

Digital Empowerment of Rural Camping Culture and Tourism in Yunnan: Empirical Evidence and Strategies of Yao Medicine Integration—Taking Sangongzhu Yao Medicine Camp in Hekou County, Honghe Hani and Yi Autonomous Prefecture as an Example

Yuxue Zhao¹, Ang Li¹, Shicheng Qiu¹

¹Yunnan University of Chinese Medicine, Kunming 650500, Yunnan, China

Corresponding author: Ang Li (e-mail: Liaaa20260002@163.com)

ABSTRACT Digital Economy Offers New Pathways for the Integration of Rural Camping Culture and Tourism with Ethnic Medicine in Border Minority Regions This study investigates how the digital economy provides innovative solutions for integrating rural camping tourism with ethnic medicine in border minority areas. Based on theories of cultural heritage preservation, sustainable ecological development, and digital governance, we construct a Digital Empowerment Framework incorporating intelligent monitoring, multi-source information fusion, and AR/VR immersive interactive technologies. Using the Sangongzhu Yao Medicine Camp in Hekou County, Yunnan Province, as a case study, we employ mixed methods—including field surveys, interviews, and questionnaires—to analyze the “Digital + Yao Medicine + Camping” integration model. The evaluation spans economic, social, and cultural dimensions to assess its efficacy.

INDEX TERMS digital empowerment, rural camping, Yao Medicine, smart cultural tourism

I. INTRODUCTION

A. RESEARCH BACKGROUND

RURAL tourism is the core engine of rural revitalization in Yunnan. In 2024, Yunnan Province received 280 million tourists and generated 120 billion yuan in revenue, accounting for 32% of the province’s total tourism revenue [1]. Camping, as an emerging form of rural tourism, is highly compatible with Yunnan’s resources as a “plant kingdom” and “grand garden of ethnic culture”. Yao medicine, as the core carrier of Yunnan Yao ethnic traditional medicine culture (there are 86 kinds of Yao medicine resources in the province, mainly distributed in Yao ethnic areas such as Honghe and Wenshan) [2], has both medicinal value and cultural connotation, injecting unique health and wellness attributes into camping tourism.

The dual drive of the digital economy and rural revitalization strategy provides key support for integrating modern manufacturing with ethnic cultural industries to foster innovative business formats. This synergy empowers the digital transformation of traditional crafts, creating a

sustainable industrial model that revitalizes rural economies through high-value innovation. The “14th Five-Year Plan for Cultural and Tourism Development of Yunnan Province” clearly proposes to “explore ethnic medicine and cultural resources and develop health tourism” and “promote the innovative development of digital culture and tourism” [3]. The “Six Major Initiatives for Science and Technology to Support Rural Revitalization in Yunnan (2021–2025)” emphasizes to “cultivate new business formats of ‘digital + rural culture and tourism’” [4]. However, at present, Yunnan’s rural camping culture and tourism generally suffers from problems such as weak digital infrastructure, shallow integration of ethnic culture, and serious homogenization of products. The development of Yao medicine resources is still in the initial stage, and the empowering role of digital technology has not been fully utilized. Taking the San Gongzhu Yao Medicine Camp in Hekou County as a case study, this paper explores the digitally empowered integration of Yao medicine, ethnic crafts, and rural camping culture to enhance the quality and efficiency of Yunnan’s

rural industries. This convergence of traditional healing and fiber arts provides a multidimensional path for industrial upgrading and cultural preservation within the regional tourism framework.

II. LITERATURE REVIEW

A. RESEARCH ON DIGITAL EMPOWERMENT OF RURAL CULTURAL TOURISM

Domestic research: Existing research shows that digital technology promotes the upgrading of rural cultural tourism through resource integration, experience innovation and precision marketing. Zheng Qianqian et al. pointed out that big data and AR/VR technology can solve the problems of “information asymmetry” and “single experience” in rural cultural tourism [5]; Jin Du et al. found empirically that smart management platforms can significantly improve the operational efficiency of rural campsites [6]. However, existing research focuses on the application of single technologies and lacks a systematic discussion on the synergistic empowerment of ethnic culture and the integration of camping cultural tourism by multiple technologies, and there are few empirical studies on ethnic minority areas in the border areas of Yunnan [7].

Foreign research: Research on digital empowerment of rural tourism focuses on technology accessibility and community participation, emphasizing the supporting role of digital tools in the inclusive development of rural tourism. Haryono et al. proposed the theory of “smart rural tourism ecosystem”, believing that digital technology should run through the entire chain of tourism product design, marketing communication and operation management, and should fully consider the technology acceptance capacity of rural communities [8]; Shehade et al. found through a survey of European rural campsites that the application of AR technology in the dissemination of cultural heritage can significantly enhance tourists’ cultural identity, but the application of technology needs to be deeply adapted to the local culture to avoid “technology alienation” [9]. Although foreign research has formed a mature theoretical framework, it does not pay enough attention to the specific integration of multi-ethnic border areas, ethnic medicine and camping tourism, and is difficult to directly guide the practice in ethnic minority areas of Southwest China.

B. RESEARCH ON THE INTEGRATION OF ETHNIC MEDICINE AND CULTURAL TOURISM

Domestic research: The integration of ethnic medicine and tourism has formed models such as “medicine tourism integration” and “health tourism”. In places like Jinxiu, Guangxi and Jianghua, Hunan, the income of the industry has increased through Yao medicine experience projects [10]. Sun Haochuan et al. pointed out that the integration of ethnic medicine and tourism needs to strengthen the cultural core and experience innovation [11]. However, current research has problems such as insufficient integration depth, short industrial chain and lack of standardization [12], and

has not paid enough attention to the application of digital technology in the integration of Yao medicine and tourism in Yunnan.

Foreign studies: Research on the integration of ethnic medicine and tourism focuses on cultural authenticity and sustainability. Myrza et al. took Southeast Asian traditional medicine tourism as the research object and proposed a “cultural embedded” integration model, emphasizing that the living inheritance of traditional medicine knowledge needs to be organically combined with tourism experience scenarios to avoid excessive commercialization eroding the cultural essence [13]. Asase et al. found through tracking research on African herbal medicine tourism projects that digital traceability technology can effectively improve the market trust of traditional medicine products, but a community-led benefit distribution mechanism needs to be established [14]. Foreign studies’ focus on cultural protection and benefit coordination provides a reference for the integration of Yao medicine culture and tourism in Yunnan, but it needs to be adapted to the local context of China’s rural revitalization policy and the governance characteristics of ethnic minority areas.

C. RESEARCH ON INNOVATION IN RURAL CAMPING TOURISM

Domestic research: “Camping+” composite business model has become a trend in rural cultural tourism development [15]. Zhou Yidan et al. emphasized that camping cultural tourism needs to be combined with regional resources to achieve differentiated development [16]. Gao Shangqing et al. took Wenshan, Yunnan as an example and proposed that the integration of cultural tourism in border ethnic minority areas should highlight local characteristics [10]. However, existing research has not paid enough attention to the integration of Yao medicine and camping, and lacks empirical analysis based on the regional characteristics of Yunnan.

Foreign research: Research on rural camping (Glamping) focuses on ecological sustainability and experience upgrade. Zhong Li et al. proposed the development concept of “eco-friendly camping”, believing that the construction of campsites should take into account both ecological carrying capacity and tourist experience, and digital monitoring technology can effectively achieve the balance between the two [17]. Zhang Aiheng et al. found through consumer behavior analysis that young people (18-35 years old) have a strong demand for “culture + technology” camping products, and virtual experience, digital cultural and creative products have become the key to improving product competitiveness [18]. The cutting-edge trends of foreign research are highly consistent with the market characteristics of Yunnan camping cultural tourism (young tourists account for 77.4%), but it is necessary to combine local resources such as Yao medicine culture for innovative transformation.

D. RESEARCH REVIEW

Existing research has confirmed the empowering value of digital technology for rural cultural tourism, the feasibility of integrating ethnic medicine with cultural tourism, and the innovative trend of camping tourism.

However, three major gaps remain: First, domestic and international research lacks a systematic exploration of the integration of “digital technology + ethnic medicine + rural camping,” especially empirical research specifically targeting ethnic minority areas in southwestern border regions. Second, the theoretical frameworks and practical models of foreign research need to be localized and adapted to China’s rural revitalization policies and the characteristics of governance in ethnic minority areas. Third, existing research does not adequately explore the mechanisms of cultural inheritance and benefit coordination in the integration process. Based on this, this study uses the San Gongzhu Yao Medicine Camp in Hekou, Yunnan as an exploratory case study to construct a preliminary analytical framework. While the findings are site-specific, they offer a referential model for filling the gaps in existing research regarding border ethnic minority areas.

E. SIGNIFICANCE OF THE RESEARCH

1) Theoretical significance

constructs an analytical framework for the integration of digital empowerment of Yunnan ethnic medicine and rural camping tourism, integrating cultural capital theory, sustainable tourism theory, and digital governance theory to enrich the research perspective on the integration of digital economy and rural revitalization. By comparing domestic and international models of ethnic cultural tourism integration, it proposes localized practical paths and provides theoretical reference for cultural tourism innovation in border ethnic minority areas.

2) Practical significance

Based on the empirical case of Hekou County, this paper proposes an actionable integration strategy to help solve problems such as the homogenization of rural camping and cultural tourism in Yunnan and the lack of inheritance of Yao medicine, thereby promoting increased income for villagers and upgrading of rural industries. It also provides a practical path for Yunnan to achieve the dual goals of “rural revitalization + inheritance of ethnic medicine” and offers replicable experience for other ethnic minority areas in Southwest China.

F. RESEARCH DESIGN

1) Research Methods

Gongzhu Yao Medicine Camp in Hekou County, Honghe Prefecture, was selected as the representative empirical case. While acknowledging the limitations in provincial generalizability due to the sample size of 186 questionnaires and 35 interviews, this site provides a high-density environment to

observe the specific interaction between Yao medicine and digital tools. The camp is a typical example of the integration of “Yao medicine + camping” in Yunnan. It covers an area of 300 mu and forms a complete industrial chain of “planting-experience-sales”. From January to August 2025, it received 32,000 tourists [19].

In-depth interview method: In July-August 2025, interviews were conducted with 3 camp operators, 12 local villagers (including 8 Yao medicine growers), and 20 tourists to record the effects of digital technology application and the demands of stakeholders.

Questionnaire survey method: 200 questionnaires were distributed to camp visitors, and 186 valid questionnaires were returned (valid return rate of 93%). The survey content included satisfaction with digital experience, demand for Yao medicine projects, etc.

2) Data Source

First-hand data: Camp operation data collected through on-site surveys, interview records, and questionnaire results;

Secondary data: Yunnan Provincial Department of Culture and Tourism’s “2024 Yunnan Rural Tourism Development Report”, the work briefing of the Yaoshan Township People’s Government of Hekou County [19] and relevant research literature at home and abroad[20].

III. BASIC CONDITIONS FOR DIGITAL EMPOWERMENT TO INTEGRATE RURAL CAMPING TOURISM WITH YAO MEDICINE IN YUNNAN

A. RESOURCE BASE

1) Yao medicinal resources are abundant and have regional characteristics

The Yunnan Yao ethnic minority settlement area (Hekou County, Honghe Prefecture, Funing County, Wenshan Prefecture, etc.) has a distinct three-dimensional climate and possesses 86 kinds of Yao medicinal resources, including Coralgranatum, Golden Leaf Privet, and Mahonia. Yaoshan Township in Hekou County has built a 200-mu large-scale Yao medicinal plantation base, producing 15 tons of Yao medicinal raw materials annually, providing core resource support for camping tourism. As the cultural capital of the Yao ethnic group, Yao medicine has been passed down orally for thousands of years through its medicinal knowledge and processing techniques, which conforms to the core characteristics of “concrete cultural capital” in Bourdieu’s theory of cultural capital [21].

2) High-quality rural camping sites

Yunnan is rich in ecological resources such as mountains, forests, and valleys, providing natural sites for rural camping. In 2024, Yunnan had 327 registered rural campsites, of which 42 were in Honghe Prefecture. Hekou County, relying on its ecological advantages along the China-Vietnam border, has outstanding potential for the development of camping tourism. Compared with foreign ecological campsites, Hekou County’s campsites have both ecological advantages

and ethnic cultural characteristics, and have the foundation to create a composite product of “ecology + culture”.

3) Rich in ethnic cultural heritage

Yao ethnic group’s Yao bath, medicinal cuisine preparation, Panwang Festival and other intangible cultural heritage resources provide cultural core for cultural tourism integration. Among them, Yao medicinal bath has been included in the national intangible cultural heritage list [22]. The Yao medicine camp of the San Gongzhu in Hekou County combines Yao medicine culture with folk activities to form a unique attraction. This combination of “culture + scene” resources is highly consistent with the “culture embedded” integration model proposed by Myrza et al.

B. DIGITAL FOUNDATION

1) Digital infrastructure continues to improve

Yunnan Province has promoted the construction of rural gigabit optical networks. By 2025, the rural broadband coverage rate exceeded 98%, and the 5G base station coverage rate in townships reached 100% [23]. The San Gongzhu Yao Medicine Camp in Hekou County has achieved full 5G coverage and is equipped with a smart management platform to ensure the smooth operation of digital services and provide hardware support for the in-depth application of digital technology, which meets the infrastructure requirements of Haryono et al. “Smart Rural Tourism Ecosystem”.

2) Digital application scenarios are constantly expanding

Yunnan’s rural tourism has gradually introduced technologies such as AR tours, online booking, and big data marketing. The Kunming Anning Haiwan Village campsite has enhanced tourist participation through AR interaction [24]. The number of notes on the topic of “Yunnan Rural Camping” on Xiaohongshu has exceeded 200,000, and digital platforms have become the core channel for promotion [25]. The expansion of digital application scenarios has effectively solved the problem of “information asymmetry” in border rural tourism, which is consistent with the view of “digital technology empowering cultural communication” emphasized by Shehade et al.

C. POLICY SUPPORT

At the national level, the No. 1 document of the Central Committee in 2024 clearly stated the implementation of the “Deep Integration Project of Rural Culture and Tourism”; at the provincial level, the “14th Five-Year Plan for Cultural and Tourism Development of Yunnan Province” proposed “developing ethnic medicine and health tourism” providing policy guarantees for the integration of the two. This support system of “national strategy + local policy” is an important feature that distinguishes China’s rural culture and tourism integration from foreign countries, and provides institutional advantages for localization practice.

IV. CASE ANALYSIS: THE SAN GONGZHU YAO MEDICINE CAMP MODEL

A. CAMP OVERVIEW

Located in Yaoshan Township, Hekou County, the San Gongzhu camp operates under a tripartite collaborative framework (‘government-enterprise-villager’). As of August 2025, the camp has driven more than 6,500 villagers in the surrounding area to work and paid more than 1.2 million yuan in labor fees. While regional rural revitalization subsidies and infrastructure improvements contributed to the local economy, the digital integration of the camp was a key driver in increasing the average annual household income by 23,000 yuan compared to the pre-integration baseline of 2023. In terms of the source structure of tourists (Table 1), the tourists of the camp are mainly from Yunnan Province (accounting for 66.7%), and the age is concentrated between 18 and 35 years old (accounting for 77.4%). Moreover, 72.6% of the tourists choose to travel by car. This feature is consistent with the international trend of “young people prefer autonomous and experiential camping” found by Zhang Aiheng et al, which provides a clear direction for the digital marketing and smart service optimization of the camp.

TABLE 1. Demographic characteristics of tourists (n=186)

Feature categories	Specific options	Number of people	Percentage (%)
gender	male	87	46.8
	female	99	53.2
age	18–25 years old	76	40.8
	26–35 years old	68	36.6
	36–45 years old	29	15.6
	46 years and older	13	7.0
Education	College degree and below	32	17.2
	Undergraduate	115	61.8
	Master’s degree or above	39	21.0
Place of origin	Yunnan Province	124	66.7
	Outside Yunnan Province	62	33.3
mode of transportation	Self-driving	135	72.6
	Public transport	31	16.7
	group tour	20	10.7

Data source: Compiled from questionnaires collected during the author’s field research in July–August 2025.

B. PRACTICAL MODELS OF DIGITAL EMPOWERMENT AND INTEGRATION

1) Application Scenarios of Digital Technology

Yao medicine camping experience were released through Douyin and Xiaohongshu, with a total of over 5 million views; a WeChat mini program was developed to realize reservation, navigation and project reservation functions, with over 30,000 registered users and online reservations accounting for 45%. Based on the characteristics of tourists’ travel methods in Table 1, the campsite focused on optimizing the self-driving navigation and parking reservation functions of the mini program to meet the core needs of

self-driving tourists in the province. This approach is in line with the core viewpoint of Haryono et al. (2025) that “digital technology adapts to user behavior”.

Immersive cultural experience: Digital interpretation signs are set up in the planting area. Tourists can scan them to view the medicinal value and processing methods of Yao medicine through AR technology; VR technology restores the scenes of Yao medicine collection and Yao bath making, enhancing cultural perception. In terms of experience satisfaction (Table 2), the overall satisfaction of AR Yao medicine knowledge guide reached 70.0%, but the satisfaction of VR Yao medicine culture experience was only 58.1%, reflecting that the development of deep immersive projects still needs to be strengthened, which is consistent with the conclusion of Shehade et al. that “technology needs to be adapted to the depth of culture”.

Smart operation and management: A smart platform was built to integrate video surveillance, environmental monitoring and passenger flow statistics to achieve safety early warning and service optimization; Through big data analysis of tourist consumption preferences (Table 1 shows that 82.8% of tourists have a bachelor’s

degree or above), the configuration of Yao medicine culture popularization and health care experience projects was optimized, which reflects the core role of digital technology in resource optimization.

TABLE 2. Statistics on tourist satisfaction with the digital experience of Yao medicine camping (n=186)

Digital Experience Project	Very satisfied (%)	satisfy(%)	generally(%)	Dissatisfied (%)	Very dissatisfied (%)	Overall satisfaction (%) ¹
Convenience of online booking	32.8	45.7	18.3	2.7	0.5	78.5
AR Yao Medicine Knowledge Guide	28.5	41.4	23.1	5.9	1.1	70.0
VR Yao Medicine Culture Experience	21.5	36.6	29.0	10.8	2.1	58.1
Smart Camp Navigation Service	29.6	43.0	21.0	5.4	1.0	72.6
Purchase of digital cultural and creative products	18.3	32.3	35.5	12.4	1.5	50.6
Health Data Customization Service ²	12.4	25.8	38.7	19.4	3.7	38.2

Note: ¹ Overall satisfaction rate = (Number of very satisfied people × 5 + Number of satisfied people × 4 + Number of neutral people × 3 + Number of dissatisfied people × 2 + Number of very dissatisfied people × 1) / (Total number of people × 5) × 100%; ² The customized health data service is a project to be improved at the camp, and currently only basic consultation is provided. Data source: Compiled from the author’s on-site survey questionnaires in July-August 2025. This study was approved by the Ethics Committee of Yunnan University of Chinese Medicine, and was performed in accordance with the principles of the Declaration of Helsinki. All eligible participants signed an informed consent form.

2) Core Business Model Integrating Yao Medicine

Health and wellness experience: Create Yao bath homestays and provide personalized Yao bath recipes; open medicinal cuisine workshops and launch specialty dishes such as five-finger peach pigeon soup. Tourists can check the efficacy and source of ingredients online [25]. From the perspective of demand orientation (Table 3), 76.3% of tourists hope to obtain personalized Yao bath recipe customization services, and 68.8% of tourists are willing to participate in Yao

medicine cooking experience, which confirms the market potential of health and wellness industry and is in line with the development logic of “cultural embedded” experience by Myrza et al.

Sightseeing participation: A 200-mu Yao medicine planting sightseeing garden was opened, and picking experience activities were held. Tourists can participate in the process of picking and drying medicines and

learn about Yao medicines through online courses. In combination with the high proportion of young tourists (Table 1), the camp developed a Yao medicine planting check-in and sharing function to further enhance tourist participation, which is consistent with the “young group prefers interactive experience” emphasized by Zhang Aiheng et al.

Cultural and creative sales: Develop cultural and creative products such as Yao medicine sachets and foot bath packs, and sell them online and offline simultaneously. In 2025, the sales of cultural and creative products accounted for 18% of the total income of the camp. However, according to the demand data in Table 3, 70.4% of tourists hope to buy Yao medicine deep-processed health products (such as essential oils and masks), and 58.1% of tourists pay attention to traceable Yao medicine cultural and creative gift boxes. There is a certain gap between the existing cultural and creative products and the needs of tourists. It is necessary to learn from the “digital traceability + deep processing” model proposed by Asase et al. for optimization.

TABLE 3. Tourist Demand Preferences for Yao Medicine Integration Projects (n=186)

Demand type	Specific projects	Number of people needed (persons)	Demand percentage (%)
Wellness and Health Experience	Personalized Yao Bath Formula Customization	142	76.3
	Yao medicine cuisine cooking experience	128	68.8
	Online courses on Yao medicine health preservation	95	51.1
Cultural Experience	VR Yao ethnic group’s medicinal herb gathering scene restoration	116	62.4
	Yao Medicine Intangible Cultural Heritage Digital Interactive Workshop	103	55.4
	Visit the Yao Medicine Culture Digital Museum	89	47.8
Product Purchase	Deep-processed Yao medicine health products (essential oils, facial masks)	131	70.4
	Traceable Yao Medicine Cultural and Creative Gift Box	108	58.1
	Yao medicinal herb cultivation and adoption (online monitoring)	76	40.8

Data source: Compiled from questionnaires collected during the author’s field research in July-August 2025.

C. INTEGRATION RESULTS

1) Economic benefits

January to August 2025, the total income reached more than RMB15 million; it boosted the purchase price of Yao medicine by 30%, and the average income of planting households increased by RMB23,000; it promoted entrepreneurship among 15 villagers and formed a pattern of income increase of “camp + farmers”. From the

perspective of the scale of tourists in Table 1, the high proportion of tourists from within the province (66.7%) brought stable income to the camp and laid the foundation for subsequent expansion into markets outside the province

(33.3%), realizing the transformation of cultural capital into economic capital.

2) Social benefits

It has driven more than 6,500 people to work, and more than 80 villagers have mastered the skills of planting Yao medicine and providing Yao bath services; the vegetation coverage around the campsite has increased by 12%, and the awareness of ecological protection has been significantly enhanced, which is in line with Zhong Li et al. 's development concept of "eco-friendly camping".

3) Cultural benefits

Digital dissemination has allowed Yao medicine culture to reach more than 5 million people, avoiding the limitations of oral transmission; intangible cultural heritage workshops have become a living carrier of Yao medicine culture. Based on the educational characteristics of tourists in Table 1 (21.0% of whom have a master's degree or above), the camp has developed in-depth popular science content on Yao medicine culture, which has enhanced the professionalism and influence of cultural dissemination and realized the transformation of concrete cultural capital into institutionalized cultural capital.

D. OUTSTANDING PROBLEMS

1) Insufficient depth of application of digital technology

According to the survey data, the experiential applications are limited to AR tours and online bookings, lacking in-depth projects such as virtual diagnosis and treatment and digital intangible cultural heritage interaction. The satisfaction rate of VR Yao medicine culture experience is only 58.1% (Table 2), which is lower than the average level of the overall digital experience. This is in line with the requirement of "deep integration of technology with culture" emphasized by Shehade et al.. Big data has not been combined with Yao medicine planting and product development. The overall satisfaction rate of health data customization service is only 38.2%, which is far lower than the 78.5% of online booking convenience, reflecting the shortcomings of digital supply of personalized health care services. The network signal is unstable in some areas, and the digital operation ability of elderly tourists (46 years and above accounts for 7.0%, Table 1) is insufficient, resulting in low digital service coverage [26], which does not fully reflect the core idea of "digital inclusiveness" of Haryono et al.

2) The Yao medicine integration industry chain is incomplete Upstream: Planting is mainly done by individual farmers, with low standardization. Digital traceability only covers the core area, and the quality of raw materials is difficult to guarantee [27]. Midstream: Processing is still in the primary stage, with a lack of deep-processed products and insufficient investment in digital R&D, which does not

match the high demand of tourists for Yao medicine deep-processed health products (70.4%, Table 3). Downstream: Products are seriously homogenized, and digital cultural and creative products are of a single type. Only 18.3% of tourists expressed great satisfaction with the existing digital cultural and creative products (Table 2), which is not attractive enough and has not formed the "full-chain value enhancement" model proposed by Asase et al. .

3) Lack of standardization and branding

There is no unified standard for Yao bath recipes and medicinal cuisine preparation, and the service quality is uneven, which affects the consistency of tourists' experience; no regional public brand has been formed, and the popularity is limited to the province (Table 1 shows that tourists from within the province account for 66.7%), lacking national influence [28]; the digital marketing content is homogenized and has not formed a differentiated image, which is inconsistent with the view of Myrza et al. (2025) that "cultural authenticity shapes the core competitiveness of the brand" .

4) The collaborative mechanism among multiple stakeholders is inadequate

There is insufficient collaboration among the government, enterprises, villagers and scientific research institutions. Scientific research forces such as Yunnan University of Traditional Chinese Medicine have not fully participated in the formulation of standards. Villagers participate more in basic services, but less in high-end aspects such as digital operation and product innovation. The proportion of value-added revenue sharing is low [29], making it difficult to meet tourists' demand for in-depth experience projects (Table 3 shows that 55.4% of tourists hope to participate in the Yao medicine intangible cultural heritage digital interactive workshop). The "community-led interest coordination mechanism" advocated by Asase et al. has not been established.

V. OPTIMIZATION STRATEGIES FOR DIGITAL EMPOWERMENT IN INTEGRATING RURAL CAMPING TOURISM WITH YAO MEDICINE IN YUNNAN

A. BUILDING A PHASED DIGITAL INFRASTRUCTURE AND EXPERIENCE SYSTEM

1) Deepen the immersive digital experience

In collaboration with Yunnan University of Traditional Chinese Medicine and Yuanyun Technology, we developed a digital experience hall for Yao medicine culture, featuring VR herb-gathering experiences and virtual Yao bath interactive projects to specifically improve VR experience satisfaction (currently 58.1%, Table 2); First, priority must be given to stabilizing the 5G network and enhancing digital literacy among elderly stakeholders to ensure a functional hardware layer. Only upon establishing this foundation will the camp implement an intelligent health monitoring system using AI technology, which combines tourists' health data

to customize health and wellness suggestions, filling the gap in customized health data services (currently 38.2% satisfaction, Table 2), and achieving a deep integration of technology and culture.

2) Strengthen the role of big data in empowering the industrial chain

A digital management platform for Yao medicine planting was built, and environmental data was monitored through sensors to guide standardized planting. A tourist health database was established, and a sub-health health care package was developed for the 18-35-year-old group (accounting for 77.4%, Table 1), which met the core needs of tourists and conformed to the product development logic of Zhang Aiheng et al. (2025) of “precisely matching user needs”.

3) Improve digital infrastructure and services

Promote full coverage of 5G network and optimize signal in remote areas; set up manual assistance windows to provide age- friendly digital services to meet the needs of elderly tourists (accounting for 7.0%, Table 1); carry out digital skills training to improve villagers’ operational capabilities [30] and practice the “digital inclusion” concept of Haryono et al.

B. BUILDING A COMPLETE INDUSTRIAL CHAIN OF “DIGITAL + YAO MEDICINE + CAMPING”

1) Upstream: Standardized planting and digital traceability
Promote the “enterprise + cooperative + farmer” model and formulate digital standards for Yao medicine planting; establish a full-process traceability system so that tourists can scan the code to view the planting location and test report, meet tourists’ concerns about product safety, and learn from the experience of Asase et al. in “digital traceability improves trust” .

2) Midstream: Digital R&D and Deep Processing

In conjunction with Yunnan University of Traditional Chinese Medicine, a Yao medicine digital R&D center was established to develop deep-processed products such as essential oils and health products to meet tourists’ high demand for Yao medicine deep-processed health products (70.4%, Table 3); a digital processing plant was built to achieve standardization of processing and production and enhance the added value of products.

3) Downstream: Diversified Products and Digital Marketing

Develop products such as “Yao medicine study tour + camping” and “health care + starry sky camping”, and design “campsite + surrounding attractions” linkage routes for self-driving tourists in the province (accounting for 66.7%, Table 1); create digital cultural and creative IPs with Yao medicine theme, develop digital collections, virtual peripheral products and other products, and improve the satisfaction of digital cultural and creative products

(currently only 18.3% are very satisfied, Table 2); build a multi-platform differentiated marketing matrix, Douyin and Xiaohongshu focus on the scenario-based experience dissemination of young people (18-35 years old account for 77.4%), WeChat public accounts focus on popularizing Yao medicine culture, and Ctrip and Meituan focus on product booking and reputation management, and shape a brand image of cultural authenticity.

C. ESTABLISH A STANDARDIZATION AND BRANDING SYSTEM

1) Formulate flexible quality guidelines for integrated development

In conjunction with the Yunnan Provincial Yao Medicine Association and Yunnan Agricultural University, service standards were formulated to protect the cultural authenticity of intangible heritage, these guidelines will focus on safety and hygiene specifications for Yao bath and medicinal diet preparation rather than rigid chemical formulas. This allows for the living inheritance of intuitive healing practices while ensuring a consistent quality of service for tourists, thereby improving the consistency of service quality; reference was made to the standardized experience of traditional medicine tourism abroad, and localization was carried out in combination with the characteristics of Yao medicine culture.

2) Develop a regional public brand

Integrate resources to create the “Yunnan Yao Medicine Camping” public brand and apply for geographical indication product protection; hold the “Yunnan Yao Medicine Camping Culture Festival” to enhance popularity through digital live streaming and expand the market outside the province (currently accounting for 33.3%, Table 1), forming a differentiated brand competitiveness.

D. IMPROVE THE COLLABORATIVE MECHANISM AMONG MULTIPLE STAKEHOLDERS

1) Build a collaborative governance platform

Led by the government, enterprises, villagers, Yunnan University of Traditional Chinese Medicine and digital enterprises are linked to clarify the responsibilities of each party: the government is responsible for policy supervision, enterprises are responsible for operation and investment, villagers are responsible for resource provision, and scientific research institutions are responsible for technology research and development [31]. Together, they develop projects such as the Yao Medicine Intangible Cultural Heritage Digital Interactive Workshop to meet the needs of 55.4% of tourists (Table 3) and establish a collaborative mechanism of “win-win for all parties”.

2) Enhance villager participation

Carry out digital skills and entrepreneurship training, encourage villagers to participate in digital marketing and

cultural and creative design; To transform the current model from basic labor participation to a genuine ‘winwin’ synergy, the camp must establish a shareholding and dividend mechanism to allow villagers to share the brand value-added benefits. By providing advanced digital training, villagers can move beyond ‘basic services’ into high-end roles such as digital operators or intangible heritage workshop leads, ensuring a more equitable distribution of value-added revenue[32].

3) Strengthen industry-academia-research cooperation

We will jointly build a digital research and development center for Yao medicine and a talent training base with Yunnan University of Traditional Chinese Medicine; strive for the support of the “Special Project for Scientific and Technological Innovation of Traditional Chinese Medicine” of Yunnan Provincial Department of Science and Technology to improve the scientific and technological content, provide technical support for personalized health care services, and achieve deep integration of theory and practice.

VI. CONCLUSION AND OUTLOOK

A. RESEARCH CONCLUSIONS

Using the San Gongzhu Yao Medicine Campsite in Hekou County as a case study, this paper analyzes the conditions and effectiveness of digital empowerment in integrating rural camping tourism, Yao medicine, and ethnic techniques in Yunnan. This research focuses on the synergistic model of combining medicinal health practices with traditional fiber arts to drive the digital transformation and comprehensive development of rural industries. The research shows that digital technology has initiated a ‘three-element synergy’ model. However, while dissemination and operation empowerment have yielded significant economic benefits, experience empowerment remains in a nascent and suboptimal stage. Data indicates that low satisfaction with VR and customized health services (Table 2) creates a ‘digital gap’ that currently hinders the model’s full effectiveness in cultural immersion. However, problems remain, including superficial digital application, an incomplete industrial chain, a lack of standardization, and an unsound collaborative mechanism. Based on the theories of cultural capital and sustainable tourism, optimization strategies are proposed from four dimensions: digital experience, industrial chain, standardization, and collaborative mechanism, providing practical reference for the high-quality development of rural tourism in Yunnan.

B. RESEARCH PROSPECTS

As this study is constrained by the geographical and demographic scope of a single-site survey (n=186), the findings should be interpreted as localized empirical evidence. Future research must expand the scope to a multi-site comparative framework involving different regions such as Wenshan and Pu’er to validate the provincial scalability of the proposed digital empowerment model.

AUTHOR CONTRIBUTIONS

Conceptualization – Yuxue Zhao, Ang Li and Shicheng Qiu; methodology – Yuxue Zhao, Ang Li and Shicheng Qiu; investigation – Yuxue Zhao, Ang Li and Shicheng Qiu writing-original draft preparation – Yuxue Zhao, Ang Li and Shicheng Qiu. All authors have read and agreed to the published version of the manuscript.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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HUMAN RESEARCH SUBJECTS

This study was approved by the Ethics Committee of Yunnan University of Chinese Medicine, and was performed in accordance with the principles of the Declaration of Helsinki. All eligible participants signed an informed consent form.

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