



The Future of Higher Vocational Education Ecosystem in Shanxi Province, China

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ABSTRACT

The aim of this study is to investigate the prospects of Shanxi's higher vocational education ecosystem. We conducted a collaborative study with 17 experts from Shanxi, China, using the Delphi technique to analyse the future development trends of higher vocational education in education administration. All experts were given a survey questionnaire consisting of 51 items. These projects are situated within the key dimensions of the Shanxi higher vocational education ecosystem. The seven dimensions are further categorised into the internal and external environments. The internal environment of an educational institution consists of students, teachers, management personnel, and other technical staff. The external environment encompasses various aspects, including politics, society, and the economy. The recommendations provided by these experts will have an impact on the policy-making process for the future development of higher vocational education in Shanxi Province.

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1. Introduction

Due to the rapid advancement of Industrial Revolution 4.0, China is actively working to increase its economic competitiveness on a global scale. A key objective in this pursuit is the establishment of a robust digital economy. In the context of the fast-paced digital economy, various regions around the world have experienced different levels of productivity development. As a result, the regional economic structure, labour market demand, and vocational education development in each industry have been tailored to local conditions. This, in turn, has brought about significant changes in the industrial design and talent structure of each field. The changes in industrial design and talent structure will have a direct impact on the progress of higher vocational education.

Higher vocational education is a form of education within the higher education system that combines the attributes of higher education and vocational education. It focuses on meeting societal needs, emphasising the practicality and skill development of various occupations. The goal is to train highly skilled professionals who are essential for frontline roles in production, construction, service, and management, based on the specific requirements of relevant occupational positions. Higher vocational education also plays a significant role in shaping the future of society's industrial and talent structures. Thus, it is imperative for higher vocational education to align with the current development trajectory and undergo corresponding adjustments and advancements.

Problem statement (Flek & Ugnich, 2021).

Shanxi Province, being the pioneer in national resource-based economic transformation and a comprehensive supporting reform pilot area, is currently undergoing industrial transformation and upgrading. However, there is an imbalance in its higher vocational education ecosystem. The existing vocational education ecosystem in Shanxi Province falls short in meeting economic development needs and keeping up with industrial transformation and upgrading. The current situation requires immediate improvement.

Research Objective (Zheng, Sun, & Guo, 2022).

This project aims to examine the future higher vocational education ecosystem in Shanxi Province, China.

Research question.

What is the future of the higher vocational education ecosystem in Shanxi Province, China?

2. Literature Review

2.1 Educational Ecosystem

Educational ecology emerged during the 1960s and 1970s, as depicted in Figure 1. Its primary focus was on examining the interplay between education and the surrounding ecological environment. The objective was to uncover the trajectory of educational development and enable individuals to comprehend the patterns governing educational progress. In 1977, Eggleston, a British scholar, published "School Ecology," which marked a significant milestone in the field of academic ecology. Over the following decades, the research scope of academic ecology expanded even further in the 1980s and 1990s (Wang & Zhang, 2019). In his work "Public Education," Lawrence Cremin introduced the notion

of an educational ecosystem. Education plays a crucial role in society, encompassing various processes such as material, energy, and information exchange.

It follows distinct development and evolution patterns. The educational ecosystem is an intricate system, encompassing education, schools, the external environment, and other factors that interact and influence one another, fostering the equilibrium and growth of the educational ecosystem (Toutain, Mueller, & Bornard, 2019). Academic research on ecology in mainland China emerged during the 1980s, and the first publication on the subject was released in 1990 by scholars Wu and Zhu. Researchers in the field of Fan Educational Ecology analyse how the educational setting influences the development of individuals, schools, and academics from different academic viewpoints, such as population, culture, resources, environment, school, and classroom.

Currently, the focus of higher vocational education in China revolves around the interplay between different ecosystem environments and education, as well as their impact on education. This includes considering the future development trajectory of higher vocational education. According to scholar Wu's theory, the ecosystem can be divided into three levels: The first level represents the system that encompasses both natural and social factors, with education being a key component in the external environment and students being the focal point. The second level illustrates the educational ecosystem, which is primarily centred around a specific school or educational level. The third level encompasses the educational ecosystem, with education itself as the central focus, in conjunction with the external natural environment, social environment, and normative environment. As a result, numerous scholars have initiated research in this area. Liu and Wu, in their scholarly work, categorised the factors that impact the higher vocational ecosystem into two distinct environments: internal and external. This theory serves as the foundation for the research conducted in this paper (Flek & Ugnich, 2020).

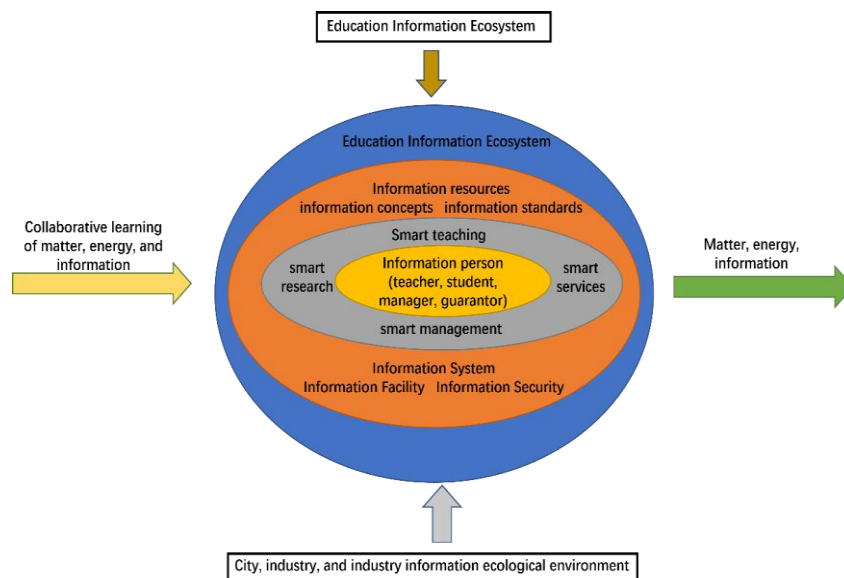


Figure 1: Education Ecosystem.

2.2 Vocational Education

Vocational education aims to train skilled individuals who can make valuable contributions to society's development. It is a form of employment-oriented education that focuses on producing high-quality human resources. The expansion of technology and the increasing variety of industries in society have led to the enhancement and enrichment of vocational education. Key drivers of vocational education growth include addressing employment challenges, fostering social stability, and facilitating economic development. As industries evolve, some individuals choose to re-enter the labour market after pursuing further education. On the other hand, another segment of the population is consistently enhancing their technical abilities in the job market. Talents will enter the labour market due to the interplay of evolving socio-economic conditions, the education and training system, and individual growth requirements. Skills will be reintegrated into vocational education through industrial renewal and iteration. The development of vocational education is being steadily promoted, leading to a more balanced state of socio-economic, vocational, and personal needs (Dubrova et al., 2021; El Haji & Azmani, 2020; Glushchenko, 2022).

In China, vocational education is categorised into primary, secondary, and higher vocational education.

2.3 Higher Vocational Education

Higher vocational education in China is categorised as 5B (technical education) according to the International Standard Classification of Education (ISCED 1997). Figure 2 illustrates how courses in this category are designed to equip students with the practical skills and knowledge needed for specific occupations or groups of professions. Upon completion, fully qualified individuals obtain the necessary qualifications to enter the labour market. This programme emphasises practical work over general higher education, highlighting the occupation's specialisation and not directly leading to further education courses (Higher Vocational Education - Encyclopaedia of China, 3rd edition, online, nd) (Wang, 2017).

China's status as the pioneer of higher vocational education is evident from its early legislation on the matter. Higher vocational education typically spans a duration of two to three years and primarily caters to individuals who have completed their studies at regular high schools and secondary vocational colleges (China Vocational Education, china.org.cn) (Fedorov et al., 2018).

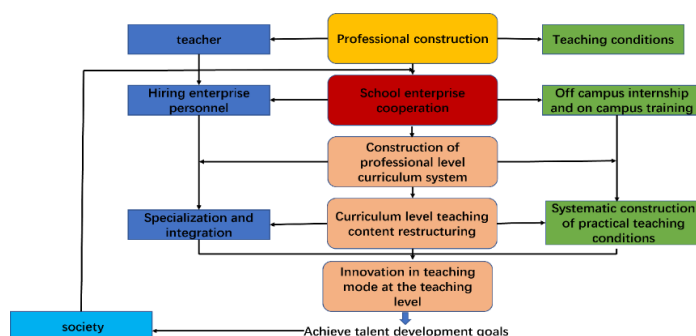


Figure 2: Higher Vocational Education.

3. Methodology

After conducting a thorough review of the literature, the research objectives and topics were identified to guide the development of the questionnaires. Prior to implementation, it is necessary to conduct a pre-test of the questionnaire, ensuring that experts are involved in evaluating the quality of the interview questions. The consent of these experts will be sought. The researcher rearranges the instrument and plans its implementation.

One crucial aspect of the procedure is the careful selection of experts and the establishment of clear criteria for their evaluation. The study participants were carefully selected experts, with a total of 17 individuals divided into two groups. The first part consists of ten experts who have extensive experience in higher vocational education management. These experts have all worked in higher vocational institutions or education departments for more than ten years and hold the title of associate professor or higher. The second part consists of seven experts from various enterprises, each possessing over five years of experience in school-enterprise cooperation. The experts involved in this project have extensive experience in shaping policies for higher vocational education in Shanxi Province, publishing academic works on higher vocational education management, or serving as seasoned business managers who have collaborated with higher vocational institutions for many years. The recommendations provided by these experts will have some influence on the development of future policies regarding higher vocational education in Shanxi Province.

The Delphi technique will be conducted in three rounds, As shown in Figure 3 (Bowles, 1999; Goodman, 1987; Thangaratnam & Redman, 2005; Vernon, 2009).

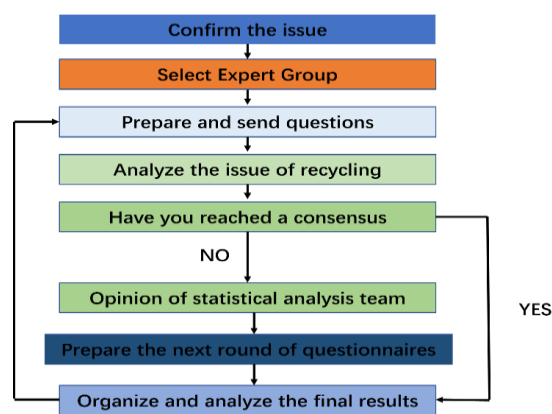


Figure 3: Delphi METHOD.

For the initial round, the researcher provided the experts with the research-need information, background information, and the first-round instrument, along with the required reference materials. The experts were then instructed to answer the questions based on their own experience, opinions, and relevant research from previous stages. The questionnaire for the first round is structured around seven dimensions of a conceptual framework. The questionnaire includes a set of statements grouped by size. An assessment was conducted using a 5-point Likert scale. The expert panellists were requested to rate

their attitudes towards each message (Williams & Webb, 1994). Greater scores indicate a higher level of agreement with the statements. The researcher sent a hyperlink to the questionnaire to the experts, who proceeded to complete the questionnaire electronically and submit it upon finishing their responses. The researcher gathered the questionnaires from specialists upon completion of the process, consolidated and examined the responses, and documented the outcomes, encompassing measures such as maximising, minimising, mean, and IQD. Following the completion of the initial round, the researcher collated and classified the viewpoints of the experts in order to formulate and design a subsequent questionnaire for the second round (Hanafin, 2004; Powell, 2003).

The second round includes the statistical results of the instrument used in the first round, as well as copies of the instrument provided by each expert for reference. The experts were provided with an explanation of the data, including measures such as the mean and interquartile deviation. They were then asked for their comments on whether any adjustments to their thinking were necessary. If the expert's view falls outside the interquartile deviation and does not alter the statement, a distinct explanation is necessary (Hsu & Sandford, 2019; Mitchell, 1991). The panellists introduced additional remarks that were given during Round 2 and subsequently evaluated by the experts in the same round. The researcher retrieved the questionnaire at the conclusion of the round, consolidated and examined the experts' responses, and subsequently documented the findings, mirroring the process of the initial round (Macmillan, 1971).

The third round follows the same approach as the second round. The instrument utilised in Round 3 was derived from the statistical findings, expert input, and additional data obtained after Round 2. Round 3 featured additional comments from expert panellists. Additionally, it was necessary to assign them a ranking. At the conclusion of the process, the data from the third cycle is gathered and systematically arranged. There were no remarks eliminated during the process (Gupta & Clarke, 1996; Rowe & Wright, 1999; Sumsion, 1998; Yousuf, 2019).

If the interquartile deviation is less than 1, it signifies the achievement of a consensus, leading to the drawing of conclusions.

4. Findings

(I) First Delphi Expert Questionnaire

The initial survey, on a 5-point Likert scale, enabled the experts to indicate the level of relevance they attributed to each indicator. A higher score corresponded to a higher level of importance. Due to time constraints, the questionnaire willingness structure was distributed along with the initial questionnaire in this study, and it was subsequently responded to by 17 experts. The hyperlink to the questionnaire was encoded as a QR code in WeChat on July 26, 2023. By August 3, 2023, a total of 17 questionnaires were gathered, all of which were valid, resulting in a recovery rate of 100%.

The initial questionnaire was bifurcated into two sections: the first segment focused on the confidential information of the experts, while the second segment centred on the importance and evaluation of aspects of the larger vocational training ecosystem in Shanxi Province. The effects of the examination of the initial questionnaire involve multiple components: Firstly, the diploma's rating of symptom significance is determined by

arranging them in descending order based on the average. This procedure evaluates the significance of the diagnosed warning signals according to specialists; second, the professionals expressed doubts about the adequacy of the indicator setup in completing the questionnaire. Based on their opinions, the indicators were modified in the current study (Wang & Zhang, 2019); third, some indicators were added and deleted; and fourth, the professionals raised various objections to the questionnaire.

In the initial stage of the survey, the basic demographics of the experts were analysed. As seen by Figure 4 and Figure 5, there are a total of seventeen experts, with seven being male and ten being female. This corresponds to a proportion of 28% and 72% respectively. The statistical analysis revealed that the work firms of the specialists frequently used phrases such as Shanxi, vocational, higher vocational, and technical. All professionals have more than five years of work experience. Among them, two have 5–10 years of experience, accounting for 8%. Six professionals have 10–15 years of experience, accounting for 24%. Nine professionals have 15–20 years of experience, accounting for 36%. Two professionals have 20–25 years of experience, accounting for 8%. And six professionals have more than 25 years of experience, accounting for 24%. This data suggests that most professionals have working experience concentrated in the range of 15–20 years. They have been actively involved in the pursuit of superior vocational training for a considerable duration and possess extensive expertise.

Out of the 25 individuals, 22 of them, making up 88% of the total, have the technical position of associate professor. Meanwhile, two individuals, accounting for 8%, are professors, satisfying the criterion that professionals have the technical designation of associate professor. Within the experts' positions, there are two individuals in the part and vice section, comprising 8% of the total; six individuals in the area, comprising 24%; five individuals in the vice department, comprising 20%; one individual in the vice department, comprising 4%; and nine individuals in other positions, comprising 36%. The professional training mostly emphasises the attainment of a master's degree, with 19 individuals representing 76% of the total. Additionally, there are five individuals with a bachelor's degree, accounting for 20%, and one individual with a doctoral degree, representing 4%. All the experts provide instruction in higher vocational education (Qing et al., 2023a, 2023b).

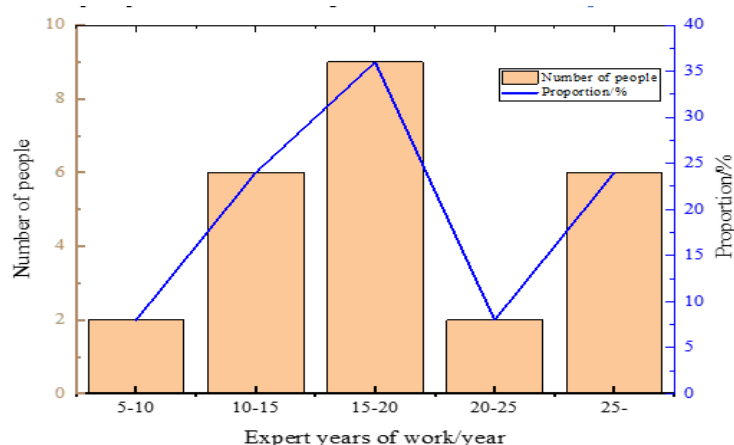


Figure 4: Expert Years of Work.

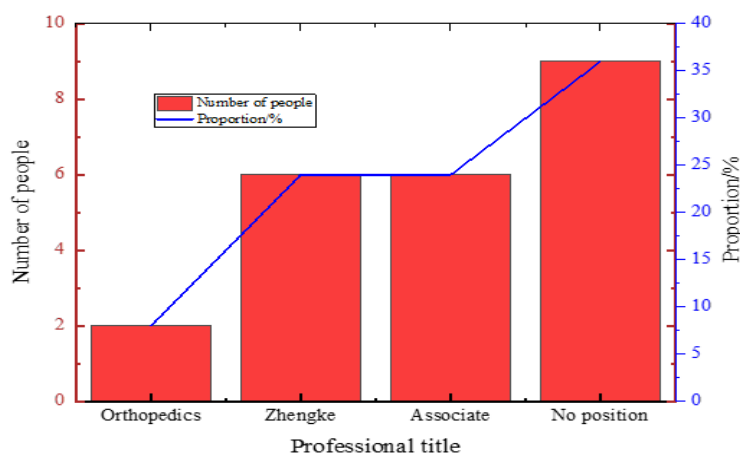


Figure 5: Expert Titles.

The second section of the questionnaire pertains to the consultation of the ecological indicator system of higher vocational education in Shanxi Province. This system comprises two primary indicators, seven secondary indicators, and 51 tertiary indicators. The first-level indicators pertain to the internal and external contexts of the higher vocational education ecosystem. The second-level hands consist of four components in the internal environment: the student dimension, the teacher dimension, the education administrator dimension, and the other technician dimension.

Additionally, the external environment comprises three dimensions: the political dimension, the social dimension, and the economic dimension. The tertiary indicators are structured based on each of the seven secondary hands. Specialists were tasked with assigning the appropriate amount of relevance to each indication, and the questionnaire was evaluated using a 5-point Likert scale. In this scale, a rating of 5 corresponds to "essential," 4 corresponds to "necessary," 3 corresponds to "average," 2 corresponds to "unimportant," and 1 corresponds to "very insignificant."

Regarding the examination of the level 1 indicators' results (see Table 4), 22 individuals deemed the internal environment of the higher vocational education ecosystem highly significant, while three individuals deemed it necessary. Sixteen individuals regarded the external environment of the higher vocational education ecosystem as highly significant, while eight individuals deemed it indispensable, and one individual perceived it as average. Experts haven't made any suggestions for changes to the key indicators of the higher vocational education ecosystem.

Table 1

Analysis of the Results of The First-Level Indicators

Project	The internal environment of the vocational education ecosystem is critical	The external environment of the vocational education ecosystem is critical	important	commonly
Number of people	22	16	8	1

The second-level indications are categorised into two sequences: sequence A and sequence B. Serial numbers A1–A4 represent sub-indicators of the internal environment inside the first-level hands, whereas serial numbers B1–B3 represent sub-indicators of the exterior environment within the first-level hands. As indicated in Table 2, A1 represents the students' aspect within the internal environment, with 19 individuals considering it crucial and 6 individuals considering it significant. A2 represents the teachers' aspect within the internal environment, with 23 individuals considering it to be crucial and two individuals considering it to be significant. A3 signifies the educational administrator aspect of the interior environment, with 19 individuals finding it quite significant and six individuals deeming it indispensable.

A4 corresponds to the additional technological practitioner aspect within the internal environment. Out of the respondents, nine regarded it as quite significant, 14 deemed it important, and two perceived it as average. Based on the analysis of the secondary indicators A1–A4 within the internal environment, experts conclude that teachers have the greatest impact on the internal environment of higher vocational education. Teachers, students, and educational administrators are equally important, while other technical practitioners are considered the second most important. B1 represents the political aspect of the external environment. Out of the total respondents, 16 individuals find this indicator to be significant, 6 individuals find it necessary, 2 individuals find it average, and 1 individual finds it unimportant.

B2 represents the societal aspect of the external environment, with 17 individuals deeming this measure highly significant and eight individuals regarding it as crucial. B3 symbolises the economic aspect of the external environment. Out of the 12 individuals surveyed, 12 people deemed the economy to be highly significant, 11 people regarded it as important, and 2 people considered it to be of ordinary importance. Experts have determined that the social dimension is the primary factor influencing the external environment of higher vocational education, based on the analysis of the second-level indicators B1-B3. The economic dimension is considered the second most influential, while the political dimension is ranked last. No experts have suggested any modifications regarding the secondary indicators of the higher vocational education ecosystem.

Table 2

Analysis of the Results of The Second Level Indicators

Project	Sequence A				Sequence B		
	A1	A2	A3	A4	B1	B2	B3
very important	19	23	19	0	16	17	12
important	6	2	6	14	6	8	11
commonly	0	0	0	2	2	0	2
Not important	0	0	0	0	1	0	0

The tertiary indicators further enhance the measurement of each of the seven distinct dimensions of the secondary indicators, including A1-A4, B1-B3, and so on. As an illustration, the A1 student dimension is more precisely categorised into nine tertiary characteristics.

Experts have determined that the students' learning attitude is the most crucial component affecting the ecology of higher vocational education in the student dimension. It has been assigned a mean score of 4.88. The students' fundamental competence and capacity for invention are ranked equally in second place, with an average score of 4.56. Following closely behind are the students' self-perception and prospects for employment, both with an average score of 4.48, which are tied

for third place. Within the realm of education, a group of 24 specialists held the belief that the moral character of teachers held great significance, as indicated by an average score of 4.96. A total of 23 experts assigned a high level of importance to teachers' initiative and motivation in education and teaching, with an average score of 4.92.

Subsequently, experts assigned a mean score of 4.84 to the significance of teachers' professional teaching skills, ranking it in third place. The professional practice skills of instructors and their education and teaching conceptions were both considered equally significant, with an average score of 4.8. However, experts typically feel that teachers' research competency is considered the least important aspect in the context of higher vocational education, with an average score of 4.32. The mean ratings for the manager dimension exhibit greater balance. Experts consider managers' management philosophy and decision-making authority to be highly significant, with an average rating of 4.88. The characteristic that ranks second in terms of importance is managers' comprehension and discernment, with an average rating of 4.8.

Following that, the third most significant dimension is managers' self-quality and communication prowess, with an average rating of 4.76. The subsequent factor pertains to the interpersonal abilities and originality of managers, achieving an average rating of 4.72. The most crucial aspect, according to experts, is the originality and creativity of managers' education and management methods. The management model's innovativeness ranks last among the dimensions, with an average score of 4.68. The primary determinant for other technicians remains teacher ethics, scoring an average of 4.88. Furthermore, the experts regard the initiative and motivation of other specialists as highly significant, ranking it second with an average score of 4.76. The educational and instructional proficiency of other technicians ranked third, with an average score of 4.48. Three questions, namely professional competence of other technicians, self-quality, and information literacy, have continuous mean values of 4.44. The inventive prowess of other technicians ranks last, with an average score of 4.4.

Experts regard government support for higher vocational education as the most crucial aspect of the political dimension of the external dimensions, with an average rating of 4.88. The second position boasts an impeccable institutional guaranteed system, achieving an impressive average score of 4.84. The formation of policies, laws, and regulations ranks third with an average score of 4.64. The social factor receives a low total score. The primary factor is the collaboration between higher vocational institutions and firms, as well as the fusion of industry and education, achieving an average rating of 4.72. The community consistently rewards firms for their strong integration of industry-specific knowledge and collaboration with educational institutions, resulting in an average score of 4.56.

The experts have widely acknowledged the significance of school-enterprise cooperation and the merger of industry and education. Ranking equally in third place are the involvement of industries and firms in creating teaching materials for higher vocational education and the incorporation of enterprises engaged in higher vocational education in the CSR report, both receiving an average score of 4.52. Following that, ranking fourth, is the involvement of other societal entities in higher vocational education, achieving an average rating of 4.48. The socio-demographic conditions and social stratification (class) rank in the final two positions, with average scores of 4.32 and 4.24, respectively. Experts highlighted the significant role of industry and business in shaping higher vocational education, focusing on the social aspect.

The average ratings of the influencing elements in the economic component are more evenly distributed. The structure of industry is considered by experts to have the most significant impact on the ecology of higher vocational education, with an average rating of 4.6. The subsequent topic pertains to the employment and unemployment status of the labour force, which has been assigned an average score of 4.52. The economic development model and the labour market model followed, achieving average scores of 4.48 and 4.44, respectively. The economic development level is ranked second to last, with an average score of 4.36. Two factors shared the lowest rank, each having an identical average score of 4.32: Economic expansion and organisational composition.

Following the expert evaluation of each factor, an assessment of relevance was conducted for each item contained in the seven dimensions A1–A4 and B1–B3. Furthermore, the experts included other aspects that could potentially impact the ecological dynamics of higher vocational education in each dimension. Behavioural The analysis of internal dimensions revealed that, in addition to the student dimension, nine experts identified other factors such as socialist guiding ideology, achievement motivation, family support, students' mentality, mental health, family factors, students' parents' educational background and educational perceptions, social perceptions and recognition of vocational education, students' self-efficacy, students' behavioural characteristics of learning, the employment environment, and social recognition. Out of the group, four specialists highlighted the impact of "family" and "parents" on kids.

In the dimension of teachers, nine experts also contributed additional factors such as teachers' proficiency in information technology, professional identity, ability to innovate, economic earnings, social recognition, social status, alignment with company positions, family factors, educational background, career planning, welfare benefits, and mentoring ability in school-enterprise cooperation. Six experts acknowledged the impact of "family" and "parents" on students. Six experts have identified additional factors that can influence the manager dimension. These factors include managers with questionable ethics, an autocratic management style, favouritism, family connections, the manager's educational background, specialised knowledge in the field, the manager's ability to coordinate, their capacity for learning, and their service-oriented mindset.

On the other technician dimensions, just one specialist provided supplementary remarks, namely on familial variables. Additionally, experts assessed the significance of students, teachers, administrators, and other technicians. Thirteen experts assigned the highest importance to the student dimension, eight experts assigned the highest importance to the administrator dimension, three experts assigned the highest importance to the teacher dimension, and one expert assigned the highest importance to the other technicians. On the other hand, 21 experts considered the other technicians to be the least important. Examining the internal aspects, 5 specialists contributed to the overall internal structure, encompassing aspects such as school ethos, work ethos, regulations, high school entrance exam admission system, system, cultural development, and student service idea.

From an external perspective, the political dimension was examined by 5 experts who identified additional factors such as the societal acknowledgment of vocational education, the criteria for selecting administrators, the government's perception, and evaluation system of vocational education, as well as the assessment and evaluation system. Regarding the social aspect, three experts introduced additional elements, such as the extensive incorporation of social requirements into schools, the public's perception of vocational education, and the involvement of businesses in vocational education. Regarding the economic aspect, just one expert contributed by including the income of local citizens, the quantity and scale of businesses, and the direction of

economic policies. Three specialists incorporated several aspects into the overall analysis, encompassing shifts in educational paradigms, the ecological context, and global influences.

Five of 25 specialists surveyed said the internal environment was more important than the external environment. However, 4 experts said the external environment was more important. When asked to evaluate internal and external environments, the remaining 16 experts thought they were equally important.

Experts rated the quiz as a total based on practical experience, theoretical knowledge and analysis, peer understanding, and intuitive assessment, with the lowest score using intuition.

No experts were "very unfamiliar" and "unfamiliar" with the questionnaire's content, while 18 were "very familiar" and "familiar". As many as 18 specialists were "very familiar" and "familiar".

(ii) *Second Delphi Expert Questionnaire*

The second Delphi questionnaire has two components. List the first questionnaire indicators in Table 3's mean order and give experts "important," "common," and "unimportant" to pick from; Experts must come up with further ideas in the third portion after the second questionnaire introduces their indicators. The second portion includes the experts' additional indicators from the first questionnaire (Feng & Hao, 2019; Han et al., 2021; Sun et al., 2022).

Table 3

Ranking of the First Expert Questionnaire

Number	Question/Options	Average score
1	A21 Teacher's Professional Ethics and Style	4.96
2	A27 Teacher's initiative and enthusiasm in education and teaching	4.92
3	A14 Students' Learning Attitudes	4.88
4	A32 Manager's Management Philosophy	4.88
5	A34 Manager's Decision-Making Power	4.88
6	A41 Professional Ethics and Conduct of Other Technicians	4.88
7	B13 Government funding for higher vocational education	4.88
8	A22 Teacher's Professional Teaching Ability	4.84
9	B12 A sound institutional guarantee system	4.84
10	A23 Teacher's Professional Practice Ability	4.8
11	A26 Teacher's Teaching Philosophy	4.8
12	A36 Manager's Understanding and Judgment	4.8
13	A28 Teachers' Self enhancement Awareness	4.76
14	A31 Self qualities of managers	4.76
15	A35 Manager's communication skills	4.76
16	A45 Proactive and proactive work of other technical personnel	4.76
17	A37 Manager's Interpersonal Management and Processing Skills	4.72
18	A38 Manager's Innovation Ability	4.72
19	B24 Cooperation between Vocational Colleges and Enterprises, Integration of Industry and Education	4.72
20	The Innovation of A33 Manager Education Management Model	4.68

21	B11 Establishment of Policies, Laws, and Regulations	4.64
22	Innovation ability of A29 teachers	4.6
23	B34 Industrial Structure	4.6
24	Basic qualities of A12 students	4.56
25	Innovation ability of A16 students	4.56
26	B27 society rewards enterprises with deep integration of industry and education, as well as school enterprise cooperation	4.56
27	B25 industry and enterprise participation in the compilation of higher vocational education textbooks	4.52
28	B26 Incorporate the implementation of higher vocational education by enterprises into corporate social responsibility reports	4.52
29	B37 Employment and Unemployment of Labor Force	4.52
30	A11 Students' self-awareness	4.48
31	A17 Students' Employment Outlook	4.48
32	Teaching experience of A25 teachers	4.48
33	A44 Education and teaching abilities of other technical personnel	4.48
34	Participation of other forces in higher vocational education in B23 society	4.48
35	B33 Economic Development Model	4.48
36	A13 Students' Professional Knowledge	4.44
37	A42 Professional competence of other technical personnel	4.44
38	A43 Self qualities of other technical personnel	4.44
39	A46 Information literacy of other technical personnel	4.44
40	B36 Labor Market Model	4.44
41	A15 Students' interests and hobbies	4.4
42	A18 Internship Rights for Students	4.4
43	A19 Students' Right to Further Education	4.4
44	A47 Innovation capabilities of other technical personnel	4.4
45	Number, proportion, and quality of A20 "dual teacher" teachers	4.36
46	B32 Economic Development Level	4.36
47	A24 Teacher's Research Ability	4.32
48	B21 Social Population Status	4.32
49	B31 GDP growth situation	4.32
50	B35 Enterprise Structure	4.32
51	B22 Social Stratification/Strata	4.24

A 100% response rate was achieved from August 10th to 17th, when 17 valid surveys were distributed and collected.

Analyse the questionnaire and award 2 to "important," 1 to "common," and 0 to "unimportant." The overall indicator average is the average; the indicator's overall standard deviation; and Important%, Common%, and Unimportant% are the overall percentage of experts who answered questions (see [Table 4](#))

Table 4*Result of the Second Delphi Expert Consultation 1*

Number	Question/Options	Average	Standard Deviation	Important%	Common%	Not Important%
1	A21 Teacher's Professional Ethics and Style	2	0.55	0.83	0.17	0
2	A27 Teacher's initiative and enthusiasm in education and teaching	1.75	0.36	0.45	0.55	0
3	A14 Students' Learning Attitudes	1.88	0.54	0.47	0.53	0
4	A32 Manager's Management Philosophy	1.64	0.62	0.54	0.46	0
5	A34 Manager's Decision-Making Power	1.91	0.65	0.44	0.56	0
6	A41 Professional Ethics and Conduct of Other Technicians	1.85	0.52	0.45	0.55	0
7	B13 Government funding for higher vocational education	1.77	0.37	0.54	0.46	0
8	A22 Teacher's Professional Teaching Ability	1.52	0.42	0.91	0.09	0
9	B12 A sound institutional guarantee system	1.34	0.45	0.75	0.25	0
10	A23 Teacher's Professional Practice Ability	1.76	0.46	0.91	0.09	0
11	A26 Teacher's Teaching Philosophy	1.77	0.51	0.89	0.11	0
12	A36 Manager's Understanding and Judgment	1.68	0.37	0.45	0.55	0
13	A28 Teachers' Self enhancement Awareness	1.91	0.61	0.88	0.12	0
14	A31 Self qualities of managers	1.78	0.62	0.44	0.48	0.08
15	A35 Manager's communication skills	1.53	0.44	0.34	0.66	0
16	A45 Proactive and proactive work of other technical personnel	1.67	0.42	0.35	0.57	0.08
17	A37 Manager's Interpersonal Management and Processing Skills	1.65	0.37	0.34	0.42	0.24
18	A38 Manager's Innovation Ability	1.55	0.41	0.56	0.44	0
19	B24 Cooperation between Vocational Colleges and Enterprises, Integration of Industry and Education	1.37	0.42	0.76	0.16	0.08
20	The Innovation of A33 Manager Education Management Model	1.67	0.37	0.54	0.46	0
21	B11 Establishment of Policies, Laws, and Regulations	1.68	0.62	0.34	0.66	0
22	Innovation ability of A29 teachers	1.71	0.58	0.88	0.12	0
23	B34 Industrial Structure	1.76	0.56	0.54	0.38	0.08
24	Basic qualities of A12 students	1.87	0.54	0.88	0.12	0
25	Innovation ability of A16 students	1.78	0.52	0.88	0.12	0
26	B27 society rewards enterprises with deep integration of industry and education, as well as school enterprise cooperation	1.65	0.46	0.54	0.46	0
27	B25 industry and enterprise participation in the compilation of higher vocational education textbooks	1.44	0.48	0.87	0.13	0

28	B26 Incorporate the implementation of higher vocational education by enterprises into corporate social responsibility reports	1.93	0.37	0.64	0.36	0
29	B37 Employment and Unemployment of Labor Force	1.92	0.36	0.54	0.38	0.08
30	A11 Students' self-awareness	1.56	0.42	0.88	0.12	0
31	A17 Students' Employment Outlook	1.54	0.39	0.76	0.16	0.08
32	Teaching experience of A25 teachers	1.77	0.47	0.94	0.06	0
33	A44 Education and teaching abilities of other technical personnel	1.87	0.41	0.65	0.35	0
34	Participation of other forces in higher vocational education in B23 society	1.76	0.58	0.65	0.11	0.24
35	B33 Economic Development Model	1.56	0.35	0.52	0.16	0.32
36	A13 Students' Professional Knowledge	1.64	0.61	0.88	0.12	0
37	A42 Professional competence of other technical personnel	1.54	0.54	0.34	0.56	0.08
38	A43 Self qualities of other technical personnel	1.76	0.52	0.34	0.56	0.08
39	A46 Information literacy of other technical personnel	1.87	0.37	0.34	0.56	0.08
40	B36 Labor Market Model	1.52	0.42	0.21	0.71	0.08
41	A15 Students' interests and hobbies	1.44	0.44	0.55	0.37	0.08
42	A18 Internship Rights for Students	1.34	0.39	0.76	0.16	0.08
43	A19 Students' Right to Further Education	1.23	0.52	0.78	0.14	0.08
44	A47 Innovation capabilities of other technical personnel	1	0.55	0.41	0.19	0.4
45	Number, proportion, and quality of A20 "dual teacher" teachers	1	0.47	0.68	0.08	0.24
46	B32 Economic Development Level	0.89	0.37	0.78	0.14	0.08
47	A24 Teacher's Research Ability	0.98	0.41	0.87	0.05	0.08
48	B21 Social Population Status	0.88	0.43	0.44	0.32	0.24
49	B31 GDP growth situation	0.76	0.47	0.42	0.5	0.08
50	B35 Enterprise Structure	0.76	0.52	0.46	0.14	0.4
51	B22 Social Stratification/Strata	0.87	0.41	0.36	0.56	0.08

Out of 17 specialists that answered this questionnaire, 7 thought "innovation ability of other technical personnel" and "enterprise structure" were unimportant. Six analysts think the "economic development model" indicator is unimportant; Four unimportant characteristics are "interpersonal management and processing ability of managers", "participation of other forces in higher vocational education in society", "number, proportion and quality of" dual teacher "teachers", and "social population status" according to five experts (see [Table 5](#)).

Table 5

Result of the Second Delphi Expert Consultation 2

	Not important%	Number of experts selected	Question/Options
1	0.24	5	A37 Manager's Interpersonal Management and Processing Skills
2	0.24	5	Participation of other forces in higher vocational education in B23 society
3	0.32	6	B33 Economic Development Model
4	0.4	7	A47 Innovation capabilities of other technical personnel
5	0.24	5	Number, proportion, and quality of A20 "dual teacher" teachers
6	0.24	5	B21 Social Population Status
7	0.4	6	B35 Enterprise Structure

Of the 17 experts that responded, 6 indicators had an average importance ratio of less than 1 point (see [Table 6](#)).

Table 6

Result of the Second Delphi Expert Consultation 3

	Average	Question/Options
1	0.89	B32 Economic Development Level
2	0.98	A24 Teacher's Research Ability
3	0.88	B21 Social Population Status
4	0.76	B31 GDP growth situation
5	0.76	B35 Enterprise Structure
6	0.87	B22 Social Stratification/Strata

This analysis of the second round of expert consultation shows that "interpersonal management and processing ability of managers", "participation of other forces in higher vocational education in society", "number, proportion and quality of" dual teacher "teachers", and "social population status" are relatively low. Experts recommend 56 items for the revised final indicators (see [Table 7](#)).

Table 7

Final Indicators

Number	Question/Options
1	A11 Students' self-awareness
2	Basic qualities of A12 students
3	A13 Students' Professional Knowledge
4	A14 Students' Learning Attitudes
5	A15 Students' interests and hobbies
6	Innovation ability of A16 students
7	A17 Students' Employment Outlook
8	A18 Internship Rights for Students
9	The cognition of parents of A48 students
10	The learning status of classmates around A49 students
11	A19 Students' Right to Further Education
12	A21 Teacher's Professional Ethics and Style
13	A22 Teacher's Professional Teaching Ability
14	A23 Teacher's Professional Practice Ability
15	A24 Teacher's Research Ability
16	Teaching experience of A25 teachers

17	A26 Teacher's Teaching Philosophy
18	A27 Teacher's initiative and enthusiasm in education and teaching
19	A28 Teachers' Self enhancement Awareness
20	Innovation ability of A29 teachers
21	Number, proportion, and quality of A20 "dual teacher" teachers
22	A31 Self qualities of managers
23	A32 Manager's Management Philosophy
24	The Innovation of A33 Manager Education Management Model
25	A34 Manager's Decision-Making Power
26	A35 Manager's communication skills
27	A36 Manager's Understanding and Judgment
28	A37 Manager's Interpersonal Management and Processing Skills
29	A38 Manager's Innovation Ability
30	A41 Professional Ethics and Conduct of Other Technicians
31	A42 Professional competence of other technical personnel
32	A43 Self qualities of other technical personnel
33	A44 Education and teaching abilities of other technical personnel
34	A45 Proactive and proactive work of other technical personnel
35	A46 Information literacy of other technical personnel
36	A47 Innovation capabilities of other technical personnel
37	The learning atmosphere of A48 school
38	B11 Establishment of Policies, Laws, and Regulations
39	B12 A sound institutional guarantee system
40	B13 Government funding for higher vocational education
41	B21 Social Population Status
42	B22 Social Stratification/Strata
43	Participation of other forces in higher vocational education in B23 society
44	B24 Cooperation between Vocational Colleges and Enterprises, Integration of Industry and Education
45	B25 industry and enterprise participation in the compilation of higher vocational education textbooks
46	B26 Incorporate the implementation of higher vocational education by enterprises into corporate social responsibility reports
47	B27 society rewards enterprises with deep integration of industry and education, as well as school enterprise cooperation
48	B31 GDP growth situation
49	B32 Economic Development Level
50	B33 Economic Development Model
51	B34 Industrial Structure
52	B35 Enterprise Structure
53	B36 Labor Market Model
54	B37 Employment and Unemployment of Labor Force
55	B38 Economic status of students in their hometowns
56	B39 Degree of emphasis on education in students' hometowns

5. Conclusion

This study examines Shanxi's higher vocational education ecosystem's future. I worked with 17 Shanxi, China, higher vocational college, and enterprise professionals. Explored future higher vocational education development from an educational administration perspective. Educational institutions and relevant departments can utilise the Delphi technique to create guidelines, norms, and predict higher vocational education trends. All experts received a 51-

item survey. These projects fall within Shanxi's seven higher vocational education ecosystem aspects. These 7 dimensions are split into internal and external environments. The interior environment includes students, teachers, management, and technical staff. The external environment comprises politics, society, and economy. These experts' recommendations will influence Shanxi Province's higher vocational education policies.

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