

Advanced vocational colleges as institutional actors in rural revitalization through medicinal plant cultivation in Jiangsu Province China

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Research Article

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Abstract

Background

The implementation of China's Rural Revitalization Strategy has intensified the demand for sustainable development of the traditional Chinese medicine (TCM) industry, particularly in relation to the standardized cultivation of medicinal plants. As key actors in applied talent training and technology transfer, advanced vocational colleges are increasingly expected to contribute to rural industrial upgrading.

Purpose

This study investigates the current development status of medicinal plant cultivation in Jiangsu Province and examines how vocational colleges can support rural revitalization through targeted industrial and educational interventions.

Methods

A mixed-methods design was adopted, combining document analysis with a field-based questionnaire survey. Data were collected from medicinal plant growers, planting enterprises, and local administrative personnel in Huai'an City using convenience sampling. Descriptive statistical methods were employed to examine planting scale, production practices, income distribution, risk exposure, and institutional support demands. The study is exploratory and descriptive in nature and does not aim to establish causal relationships.

Results

The results show that Jiangsu Province has formed an initial regional pattern of medicinal plant cultivation centered on representative varieties such as mint (*Mentha haplocalyx*), *Atractylodes macrocephala* (*Chinese Atractylodes rhizome*), and *Pseudostellaria heterophylla* (*heterophylly falsestarwort root*). While planting scale and total output value have expanded steadily, structural challenges persist, including fragmented production units, insufficient improved seed systems, limited on-site primary processing capacity, and weak market branding. Most growers rely heavily on experiential knowledge and are highly vulnerable to price volatility.

Conclusions

Advanced vocational colleges may play a strategic role in addressing these constraints by integrating education, technology services, and industry collaboration. Strengthening industry clusters, enhancing

technical extension capacity, and improving market-oriented cooperation mechanisms are important pathways for promoting the high-quality development of medicinal plant cultivation and advancing rural revitalization.

1. Introduction

The medicinal plant industry constitutes a fundamental component of the traditional Chinese medicine (TCM) sector, and its development status directly affects the quality, safety, and sustainability of TCM resources (Liu et al., 2020). In recent years, China has elevated rural revitalization to a national strategy, emphasizing industrial prosperity, ecological sustainability, and farmers' income growth (Zhang & Fan, 2020). Against this backdrop, the cultivation of medicinal plants has been increasingly recognized as a strategic emerging industry with both economic and cultural value, particularly in regions with established TCM traditions (Huang & Rozelle, 2018).

Jiangsu Province is rich in medicinal plant resources and has gradually established a modern TCM industrial system characterized by region-specific varieties known as “Su-yao” (authentic medicinal materials from Jiangsu). Despite notable progress, the medicinal plant cultivation sector in Jiangsu continues to face structural challenges, including fragmented production, limited technological input, and weak integration across the industrial chain, which are common issues in rural industrial development globally (Li et al., 2019; OECD, 2020).

Advanced vocational colleges, as key providers of technical and skilled human capital, possess advantages in applied research, technology transfer, and industry–education integration (Tang & Gavin, 2016; McGrath et al., 2020). Their active involvement in medicinal plant cultivation offers new pathways for promoting rural revitalization and sustainable rural transformation (Pretty et al., 2011). Existing studies have emphasized that rural transformation processes are closely linked to institutional restructuring, governance capacity, and the allocation of critical resources, particularly in the context of regional development and structural change (Long et al., 2016; Shucksmith, 2018; Zhou et al., 2021). This study explores how vocational colleges can effectively serve rural revitalization by participating in medicinal plant cultivation and proposes evidence-based optimization strategies.

The diagram illustrates three core mechanisms—technology transfer, education & training, and industry integration—that connect vocational colleges with sustainable rural development outcomes. The framework emphasizes the mediating role of vocational institutions in bridging policy objectives, industrial needs, and local farming practices.

2. Methods

2.1 Study Design and Participants

This study employed a cross-sectional survey design. Data were collected via an online questionnaire platform (“Wenjuanxing”) targeting medicinal plant growers, planting enterprises, and relevant

management personnel in Huai'an City, Jiangsu Province. Convenience sampling was adopted, and participation was voluntary. Ethical approval and informed consent procedures are reported in the Declarations section below.

2.2 Data Collection

Prior to questionnaire distribution, the research team conducted field visits to key villages, planting bases, and agricultural administration departments to ensure contextual relevance. The questionnaire link was distributed through social media platforms, including WeChat and QQ. Data collection lasted 30 days. After screening for completeness and validity, 45 valid questionnaires were retained for analysis. Given the exploratory nature of this study and the field-based constraints, the sample size was considered appropriate for descriptive analysis. Due to the limited sample size and field-based constraints, the online questionnaire was used primarily to obtain structured descriptive information rather than to support statistical generalization.

2.3 Survey Instrument

The questionnaire covered four dimensions: (1) respondents' demographic characteristics; (2) planting scale, income, and years of cultivation; (3) planting varieties, technical sources, and sales channels; and (4) perceived risks, support needs, and expectations regarding vocational college involvement.

2.4 Data Analysis

Descriptive statistical analysis was conducted using frequency and percentage distributions to summarize respondents' characteristics and key survey variables. Field-based surveys of medicinal plant growers are constrained by seasonal labor mobility and fragmented production units, which limits access to large-scale random sampling. No inferential statistical tests were conducted, as the study focuses on mapping structural characteristics and stakeholder perceptions rather than testing hypotheses. Ethical approval was obtained prior to data collection.

3. Results

3.1 Demographic Characteristics of Respondents

Among the 45 respondents, 73.33% were male and 26.67% were female. The majority were aged between 51 and 60 years (55.56%). Educational attainment was predominantly at senior high school level or below (71.11%), indicating relatively limited formal agricultural training among growers.

Table 1
Demographic characteristics of respondents (n = 45).

Variable Category		Frequency	Percentage (%)
Gender	Male	33	73.33
	Female	12	26.67
Age	≤ 40	6	13.33
	41–50	8	17.78
	51–60	25	55.56
	≥ 61	6	13.33
Education	Junior high or below	18	40.00
	Senior high	14	31.11
	College or above	13	28.89

3.2 Planting Scale and Economic Outcomes

Most respondents cultivated medicinal plants on a small scale, with 55.56% managing less than 10 mu of land. Annual income per mu was mainly concentrated between 1,001 and 3,000 CNY (31.11%). The most common cultivation experience ranged from 2 to 5 years (42.22%).

Table 2
Planting scale and economic outcomes of respondents

Indicator	Category	Frequency	Percentage (%)
Planting area	< 10 mu	25	55.56
	10–30 mu	13	28.89
	> 30 mu	7	15.55
Income per mu (CNY)	≤ 1,000	11	24.44
	1,001–3,000	14	31.11
	> 3,000	20	44.45
Years of cultivation	< 2 years	10	22.22
	2–5 years	19	42.22
	> 5 years	16	35.56
Note: 1 mu ≈ 0.067 ha.			

3.3 Planting Modes and Technical Sources

Intercropping and monocropping were the dominant planting modes. Technical knowledge was primarily acquired through family inheritance (37.78%), while policy support and institutional cooperation accounted for a relatively small proportion, reflecting insufficient external technical guidance.

Table 3
Sources of cultivation technology

Source	Frequency	Percentage (%)
Family inheritance / experience	17	37.78
Enterprise guidance	10	22.22
Government extension services	9	20.00
Vocational colleges / research institutions	9	20.00

3.4 Risks and Support Needs

Price fluctuation was identified as the most significant risk (35.56%), followed by high investment costs and sales difficulties. Respondents expressed strong demand for technical guidance (60%) and grassroots talent training (20%) provided by vocational colleges.

Table 4
Perceived risks and support needs

Item	Frequency	Percentage (%)
Price volatility	16	35.56
High production costs	11	24.44
Sales difficulties	10	22.22
Natural / climatic risks	8	17.78
Demand for technical guidance	27	60.00
Demand for talent training	9	20.00

4. Discussion

The findings of this study indicate that medicinal plant cultivation in Jiangsu Province has entered a stage of steady expansion; however, its overall development remains constrained by structural and institutional limitations. Small-scale and fragmented production continues to dominate, which is associated with limited adoption of standardized cultivation techniques and weaker capacity to respond to market fluctuations. Similar challenges have been reported in previous studies on regional medicinal plant industries in China, suggesting that these issues are not unique to Jiangsu but reflect broader structural characteristics of rural industrial development in China. Moreover, these constraints are closely related to uneven spatial organization and limited factor mobility in rural areas. Fragmented land-

use patterns and weak regional coordination are widely recognized as persistent challenges that coincide with difficulties in industrial upgrading, even in economically developed provinces.

Studies have shown that fragmented land use patterns and weak regional coordination can significantly constrain the upgrading of rural industries, even in economically developed provinces (Li et al., 2021). In this sense, the challenges observed in Jiangsu's medicinal plant cultivation reflect broader issues in China's rural transformation process rather than isolated local problems.

Note

Conceptual synthesis of key production, technical, market, and institutional constraints identified through field observations and descriptive analysis.

Figure 3 provides a conceptual synthesis of recurring structural constraints discussed above in Jiangsu Province. Each category encompasses specific operational challenges identified through field observations and respondent interviews. These constraints highlight the structural nature of challenges faced by the medicinal plant cultivation industry and underscore the relevance of institutional arrangements in understanding rural development contexts. In this regard, this study suggests that closer institutional integration of vocational colleges into rural governance frameworks may contribute to sustainability-oriented rural development efforts. Recent research has further highlighted the relevance of regional systems and education-industry collaboration in supporting rural revitalization and governance innovation, particularly within the Chinese context (Liu et al., 2022; Xie & Li, 2022).

One notable finding is the heavy reliance of growers on experiential knowledge rather than formal technical guidance. Although such experience-based practices provide short-term stability, they limit productivity improvement and quality control in the long run. This highlights a critical gap between agricultural production and technical support systems, underscoring the necessity of institutional intervention.

Advanced vocational colleges are well positioned to engage with this gap by providing applied training, technical support, and coordination mechanisms aligned with local development needs. Through curriculum alignment, applied research, and industry-education integration, vocational colleges have the potential to translate scientific knowledge into cultivation practices adapted to local conditions. The establishment of demonstration bases and long-term technical service mechanisms can enhance growers' capacity to manage risks and improve product quality. Moreover, vocational colleges can facilitate interaction among government agencies, enterprises, and farmers, which may support more coordinated approaches across the medicinal plant industrial chain.

From a policy perspective, the results suggest that rural revitalization initiatives should move beyond production expansion and place greater emphasis on organizational innovation and capacity building. In particular, vocational colleges may be institutionally embedded into local rural governance and industrial development frameworks, rather than participating only through short-term projects. Such embedded

engagement may enhance knowledge diffusion, improve institutional coordination, and strengthen long-term development capacity at the grassroots level. While this study focuses on Jiangsu Province, the institutional model of vocational college engagement offers insights for other regions seeking to link vocational education with sustainability-oriented agricultural upgrading.

5. Conclusion

This study empirically illustrates how vocational colleges function as intermediary institutions in rural revitalization, highlighting their role in bridging policy objectives, industrial needs, and local production practices within a sustainability-oriented framework. From a descriptive and exploratory perspective, the findings suggest that interactions between vocational education institutions and rural industries are shaped by local resource conditions, institutional arrangements, and market structures. In the case of medicinal plant cultivation in Huai'an City, region-specific industrial clustering, strengthened technical extension services, improved policy coordination, and integrated market linkages appear particularly relevant. Advanced vocational colleges may contribute to these processes by aligning applied training, technical support, and industry engagement with local development contexts, thereby supporting sustainability-oriented rural development while remaining sensitive to regional diversity and governance capacity.

Declarations

Ethical approval

This study was approved by the Ethics Committee of Jiangsu College of Nursing (approval no. JCN-2025-03-015).

The research was conducted in accordance with the Declaration of Helsinki and the relevant ethical guidelines and regulations of the Ethics Committee.

Consent to participate / Informed consent

Informed consent was obtained from all participants involved in the study.

Consent to publish

Not applicable.

Data availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

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Clinical Trial Number

Not applicable.

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Author Contributions

Conceptualization: E.C. conceptualized the study, conducted formal analysis, and wrote the original draft. X.L. contributed to methodology and writing review. Y.Y. conducted investigation and data curation. H.Z. supervised the study. All authors read and approved the final manuscript.

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Figures

**Mechanism Framework of Vocational Colleges' Participation in Rural Revitalization
(Through Medicinal Plant Cultivation)**

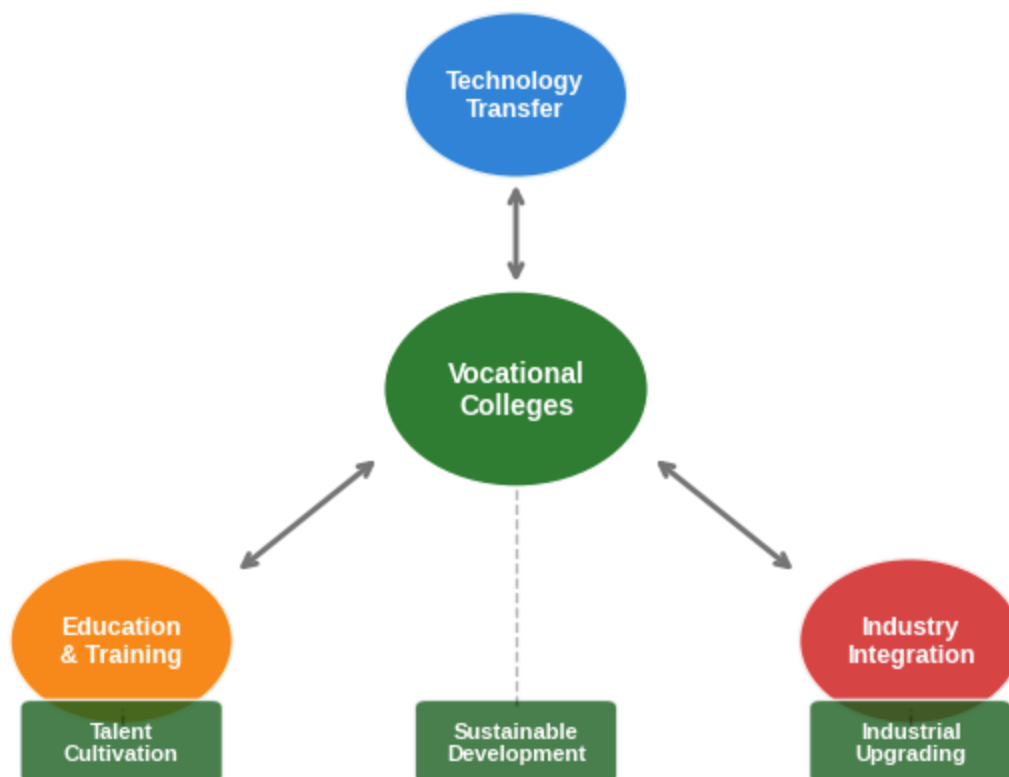
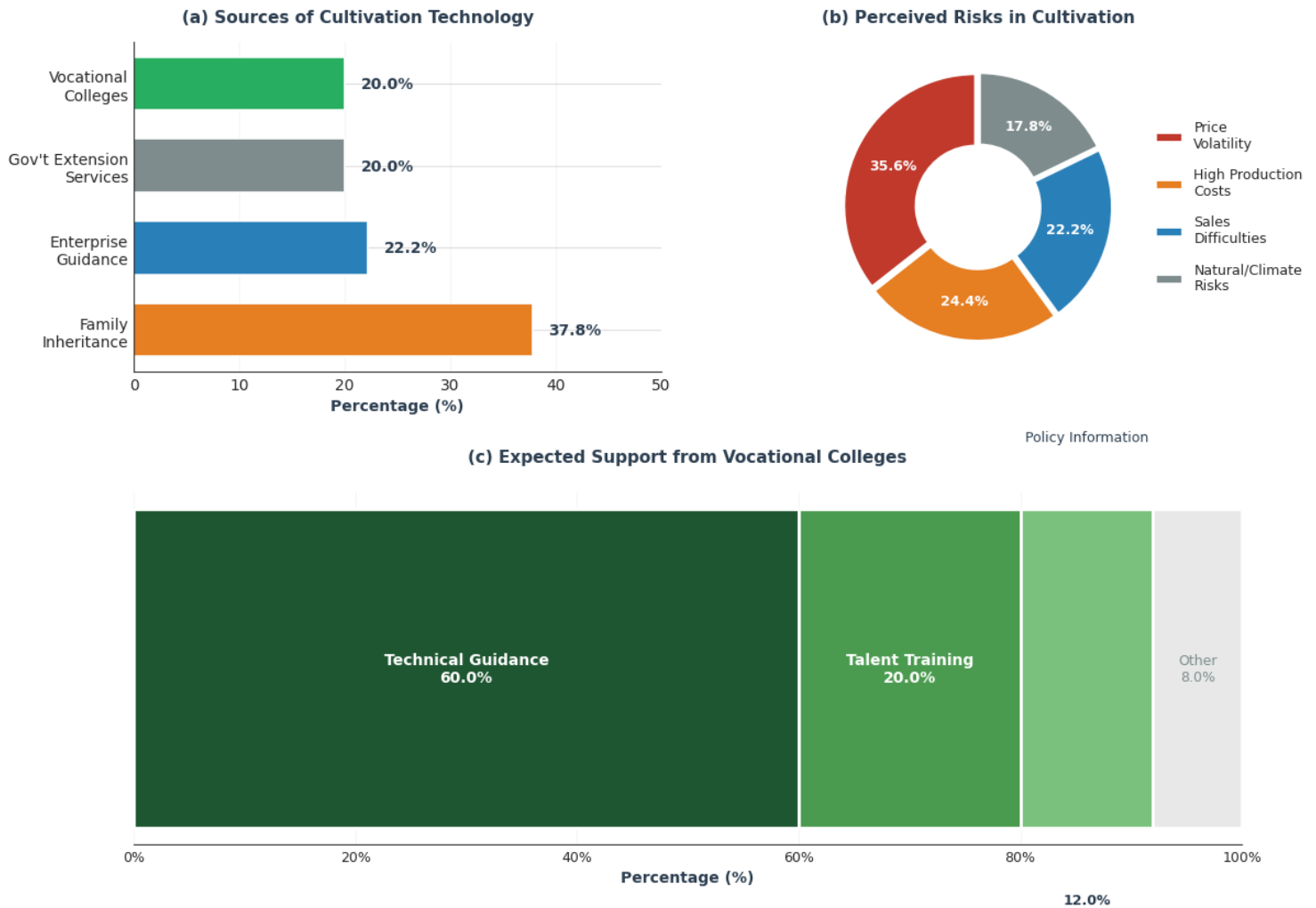


Figure 1

Conceptual framework of vocational colleges' participation in rural revitalization through medicinal plant cultivation.

Note: Conceptual framework derived from field observations and descriptive analysis.

Technical Sources, Risk Analysis, and Policy Expectations in Medicinal Plant Cultivation



Note: All data represent descriptive statistics from farmer surveys (n=45). No statistical inference tests were performed.

Figure 2

Demographic and operational characteristics of medicinal plant growers in Huai'an City, Jiangsu Province (n = 45).

Note: Descriptive summary of field survey data showing (a) sources of cultivation technology, (b) perceived production and market risks, and (c) expected support from vocational colleges.

Value Chain Integration Model for Medicinal Plant Industry (Government-Enterprise-College-Farmer Cooperation)

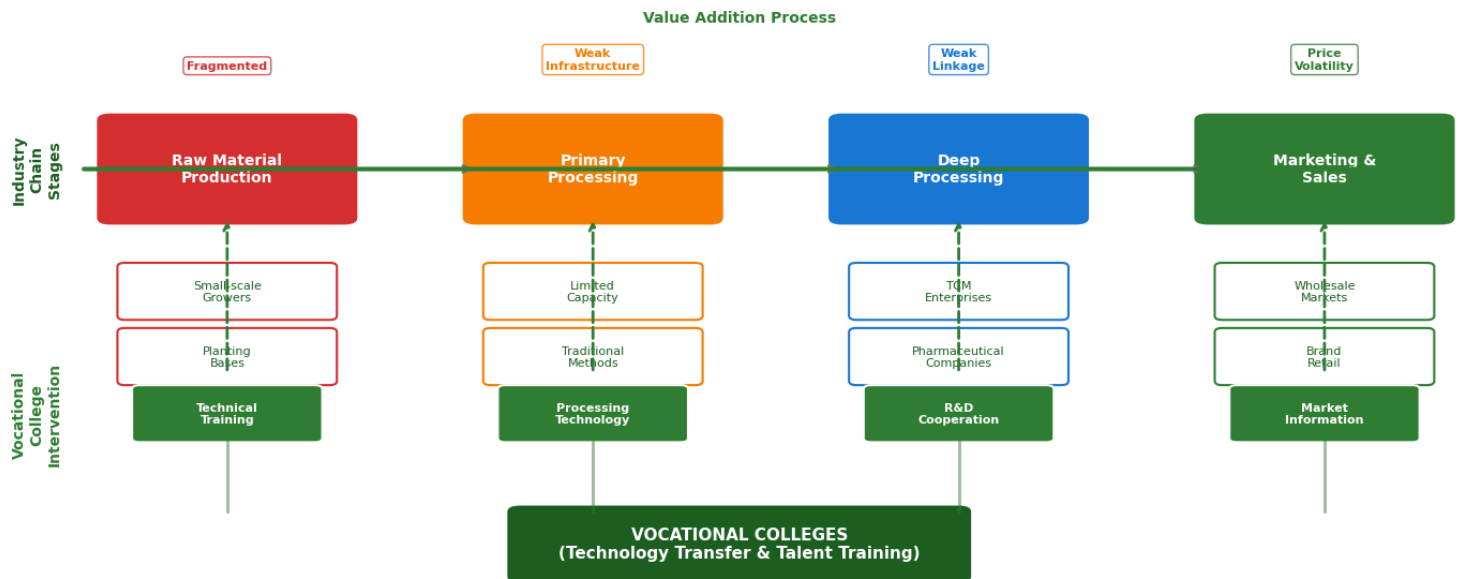


Figure illustrates how vocational colleges intervene across the value chain to upgrade the medicinal plant industry

Figure 3

Structural constraints in the medicinal plant cultivation industry in Jiangsu Province.

Note: Conceptual synthesis of key production, technical, market, and institutional constraints identified through field observations and descriptive analysis.