered villages", and after being copied by provinces like Guizhou, the problem of idle facilities exceeding 40% occurred. The existing experience lacks adaptive design for mountainous terrain and is unable to directly guide the practice in Guizhou.[2]

In the research on optimizing agricultural product production and marketing and cultural empowerment, scholars have focused on the value of marketing innovation and cultural integration, but the specific path research is still rather general.

Liang Juefei (2024) proposed in "Green Packaging" that integrating intangible cultural heritage elements into agricultural product packaging can increase the product's premium rate by more than 30%, but currently, most regions are still at the shallow stage of "pattern imprinting", lacking the deep integration of "cultural stories + digital dissemination", and the e-commerce transformation of resources such as Miao embroidery and batik in Guizhou has not yet formed a mature model.[3]

Based on different economic foundations and regional characteristics, in the field of research on efficient circulation driven by technology,

Emily C. Jones (2020) mentioned in "Local Economy" that the British government established e-commerce service points in 92% of rural areas through financial subsidies, along with the upgrading of fiber optic networks, which led to a 58% increase in the global sales of rural handicrafts. The "government subsidy for infrastructure" approach has significance for reference in Guizhou.[4]

In terms of low-cost technology adaptation research,

Ravi Shankar (2021) disclosed in "Electronic Commerce Research and Applications" that the "rural e-commerce service stations" in India trained farmers to use WhatsApp for order taking and Excel for inventory management, increasing the participation rate of small and medium-sized farmers in e-commerce from 18% to 72%. This low-barrier technology penetration model can be explored to adapt to the digital foundation of farmers in Guizhou.[5]

In the research on the transformation of niche culture through cultural empowerment,

Marie Lefèvre (2020) confirmed through the case of Bordeaux wine in the "Journal of Rural Studies" that the display of traditional brewing techniques through short videos increased the product cultural identification by 62% and the premium rate by 38%. This provides a solution for the integration of Guizhou's ethnic culture and agricultural products.[6]

Overall, the existing research has discussed the models and constraints of agricultural e-commerce more, but there is still room for supplementary research on the systematic construction of the "policy guidance - technology empowerment - market drive" analysis framework for the karst multi-ethnic mountainous areas. There is also less systematic exploration of the long-term development history of specific regions and in-depth analysis of stage contradictions.

1.3 Core Concepts

The core essence of agricultural e-commerce refers to a new business model that is supported by information network technology as the underlying infrastructure and relies on the Internet platform to achieve the online integration of all elements in the agricultural value chain. It is not limited to the online sales of agricultural products alone; instead, it encompasses the entire process of "agricultural input procurement - production guidance - product trading - logistics distribution - after-sales service", which is a digital integration of the entire process. From the core characteristics, agricultural e-commerce has the attribute of breaking through time and space limitations, eliminating the pain points of traditional agricultural product transactions such as "limited geographical location and short time span", and expanding the circulation radius from regional markets to the entire country and even the world through online platforms; at the same time, it highlights the advantage of information transparency, allowing consumers to query detailed information about agricultural products through the traceability system, and producers can also rely on platform data to understand changes in market demand. Based on the digital connotation of the entire value chain of agricultural e-commerce, this article conducts an analysis from three dimensions: "policy guidance - technology empowerment - market driving", and systematically examines the development and evolution of agricultural e-commerce in Guizhou from 2012 to 2023.

2. Initial Exploration Period (2012 - 2015)

2.1 Evolution Motivation: The Nationwide Rural E-commerce Wave and the Initial Conditions of Industry in Guizhou

Guizhou is located in the hinterland of the Yunnan-Guizhou Plateau. Its unique geographical and ecological conditions constitute the core natural foundation for the development of agricultural e-commerce, and its environmental characteristics have a direct impact on the supply of characteristic agricultural products and the choice of e-commerce models. From the perspective of topography and landforms, the proportion of mountainous and hilly areas in the province is as high as 92.5%, and the area covered by karst landforms is 61.9%. On one hand, the mountainous terrain restricts traditional large-scale mechanized farming, making the scale production of agricultural products more difficult than in plain areas, and directly causing the fragmentation of rural logistics networks, increasing the cost and loss of

agricultural product circulation. On the other hand, the complex terrain has created significant vertical climate differences - from the subtropical climate of low-altitude river valleys to the temperate climate of high-altitude mountains - creating diverse ecological environments that provide natural advantages for cultivating high-value-added characteristic agricultural products, which precisely meet the demand of the e-commerce market for "differentiated, original ecological" agricultural products.

From the perspective of characteristic agricultural product supply, relying on high-quality ecological endowments, Guizhou has formed a number of advantageous industries that are suitable for e-commerce, providing core product support for agricultural e-commerce development: In the tea industry, as the province with the largest tea planting area in the country, famous brands such as Duyun Maojian and Meitan Cuibao have been cultivated; in the characteristic fruit and forestry industry, processed products such as astringent fruit juice, preserved fruits, and health supplements, due to their "natural and healthy" attributes, are in line with the e-commerce consumption trend; in the medicinal herbs and edible fungi industry, products such as ginseng and yuba mushroom have formed the core advantages of "ecological cultivation, high-quality products". In summary, although the mountainous terrain and ecological endowments of Guizhou have certain limitations on traditional agricultural development, through the innovation of agricultural e-commerce channels and models, the characteristic agricultural products nurtured by its unique natural environment have been transformed into core competitive advantages.

Guizhou is a multi-ethnic settlement area, and rich ethnic culture has given rise to a variety of traditional handicrafts: Silver of the Miao ethnic group, Dong ethnic group's weaving, and the batik of the Buyi ethnic group, with their colorful patterns and exquisite designs, are made into clothing and home accessories and sold to domestic and foreign markets, becoming popular in the field of cultural products. Under the "Internet+" background, the integration of Guizhou's ethnic cultural products and e-commerce is increasingly deepening, and traditional craftsmanship masters showcase the production process on short-video platforms, along with some ethnic villages creating the "e-commerce + ethnic heritage experience" model, jointly promoting cultural dissemination and industrial development. For example, the silver jewelry of the Miao ethnic group in Leishan integrates traditional techniques and modern design through live-streaming on Douyin. However, overall, the mechanism for transforming ethnic cultural resources into agricultural product value-added is still not perfect, and the commercial value of ethnic cultural IPs has not been fully released. In the "Internet +" era, relying on characteristic agricultural products and market demands, Guizhou, with the help of the Internet and modern marketing methods, has great potential in enhancing the popularity of agricultural products, expanding sales channels, and achieving sustainable rural economic development.

2.3 Achievements of Development in This Stage

In 2012, domestic e-commerce began to penetrate into rural areas of county-level regions. In Guizhou, agricultural e-commerce was in its initial stage of being explored by farmers on a voluntary basis and with scattered distribution. The policy support system had not yet been established, and the overall scale of the industry was relatively small. In 2013, the online retail sales volume of agricultural products in the province was only 1.52 billion yuan.

2.4 Constraints and Contradictions Leftover from the Previous Stage and Their Impact on the Subsequent Stage

The constraints in this stage mainly manifest as weak basic conditions: Firstly, due to the influence of karst landforms, the fragmented characteristics of rural logistics networks have initially emerged, with low logistics coverage in administrative villages and almost no cold chain facilities, resulting in high losses during the circulation of fresh agricultural products; Secondly, the standardization and branding of agricultural products are extremely low, with most products entering the market in their raw form and lacking unified grading standards and brand packaging; Thirdly, the digital skills of rural practitioners are generally lacking, and there is a shortage of professional e-commerce talents, with the problem of talent shortage beginning to emerge, which restricts the further expansion of the industry. The multiple shortcomings exposed in this stage, such as fragmented logistics, weak foundation for standardization and branding, and insufficient supply of digital talents, have become the practical problems that need to be addressed during the rapid expansion stage from 2016 to 2020. They have also laid the groundwork for the large-scale implementation of subsequent policies and the upgrading of the industry.

3. Rapid Expansion Period (2016 - 2020)

3.1 Evolution Motivation: Implementation of the National Policy on Promoting E-commerce in Rural Areas

During the "13th Five-Year Plan" period, the Guizhou Provincial Government clearly identified e-commerce as the core strategy for achieving a leapfrog development. They successively issued over ten policy documents such as the "Implementation Opinions of the Guizhou Provincial Government on Vigorously Developing E-commerce", and established an e-commerce development working group to comprehensively promote the construction of e-commerce platforms, the cultivation and introduction of enterprises, the promotion of application scenarios, and the improvement of service systems, aiming to create an e-commerce development model that suits the mountainous characteristics of Guizhou. The gradual improvement of the policy system has played a distinct policy guidance role and is an important part of the "policy guidance - technology empowerment - market drive" framework.

In 2017, the "Guizhou Products Out of the Mountain" project was launched. By expanding online marketing channels and improving logistics nodes in the production areas, it laid the foundation for the large-scale development of

agricultural e-commerce. In September 2020, the Guizhou Poverty Alleviation Live Streaming E-commerce Base was launched, with "live-streaming to help agriculture" as the core to build a "from the field to the cloud" direct connection model between production and sales, forming a collaborative mechanism of "government hosting, enterprise operation, farmers participation". During the policy implementation process, efforts were also made to strengthen talent support. During this period, nearly 100,000 rural brokers and e-commerce practitioners were trained across the province, and 80% of the trainees grew into key personnel in the field of agricultural product circulation [2].

3.2 Main Practices and Development History

In response to the constraints of mountainous terrain, Guizhou Province focused on breaking through the bottlenecks of logistics and network communication, and established an infrastructure system suitable for the development of agricultural e-commerce. The first step was the construction of a three-level logistics network, aiming to solve the "last mile" problem of rural logistics. Taking Liupanshui as an example, 1 county-level warehousing and distribution center, 92 township logistics service stations, and 1,200 village-level e-commerce service points have been built, enabling the two-way circulation of agricultural products "upward" and industrial products "downward". This system effectively improved the shortcomings of rural logistics previously. As pointed out in the research, compared with urban areas, the transportation efficiency in rural areas is much lower. It not only increases transportation costs but also may cause problems such as loss and quality changes of agricultural products during transportation [3].

The second step was the coverage of network communication facilities. The broadband access rate in rural areas has continued to increase. High-speed and stable network infrastructure provides technical support for live-streaming e-commerce, big data production and sales matching, and online order management, promoting the upgrade of agricultural e-commerce from the traditional "shelf sales" to "digital interactive sales".

Finally, public service facilities were complemented. Relying on the national comprehensive demonstration projects for e-commerce in rural areas, many places have built e-commerce public service centers, origin pre-cooling warehousing centers, etc., providing one-stop services such as product packaging design, quality inspection and traceability, order processing, and logistics connection for farmers and small and micro enterprises, reducing the participation threshold of agricultural e-commerce and further releasing the development potential of rural e-commerce.

3.3 Achievements of Development in This Stage

The comprehensive demonstration projects for e-commerce in rural areas were widely implemented in Guizhou. In 2017, the "Guizhou Products Out of the Mountain" project was officially launched. The policy support continued to increase, and the industrial scale grew rapidly. New business models such as live-streaming e-commerce gradually emerged. By 2020, the online retail sales of agricultural products in the province had achieved several times the growth compared to the initial stage.

The characteristics of agricultural e-commerce in Guizhou during this stage are as follows: First, the industrial scale grew rapidly. Under the policy-driven influence, the online retail sales of agricultural products continued to rise. In 2020, it exceeded 6 billion yuan, achieving several times the growth compared to 2013. The number of market entities increased rapidly. Second, new business models gradually emerged. Live-streaming e-commerce began to become a new driving force for agricultural e-commerce. In some regions, a model of "government guidance + enterprise training + farmers participation" was adopted to cultivate local hosts. The live-streaming GMV gradually increased, becoming a new channel for agricultural products to move up the chain. Third, the return of talents was initially initiated. The development of agricultural e-commerce gave rise to diverse job positions, attracting some migrant workers andreturning entrepreneurs to return. A total of nearly 100, 000 rural brokers and e-commerce practitioners were trained in the province, providing initial talent support for industrial development. Fourth, the models continued to diversify. On the basis of platform-based e-commerce, some powerful agricultural enterprises began to explore self-operated e-commerce models, creating their own online brands, and enhancing added value for the middle and high-end market.

3.4 The remaining constraints and contradictions from the previous stage and their impact on the subsequent stage

As the industrial scale expanded rapidly, deeper contradictions gradually emerged: Firstly, the fragmentation of the logistics network continued to intensify, with the shortage of cold chain support being particularly prominent. The transportation loss rate of fresh agricultural products was high, restricting the radius of product export; Secondly, the problems of low standardization and branding of agricultural products became more obvious. The value of geographical indication products was underexploited, the transformation of cultural and ethnic IP was lagging behind, and the product added value was low; Thirdly, the problem of talent shortage due to the lack of digital skills gradually expanded. The age structure of practitioners was unbalanced, there was a shortage of multi-skilled e-commerce talents, and the problem of talent loss began to emerge. The quality shortcomings accumulated during the rapid expansion process, such as prioritizing scale over quality, insufficient standardization and cultural and ethnic IP transformation, continuous talent shortage, and increased reliance on policy subsidies by the industry, directly pushed the agricultural e-commerce in Guizhou to shift to a quality improvement-oriented transformation stage in 2021-2023.

4. Quality Enhancement and Transformation Period (2021 - 2023)

4.1 Driving Factors for Stage Evolution: The Strategy of Promoting Agriculture through Digital Commerce and the Shift towards High-Quality Industrial Development

In 2023, the "Guizhou Province Rural Revitalization Promotion Regulations" further focused on rural e-commerce, explicitly stating support for the construction of e-commerce systems, the optimization of logistics distribution networks, and the deepening of the "Guizhou Products Out of the Mountain" project; in the same year, the Provincial Finance Department and the Commerce Department jointly issued the "Guizhou Province Rural E-commerce Development Special Fund Management Measures", providing financial support for the establishment of e-commerce demonstration counties, the filling of logistics shortcomings, and the upgrading of brand cultivation, helping many places such as Guiyang, Zunyi, and Liupanshui successfully be selected as national comprehensive demonstration counties for e-commerce entering rural areas, and receiving central government subsidies for infrastructure construction. The policy focus shifted from scale expansion to quality improvement, and placed greater emphasis on the cultivation of internal driving forces within the industry.

4.2 Main Practices and Development History

From 2021 to 2023, as the policy orientation shifted towards improving quality and efficiency, Guizhou focused on the shortcomings of mountain agriculture e-commerce and implemented a series of practices in multiple dimensions such as smart logistics, technology traceability, brand IP, and talent cultivation.

Firstly, an optimized multi-level collaborative mountain smart logistics system was established. In response to the fragmented logistics network caused by the complex mountainous terrain in Guizhou, the "multi-level node collaboration" model was applied to optimize the logistics system. Taking the cold chain cloud warehouse in Xingguang District of Bijie City as an example, a smart cloud warehouse with functions such as agricultural product sorting, pre-cooling, and packaging was built at the county-level area. By integrating the storage process, the length of the supply chain was shortened and the logistics efficiency was improved. A three-level distribution system coordinated by the government and involving postal services, supply cooperatives, and covering "county-town-village" was constructed to achieve efficient circulation of agricultural products from the origin to the terminal, actively solving the bottleneck problem of the "last mile" logistics and delivery, and ensuring that "industrial products go to the countryside and agricultural products go to the city" were unimpeded [4].

To address the logistics problems in remote mountainous areas, Leishan County piloted the "drones across mountains + station distribution" model based on the mountain logistics optimization plan. The 2024 pilot report of the Logistics Bureau of Qiandongnan Prefecture showed that this model increased delivery efficiency by 40% and reduced costs by 25%. Drone logistics reduced intermediate transfers and effectively reduced cold chain costs. As of now, in some areas of Guizhou, direct delivery from the field to the market has been achieved through drones, improving product freshness, shortening transportation time, and enhancing the market competitiveness of agricultural products [5].

Secondly, a pilot application of blockchain agricultural traceability technology was promoted. Under the policy guidance of the "Opinions of the Provincial People's Government on Accelerating the Application and Development of Blockchain Technology", in 2021-2023, Guizhou implemented agricultural blockchain traceability pilot projects based on the production and sales needs of "Guizhou products leaving the mountain". Puanan black tea, Xingren jujube rice, and Guiding litchi, among others, were successively involved in technical practices. By leveraging the immutable characteristics of blockchain to record all-chain information such as agricultural production, processing, and circulation, one-item-one-code scanning and traceability were achieved, thereby enhancing the trust of out-of-province consumers in Guizhou's agricultural and specialty products.

Thirdly, a practice of integrating geographical indication certification and ethnic cultural IP was carried out. From 2021 to 2023, Guizhou relied on geographical indication resources to carry out brand cultivation practices. Some counties leveraged local intangible cultural heritage resources of the Miao, Dong, and Buyi ethnic groups and attempted to integrate ethnic handicrafts and traditional planting techniques into the packaging and short-video dissemination scenarios of agricultural products. Some e-commerce entities conducted pilot projects of "e-commerce + intangible heritage + tourism", using live-streaming platforms to showcase ethnic traditional skills, promoting the combination of ethnic cultural resources and agricultural product sales scenarios, and exploring the practical path of IP empowerment for agricultural products. The "one county one mark" certification was actively promoted to create regional quality marks for Guizhou's characteristic agricultural products, and representative products that had been created needed to undergo standardized certification to consolidate quality and market position. For example, Duyun Maojian tea needed to formulate standards for planting, picking, processing, and packaging, including specifying the climate conditions for planting and clear picking standards, while unifying packaging materials specifications, indicating quality information, and integrating regional culture to significantly enhance product quality advantages and market trust.

Fourthly, a multi-level localized e-commerce talent cultivation system was established to address the talent gap in rural e-commerce in Guizhou. A "government investment + university teaching + enterprise training" cultivation system was constructed. At the vocational education level, Guizhou Business College offered the "Mountain E-commerce Operation" major, with course settings centered around live talk strategies, logistics transportation management, and ethnic cultural marketing, and combined with local industry characteristics to systematically cultivate professional e-commerce talents. Schools establish long-term and stable cooperative relationships with enterprises. Through signing cooperation agreements, introducing industry-education integration projects, jointly building training bases, or

conducting customized class teaching, students have the opportunity to participate in actual projects of enterprises [6].
At the policy level, the Guizhou Provincial Government has issued the "Implementation Opinions on Supporting 'Guizhou Returnees' Entrepreneurship and Innovation", guiding talents to return to their hometowns and participate in e-commerce entrepreneurship through measures such as entrepreneurship subsidies, tax incentives, and e-commerce skills training. For example, Qiandongnan Prefecture, relying onspecial industries such asMiao embroidery and tea, has created a "e-commerce + intangible heritage + tourism" integration model, enablingreturning talents to open online stores or live-streaming studios, promoting the sales of agricultural products and industrial upgrading. A study in "Guizhou Ethnic Studies" in 2022 showed that under the dual attraction of policies and industries, 40% of thereturning entrepreneurial talents in the province have e-commerce operation experience, becoming new driving forces for rural economic development. Tongren City implemented a similar policy in 2024 to attract 3, 000 young people to return to their hometowns. By opening online stores and conducting live-streaming sales of characteristic agricultural products, it injected vitality into rural development. Regarding the language and technical barriers in ethnic minority concentrated areas, "dialect version e-commerce tutorials" have been promoted, using minority languages such as Miao and Dong to explain basic e-commerce operations through community night schools, "Guizhou Rural School" mobile apps, etc.
The cultivation of rural e-commerce talents in Guizhou has established a "government - university - enterprise" tripartite collaborative mechanism: The government plays a leading role, by introducing special entrepreneurship subsidies, talent settlement incentives, etc., to reduce the "perceived risks" for students to return to work, while building a provincial e-commerce talent training public platform to coordinate resources from all parties; Universities closely follow market demands to optimize the curriculum system, for example, Guizhou University has cooperated with Alibaba to launch the "rural e-commerce training class", specifically cultivating practical talents such as live-streaming operation, data analysis, and cross-border e-commerce; Enterprises provide practical scenarios, through setting up internship bases, conducting project-based teaching, etc., allowing trainees to enhance their abilities in real business situations.
The rapid development of agricultural e-commerce has given rise to diverse employment positions such as e-commerce operation, live-streaming sales, agricultural product sorting and packaging, and logistics distribution, absorbing rural surplus labor for nearby employment. The "White Paper on the Development of Rural E-commerce in Guizhou Province in 2023" shows that there are over 32, 000 rural e-commerce-related market entities and over 500, 000 jobs, of which about 30% arereturning laborers; For example, Baizhou District of Zunyi City has built an e-commerce live-streaming base, enabling 20% of idle labor in surrounding towns to participate in agricultural product online sales, achieving a transformation from "agriculture-based work" to "business-based work" and income improvement. Returned talents not only expand the sales channels of agricultural products, enhance market competitiveness, and increase farmers' income, but also bring new thinking and entrepreneurial spirit, helping to promote rural revitalization [7].

4.3 Achievements of Development in This Stage
The focus of industrial development has shifted from scale expansion to quality improvement. Greater emphasis has been placed on geographical indication certification, brand building, and talent system cultivation. The "Digital Agriculture Boosting Rural Development" initiative has been further advanced. By 2023, the online retail sales of agricultural products in the province reached 11 billion yuan, and agricultural e-commerce has entered a new stage of high-quality development.

4.4 Remaining Constraints and Contradictions from the Previous Stage
The core contradictions that hinder the high-quality development of the industry still exist in this stage: Firstly, the fragmentation problem of the logistics network caused by karst landforms has not been fundamentally resolved. The problems of high cost and high loss in cold chain logistics remain prominent, and the coverage of smart logistics is limited. Secondly, the overall level of standardization and branding of agricultural products is not high, and the mechanism for converting ethnic cultural IPs is still not perfect. The added value of products and their market premium capabilities are relatively weak. On one hand, the integration ratio of culture and agricultural products is low. A survey conducted by the Social Sciences Academy of Guizhou Province in 2023 shows that the proportion of agricultural products with ethnic cultural elements integrated in their brands is less than 15%. Although Guizhou's honey fruit and fragrant rice have obtained national geographical indication certifications as characteristic agricultural products, they still mostly enter the e-commerce market in their raw product form, lacking packaging designs that combine ethnic culture and story-based marketing, and failing to fully leverage the enhancement effect of cultural resources on brand value. On the other hand, the added value and market premium capabilities of agricultural products are weak, resulting in a lack of differentiated competitiveness for products in the e-commerce platform, and the market prices remain at a low level for a long time. Thirdly, the problem of talent shortage caused by the lack of digital skills remains prominent. The imbalance in the talent structure and the outflow of young people have not been fundamentally reversed. The "Guizhou Rural E-commerce Talent Development Report (2023)" shows that among the rural e-commerce practitioners in the province, 62% are over 45 years old, and the aging of the team is prominent. Only 28% have a college degree or above. The e-commerce talent outflow rate in Weining County, Bijie City, reached 41% in 2023.

5. Conclusion

Research Conclusion

By reviewing the evolution process from 2012 to 2023, the overall development of agricultural e-commerce in Guizhou can be described as "policy guidance as the starting point - technology empowerment for expansion - market-driven for improvement". This evolution pattern has inherent development logic and is of reference value for similar mountainous and multi-ethnic regions in the western part.

Over the past decade, Guizhou's agricultural e-commerce has progressed from the initial stage of farmers' spontaneous exploration, to the rapid expansion stage driven by policies, and then to the stage of high-quality development and transformation. The industry scale has continuously expanded, and the business models have become increasingly diverse. However, throughout the development process, three core constraints - karst landform causing fragmented logistics networks, low standardization and branding of agricultural products, and the lack of digital skills leading to a talent gap - have always existed, although their manifestations vary at different stages. In the future, by optimizing infrastructure, activating cultural resources, and improving human capital supply, a three-in-one development framework of "policy guidance - technology empowerment - market-driven" can be constructed. This will facilitate the effective connection between small farmers and modern markets, providing a practical sample for the development of agricultural e-commerce in multi-ethnic mountainous areas in the western region.

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