ORIGINAL ARTICLE

The Coordinated Development of Secondary Vocational School Specialty Clusters and Industry Clusters: Citing Longgang No.2 Vocational and Technical School of Shenzhen as a Case Study

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***Abstract**: With the implementation of the state's Plan of Constructing High-Level Vocational Schools and Specialties with Chinese Characteristics, the construction of specialty clusters has become a hot topic. They are critical tools for improving the educational quality of vocational schools by promoting vocational education transformation, upgrading, and innovation. To maximize the effectiveness of specialty cluster development in secondary vocational school curriculum reform, we must first identify the rationale for multi-agency involvement in the development of specialty clusters and then formulate action plans. This article examines the definitions and connotations of specialty clusters and discusses the contexts in which specialty clusters emerged. It examines strategies for developing specialty clusters using Shenzhen's Longgang No. 2 Vocational and Technical School as an example.*

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***Keywords**: Vocational Education, Specialty Cluster, Industry Cluster, Industrial Chain, School-Enterprise Partnership, ICT*

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SECONDARY vocational education's specialty clusters are a response to the growing demand for well-rounded technical and skilled workers in the current development of industry clusters and job clusters. Specialty cluster education is a method of skill development based on an in-depth examination of technical and skilled occupations within regional industry clusters. The strength of a specialty cluster is in its ability to integrate pertinent specialties and then maximize their effectiveness as a "cluster." To advance the quality of vocational education and the development of high-level specialty clusters, secondary vocational schools' original curriculum components, such as curriculum objectives, teaching teams, and practical training, must be transformed. Using policies issued by the Ministry of Education as a guide, this paper seeks to define the mechanism of coordination between the construction of specialty clusters and the development of industry clusters, as well as the implications of this mechanism. We examine the practice of developing specialty clusters using Longgang No.2 Vocational and Technical School in Shenzhen (hereinafter referred to as Longgang No.2 Vocational School) as a case study, attempting to provide useful guidelines for the scientific and efficient construction of high-level specialty clusters for other secondary vocational schools.

Definitions of "Industry Cluster" and "Specialty Cluster"

The term "industry cluster" derives from Michael Porter's industry cluster theory, a Harvard Business School professor who specializes in competitive strategy and international competition. It is a phenomenon in which a group of competitive enterprises in a particular industry, along with their partners, specialized suppliers, service providers, and related institutions, consolidate in a particular area (Zhao, 2011), with the goal of increasing their market competitiveness through production factor optimization, resource sharing, and cost reduction. At a vocational college or school, a specialty cluster is a collection of specialties comprised of one or more core specialties associated with employment advantages and other related specialties that share a common professional and technical background. Specialty clusters are classified into two types: (i) One is defined from the school's perspective. It integrates and shares teaching resources and basic tangible facilities by combining a specialty of abundant resources with other related specialties. (ii) The other is classified according to industry. It is a collection of specialized skills required by a particular industry. The classification's guiding principle is to maximize support for the target industry's overall development. Various vocational colleges and schools use this guideline to classify the specialties required by industrial chains or industry clusters as specialty clusters (Mi & Guo, 2019). Both types share a common objective: to contribute to societal and industrial development.

The Background of the Popularity of Specialty Clusters

A New Phase of High-Quality Development in Vocational Education in China

With the development of China's educational system, public demand for elementary education has evolved into a demand for higher education. Currently, the educational levels of various vocational schools vary considerably, and there is still considerable room for improvement. The purpose of vocational education is to improve the quality of skilled labor, which necessitates the deliberate development of specialties. Secondary vocational education in China began with the development of a market economy, but the emphasis on "planning" and "supply" in the planned economy model has had such a profound effect on vocational education that vocational education in China has for decades followed traditional ideas of specialty design and accumulated numerous problems. For example, secondary vocational colleges and schools' segmentation of specialties limits their service capacities, making it difficult to obtain effective industry support for specialty design. The rate at which new specialties are added, on the other hand, will never keep up with changing market demand. On the other hand, the constant addition of new specialties has resulted in the unnecessary consumption of secondary vocational school educational resources and has even undermined the culture that developing a specialty requires long-term commitments and efforts (Shen & Shi, 2011). These issues become more pressing as China's economic development model shifts, industrial transformation and upgrading accelerates, and a market-oriented employment mechanism is established. In this context, the establishment of specialty clusters becomes even more critical in the reform of vocational education.

At present, China's economy is transitioning from rapid growth to quality growth, and the positive effects of industry clusters are becoming increasingly apparent, resulting in a pressing need for high-quality technical and skilled labor. Not only has internet technology been fully implemented in the service sector, but it is also permeating primary and secondary industries. The integration of traditional industries with new intelligent technologies such as cloud computing, big data, and the internet of things continuously generate new industrial growth points, new trades, and new types of jobs, while also imposing new requirements on workers, such as the ability to handle increased complexity. In comparison to individual specialties, specialty clusters are more adaptable to market demand changes. As a result, secondary vocational schools should prioritize collaboration between specialty clusters and industry clusters in order to increase the adaptability and relevance of training and education (Yuan, 2007).

The Supporting Role of Shenzhen's Information Technology Industry in the Creation of Specialty Clusters in the ICT Industry

The municipal government of Shenzhen has set the goal of developing a world-class new-generation information technology industry base for the city's industrial development. Furthermore, it launched implementation strategies for capitalizing on artificial intelligence and fifth-generation mobile communication (5G) advancements, as well as adhering to the new internet of everything trend. The information and communications technology (ICT) industry in Shenzhen's Longgang District is one of the largest in Asia. Longgang District has been a global leader in research and development of 5G technology, ranking first among China's top 100 industrial districts. The Banxuegang Science and Technology Center in Longgang (also known as the ICT industry center in the Asia-Pacific region) is particularly noteworthy for its ideal and powerful industrial chains.

To ensure the continued development and talent supply of Longgang District, the Ministry of Education and the provincial government of Guangdong encourage vocational education colleges and schools to establish first-class specialty clusters aligned with regional high-end industries and to connect their specialty planning to emerging strategic industries and industry clusters worth 100 billion or more yuan. Longgang No.2 Vocational School, located on Yuanshan Street in Longgang District, has naturally become a target school for establishing high-quality specialty clusters. In September 2021, the Longgang District Local Government officially launched a plan to construct high-level secondary vocational schools, which included Longgang No. 2 Vocational School. Since then, by concentrating on cutting-edge technologies and the critical needs of industrial chains, the school has garnered significant government support for the development of ICT specialty clusters.

Criteria and connotations

Connotations of Specialty Clusters

(i) Market-driven: As industrialization progresses, businesses are increasingly interested in recruiting multi-skilled workers, as those with a single specialty are unable to meet market demand.

(ii) Vocational education remains a vital component of education. The specialty cluster is not arbitrary; it is determined based on the requirements of each vocational position (Li, 2020).

(iii) Coordinative: A cluster's specialties have a coordinated relationship. While each specialty is self-contained, they function in concert with other specialties.

(iv) Systematic: A specialty cluster can be thought of as an organized system. It must not only produce qualified, skilled workers for the world outside the system, but also gather information from outside the cluster in order to optimize internal cluster elements such as relationships between specialties, curriculum, training conditions, and teaching team.

(v) Innovative: The transformation of traditional industries and the rapid growth of emerging industries have resulted in the creation of new types of jobs; digitaliza-

tion has increased the requirements for a variety of occupations. As a result, secondary vocational schools must constantly innovate and adapt their specialty clusters to changing industrial and environmental conditions. (Wu, 2019).

Criteria for Developing Specialty Clusters

(i) An outstanding teaching team. It is comprised of teaching research groups, top researchers in each specialty, and qualified part-time faculty.
(ii) A state-of-the-art practice and training facility. The base's facilities should be sufficiently advanced to accommodate the training and teaching of the specialties.
(iii) Constant curriculum updates. Curriculum development for specialty clusters requires enterprise involvement in order to reflect emerging technologies, techniques, and industry standards.
(iv) Admissions criteria are in place for qualified students.
(v) Post-graduation survey to determine students' employment status, employers' evaluations of students, and students' job satisfaction.
(vi) Extensive collaboration between schools and businesses. Collaboration between schools, businesses, and industries results in significant collaboration projects and patents (2019, Ren).

Strategies for the Development of Specialty Clusters

To Connect Specialty Cluster Construction with Socio-economic Development

Prior to developing specialty clusters, it is critical to ascertain the relationship between vocational education and regional industrial development. Shenzhen is currently accelerating the development of strategic emerging industries with the goal of establishing a world-class industrial base for next-generation information technology. Longgang District is expected to develop a trillion-yuan ICT industry. Industrialization on a massive scale generates enormous demand. According to the China Software Industry Association's Research on the Demand for Talents in China's ICT Industry, released on August 21, 2018, the industry requires an additional 7.65 million practitioners and the demand is still growing. Shenzhen's advantages in terms of land use, capital, and talent ensure the region's rapid development in the ICT industry. Vocational colleges and schools should seize this opportunity and invest heavily in the development of specialty clusters.

To Focus on the Needs of the Industrial Chain in Designing Specialty Clusters

The industrial chain is a term from industrial economics that refers to a chain relationship that forms spontaneously between various industrial segments as a result of certain technical and economic associations as well as spatial-temporal relationships. Compa-

nies in the industrial chain exist in response to market conditions of supply and demand, perform a variety of tasks, and have varying demands for skilled labor. Secondary vocational schools should determine the role of each specialty and the distinct skill requirements of different enterprises along the industrial chain when designing specialty clusters. They should also analyze the trainees' unique learning situations and recommend appropriate specialties and curricula based on their future employers' recruitment plans (Xu & Zhu, 2022).

Along with providing students with fundamental vocational knowledge, Longgang No.2 Vocational School frequently arranges for students to receive off-campus training at Shenzhen Toulang E-Commerce Co., Ltd. Through highly intensive practical training, students will gain a true sense of the corporate atmosphere within the industrial chain, an understanding of how e-commerce related tasks are performed, and a mastery of the various skills required in the e-commerce industry. Students gain an understanding of their potential job positions in the job market, the requirements for multi-skill application-oriented jobs, and the ability to make autonomous decisions about their future development as a result of their practical operation experience (Zheng, 2020).

To be Forward-Looking and Flexible in Developing Specialty Clusters

Apart from meeting the immediate needs of regional core industries, vocational schools should anticipate future specialty cluster development. This means that specialty clusters should focus on emerging industries that are still in their infancy but have the potential to last at least two decades, if not longer. After twenty to thirty years of development, an industry may experience a period of industrial recession or transformation. As a result, the planner must account for the possibility that specialty clusters will need to transform at some point in the future if the industry underlying the specialty clusters experiences a recession. When this occurs, teaching teams responsible for declining specialty clusters should be able to restructure their curricula. The cluster's combination of specialties should be adaptable to changes in demand as industrial development progresses. As long as it retains this adaptability, when an industry's recession renders a specialty cluster obsolete, the vocational school's intellectual resources can rapidly transform and generate a new specialty cluster (Zhou, 2001).

Experts from colleges and universities, as well as industry leaders, have aided in the specialization planning of Longgang No. 2 Vocational School, ensuring that it is aligned with the needs of modern enterprises in Shenzhen. At the school's inception, nine popular specialties were offered: computer network technology, exhibition service and management, animation and game production, e-commerce, accounting, financial services, community affairs administration, high-star hotel management, and optometry and eyeglasses. In 2020, internet of things application technology was added to the specialty range (Zheng, 2020). Longgang No. 2 Vocational School demonstrates foresight and adaptability in specialty settings, ensuring students' employment success.

To Develop High-level Human Resources and Recruit Teachers with Outstanding Professional Background

Secondary vocational schools should recruit teachers with extensive professional knowledge, innovative teaching strategies, and extensive scientific research experience to serve as leaders in developing specialty clusters. Moreover, to better serve regional economic development, vocational schools should recruit senior executives with extensive management experience and a strong sense of reform and innovation from influential leading enterprises in the information and communications technology industry; they can integrate their expertise in the high-end industry into the school's curriculum development and guide the future development of specialty clusters (Wu, 2019).

Shenzhen Toulang E-commerce Co., Ltd. serves as the Longgang No. 2 Vocational School's off-campus training base. It has sent a professional training team to the school to implement a pertinent training plan based on current e-commerce industry demand (Zheng, 2020).

To Upgrade Basic Training Equipment and Facilities for Specialty Clusters

To connect specialties with industry and supply the industry with skilled labor, vocational schools should have training devices that function similarly to the industry's actual production equipment. Due to the constant updating of technologies and equipment in national or local strategic industries, the school should invest sufficient funds in teaching equipment renewal to keep up with the rate of technological advancement. If current training is conducted using obsolete equipment, the school will be unable to produce qualified skilled workers for future industrial development.

Longgang No. 2 Vocational School's newly constructed training building contains 57 classrooms. Additionally, the hotel's training room was converted from the former canteen. Each specialty is assigned four to eleven training classrooms. Besides, the school has constructed an art design training room, a 3D printing training room, and a design display training room; virtual reality technology is being implemented in the specialty of community affairs administration. The comprehensive training facilities each have their own distinct characteristics and functions, laying the groundwork for the development of high-quality specialty clusters.

To Develop Unique Specialty Clusters Different from those of other Schools

Since the country began promoting the development of vocational colleges and schools in 2019, high-level schools and clusters of high-level specialization have sprouted up throughout the country. In Shenzhen City alone, there are two vocational colleges with four specialty clusters and eight secondary vocational schools with 12 specialty clusters; the numbers continue to grow. To avoid oversupply and waste of educational resources in a particular specialty cluster, vocational schools should first investigate established specialty clusters at other schools before embarking on developing their own differenti-

ated ones. The differentiation may be reflected in the various industries they serve or in the various links in the industrial chain through which they operate.

Problems with the Current Coordination between Specialty Clusters and Industry Clusters

Almost all vocational colleges and schools have some form of school-business partnership. While some schools have achieved the desired results, the majority have failed to establish a long-term mechanism for close collaboration with businesses. The primary reason for this is the latter's reluctance to participate fully in the partnership. In a market-oriented economy, enterprises are profit-driven entities; the majority of them view involvement in vocational education as a source of direct or indirect financial loss. (i) School-enterprise collaboration increases their operational costs, as they must cover all living expenses for students trained in their companies, and students are typically inefficient workers who waste raw materials when operational errors occur. (ii) School-enterprise collaboration introduces significant risks. In the event of an accident caused by a student's error, the enterprise is liable for the resulting costs, including medical expenses and compensation, and its goodwill may be harmed. Additionally, without policy incentives, businesses are disincentivized from directly engaging in vocational education. They have not integrated school-business collaboration into their value chain. As a result, the current model of school-business collaboration has not yet been fully integrated into the development of businesses. Promoting school-business collaboration is primarily a temporary and ad hoc endeavor on the part of schools and departments of education. There is no coordinated bilateral action plan in place (Zhang, 2012). To accomplish the goal of deep school-enterprise collaboration, we propose that joint-stock partnerships be encouraged to align both parties' interests. A board of directors shall be established in proportion to the assets invested by schools and enterprises in order to manage and operate the schools cooperatively. Local educational authorities must develop regulations governing school-business collaboration, defining the parties' rights and obligations and prescribing evaluation and incentive mechanisms (Hong, 2010).

Conclusions

Among the ten specialties offered by Longgang No.2 Vocational School, finance and trade can be classified as e-commerce, accounting, and financial services. The three-specialty cluster has already been recognized by Shenzhen educational authorities as a high-level specialty cluster. Its target industry is Shenzhen's modern service sector. Moreover, the school intends to establish an electronic-information cluster based on the two established specialties of computer network technology and internet of things application technology for the following reasons: (i) At present, ICT is a growing industry that encompasses the hardware, software, and equipment associated with IT and telecommunications. It has a long industrial chain, involves numerous enterprises and job clusters, and can generate a large number of technical positions suitable for secondary

vocational students. (ii) The Longgang District is the center of the ICT industry, providing a unique opportunity to engage enterprises in the development of specialty clusters. And (iii) the school's existing equipment and teaching resources provide adequate support for the development of a cluster of this type.

It is necessary to emphasize the importance of closely coordinating the development of secondary vocational school specialty clusters with the development of industry clusters. Secondary vocational schools can truly achieve high-quality education and contribute to regional economic and social development by establishing high-level specialty clusters with strong industrial support and following the industrial chain's development trend.

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