

DEVELOPMENT MODEL OF MODERN APPRENTICESHIP IN HIGHER VOCATIONAL COLLEGES IN GUANGDONG PROVINCE

Yuhong Zhang^{1*} and Suttipong Boonphadung²

¹Graduate School, Suan Sunandha Rajabhat University Thailand,

²Graduate School, Department of Educational Administration, Suan Sunandha Rajabhat University

*Corresponding author e-mail: s65584951017@ssru.ac.th

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Abstract

This study aims to develop a model for establishing a modern apprenticeship system in higher vocational colleges in Guangdong Province, China. The research objectives are: 1) to identify the exploratory factors of modern apprenticeship in higher vocational colleges in Guangdong Province using factor analysis; and 2) to propose a development model for modern apprenticeship in these colleges. The study employed a sequential explanatory mixed-methods design. For the quantitative phase, we selected a stratified random sample of 500 administrators and teachers from 63 higher vocational colleges across Guangdong Province. The research instrument was a 120-item, five-point Likert-scale questionnaire, validated by five experts (IOC = 0.80–1.00) and demonstrating high reliability (Cronbach's α = 0.98). We analyzed quantitative data using descriptive statistics and exploratory factor analysis (EFA) with principal axis factoring and Varimax rotation. EFA extracted five critical factors that collectively explained 63.957% of the total variance: 1) Policy and Institutional Environment (PIE), 2) Apprentice Professional Identity and Engagement (APIE), 3) Institutional Support and Collaboration (ISC), 4) Enterprise Training Quality and Support (ETQS), and 5) Regional Economic and Industrial Support (REIS). These factors form an ecosystem model in which REIS and PIE constitute the external macro-environment, ISC and ETQS serve as the implementation pillars, and APIE lies at the central core. The study concludes that sustainable development requires coordinated efforts among government, institutions, and enterprises, and offers recommendations for implementation, policy, and future research.

Keywords: Modern Apprenticeship, Development Model, Higher Vocational Education

Introduction

Globally, the full advent of the Industry 4.0 era is reshaping industrial landscapes and talent demands with unprecedented force. Disruptive technologies such as artificial intelligence, 5G communications, and digital twins are not only creating enormous economic value expectations but also accelerating the obsolescence of traditional professions and the emergence of new skills (McKinsey Global Institute, 2023). Against this backdrop, modern apprenticeship, as a strategic bridge between education and work, is increasingly being highlighted for its value. Through its core mechanism of "learning by doing," this apprenticeship system has been shown to shorten the skill-acquisition cycle and significantly enhance learners' adaptability to real work scenarios (OECD, 2023).

In the Chinese context, Guangdong Province, a forefront of reform and opening-up and a major economic powerhouse, exemplifies both the distinctive and modern characteristics of apprenticeship. The province has established a three-level pilot system involving national, provincial, and institutional initiatives, and innovatively promotes industry-education integration through a "three-dimensional synergy" mechanism involving government, industry, and enterprises. However, significant developmental disparities between the Pearl River Delta region and Guangdong's eastern, western, and northern regions have led to regional imbalances in apprenticeship promotion effectiveness, which is the practical focus of this study. Meanwhile, existing research largely focuses on policy interpretation and model description, leaving a clear gap in using empirical methods to systematically identify key factors affecting apprenticeship implementation effectiveness and to construct a development model based on these findings. This study aims to fill this gap.

To address these issues and move beyond the limitations of existing research, this study empirically identified the key factors influencing the implementation of modern apprenticeship and constructed a scientifically grounded, scalable development model. Adopting a mixed-methods approach, we conducted a questionnaire survey with 500 administrators and teachers from 63 higher vocational colleges in Guangdong Province, supplemented by in-depth interviews with nine experts. Exploratory Factor Analysis (EFA) was employed to analyze the data, ultimately extracting five core factors: Policy and Institutional Environment, Apprentice Professional Identity and Engagement, Institutional Support and Collaboration, Enterprise Training Quality and Support, and Regional Economic and Industrial Support. Based on this empirical analysis, we developed a model of modern apprenticeship in Guangdong's higher vocational colleges, clarifying the interactive relationships among the factors. This model provides a theoretical foundation and a practical pathway for systematically advancing modern apprenticeship.

Research Objectives

The objectives of this research are as follows:

1. To study the exploratory factor analysis of modern apprenticeship in higher vocational colleges in Guangdong Province.
2. To propose a development model of modern apprenticeship in higher vocational colleges in Guangdong Province.

Conceptual Framework

This study follows a conceptual framework designed to systematically develop a modern apprenticeship model for higher vocational colleges in Guangdong Province. The framework, illustrated in Figure 1, integrates a theoretical foundation with empirical validation through a structured process.

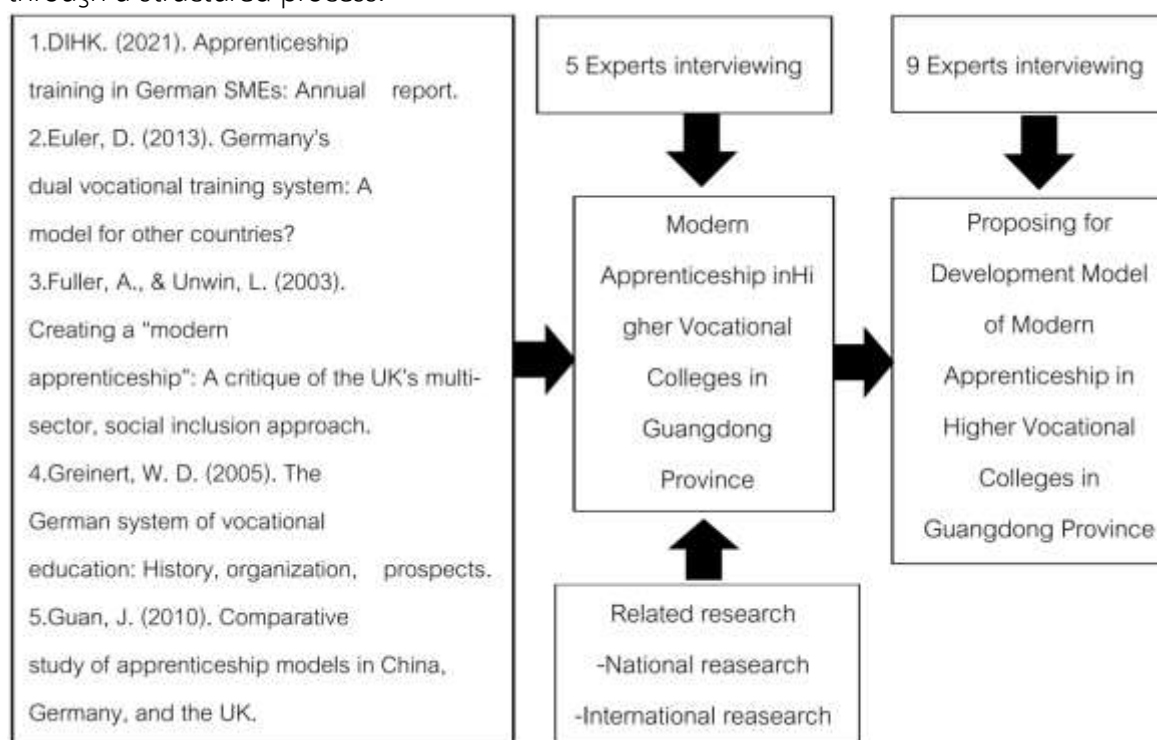


Figure 1. Conceptual Framework of Development Model of Modern Apprenticeship in Higher Vocational Colleges in Guangdong Province

The conceptual framework for this study was developed through a systematic process integrating theoretical foundations and empirical validation. It commenced with a comprehensive literature synthesis encompassing international models (e.g., Euler, 2013; Greinert, 2005) and national research, establishing the theoretical basis. In the first empirical stage, the researchers conducted preliminary interviews with 5 experts. These interviews helped refine the core research issues and contextual variables, directly informing the development of the 120-item questionnaire for the quantitative phase. In the second

empirical stage, after the EFA of the quantitative data, researchers conducted in-depth interviews with 9 experts to validate, refine, and enrich the five extracted factors. The Research Methodology section details the interview methodology, including the semi-structured interview protocol. Synthesizing these theoretical and empirical elements informed the core analysis of modern apprenticeship in Guangdong's higher vocational colleges and culminated in the proposed development model.

Research Methodology

1. Research Design

This study adopted a sequential explanatory mixed-methods design, prioritizing quantitative data collection and analysis, followed by qualitative data collection to provide depth and context. The primary quantitative phase involved a cross-sectional survey to assess the current level and identify the underlying factor structure of the modern apprenticeship system. The subsequent qualitative phase utilized in-depth interviews to explore the implementation status, challenges, and contextual factors in greater detail. This design ensured a comprehensive understanding of the research problem by integrating numerical trends with rich, experiential insights.

2. Research Steps

The research was executed systematically through the following steps, aligned with the conceptual framework:

Step 1: Instrument Development and Variable Synthesis. The research team developed research instruments, including a questionnaire and an interview form, based on an extensive literature review, policy analysis, and preliminary fieldwork (including initial interviews with 5 experts). A panel of five experts conducted a rigorous content validity check using the Index of Item-Objective Congruence (IOC). Items with an IOC value below 0.5 were revised or discarded, resulting in a final questionnaire of 120 items with IOC values between 0.80 and 1.00. Cronbach's alpha for the 120-item questionnaire was 0.98, indicating excellent internal consistency.

Step 2: Quantitative Data Collection and EFA. The validated questionnaire was distributed to a sample of 500 administrators and teachers from 63 higher vocational colleges in Guangdong Province. The collected quantitative data were analyzed using descriptive and inferential statistics, including Exploratory Factor Analysis (EFA) to extract the core factors of the modern apprenticeship model.

Step 3: Qualitative Interviews and Model Proposition. Based on the EFA results, the study conducted in-depth interviews with 9 key expert informants. The study analyzed qualitative interview data using content analysis to identify key themes and patterns. The study integrated findings from both quantitative and qualitative analyses to propose the final development model.

3. Data Analysis

1. Survey data were collected from 500 administrators and teachers across 63 higher vocational colleges in Guangdong Province. The sample was selected using stratified random sampling to ensure representation across college types (public, private) and regional distribution within Guangdong Province. All respondents were directly involved in modern apprenticeship programs. Descriptive statistics summarized demographic variables to ensure sample representativeness across gender, age, highest education, work experience, and position. For the qualitative phase, nine key informants were purposively selected for their expertise in modern apprenticeship, including college administrators, senior teachers, industry association leaders, and enterprise training managers, to ensure diverse perspectives.

2. The research instrument was structured around core dimensions of modern apprenticeship implementation, with all items measured on a five-point Likert scale. Reliability was verified using Cronbach's alpha ($\alpha = 0.98$), and construct validity was assessed through the KMO measure (0.98) and Bartlett's test of sphericity ($\chi^2 = 45743.647$, $df = 7140$, $p < .001$).

3. Exploratory Factor Analysis (EFA) was conducted using principal axis factoring with Varimax rotation, eliminating items with factor loadings below 0.50. The analysis yielded a clear factor structure explaining over 60% of the total variance.

Additionally, key informant interviews with nine selected experts were conducted and thematically analyzed to validate the survey results and address Objective 2: proposing a development model for modern apprenticeship in Guangdong's higher vocational colleges.

Research Results

1. Results of Descriptive Analysis of Quantitative Data

Overall, respondents perceived the level of modern apprenticeship implementation as moderate to high ($M = 3.24$, $SD = 0.67$ on a 5-point scale). The mean scores for the five factors were: PIE ($M = 3.15$, $SD = 0.71$), APIE ($M = 3.31$, $SD = 0.69$), ISC ($M = 3.18$, $SD = 0.72$), ETQS ($M = 3.08$, $SD = 0.74$), and REIS ($M = 3.48$, $SD = 0.65$). This indicates that regional support was perceived most favorably, while enterprise training quality was a relative concern.

2. Results of the Exploratory Factor Analysis

Before conducting the EFA, we confirmed the data's suitability. The KMO value was 0.98, and Bartlett's test of sphericity was significant ($p < 0.001$), indicating high sampling adequacy.

Table 1 KMO and Bartlett's Sphericity Test

KMO and Bartlett's Sphericity Test		
KMO		.984
	Chi-Square	45743.647
Bartlett's Test of Sphericity	df	7140
	Sig	.000

EFA extracted five factors with eigenvalues greater than 1, explaining 63.96% of the total variance. After iteratively eliminating 40 items with low commonality or high cross-loadings, 80 items remained. The final rotated solution yielded five interpretable factors with the following item distribution:

Factor 1: Policy and Institutional Environment (PIE) - 22 items (17.34% variance)

Factor 2: Apprentice Professional Identity and Engagement (APIE) - 19 items (15.22% variance)

Factor 3: Institutional Support and Collaboration (ISC) - 15 items (12.47% variance)

Factor 4: Enterprise Training Quality and Support (ETQS) - 14 items (10.95% variance)

Factor 5: Regional Economic and Industrial Support (REIS) - 10 items (7.98% variance)

Table 2 Total Variance Explained

Total Variance Explained									
Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotating Load Square Sum		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	48.31	54.290	54.290	48.31	54.290	54.290	15.43	17.342	17.342
2	3.22	3.623	57.913	3.22	3.623	57.913	13.54	15.217	32.559
3	2.25	2.531	60.444	2.25	2.531	60.444	11.10	12.472	45.032
4	1.80	2.023	62.466	1.80	2.023	62.466	9.74	10.947	55.979
5	1.33	1.491	63.957	1.32	1.491	63.957	7.10	7.978	63.957

3. Results of the Development Model Construction

To construct the development model, this study conducted in-depth interviews with nine experts from seven distinct higher vocational colleges and universities in Guangdong Province, ensuring a diverse and representative perspective. The interview questions focused on five key areas: (Q1) the role of the policy and institutional environment, (Q2) the impact of apprentice professional identity and engagement, (Q3) the function of institutional support and collaboration, (Q4) the importance of enterprise training quality and support, and (Q5) the influence of regional economic and industrial support.

The interview data were processed using a structured qualitative content analysis methodology. This involved distilling expert opinions into concise content summaries, identifying key conceptual labels (codes), and finally abstracting these codes into the overarching themes that constitute the model's core factors. Table 3 systematizes the analytical procedure and its outcomes.

Table 3 Thematic Analysis Process and Results for the Modern Apprenticeship Development Model

Item	Content Analysis	Coding	Themes
Q1	Experts universally acknowledged policy as the foundational framework. They highlighted well-developed top-level design but pointed to significant implementation challenges, including insufficient corporate incentives, regional disparities in execution, and inefficiencies in cross-departmental coordination.	• Policy as Foundation • Implementation Gaps • Incentive Mechanisms • Coordination Challenges	Policy and Institutional Environment (PIE)
Q2	Analysis revealed that this factor is perceived as the central driver of learning effectiveness and program success. Experts stressed that engagement is contingent upon meaningful enterprise roles and clear career pathways, and can be cultivated through targeted admission and mentoring.	• Core Driver of Success • Learning Effectiveness Multiplier • Meaningful Engagement • Professional Identity Development	Apprentice Professional Identity and Engagement (APIE)
Q3	The discussions positioned the institution as a crucial coordinator and resource provider. The need for institutional roles to evolve from traditional administration	• Strategic Coordinator • Resource Provider • Flexible Systems	Institutional Support and Collaboration (ISC)

	to active collaboration was emphasized, requiring flexible credit systems, dual-qualified faculty, and dedicated liaison functions.	• Evolving Institutional Role	
Q4	This factor was identified as the key differentiator between true apprenticeships and simple internships. Experts underscored the necessity of systematic training and skilled mentorship, while noting the prevalent risk of enterprises treating apprentices as low-cost labor.	• Quality Differentiator • Systematic Training & Mentorship • Strategic Talent Investment • Risk of Labor Exploitation	Enterprise Training Quality and Support (ETQS)
Q5	Analysis confirmed that regional economies provide the external ecosystem. Experts advocated for regionally-tailored strategies, aligning programs with local industrial clusters (e.g., advanced manufacturing in the Pearl River Delta, specialty sectors in other regions).	• External Ecosystem • Regional Alignment • Differentiated Strategies • Industry-Talent Synergy	Regional Economic and Industrial Support (REIS)

Summary of the Model Construction:

Through structured content analysis, coding, and thematic abstraction, this study identified five core themes that constitute the development model of modern apprenticeship. The model conceptualizes the modern apprenticeship as an ecosystem wherein the Regional Economic and Industrial Support (REIS) and Policy and Institutional Environment (PIE) form the external macro-environment, providing directional guidance and foundational support. The Institutional Support and Collaboration (ISC) and Enterprise Training Quality and Support (ETQS) act as the dual implementation pillars, undertaking the critical tasks of talent cultivation. The Apprentice Professional Identity and Engagement (APIE) is positioned at the central core of the entire model, underscoring that the apprentice's active participation and professional development are the ultimate goals and intrinsic drivers of the system's success.

Figure 2 presents the visual representation of the proposed development model. It is important to clarify that the 15 guidelines shown in the figure are synthesized, action-oriented principles derived from the full set of 80 quantitative items and the qualitative expert insights. Each guideline represents a cluster of related questionnaire items and interview themes, ensuring that the model is both empirically grounded (based on the 80 EFA-retained items) and practically applicable. For example, the guideline "Career orientation, selective

admissions, role model guidance" under the APIE factor synthesizes the findings from all 19 items loading on that factor. Thus, the 15 guidelines are a high-level operationalization of the 80 empirical indicators, not a replacement of them.

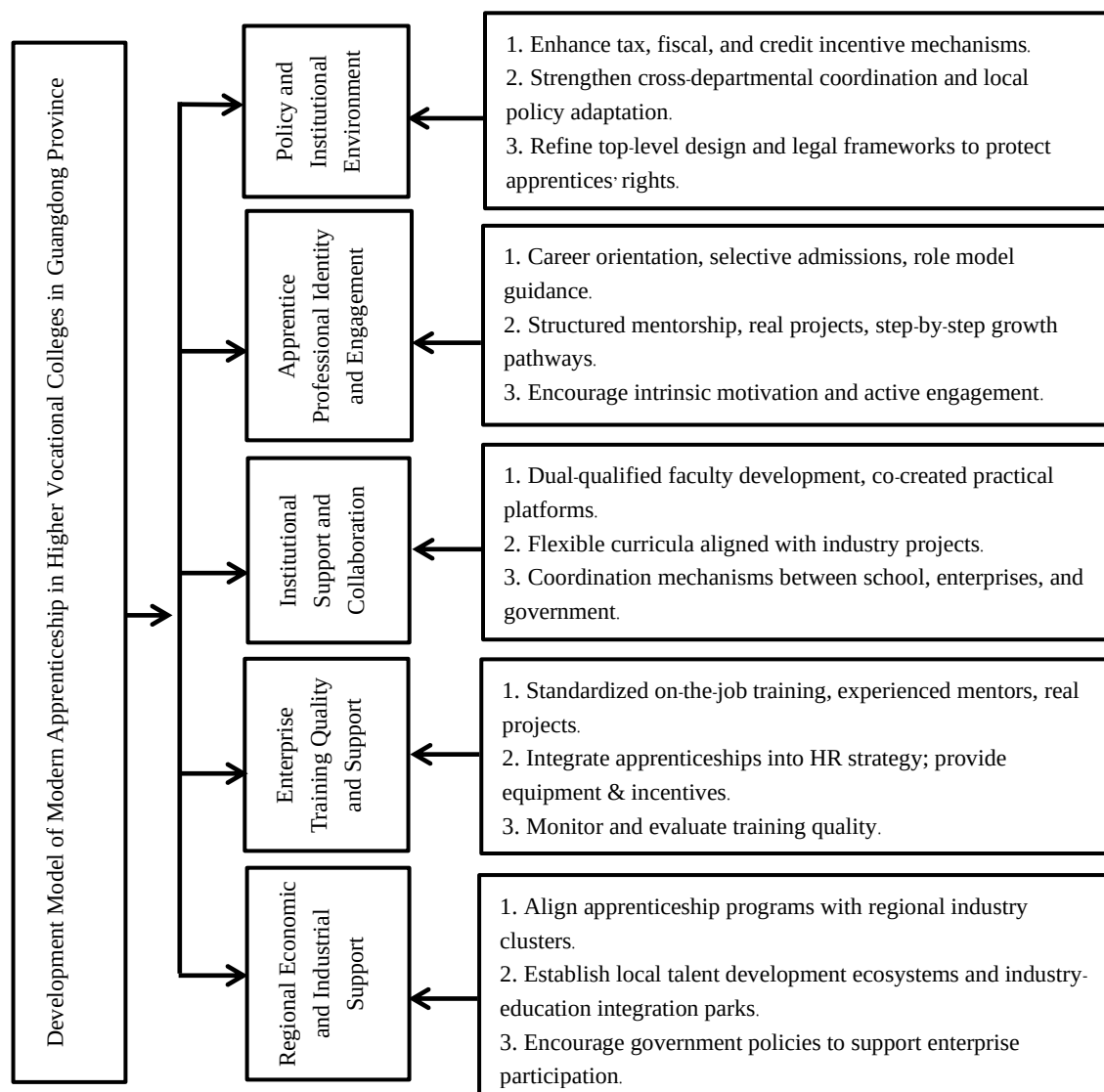


Figure 2. Development Model of Modern Apprenticeship

4. Guidelines for Applying the Development Model

Based on the established development model, the following implementation guidelines are proposed: First, regarding the external environment, governments should establish performance incentive mechanisms and provincial credit bank systems to strengthen policy support (PIE), while formulating regional strategies aligned with local industrial characteristics to enhance regional economic support (REIS). Second, regarding implementation pillars, vocational institutions should deploy digital management platforms

and implement flexible credit systems to enhance institutional collaboration (ISC). Enterprises must establish shared training centers and implement industry-led mentor certification systems to improve training quality (ETQS). Finally, at the core system level, all stakeholders should focus on cultivating apprentices' professional identity and engagement (APIE) through structured career pathways, while linking training outcomes to career advancement.

These coordinated implementation guidelines establish a comprehensive framework for Guangdong's modern apprenticeship ecosystem, ensuring the effective cultivation of high-quality technical talent.

Discussion

This study focuses on higher vocational colleges in Guangdong Province, employing questionnaire surveys and exploratory factor analysis (EFA) to construct a development model for modern apprenticeship systems. The analysis revealed five core dimensions collectively explaining 63.96% of the total variance: Policy and Institutional Environment (PIE, 17.34%), Apprentice Professional Identity and Engagement (APIE, 15.22%), Institutional Support and Collaboration (ISC, 12.47%), Enterprise Training Quality and Support (ETQS, 10.95%), and Regional Economic and Industrial Support (REIS, 7.98%). All factors demonstrated strong construct validity, with eigenvalues exceeding 1.0. Implementation assessments indicated overall moderate performance (mean = 3.24), with individual indicators ranging from 2.72 to 3.96, confirming a robust multidimensional framework for modern apprenticeship development.

The factor structure provides valuable insights into the operational dynamics of modern apprenticeship systems. The predominant influence of PIE (explaining the largest variance, 17.34%) underscores the foundational role of governmental leadership and coherent policy systems in enabling apprenticeship development. This finding aligns with Greinert (2005), who argued that a supportive policy environment is the cornerstone of any successful dual vocational training system. PIE likely emerges as the strongest factor because, in the Chinese context, top-down policy directives and government financial incentives create the conditions for schools and enterprises to initiate and sustain apprenticeship programs. The significant variance explained by APIE (15.22%) highlights the crucial importance of cultivating students' professional identity and maintaining their active engagement for long-term program effectiveness. This resonates with Fuller and Unwin's (2003) critique of the UK's apprenticeship model, where insufficient attention to apprentice identity led to lower retention rates. The present study suggests that APIE acts as an internal driver: when apprentices identify with their roles and see clear career pathways, their motivation and learning outcomes improve, which in turn sustains the whole system. The complementary roles of ISC (12.47%) and ETQS (10.95%) reflect the essential partnership between educational institutions and enterprises. Euler (2013) emphasized that a well-functioning dual system requires clear role definitions and mutual

trust between schools and companies. The variance explained by these two factors is similar, indicating that neither side can be neglected; weak institutional support or poor enterprise training quality can undermine apprenticeship success. Finally, REIS (7.98%) emphasizes how regional economic conditions shape program adaptability across Guangdong's diverse contexts. Although it explains the smallest proportion of variance, its presence confirms that regional industrial structures matter—a finding consistent with Guan (2010), who noted that apprenticeship models must be tailored to local economic conditions. The relatively lower variance may be because REIS is an external macro-level factor that influences the other factors indirectly, rather than directly determining daily implementation.

The proposed model makes important theoretical and practical contributions. Theoretically, it advances beyond descriptive policy analyses by presenting an integrated framework that captures the multidimensional, systemic nature of modern apprenticeship implementation. Unlike previous studies that focused on single aspects (e.g., policy or enterprise cooperation), this research empirically demonstrates how the external environment, implementation pillars, and core drivers interact as an ecosystem. Practically, it offers stakeholders a diagnostic tool to identify implementation challenges, optimize resource allocation, and design targeted improvement strategies. By conceptualizing modern apprenticeship as an interdependent ecosystem, the model provides both an analytical framework for understanding existing programs and a strategic guide for developing new, context-sensitive implementations across Guangdong's varied regional landscapes.

Recommendation

Based on the comprehensive research findings, this study proposes the following strategic recommendations:

1. **Model Application.** Education authorities and vocational institutions should use the five-dimensional framework to assess existing programs, identify gaps, and establish monitoring mechanisms. Regional characteristics should guide differentiated implementation plans.

2. **Policy and Mechanism Building.** Education departments, in collaboration with industry sectors, should develop cross-departmental policies with financial and tax incentives. Establish long-term school-enterprise cooperation mechanisms and flexible credit bank systems to enable mutual recognition between academic credentials and vocational certificates.

3. **Future Research.** Future studies should adopt longitudinal designs, conduct comparative analyses across regions and institution types, explore digital apprenticeship models, and develop comprehensive assessment tools for long-term impact evaluation.

These recommendations provide a systematic approach to advancing modern apprenticeship systems, ensuring effective implementation and continuous scholarly development.

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