



Providing Targeted Rural Vocational Education to Serve Rural Revitalization from a Systematic Perspective

Bing Xiao^{1*}, Xiaolin Wu², Zhiyong Lin³, Xuelan Ma⁴ and Hailan Huang⁵

School of Computer Science, Guangdong Polytechnic Normal University, Guangzhou, Guangdong 510665

E mail: ¹bingxiao619@126.com, ²1291276382@qq.com, ³bpb1739@163.com, ⁴2771646702@qq.com, ⁵1589552511@qq.com.

Corresponding Author: Bing Xiao, bingxiao619@126.com

Abstract. Providing targeted rural vocational education is the inevitable choice for implementing the rural revitalization strategy. In view of the contradiction between the supply of rural vocational education and the demand of rural revitalization, this paper analyzes existing problems of the targeted supply system of rural vocational education from four aspects: supply subjects, the supply and demand structure, the supply function of public services, and the supply environment, with a map drawn to show the correlation of factors that influence the targeted provision of rural vocational education. Then, based on a deeper understanding of the system, this paper analyzes its elements, functions, environment, and complexity, and puts forward a 3D structural model for providing targeted rural vocational education, a framework for analyzing the process of supply and a structural equation model among supply subjects. Finally, this paper puts forward a general supply strategy featuring “clear supply subjects, optimized supply environment, alleviated supply and demand contradiction, improved public services and effective supply”.

Keywords: Targeted provision; Rural vocational education; Rural revitalization; Systematic perspective; 3D structural model

DOI: <https://doi.org/10.14733/cadaps.2023.S12.235-260>

1 INTRODUCTION

Rural revitalization is a long-term development strategic goal in China. This is evidenced from the implementation of the rural revitalization strategy proposed at the 19th National Congress of the CPC, to the formulation of Opinions of the Central Committee of CPC and The State Council on Comprehensively Promoting Rural Revitalization and Accelerating Agricultural and Rural Modernization, the formal establishment of the National Rural Revitalization Bureau (an institution directly under The State Council), and the promulgation of the Rural Revitalization Promotion Law of the People's Republic of China, it can be seen that rural revitalization is a long-term development strategic goal in China. To implement the rural revitalization strategy, we must break the bottleneck of talent nurturing, vigorously train new professional farmers, and build a team of rural talents [1]. Rural vocational education is the pivotal for integrating education and agriculture, education and countryside, and education and farmers, and serves as the main way to nurture new professional farmers. It has a fundamental and guiding role in building a new socialist countryside [2]. The National Plan for the Implementation of Vocational Education Reform (January 2019) also clearly points out that vocational education, especially secondary vocational education, should "serve the rural revitalization strategy and train rural talents, especially new professional farmers in a practical way for the vast rural areas". Therefore, to implement the "rural revitalization strategy" in the new era, the rural vocational education must focus on how it can serve rural revitalization strategy through targeted supply.

2 OVERVIEW ON THE STATUS QUO OF THE PROVISION OF RURAL VOCATIONAL EDUCATION AND LITERATURE REVIEW

2.1 The Provision of Rural Vocational Education and Literature Review

As the rural revitalization strategy is gaining momentum, the research group, in order to know about how the rural vocational education is provided, handed out questionnaires to and conducted field study in selected rural vocational schools and villages in Guangdong Province. After analyzing the Education Statistics Yearbook, it was found that rural vocational education was facing the following difficulties in terms of its supply. 1. Graduates were unwilling to return to their hometown. According to a survey on graduates from secondary vocational schools in terms of whether they were willing to go back to the hometown and work in the field of e-commerce--a total of 81 secondary vocational schools in Guangdong Province were included in the survey, only 12.32% had strong wills to go back to where they were from [3]. 2. What was taught secondary vocational schools failed to match with what was needed by rural industries. For example, there were 3,834,642 graduates in secondary vocational schools in 2020, among which 237,001 were engaged in the primary industry (agriculture, forestry, animal husbandry and fishery industries), accounting for about 6.18%, and 445,185 in the secondary industry (processing and manufacturing industry), accounting for about 11.6%. Although those working in the tertiary industry took up 82.22%, only 47,186, or 1.2% were related to public administration and services that served rural revitalization. 3. There was an adequacy of teachers at the township level. By 2020, the number of teachers in secondary vocational schools majoring in the primary industry was 16,387, while the number of students was 664,007, representing a student-teacher ratio of 40.5:1, much lower than the standard of 20:1 set by the country. Only 31.5% of teachers in secondary vocational schools had two qualifications, and the number had been expected to be at least a half [4-5]. 4. There was not enough funds to meet the needs of rural vocational education. In 2020, the average expenditure on student was 4,305.29 yuan in senior high schools, up 9.13% from 3,945.10-yuan last year; and 5,489.56 yuan in secondary vocational schools, down 0.36% from 5,509.59-yuan

last year [4]. The rough conclusion was: in terms of the output, the number of graduates nurtured through the rural vocational education system could not meet the demand for talents under the rural revitalization strategy; in terms of the input, government resources (teachers and funds, etc.) are lacking for providing targeted rural vocational education; in terms of employment, rural vocational education could not equip graduates with enough skills to find targeted jobs. Therefore, there is a contradiction between supply and demand in both the rural vocational education system and between the system and the market.

2.2 Foreign Studies on Rural Vocational Education

In view of the provision of rural vocational education, foreign scholars mostly focused on a certain aspect of vocational education and applied micro and empirical analysis. Eduardo Ahumada-Tello (2016) used the complex system theory to analyze the relationship between subjects and variables [6]. Nasibullov, R et al. (2016) used a normative competency model to measure the social ability of students receiving vocational education [7]. Nasibullov et al. (2016) constructed a rural social, economic and cultural development model with rural schools as the source of talent and labor force, with the intention to keep the competitive advantage of the Russian agriculture [8]. Katja Schuster (2021) analyzed vocational training from a regional perspective, and the econometric analysis according to the personal characteristics and market characteristics of local junior high school students showed that in the diversified and competitive urban labor market, the vocational skills needed by the market was often very close to those an individual required of himself [9]. Rishi Kumar et al. (2019) analyzed factors affecting vocational training, and applied logit and multinomial logit models to verify the necessity of formal vocational training and the correlation between education and higher wages. He also found that the employment rate was the highest among those receiving primary vocational training [10]. Krista Loogma (2019) analyzed the structural conflict between post-academic competition and post-vocational competition, and the negative alternative of secondary education for vocational education [11]. Mauricio Farías (2015) studied the relationship between vocational education and academic education, and found that vocational students had lower enrollment rate, less learning persistence and fewer chances of obtaining higher education funding than academic students [12].

2.3 Domestic Studies on Rural Vocational Education

Since the rural revitalization strategy was put forward, rural vocational education has attracted the attention of domestic scholars. Liu Jun and Liang Xiaoyan (2021) believed that rural vocational education had the strongest direct correlation with rural revitalization, and there was a synergistic effect between the two. And they proposed to facilitate synergetic development of rural vocational education and rural revitalization along the path of "industrial agglomeration → education development → industry and education coordination → rural revitalization" [13]. Gao Jian et al. (2018) used the complex system-related theory to analyze the characteristics, status quo, problems and the environmental impact of the rural vocational education system, and proposed that theories of vocational education should be combined with real practices, the supply of talents should meet social demand, the career development of rural teachers and rural students should stay tune with social development [14]. Liao Cequan (2018) analyzed the opportunity for the supply-side reform of rural vocational education arisen from the economic and social development in rural areas, discussed current problems in rural vocational education, and proposed to advance the reform by reshaping the focus of the schooling, improving the training system, adjusting

functions and the structure on an on-going basis and making innovation in the system and institutions [15]. Huang Ying et al. (2019) proposed that the reform of rural vocational education should be made in terms of the management system, funds guarantee system, the scope of service and the talent training system in order to reshape the value orientation [16]. Zhu Chengchen (2019) proposed to find a development path of targeted poverty alleviation through “extrapolated” and “endogenous” rural education based on “agriculture-centered” values [17]. Shou Weiyi (2022) put forward the effective supply of rural vocational education from resource input, publicity and institutional reform [18]. These studies focus on different priorities of the “supply”. However, there is not a single study comprehensively discussing how to provide targeted rural vocational education in a systematic way. So the systematic perspective can be a new point of view.

3 SYSTEMATIC ANALYSIS OF PROBLEMS IN THE PROVISION OF RURAL VOCATIONAL EDUCATION

To find out how existing problems in the supply of rural vocational education have taken shape and look for solutions, this paper analyzes existing problems from four aspects: supply subjects, the supply and demand structure, the supply function of public services and the supply environment.

3.1 Unclear Understanding of Supply Subjects

Rural vocational education is key to poverty alleviation. Targeted rural vocational education will not be realized without the support of multiple subjects such as schools, families, enterprises, students, governments, and teachers. However, there lacks a consensus among different subjects. Firstly, definitions of supply subjects of rural vocational education vary from each other and therefore are not clear enough. Most scholars tend to define rural vocational education by region and function [13]. Scholars defining rural vocational education by region simply classify rural vocational education as rural education. Such definition is limited to the urban-rural dual structure, which to some extent is a departure from the talent demand of the integration of three industries in the process of rural revitalization and results in the lack of drive to rural revitalization through education. Scholars defining rural vocational education by function equate rural vocational education with agricultural vocational education, which narrows the scope of the rural vocational education system [19]. Under such circumstances, student enrollment, major setting and objects of talent cultivation would be agricultural-oriented in no favor of secondary and tertiary industries. As a result, the education would be dissected and may not meet diversified needs in the move to realize rural revitalization. Secondly, the value orientation of rural vocational education subjects is not clear, and the goal of talent training shifts between “serving the agriculture” and “a departure from agriculture”. Some scholars believe that rural vocational education should not only make good use of agricultural resources to improve farmers’ education, but also train new professional farmers who are essential to rural revitalization. A two-way approach should be adopted and both goals of “serving the agriculture” and “a departure from agriculture” should be pursued [20]. As a matter of fact, many vocational colleges are designed to serve “agriculture, rural areas and farmers” whereas improving farmers’ education is considered as a less important goal. However, as a higher diploma means more opportunities in the competitive market, rural vocational education has fumbled its way out of the agricultural sector, ignoring the coordination between the supply of rural vocational education and the talent demand of rural revitalization. Finally, some scholars overstate the function of rural vocational education subjects, believing that through education rural areas will embrace thriving businesses, pleasant living environments, social etiquette and civility, effective

governance, and prosperity. Some scholars believe that the agricultural-oriented rural vocational education should reshape the cultural values of farming [20] and help with targeted poverty alleviation [17], without giving importance to improving farmers' education.

3.2 Unreasonable Supply and Demand Structure

There is now a contradiction between the supply of rural vocational education and the demand of rural revitalization. The main problems are as follows. First, in terms of the supply of resources, vocational education schools in urban areas which aim at nurturing non-agricultural talents has adequate high-quality vocational education resources such as supporting funds, low student-teacher ratio, and sound infrastructure, while vocational education schools in rural areas which aim at nurturing agricultural talents obviously lacks such resources [15]. Second, in terms of major setting, there are few agriculture-related majors in rural vocational schools. The major setting cannot effectively meet the needs for implementing the rural revitalization strategy, the nurturing of new professional farmers is not made a goal, and these majors are not designed to serve "agriculture, rural areas and farmers" [15]. Third, the supply of rural vocational education is inadequate. On one hand, as the rural vocational education system does not fit in the requirements of current urban-rural integrated development, the major setting, talent training objectives, teaching content, teaching sites and industry-education integration are mismatch with the needs of enterprise development; on the other hand, it is difficult to meet the demands of students due to the single form of most rural vocational education, and departments do not perform their duties or have too much red tapes. All these resulted in that the rural vocational education is inadequate in supply, and has low adaptability with little contribution to the rural revitalization strategy. Finally, modern rural vocational education as a complex system, decoups with industries. The flow of information between secondary and higher vocational education in major setting, curriculum construction, teaching evaluation is not effective nor efficient; Major setting and teaching management cannot fulfill the need of serving regional economy; training models are homogeneous, nor good social resources can be leveraged to complement educational resources of vocational colleges.

3.3 Ineffective Supply Function of Public Services

The effective supply of public services is key to the development of rural vocational education [21]. According to the status quo of the supply and literature review above, main problems in the supply of public services are as follows. First, the financial investment is insufficient [14]. Compared with 2019, the average expenditure on student of rural vocational education presents a downward trend. Rural vocational education is a system where teaching factors such as funds, major setting, teaching equipment, teachers, training conditions and technology level are mutually reinforcing. So a lack of funds will cause the shortage and backwardness of other factors. Second, the network connection awaits speeding up. In less developed areas, network service remains weak in rural vocational education [22]. In particular during the epidemic, network service is important for online teaching, which affects the openness of the rural vocational education system. Finally, teaching resources are not shared. From a horizontal perspective, there is a lack of effective communication between schools and teachers, and schools build facilities independently. From a longitudinal perspective, there is a lack of coordination among the primary vocational education, secondary vocational education and higher vocational education in terms of major setting and resource investment.

3.4 Incomplete Supply Environment

As an important force supporting rural revitalization, rural vocational education needs support at the macro level. First, in terms of policy, the policy system supporting rural vocational education is not complete. Although governments at all levels have issued a large number of supporting policies on rural vocational education with which remarkable achievements have been made in rural revitalization, a complete and systematic policy system has yet put in place [15]. Second, in terms of social environment and cultural environment, the current rural vocational education is still in a disadvantaged position. A lot of rural people have been transferred to industries other than agriculture. Third-level vocational colleges and vocational training institutions in counties and villages are revoked or merged, severely damaging the rural vocational education system, and resulting in a lack of drive to the development of rural vocational education [20]. Third, in terms of economic environment and market environment, the rural economy lacks appeal, and small enterprises cannot provide necessary insurances and other guarantees for employees, and the market demand is unstable. Thus, working in rural areas cannot meet the safety need of those graduating from vocational schools while the safety need is quite basic according to Maslow's Hierarchy of Needs.

The above four problems are interconnected, and their correlation is shown in a network structure. Therefore, this paper draws a map to show the correlation of these factors that influence the targeted provision of rural vocational education, as shown in Figure 1.

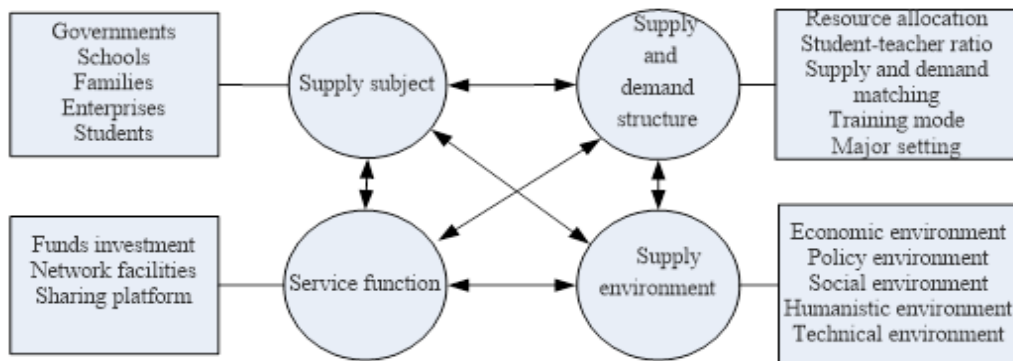


Figure 1: Relationship diagram of the influencing.

4 THE MODEL FOR PROVIDING TARGETED RURAL VOCATIONAL EDUCATION

With the change of demand and the proposal of rural revitalization strategy, it is necessary to reinterpret rural vocational education from a systematic perspective. To rationalize ideas, improve management and control and make optimization, this paper adopts the system engineering method to build a 3D structural model for providing targeted rural vocational education, a framework model for analyzing the process of supply and a structural equation model among supply subjects.

4.1 Meaning of the Targeted Supply of Rural Vocational Education

The above analysis shows that the targeted supply of rural vocational education involves the participation of multiple subjects, the application of multiple technologies, the integration of multiple elements, the integration of multiple demands and the policy guarantee. Therefore, the word "targeted" has three levels of meaning. First, graduates from rural vocational schools meet the needs of the rural revitalization strategy, and they are willing and able to serve rural revitalization. Second, the government's supply is in line with the sustainable development of rural vocational education, and the government is willing and able to serve rural vocational education. Third, customized teaching is carried out according to the situation of students. To further understand the targeted supply system of rural vocational education, this paper is trying to clarify its elements, functions, subsystems, environment and complex characteristics.

1 Elements of the targeted supply system of rural vocational education

A system is composed of more than two basic elements. The elements of the targeted supply system of rural vocational education include supply objects, supply policies and supply conditions. Among them, supply policies include staffing, salary, status, taxation, social security, etc.; supply conditions include funds, teachers, site, training mode, equipment, curriculum resources, major setting, and technology, etc.

2 Functions of the targeted supply system of rural vocational education

Any system has its role and value as well as specific purpose of operation, that is, it has its specific function. Rural revitalization, as a national strategy, is a major decision under the background of adjusting urban-rural correlation in the new era. Promoting rural revitalization on all fronts has become the focus of "agriculture, rural areas and farmers" in the new stage of development and is an important part of building an all-round modern socialist country. As the education is key to rural economic and social development, providing targeted rural vocational education is designed to serve "agriculture, rural areas and farmers", nurture talents and conduct R&D in agriculture. Serving "agriculture, rural areas and farmers" should also be the starting point and purpose of the latter two.

3. Subsystems of the targeted provision system of rural vocational education

The subsystem is the component of the elements of the system divided according to certain principles. According to the functions of the targeted provision system of rural vocational education, the subsystem can be divided into demand subsystem and supply subsystem. The demand subsystem includes the needs for the rural revitalization strategy and the sustainable development of rural vocational education; The supply subsystem includes the supply of the rural vocational education system in serving rural revitalization, of the internal training process of the rural vocational education system, and of the government to the rural vocational education. Therefore, the supply subsystem consists of secondary supply subsystems of the subject, the process, the content and the evaluation.

4. Environment and the targeted provision system of rural vocational education

Any system is a component of and interacts with a larger system to which it belongs, and the larger system is the environment or the supersystem. A close input and output relationship is

maintained between the system and the environment. The environment of the targeted provision system of rural vocational education includes economic, policy, social, cultural, and market environment etc.

5. Complex characteristics of the targeted provision system of rural vocational education

As mentioned above, the targeted provision system of rural vocational education is complex, containing general properties such as integrity, relevance, purpose, hierarchy, and environmental adaptability etc., as well as unique properties of complex systems such as dynamics, diversity, synergy, self-organization, emergence, openness, and non-linearity, etc.

4.2 3Dmodel of the Targeted Provision Path of Rural Vocational Education

Based on the rural revitalization strategy, when solving the focus of work concerning “agriculture, rural areas and farmers” through urban and rural integration, the scope of rural vocational education can be expanded to vocational undergraduate colleges, higher vocational colleges, secondary vocational schools (secondary vocational schools, secondary schools, adult secondary schools, ordinary technical secondary schools and rural training institutions), adult high schools (high schools for workers and high schools for farmers) and vocational and technical training schools, with obvious hierarchy and diversity. The process of targeted provision (including major setting, teaching mode, resource allocation and evaluation, etc.), and student sources and foundations of different academic levels, are different. At the same time, the targeted provision of rural vocational education is dependent upon the coordination among schools, teachers, students, families, governments, and enterprises. Therefore, the 3D model of the targeted provision path of rural vocational education is built upon “supply (subject dimension) - process (process dimension) - demand (education dimension)”, as shown in Figure 2.

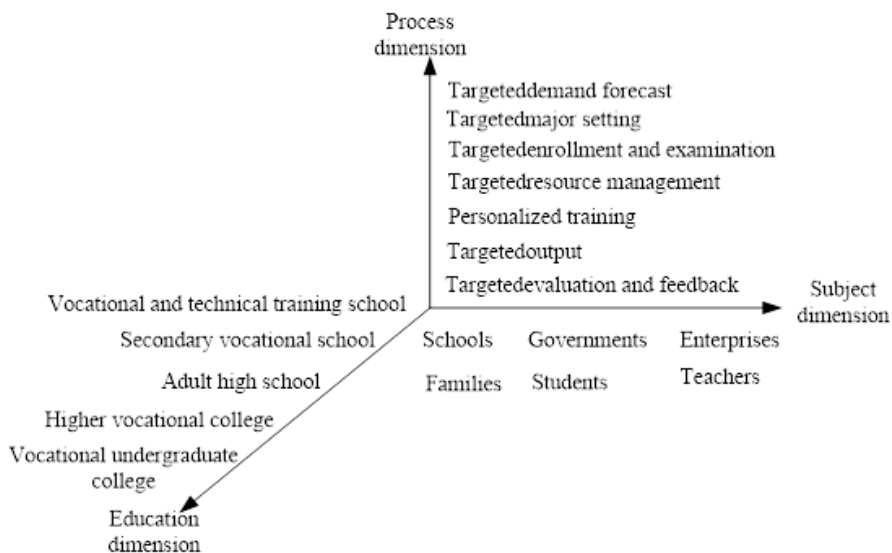


Figure 2: 3D Model for targeted provision path of rural vocational Education.

As showed in the figure, the subject dimension is based on the demand for the coordinated development of rural vocational education and rural revitalization, and the targeted provision of rural vocational education needs the coordination among schools, teachers, students, families, governments and enterprises; aimed at the targeted provision of rural vocational education, the process dimension includes seven steps: targeted demand forecast, targeted major setting, targeted enrollment and examination, targeted resource management, personalized training, targeted output and targeted evaluation and feedback; the education dimension is based on the scope of rural vocational education, and can be divided into vocational and technical training schools, secondary vocational schools, adult high schools, higher vocational colleges and vocational undergraduate colleges.

In Figure 2, the subject dimension reflects the diversity of subjects. The subjects provide different service functions in the targeted provision of rural vocational education for different education backgrounds, and the coordination modes between subjects differ, reflecting the non-linear differences of subjects; the process dimension plans the steps in implementing the targeted provision path of rural vocational education, and the targeted provision requires the precise analysis of demand by considering the interaction between rural vocational education system and rural revitalization environment, hence the dynamics, openness and environmental adaptability of the system; the education dimension reflects the differences of students with different education backgrounds in knowledge provision, employment and contribution to the implementation of rural revitalization strategy, different needs with different educational requirements. The 3D model of the targeted provision path of rural vocational education requires the coordination of the three dimensions to make the whole system optimal and achieve targeted provision.

In Figure 2, we can see from the relationship among the subject, the structure, the function and the environment [23], that to meet the different needs for the rural revitalization strategy, the effect of the targeted provision varies depending on the different relations between subjects. Therefore, it is necessary to clarify the content of the process dimension and the coordinated relationship between subjects in the path model of the targeted provision of rural vocational education.

1. Work content analysis framework model of the process dimension of the targeted provision path of rural vocational education

In order to clarify the work content of the process dimension, we analyze the seven steps of the process dimension, namely, targeted demand forecast, targeted major setting, targeted enrollment and examination, targeted resource management, personalized training, targeted output and targeted evaluation and feedback. The framework model is shown in Figure 3.

In the Figure 3, is the analysis and forecast based on the demand quantity, the demand major and the demand capacity according to the demand of the rural revitalization strategy. Targeted demand forecast is the premise of achieving targeted provision; targeted major setting, as the basis of targeted provision, is to set the objectives, basic curricula, core curricula and practical curricula base on the predicted demand major, analyze the abilities that students need to have when graduating and demonstrate their employment scope according to the needs of "agriculture, rural areas and farmers", and discuss whether they conform to the characteristics of the implementation of the rural revitalization strategy; targeted enrollment and examination is the fundamental to targeted provision; it is to carry out enrollment publicity and planned number of enrollment, enrollment targets, and examination and admission according to the demand quantity, the demand

major, the actual situation of the rural economy and the current situation of rural vocational education resources; targeted resource management is the guarantee of targeted provision, and it is to allocate resources for different majors according to the enrollment results and forecast results to ensure the precise training, including policy resources, teaching resources, funding resources, basic resources and teachers; personalized training, the key to achieve targeted provision, is to select different training modes according to different academic qualifications based on the analysis of students' learning situation and the demand analysis of rural revitalization environment, and use information technology to achieve targeted teaching; targeted evaluation and feedback, as a means to verify the effectiveness of targeted provision, is to evaluate the matching between rural revitalization and rural vocational education in talent training, including the establishment of evaluation index system, selection of evaluation personnel, fairness of evaluation process, rationality of evaluation method, and accuracy of evaluation and feedback results.

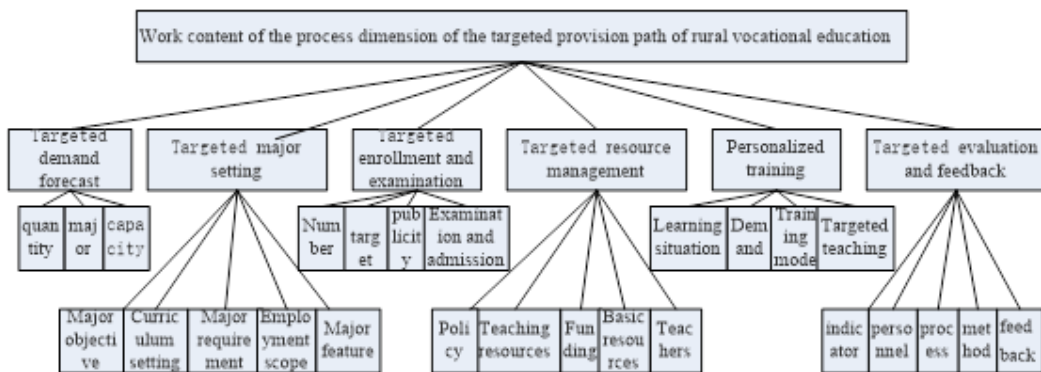


Figure 3: Work content analysis framework model of the process dimension of the targeted provision path of rural vocational education.

2. Structural relation model between the subjects of the targeted provision of rural vocational education

According to Figure 2 and 3, and the provision status of rural vocational education, due to the influence of social, economic and cultural environment, the small proportion of students willing to serve "agriculture, rural areas and farmers" upon graduating from rural vocational education, this paper believes that the targeted provision not only includes targeted teachings and trainings in vocational schools, but also includes the willingness and ability of graduates to use their knowledge to serve "agriculture, rural areas and farmers", as well as the government's targeted services for the sustainable development of rural vocational education. Therefore, this paper takes the interactive system of rural vocational schools, students, enterprises, families and teachers as the core system, and the policy, social, economic, cultural, and technical environment of rural revitalization as the external environment. Information, material, energy, and talent are constantly exchanged between the core system and the external environment. The government as a part of both subjects and the environment of the system, it plays a very important role in the process of implementing the targeted provision of rural vocational education. Thus, it is necessary to put forward the structural model between the subjects of the targeted provision of rural vocational education from the perspective of government management process, and the model is shown in Fig. 4.

In the model, rural vocational schools, enterprises, families, and teachers precisely train students as the core, by adopting appropriate teaching modes according to the needs of rural revitalization and the market environment, and students precisely serve "agriculture, rural areas and farmers" after graduation. In the whole provision process, the subjects and the environment are the controlled party. The effectiveness of the targeted provision of rural vocational education relies on various resources and planning and management provided by the government. Therefore, the government is the control party and the service party. According to the rural revitalization development and environment situation, the government functions should include planning and design, formulation of policies and programs, planning and implementation, service management, and evaluation and feedback etc. The five functions are a gradual process, and they need to be repeatedly demonstrated and constantly innovated due to the complexity and dynamics of the rural vocational education system.

5 STRATEGY OF THE TARGETED PROVISION PATH OF RURAL VOCATIONAL EDUCATION SERVING RURAL REVITALIZATION

From the above analysis, we can see that the targeted provision system of rural vocational education involves many subjects and factors, with complex supply and demand structure, and diversified purposes and functions, leading to constant exchange and coordination of information, talent, knowledge, and technology of the rural vocational education system in the process of adapting to the strategic environment of rural revitalization. The whole system is dynamic, non-linear, self-organizing and open.

Based on Figure 2, 3, 4 and the systematized, optimized and integrated system engineering principles, we put forward the macro supply path strategy of "clarified subject understanding, optimized environment, alleviated contradiction between supply and demand, improved public services, and guaranteed effective supply".

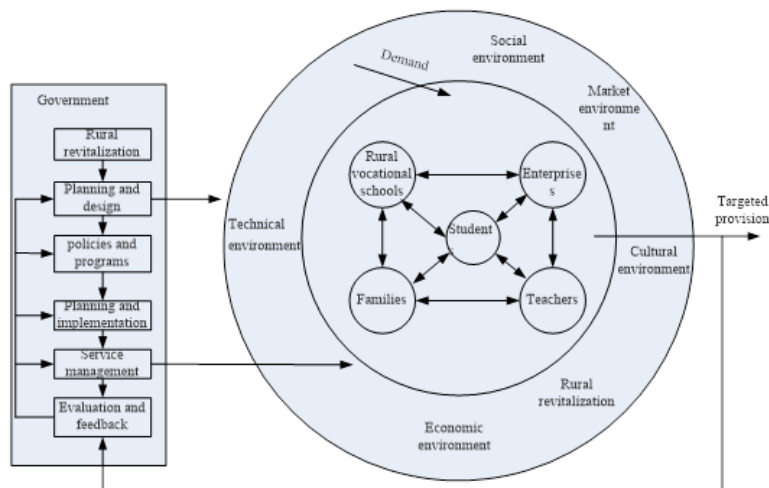


Figure 4: Structural relation model between the subjects of the targeted process of rural vocational education.

(1) Attach importance to integrity and purpose, top-level design, precisely forecast the demand, and clarify the subjects' understanding

The purpose of the targeted provision of rural vocational education is to support rural revitalization. Industrial prosperity is the key to rural revitalization. How to build an integrated system for the development of primary, secondary, and tertiary industries in rural areas? When promoting the targeted provision of rural vocational education, the government needs to make overall consideration and put forward the top-level design. Firstly, the purpose, the structure, the function, the environment, and the boundary of the rural vocational education system should be clarified; urban and rural vocational education should be integrated, and the curriculum in vocational undergraduate colleges, higher vocational colleges, secondary vocational schools and vocational and technical training schools should be connected. Secondly, rural vocational education needs to improve the forecast of the future rural economic development and the talent demand at home and abroad, and systematically carry out the overall feasibility study, to ensure targeted enrollment, major setting and talent training positioning. Finally, the subjects should have a clear understanding of rural vocational education, which is an important pillar for rural revitalization. Meanwhile, do not overstate its extension functions. While boosting the rural revitalization strategy, attention must be paid to the development of the essence of the rural vocational education system.

(2) Pay attention to diversity and adaptability, formulate policies and programs for targeted major enrollment and optimized supply environment

To implement the rural revitalization strategy, institutional construction must be carried out throughout the whole process. The priority should be given to developing rural education and improving the property rights system and market-based allocation of elements, to stimulate the subjects, elements, and the market. The targeted provision system of rural vocational education involves the participation of multiple subjects and the integration of multiple elements. When formulating policies and programs, the government should pay attention to the diversity of subjects, elements, and functions, as well as the adaptability between the development of rural vocational education and the environment, to establish a complete and systematic policy system. Firstly, formulate policies on the talent flow, self-employment, establishment, salary, status, social security, and tax preference to serve "agriculture, rural areas and farmers", and strive to grasp and guide the dynamic balance between the supply and demand of talents. Secondly, expand the enrollment of majors serving "agriculture, rural areas and farmers", and provide favorable support in resources. Finally, optimize the policy, network, cultural, and social, environment, strengthen vocational education, and gradually promote the exemption of tuition and miscellaneous fees for students willing to serve "agriculture, rural areas and farmers", or reach order-based talent training programs with employers serving "agriculture, rural areas and farmers".

(3) Guide the coordination and self-organization, carry out the planning and implementation of targeted teaching and training, and alleviate the contradiction between supply and demand

According to the definition of rural vocational education and the analysis of Fig. 1~Fig. 4, targeted provision refers to targeted teaching and training for students for the rural vocational education system, and to precisely serve "agriculture, rural areas and farmers" for the system and the environment. The subjects of the targeted provision interact with each other, and materials, information, talents, and energy are constantly exchanged between the system and the environment. Therefore, the targeted provision of rural vocational education needs the coordination

between subjects, rural vocational education subsystems at all levels, and the coordinated development between rural vocational education and rural revitalization environment. At the same time, each subject should also implement the targeted teaching and proactively strengthen the construction of rural vocational education and its essence according to the changes in the environment and market needs. The government should implement policies and programs according to the planning and design, actively guide the coordination and self-organization of subjects, and make full use of order parameters, in order to increase the synergy between subjects, improve self-organization, and solve the supply-demand contradiction between rural vocational education and rural revitalization.

(4) Understand the hierarchy and relevance, strengthen the service management and targeted resource allocation, and improve public services

The development of vocational education in rural and urban areas is different in resource. The urban vocational education has abundant resources with limited majors designed to serve "agriculture, rural areas and farmers"; by contrast, in the rural areas where the education resource is scarce, there is plenty of subjects and curricula serving "agriculture, rural areas and farmers". Other discrepancies include educational hierarchy in vocational undergraduate colleges, higher vocational colleges, secondary vocational schools and technical training schools. However, vocational education in rural and urban areas is interrelated. For example, they have similar major settings and various academic and technical exchanges. Vocational undergraduate colleges, higher vocational colleges, secondary vocational schools are also interrelated in enrollment, knowledge cohesion, division of skills, etc. Therefore, after planning and implementation, the government should distinguish the hierarchy and relevance of rural vocational education and improve the service management mode, such as integrate and optimize current public resources, focus on supporting majors that serve "agriculture, rural areas and farmers", identify and strengthen weak links and key resources, so as to realize targeted allocation of resources, and enhance the capability of public services in network and resource sharing platforms among others.

(5) Based on the openness and dynamics, carry out real-time evaluation and feedback, targeted enrollment and examination, and ensure effective provision

Due to the constant changes in the policy, technical, economic and market environment of the rural vocational education system, the targeted provision of rural vocational education is also dynamic. The subjects in the targeted provision system need to rethink the status and sustainable development of rural vocational education with an open, developing, and dynamic mind. They should carry out real-time evaluation and feedback, including the establishment of an evaluation index system, the selection of evaluation methods, the verification of evaluation results, and the selection of evaluation personnel. Meanwhile, the evaluation includes not only the evaluation and feedback of personalized targeted teaching within the system, but also the coordination between the system and the environment. With evaluation and feedback, the government's planning and designs, policies, and programs, implementation, and service management are constantly revised and improved. In addition, they should adjust the number of enrollments, enrollment targets, enrollment publicity and enrollment and examination to promote the internal construction and external development of rural vocational education and ensure the effectiveness of targeted provision.

6 CONCLUSIONS

This paper regards the targeted provision of rural vocational education as a system, and analyzes its connotation, characteristics, complexity, the path model of targeted provision, the work content framework model of the process dimension, and the structural model between the subjects and path strategy of targeted provision under the rural revitalization strategy by using the principle and theory of systems engineering. And the conclusions are drawn as follow:

(1) There is a contradiction between the supply of rural vocational education and the demand of rural revitalization, including: vague understanding of subjects, unreasonable supply and demand structure, unqualified supply function of public services, and incomplete supply environment system. These problems are interconnected in a network structure.

(2) The targeted provision of rural vocational education mainly includes three parts. One, the graduates graduated from rural vocational education meet the needs of the rural revitalization strategy, and the graduates are willing and able to serve rural revitalization. Two, the government's supply meets the needs of the sustainable development of rural vocational education, and the government is willing and able to serve rural vocational education. Three, personalized teaching is implemented according to the learning situation of different students.

(3) The targeted provision path of rural vocational education is the result of synergy in the subject dimension, the process dimension and the education dimension. The subject dimension includes schools, teachers, students, families, governments and enterprises; the process dimension includes seven steps: targeted demand forecast, targeted major setting, targeted enrollment and examination, targeted resource management, personalized training, targeted output and targeted evaluation and feedback; the education dimension includes vocational and technical training schools, secondary vocational schools, adult high schools, higher vocational colleges and vocational undergraduate colleges. The government affects and interacts with the system composed of schools, teachers, students, families, and enterprises.

(4) Implementing rural vocational education to serve rural revitalization, we should adhere to the macro supply strategy of "clarified subject understanding, optimized environment, alleviated supply-demand contradiction, better public services, and guaranteed effective supply".

7 ACKNOWLEDGEMENTS

This work is supported by the Humanities and Social Sciences Planning Fund Project of the Ministry of Education "Research on the Precise Supply Path of Rural Vocational Education System under the Strategy of Rural Revitalization" (No.20YJA880058) and the Key Special Project of Guangdong Provincial Department of Education (No. 2020ZDZX1007), and it is also supported by Guangdong Provincial Department of Science and Technology Project "Research on Township E-commerce Industry Development and Technical Support" (KTP20210286), Graduate Education Innovation Program of Guangdong Province, No. 2021SFKC062 (Graduate Demonstration Course Construction Project "Intelligent Optimization Method").

Bing Xiao, <https://orcid.org/0000-0003-1653-4659>

Xiaolin Wu, <https://orcid.org/0000-0002-3583-9506>

Zhiyong Lin, <https://orcid.org/0000-0003-4624-9373>

Xuelan Ma, <https://orcid.org/0000-0002-6324-9837>

Hailan Huang, <https://orcid.org/0000-0003-3494-0626>

REFERENCES

- [1] The Central People's Government of the People's Republic of China. Opinions of the State Council of the Central Committee of the Communist Party of China on the Implementation of Rural Revitalization Strategy [R/OL]. [http://www.gov.cn/zhengce/2018-02/04/content_5263807.htm,\(2018-02-04\)\[2022-5-8\]](http://www.gov.cn/zhengce/2018-02/04/content_5263807.htm,(2018-02-04)[2022-5-8])
- [2] Zhang Qiwu.: Serving rural revitalization urgently needs to fill the shortcomings of rural vocational education, *Vocational and Technical Education*, 38(36), 2017, 1.
- [3] Mo Jidi.: Research on the Training System of E-commerce Talents in Secondary Vocational Schools under the Rural Revitalization Strategy, *Journal of Guangdong Polytechnic Normal University*, 2021.
- [4] Ministry of Education of the People's Republic of China, Education Statistics [DS/OL]. http://www.moe.gov.cn/s78/A03/moe_560/jytjsj_2018/, (2019-8-8)[2022-5-8].
- [5] Ministry of Education of the People's Republic of China, Opinions of the Ministry of Education on Strengthening the Teaching Staff of Secondary Vocational Schools during the 12th Five-Year Plan [R/OL].
- [6] Eduardo Ahumada-Tello.: Manuel Castanon-Puga. Modelling Complex Systems with Distributed Agency and Fuzzy Inference Systems. *Knowledge-based Curricula in Higher Education, Procedia Computer Science*, 5, 2016, 2317-2321. <https://doi.org/10.1016/j.procs.2016.05.429>
- [7] Nasibullov, R.: et al. Rural school as a resource for the intellectual and labour potential formation of the rural society, *International Journal of Environmental & Science Education*, 3, 2016, 119–128. <https://doi.org/10.12973/ijese.2016.296a>
- [8] Monnier, M.; Tschöpe, T.; Srbeny, C.; Dietzen, A.: Occupation-specific social competences in vocational education and training (VET): the example of a technology-based assessment, *Empirical Res Voc Ed Train*, 8(10), 2016, 1-18. <https://doi.org/10.1186/s40461-016-0036-x>
- [9] Katja Schuster*and Anne Margarian.: Vocational training choice from a regional perspective, *Schuster and Margarian Empirical Res Voc Ed Train* 13, 2021, 3 <https://doi.org/10.1186/s40461-020-00105-9>
- [10] Kumar, R.; Mandava, S.; Gopanapalli, V. S.: Vocational training in India: determinants of participation and effect on wages, *Kumar et al. Empirical Res Voc Ed Train*, 11, 2019, 3 <https://doi.org/10.1186/s40461-019-0078-y>
- [11] Loogma, K.; Ümarik, M.; Sirk, M.; Liivik, R.: How history matters: The emergence and persistence of structural conflict between academic and vocational education: The case of post-Soviet Estonia, *Journal of Educational Change*, 20, 2019, 105–135. <https://doi.org/10.1007/s10833-018-09336-w>
- [12] Farias, M.; Sevilla, M. P.: Effectiveness of Vocational High Schools in Students' Access to and Persistence in Postsecondary Vocational Education, *Res High Educ*, 56, 2015, 693–718. <https://doi.org/10.1007/s11162-015-9370-2>
- [13] Jun, L.; Xiaoyan, L.: Logical Optimization and Path Analysis of Rural Vocational Education Cooperating with Rural Revitalization, *Chinese Vocational and Technical Education*, (36), 2021, 65-69+81.
- [14] Jian, G.; Zhigang, Z.; Haisheng, P.: Study on the Path of Perfecting Vocational Education System under New Era—An Analysis Perspective based on Complex System, *China Educational Technology*, 2018, 378.
- [15] Cequan, L.: Study on the Supply-side Reform of Rural Vocational Education Based on Rural Economic and Social Demands, *Vocational and Technical Education*, 39(16), 2018, 58-62.

- [16] Ying, H.; Xin, G.; Zhang, H.-C.: Reconstruction and Realization of the Value Orientation of Rural Vocational Education under the Background of Rural Revitalization Strategy, *Adult Education*, 39(07), 2019, 67-71.
- [17] Chengchen, Z.; Guangfen, Y.; Dequan, Z.: Rural Construction and Rural Education: An Integrated Model for Targeted Poverty Alleviation of Vocational Education and Rural Revitalization Strategy, *Journal of East China Normal University(Educational Sciences)*, 37(02), 2019, 127-135.
- [18] Weiyi, S.:Research on the Effective Supply of Rural Vocational Education under the Background of Rural Revitalization Strategy, *Education and Vocation*, (5), 2022, 98-102.
- [19] Hongjiang, Z.; Rui, L.; Xiangyu, G.: Analysis of the Concept of Rural Vocational Education, *Education and Vocation*, (8), 2015, 5-9.
- [20] Chunlei, Z.; Jun, L.: Development Logic and Path Choice of Rural Vocational Education under the Background of Rural Revitalization Strategy, *Food Science and Technology and Economy*, 45(2), 2020, 124-126.
- [21] Feng, G.: Development Status and Countermeasures of Rural Vocational Education under the Strategy of Rural Revitalization, *Journal of Vocational Education*, (04), 2019, 135-138.
- [22] Shipian, W.: Systematic Analysis of the Shortcomings of Rural E-commercePublic service, *Journal of Guangdong Polytechnic Normal University*,2021.
- [23] Zhanyong, Q.; Zhiyuan, W.: The Dilemma and Orientation of Rural Vocational Education Development under the Rural Revitalization Strategy, *Journal of East China Normal University(Educational Sciences)*, 38(04), 2020, 107-117.
<https://doi.org/10.16382/j.cnki.1000-5560.2020.04.009>
- [24] Bing, X.; Chao-tian, C.:The Dynamic Relationshipof"Structure — Function Based on Complex Adaptive System Theory, *Chinese Journal of Systems Science*. 23(02), 2015, 41-44.