RedFame

Journal of Education and Training Studies
Vol. 12, No. 3; July 2024
ISSN 2324-805X E-ISSN 2324-8068
Published by Redfame Publishing
URL: http://jets.redfame.com

Challenges and Strategies of Higher Vocational Education in China with the New Demographics-*Based on the Data Analysis of China's Seventh National Census*

Shijie Wang[1,2]

[1]Professor of Institute of Higher Education, Hefei Information Technology University, Hefei, China

[2]Postdoctoral Fellow, Kennedy School of Government, Harvard University, Cambridge, MA 02138, USA

Correspondence: Shijie Wang, Professor of Institute of Higher Education, Hefei Information Technology University, Hefei, China; Postdoctoral Fellow, Kennedy School of Government, Harvard University, Cambridge, MA 02138, USA.

Received: March 14, 2024 Accepted: April 17, 2024 Online Published: April 21, 2024

doi:10.11114/jets.v12i3.6889 URL: https://doi.org/10.11114/jets.v12i3.6889

Abstract

There is an important connection between the development of higher vocational education and the national demographics. According to the data of the seventh national census, China is facing a population reality with negative growth, an inverted pyramid structure, expanding migration, and stable quality improvement. The change in demographics sets out new requirements for the goal, types, structure and quality of higher vocational education. To develop higher vocational education, we should constantly optimize development planning, expand development types, optimize resource allocation and improve development quality.

Keywords: population, higher vocational education, high-quality talents, Seventh National Population Census

1. Introduction

In 2022, the 34th meeting of the Standing Committee of the 13th National People's Congress voted to pass the newly revised Vocational Education Law of the People's Republic of China (hereinafter referred to as the Vocational Education Law), which marked that China entered a new stage of high-quality development of vocational education and building a skilled society (Xinhua News Agency, 2022). Developing higher vocational education is the inevitable requirement of higher education popularization. Professional talent is in high demand in the labour market at the stage of higher education popularisation. This type of talents was previously primarily supplied by technical secondary schools and vocational middle schools. With the shift from extensive to intensive production and the continuous economic and social development, a sizable number of professional posts, especially posts in high-tech production departments and the third industry, increasingly need specialized talents with higher vocational and technical education (Serban, 2012).

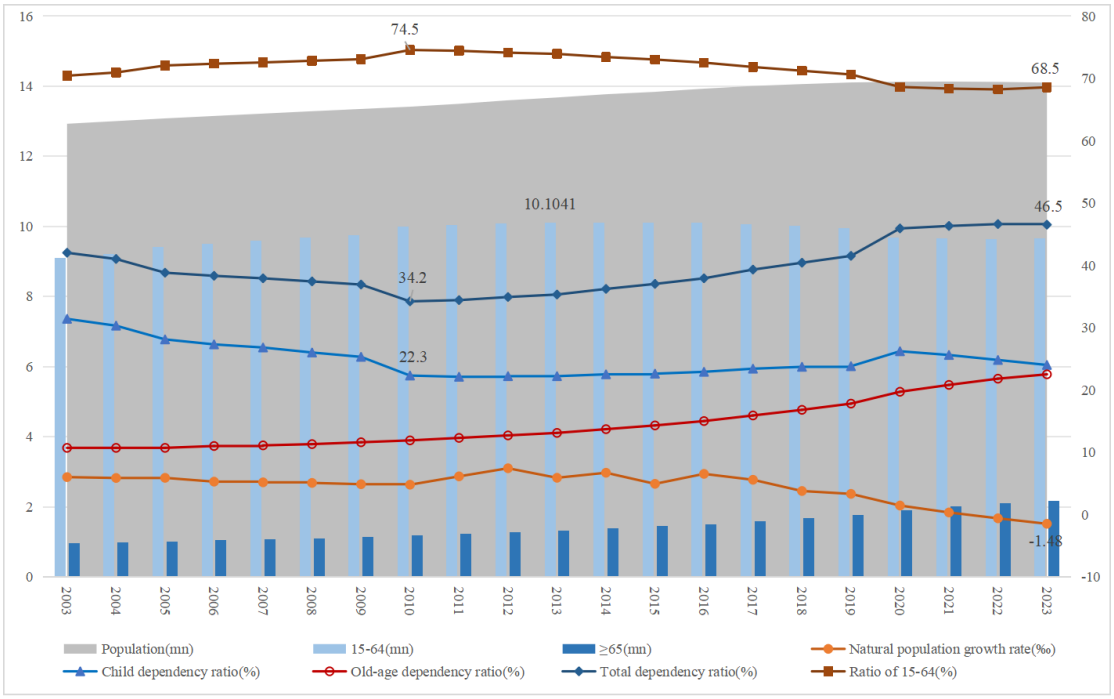

Figure 1 (Note1). Age structure and dependency ratio of China's population from 2003 to 2023

At present, China is experiencing increased aging in its working population creating challenges for the economy. Within the age structure (Figure 1), the working-age population of China reached its peak at 1,010.41 million in 2013 and began to decline in 2014. The proportion of the working-age population in the total population showed a turning point in 2010, demonstrating the trend from rising to dropping, specifically from 74.5% in 2010 to 68.5% in 2023. Child dependency ratio fluctuated and declined before 2010, and was generally stable between 2010 and 2014. With the adjustment of the birth policy, the newly-born population increased and the working-age population decreased. After 2014, the infant dependence ratio exhibited an upward trend, while the old-age dependence ratio was on the rise in the past twenty years. The total dependence ratio also began to grow after reaching 34.2% in 2010 and rose to 46.5% in 2023. China is currently dealing with a diminishing working-age population ratio and increasing aging. According to the World Bank's conventional classification from 2015, China has entered the late stage of the demographic dividend, and the traditional demographic dividend is changing (World Bank,International Monetary Fund, 2015).

It is imperative to create new demographic dividends since old and affordable demographic dividends are slowly vanishing. According to Li (2012), the new demographic dividend is the human capital dividend, which refers to the promotion of industrial upgrading and independent innovation through the cultivation of a large number of skilled technicians. Education, the primary means of human capital investment, has played an important role in improving labor productivity, labor participation rate and total factor productivity, which has been widely studied and validated (Wei, 2010; Cheng, 2015). Strengthening education supply, improving education level of the people, and encouraging the transition of quantity to quality of labor supply have become important trends in economic and social development(Zhong, 2016). General education and vocational education are comparable to two wheels or two wings of China's transformation from "a big country with a large population" to "a big country with talents". On the one hand, we require regular higher education in order to develop top-notch innovative talents, vigorously enhance people's creativity, and produce dividends of highly educated or research talents. On the other hand, to train a large number of technical and skilled talents with professional skills and "craftsman spirit" and form more universal dividends of technological and skilled talents, we need vocational education and training.

Economists generally believe that vocational education is an important input-output behavior. The skills acquired through education are a form of fixed capital in *The Wealth of Nations*. "Learning certainly costs a sum of money, but it can be repaid and profits can be earned" (Smith, 2008). In 1960, American economist T.W. Schultz proposed at the annual meeting of the American Economic Association that the investment and cost for improving people's abilities can form human capital, which differs from material capital (Schultz, 1990). The input of human capital can increase the income of educated individuals and the whole society. Vocational education and training are particularly successful forms of human capital investment. China has essentially built a modern vocational education system consisting of the vertical integration of secondary vocational schools, higher vocational colleges (junior-college level) and undergraduate

education, the horizontal merger of vocational education and general education, as well as the interconnection between formal education and lifelong-learning. Higher vocational institutions have developed from solely junior colleges in the past to a multi-level system consisting of junior colleges, undergraduate and postgraduate education. There are more than 30 undergraduate-level "vocational universities" and "vocational and technical universities", and the postgraduate-level vocational education is also actively demonstrated and explored. The talent cultivation system is gradually improved. According to the data of National Statistical Bulletin on Education Development (2023), there were 1,489 higher vocational (junior-college level) institutions and 32 undergraduate-level vocational schools in China, accounting for 53.95% of the national ordinary institutions of higher learning in 2022. We can say that vocational education makes up half of the higher education system.

The National Bureau of Statistics released the key data of the seventh national census on May 11, 2021. These findings helped improve China's population development strategy and policy system, helped create economic and social development plans, and promoted high-quality economic development. The seventh national census provided information on China's population size, composition, distribution, and migration as well as on the trends, structural changes, and social shifts brought about by population changes. What challenges and opportunities will it bring to the development of higher vocational education in China, and how should we better prepare for upcoming demographic shifts?

2. Theoretical Underpinnings of How Demographics Affect the Development of Higher Vocational Education

Population and education are two social systems that interact with each other and have their own distinct shifting laws (UNDESA, 2001). According to the conventional view, people only consider the influence of politics, economy and culture on education, ignoring the role of population on education.

The West was more aware of the connection between population and education earlier. However, a lot of studies concentrated on the education of various ethnic populations and the relationship between immigrants and education (Mansouri, 2013) due to its unique population history and social context (Wang, 1980; Nimer, 1990). Since the 1980s, some Chinese educators and demographers have focused more on the relationship between population and education, leading to earlier and more representative research findings. Pan Maoyuan proposed the laws of internal and external relations of education in 1980. Among them, the ties between education as a social subsystem and the social system at large, as well as between education and other subsystems, are referred to as the rules of external relations of education. In other words, social politics, economy, culture, science and technology, population and geography are some of the external variables that limit the growth of education, and education must adapt to social development. He went on to define this kind of adaptation as "active adaptation", believing that "education should play its role of subject judgment and choice, and school runners should take the initiative to seek advantages and avoid disadvantages, and strive for active adaptation instead of passive adaptation" (Pan, 1990). The impact of various external factors on education varies, but one clear and direct effect of population density is its restricting influence on education. Tian (2000) wrote *Educational Demography*, which is an early representative work in China that systematically expounds on education and population. He believes that "population and education are prerequisites, influences and constraints of each other.". Population, according to He & Qi (2000), is the fundamental component of human society, and education is the fundamental activity that keeps human society alive (cultivating people). They both serve as necessary conditions for human society to exist and flourish and are enduring phenomena that coexist with it. "Researching the population-education relationship is crucial to the population's health as well as the healthy development of education.". As knowledge about the relationship between population and education has grown, there is now general agreement on that population quantity, structure and distribution always place limits on the scale, function and layout of education, and the size, scope, and design of education should align with these factors.

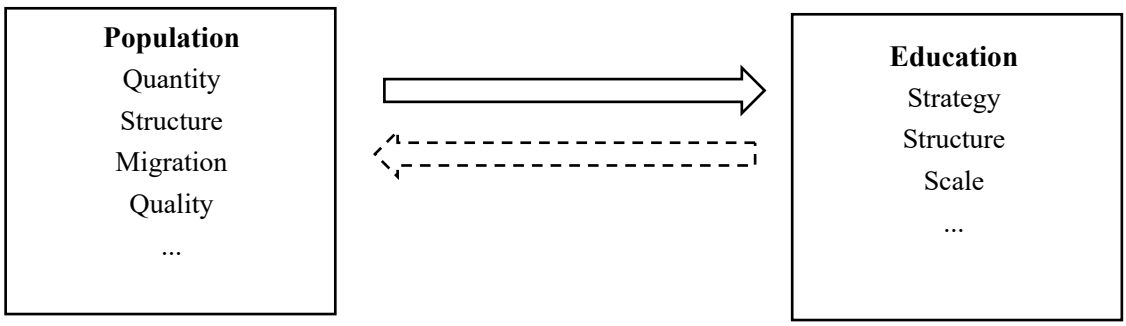

Figure 2. Relationship between population and education

In conclusion, population and education are interacting with each other in an extremely complex relationship. Education can be either a cause or a result of population change. The interactive and mutually constraining relationship between each other is shown in the following figure (see Figure 2).

Nevertheless, earlier research focused more on the population development of that era, using "population control" as a logical starting point, focusing on the decline of population quantity through education, and asserting that "improving education level is the direct driving force for the decline of fertility rate"(Liu, 1992). and "the key to population control is to popularize compulsory education"(Deng, 1992). For instance, Dong (2009) believes that the influence of population on education is mainly reflected in "the pressure of population expansion on education, the impact of population fluctuation on education, the impact of population structural change on education, the challenge of population mobility on education, and the restriction of uneven population distribution on education". According to figures from the seventh national census, China's population has reached a new stage of development and a critical turning point.

3. The Fundamental Traits of China's New Demographics

3.1 Negative Population Growth

China's population reached a peak of 1.412 billion in 2022, while the world's population surpassed 8 billion in the same year. According to the forecast results in *World Population Outlook 2022.* Released by the Population Division of the United Nations, the population of East Asia and Southeast Asia, including China, is exxpected to reach a peak of 2.4 billion people around 2034. Meanwhile, the population of Central Asia and South Asia is expected to grow, peaking at 2.7 billion people around 2072. Despite having a sizable population, China's growth rate is still declining, and it is about to enter a phase of negative growth. Compared with the population of the sixth national census in 2010, that of the seventh national census in 2020 increased by 5.38%, with an average annual growth rate of 0.53% declining. According to the data from population sample survey in 2023, China's natural population growth rate has been as low as -1.48‰, demographers typically have negative expectations about future population growth. It is imperative to conduct methodical research and implement effective solutions as soon as possible because, from the standpoint of population replacement laws and the overall state of nations, once the population enters the negative growth channel, it will have a strong "downward inertia" that will cause a strategic crisis to social and economic development.

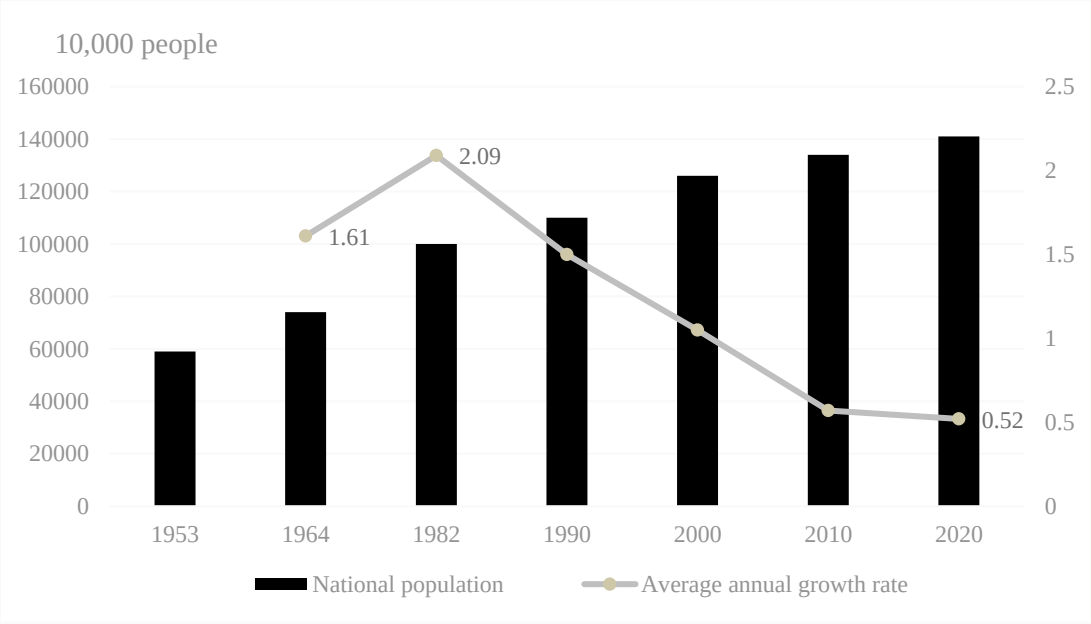

Figure 3. National population and average annual growth rate of previous censuses from 1953 to 2020

Figure 3 (data from China's recent population census) shows that the country's population growth rate has a negative trend. The line graph of the average annual population growth rate's changing trend makes it evident that 1982 was a turning point, and that China's population has been rapidly declining ever since. In 1982, China's average annual population growth rate was 2.09%, and in 2010 it decreased to 0.57%, a full reduction of 1.52%.The stringent application of the family planning policy, which causes China's birth rate and natural growth rate to fall quickly and its fertility level to remain low, is the primary cause of the country's sharply reduced population growth rate. The population growth began to slow down in 2010, and the average annual population growth rate was only 0.04% from

2010 to 2020. The main reason is that the success of China's reform and opening up and the deepening socialist modernization accelerated the urbanization process. Consequently, many factors, such as high cost of living, high expense of education, the rising housing prices and great employment pressure, all reduced young people's willingness to have chilldren. As a result, China's population growth slowed down, the average annual growth rate gradually flattened, and the fertility level showed a downward trend.

3.2 The Inverted Pyramid Shape of the Population Structure

The decreasing annual birth rate and the steadily declining fertility rate are the main causes of the slowing population growth rate. China's overall fertility rate has been below the 2.1 generation replacement threshold since 1992.

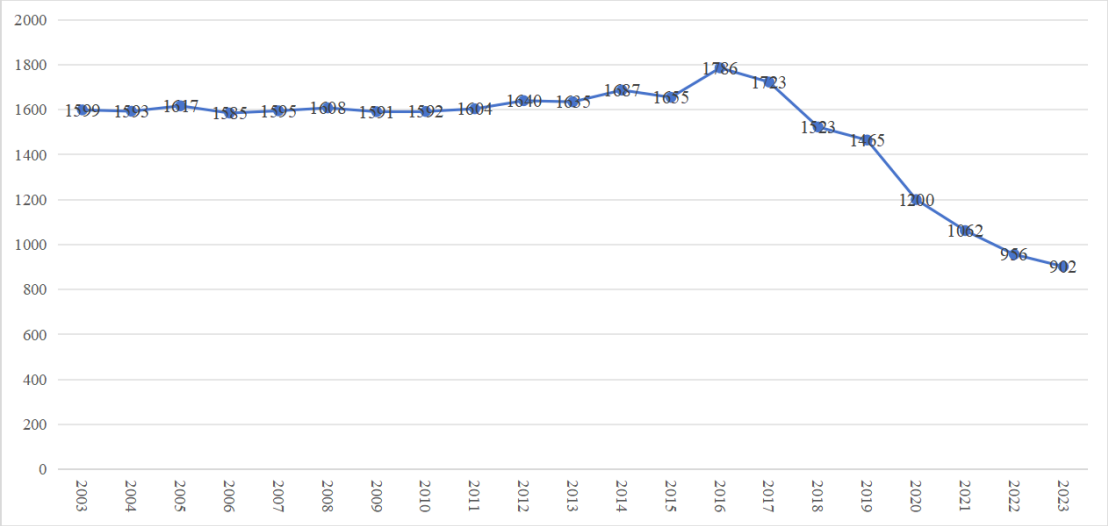

Figure 4. Trend of births from 2003 to 2023

Figure 4 (based on the data from National Bureau of Statistics) illustrated that in 2020, China's overall fertility rate for women of reproductive age is 1.3, below the 1.5 warning line that is typically regarded by the international community (National Bureau of Statistics, 2021). Following a five-year decline to 12 million in 2020, the number of newborns fell again to 9.02 million in 2023. China's population policy has evolved from "restrictive" to "inclusive" and "encouraging," and the state's concerns about births have shifted from "too many" to "not enough" with the seventh national census serving as a node. Additionally, in this new phase of China's population development, this is the most noticeable shift.

In China, 228 million individuals were born between 1981 and 1990, 174 million between 1991 and 2000, and 146 million between 2001 and 2010. This suggests that the number of people born in China after 2000 is significantly lower than the number born in the 1980s. The "two-child" policy came into effect in 2016. All other years saw a continual reduction in natural population growth rates, with the exception of 2016, when it increased dramatically to 6.53 ‰. It has decreased to -1.48‰ in 2023. With only over one-third of the population born in 1963, China's newly-born population fell to 9.02 million in 2023, the lowest since the PRC's formation. China's population age distribution has seen significant changes as a result of the country's ongoing low fertility rate. The proportion of people over 60 in the population increased from 13.26% in 2010 to 18.75% in 2020 (see Table 1).

Table 1. Age structure in the sixth and seventh national censuses

	6th Census (2010)		7th Census (2020)	
Age	Population (person)	Proportion (%)	Population (person)	Proportion (%)
Total	1370536875	100.00	1411778724	100.00
0-14	222459737	16.60	253383938	17.95
15-59	939616410	70.14	894376020	63.35
60 and above	177648705	13.26	264018766	18.70
Including： 65 and above	118831709	8.87	190635280	13.50

Low birth rates, negative or slow population growth, and aging populations are global issues facing the world in the

twenty-first century, not just China (Mark, Gradstein et al., 2004). While the world's population is still increasing overall, compared to fifty years ago, the primary factors contributing to this expansion are not as much new births as they are the decline in mortality and the increase in life expectancy. From 64.0 years old in 1990 to 72.8 years old in 2019, the average life expectancy worldwide is predicted to rise to 77.2 years old by 2050 (United Nations, 2022). This means that the elderly will contribute more to population growth in the future.

3.3 Constantly Expanding Population Migration

China has consistently seen an increase in both the volume and velocity of its population migration since the reform and opening up.

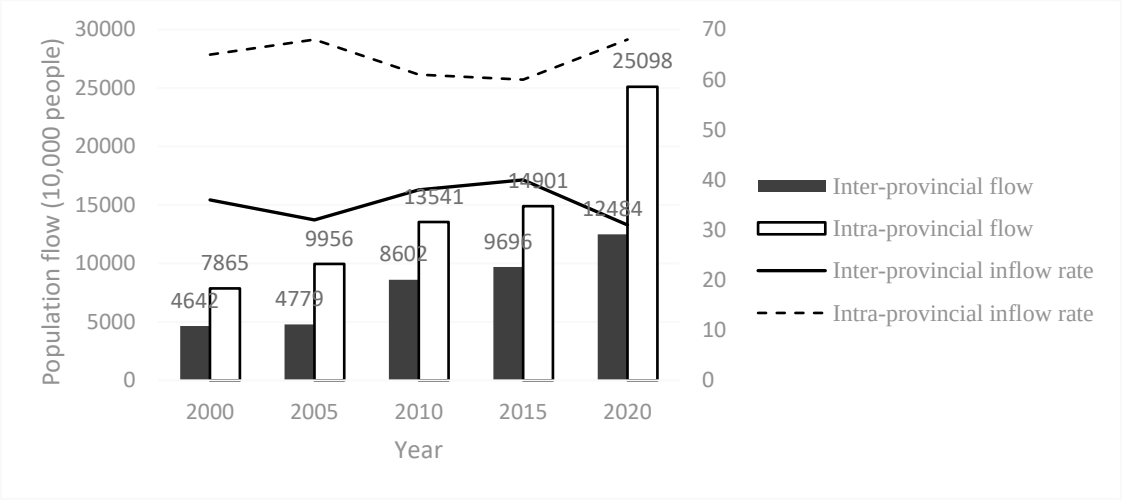

Figure 5. Trend of scale and intensity of population flow in China (2000-2020)

As illustrated in Figure 5 (based on previous census data since 2000), the 2010 population's scale and rate of flow have grown to 221.43 million and 16.53%, respectively, exceeding those of 2000 by 100.36 million and nearly 7%. It grew to 375.82 million in 2020 and 26.62% in 2020, which is 154.39 million more and 10% more than in 2010 respectively. Among them, the population flow within and between provinces in 2020 was 250.98 million and 124.84 million, respectively, up 85.35% and 45.13% from 2010. The population flow within provinces grew at a rate 1.89 times faster than the population movement between provinces. While the inter-provincial population mobility rate continued to decline, the intra-provincial population mobility rate rose by 5.63%. As a result, the share of the total population flow that came from inter-provincial migration decreased from 38.85% in 2010 to 33.22% in 2020, while the share that came from intra-provincial migration increased from 61.15% in 2010 to 66.78%. It is evident that the population flow in 2020, particularly the intra-provincial population flow, has experienced a "explosive" growth as the population with separated registered and actual residences, and its proportion in the population flow, has increased significantly in comparison to the data of previous censuses, sample surveys, and population surveys by the Health and Wellness Committee.

In economically developed provinces and cities, there is a large-scale influx of people from other provinces; the first group includes Guangdong, Jiangsu, Zhejiang, and Shanghai, with an influx of over 10 million people. With a net inflow of 29.6221 million, Guangdong Province has the most, followed by Zhejiang Province with 16.1865 million. Beijing, with an interprovincial inflow of 8,418,400 individuals, can likewise be classified as part of the first category. Approximately 60% of China's interprovincial population influx comes from the five provinces and cities in the first group, indicating a highly concentrated distribution of interprovincial population inflow. There is little immigration to regions like Tibet, Gansu, Qinghai, Ningxia, and other economically impoverished provinces; these areas have less than a million inhabitants. Only 829,200 people have moved into Heilongjiang Province in recent years, a population loss that has received much attention.

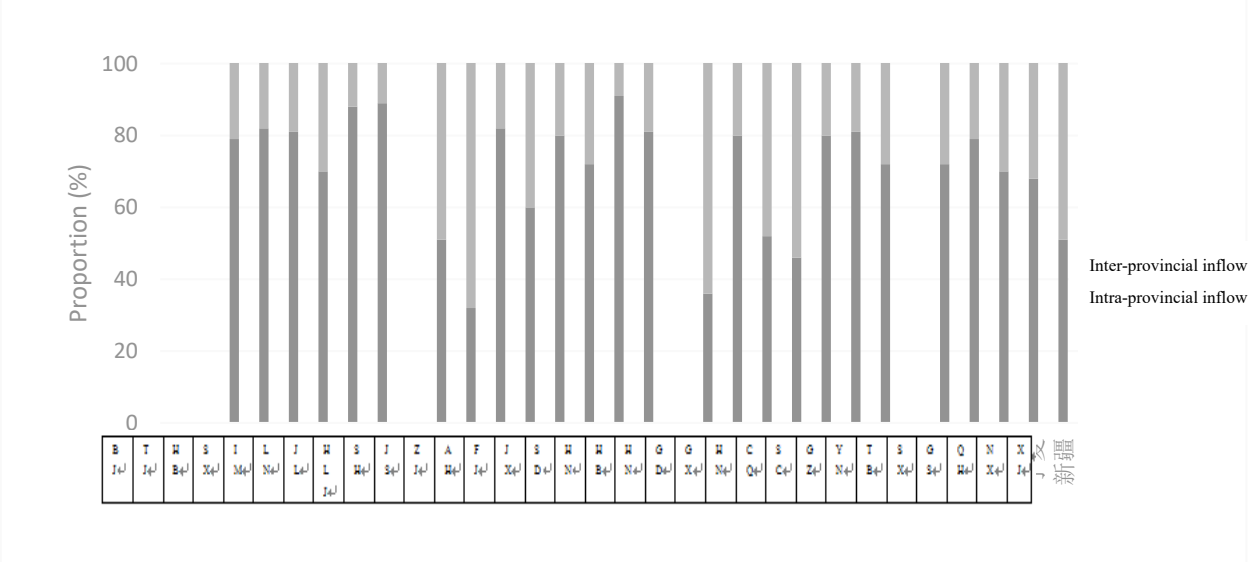

Figure 6. Inter-provincial comparison of the proportion of inter-provincial inflow and intra-provincial inflow in China (2020)

Figure 6 illustrates that a significant share of the population influx into this province (region) originates from interprovincial migration in economically prosperous provinces. Jiangsu, Zhejiang, Guangdong, Hainan, Chongqing, Xinjiang, and other provinces have more than 40% inter-provincial population inflow in the total population inflow in the province, with the highest percentage (63.33%) in Zhejiang Province and the second-highest percentage (56.89%) in Guangdong Province. The data for Beijing, Tianjin, Shanghai, Hunan, and Tibet has not yet been made public. Certainly, a larger share must come from the interprovincial population inflow of Beijing, Tianjin, and Shanghai. Generally speaking, the economically underdeveloped provinces—Shanxi, Inner Mongolia, Jilin, Heilongjiang, Anhui, Jiangxi, Shandong, Henan, Guangxi, Sichuan, Guizhou, Gansu, and other provinces—have an intraprovincial population flow because they are not as appealing to the people of other provinces. More than 80% of the province's overall population influx is accounted for by their intra-provincial population flow. Of them, the provinces of Heilongjiang and Henan account for less than 10% of the inflow of people between provinces, while the populous province of Henan has 6% of the inflow of people between provinces but 94% of the inflow within provinces. China's unbalanced population spatial distribution is made worse by the constant influx of new residents into densely populated areas and the exodus of inhabitants from less populous areas.

3.4 Stable Improvement of Population Quality

Table 2. Education of China's population

	University (junior college or above)	High school (including technical secondary schools)	Junior high school	Primary school	Illiterate population
2010	119636790	187985979	519656445	358764003	54656573
2020	218360767	213005258	487163489	349658828	37750200

As shown in table 2 (data from Office of the Leading Group for the Seventh National Census of the State Council, 2021), the general quality of the Chinese population has reached a certain point, and both the demand for and participation in education from the populace are always rising. These are two significant aspects of the population. The seventh national census data shows that the proportion of illiterate people in the overall population has decreased by 1.41%, from 4.08% to 2.67%, and that the number of illiterate people (those who are 15 years of age and older) has decreased by approximately 169 million since the sixth national census in 2010.

Table 3. Size and proportion of educated population in China from 1982 to 2020 (100,000 people,%)

	1964	1982	1990	2000	2010	2020
Total	34745	60523	69862	84419	88529	89829
Primary school	28330	35237	37057	35701	26779	24766
Junior high school	4680	17892	23344	33961	38788	34507
High school and technical secondary school	1319	6779	8039	11146	14032	15088
Junior college or above	416	615	1422	3611	8930	15467

The information in Table 3(data from National Bureau of Statistics, 2020; Office of the Leading Group for the Seventh National Census of the State Council, 2021) indicates that attendance in formal schools is growing in popularity. In the second national census, just 3.5 out of 10 individuals reported having gotten an education, as the first row of Table 3 illustrates. Following that, the proportion of educated individuals rose steadily and the number of educated people increased. By the time of the seventh national census, about 90% of the population had completed their schooling. In 2000, the percentage of the population with a primary and secondary education began to fall; by 2010, the percentage of people with a junior high education had overtaken it. The percentage of the population with a primary school education rose from 28.33% in the second national census to 35.24% in the third, 37.06% in the fourth, and then started to fall to 35.70% in the fifth and 24.77% in the seventh, as seen in the second row of Table 3. The proportion of people who had completed primary school was highest in the fifth national census and earlier, while in the sixth national census, the proportion of people who had completed junior high school outweighed the proportion of people who had completed primary school. The aforementioned adjustments demonstrate that between 2000 and 2010, China's educational system finished upgrading and transforming from primary school to junior high school. After completing the second structural upgrading and transformation, which resulted in 1/3 of the population having a junior high school education, it took China 40 years to reach its goal of having 1/3 of the people educated in elementary school. In 2020, the percentage of adults having a junior high school diploma began to fall for the first time. The percentage of the population with a junior high school diploma increased more than seven times, from 4.68% in the second national census to 38.79% in the sixth; it fell to 34.51% in the seventh national census, as the third row of Table 3 illustrates. At that point, the third structural upgrade and transformation of the educational structure had begun, and the majority of the population still only completed junior high school.

4. Challenges Faced by Higher Vocational Education with the New Demographics

4.1 The Contradiction Between the Fluctuation of Population and the Weak Awareness of Education Planning in Higher Vocational Education

Because education is continuous, population fluctuations will have a ripple effect on education at different levels, with the peak of one level influencing the next several years later, like a wave. The impact of population fluctuations is initially felt in compulsory education, with high school education being the next priority, and then further education.

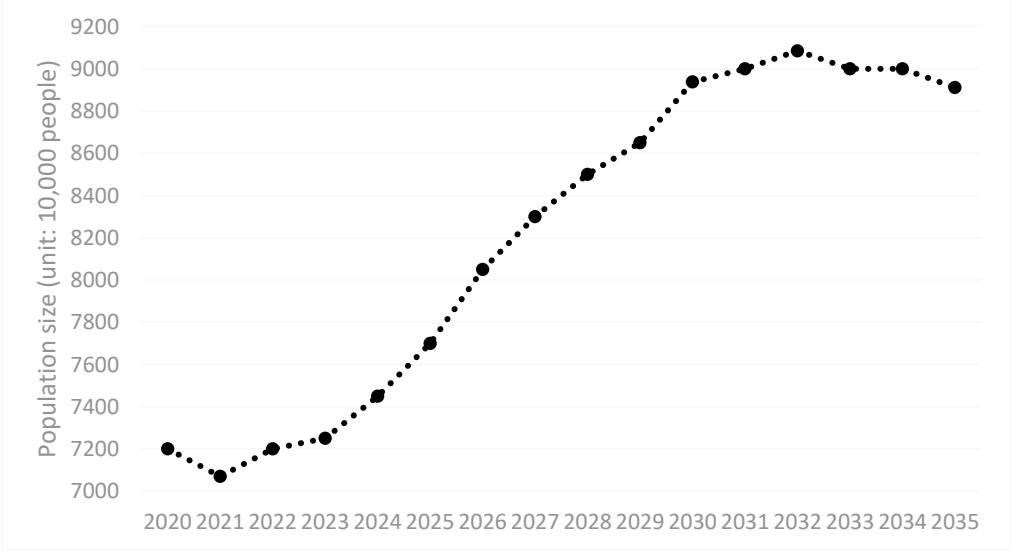

Figure 7. Change trend of school-age population of higher education from 2020 to 2035

As shown in Figure7, Zhang et al. Predicted that the total number of people in higher education who are between the ages of 18 and 22 who are school-age will rise gradually until 2032; it will rise from 89.38 million in 2030 to a peak of 90.85 million in 2032, and then it will drop to 89.11 million in 2035, with the largest fall occurring between 2034 and 2035.

In China, there were 37.27 million new babies born between 2019 and 2021. This number is equal to the population of school age who will graduate from high school in 2036. It is anticipated that at that point, technical institutions will cease to accept new students and that the gross enrolment rate for high school education will have reached 100%. There is ample space at the secondary vocational and general high schools currently in place. The number of births is declining between 2021 and 2023, and if the current number of births is maintained, there will only be about 30 million school-age people in high school by 2038. Not to mention that the number of newborns is on a downward trend. By that time, secondary vocational schools will be facing an extremely acute enrollment crisis. In the event that the number of babies declines further, fewer people will be of school age, which will worsen the vocational education enrollment situation.

4.2 The Contradiction Between the Change in Population Structure and the Lag of Major Setting in Higher Vocational Education

China faces a serious issue with "a decreasing birth rate" and "an aging society" coexisting,which will lead to a future "inverted pyramid" demographic structure. The loss of the quantitative dividend of our working population is caused by fewer births, an aging population, a smaller share of the producing population, and increased labor expenses(Zhu &Xu, 2019). Higher vocational education is undoubtedly unable to confront the future given its focus on developing technical and skilled talent as well as its continued reliance on the major framework of higher vocational education today. In order to ensure the long-term, sustainable growth of China's economy and society, it must gradually tranform demographic dividend into talent dividend. Higher vocational education's primary location will unavoidably need to change.

Table 4. Names and enrollment of the Top 10 majors in higher and junior vocational colleges in 2021

China			Hunan		
Ranking	Major	No. of students enrolled (10,000)	Ranking	Major	No. of students enrolled (10,000)
1	Nursing	86.78	1	Nursing	4.24
2	Preschool education	81.50	2	Big data and accounting	3.90
3	Big data and accounting	73.77	3	Software technology	3.07
4	Computer Application Technology	54.42	4	Preschool education	2.43
5	E-commerce	53.99	5	E-commerce	2.37
6	Mechatronics technology	41.44	6	Mechatronics technology	2.09
7	Computer network technology	34.18	7	Primary education	1.80
8	Project cost	33.45	8	Computer network technology	1.49
9	Software technology	33.35	9	Architectural engineering technology	1.49
10	Architectural engineering technology	32.49	10	Computer Application Technology	1.48

Low-level recurring major building is currently an embarrassing issue that affects secondary and higher vocational education across the nation. Taking Hunan Province as an example (Table 4),. with 20.58% of all enrolment in higher

and junior vocational colleges in 2021, the five majors with the highest enrollment were nursing, big data and accounting, software technology, preschool education, and e-commerce (data from Liu et al., 2021). Mechatronics technology is the major most closely associated with Hunan's unique and favorable equipment manufacturing business; its student size is ranked sixth in the province. The main differences between this major and other top majors are the higher instrument and equipment investment, higher operating costs, and greater use of practical training consumables. Vocational institutions fall into the embarrassing trap of "cutting the feet to fit the shoes" because they are unable or unwilling to meet market demand and set up majors to support the "three high and four new" strategy. Instead, they can only set up majors with low input in accordance with their current conditions. This is due to the long-term serious lack of investment and poor conditions. Nine of the top ten majors in China are the same as those in Hunan, notwithstanding minor variations in major rankings, according to a comparison of the top 10 majors at junior and upper vocational institutions.

The issue of a falling employment rate and a major-matching employment rate will inevitably gain prominence in society over time. It is also challenging to fulfill the fundamental and leading position that education plays when there is a mismatch and waste of excellent educational resources, which can scarcely aid in the upgrading and change of the regional industrial structure. Higher education and vocational institutions must therefore consider the primary environment and even the role of education. These days, China's population is composed primarily of elderly people rather than young people. The population that receives formal education is declining since the low-age group is the primary consumer of education, as seen by the decline in both the group's size and share of the overall population. Higher vocational schools should consider how to shift from a "universal" to a "inclusive" model, meaning that they should provide all citizens with education with very low or no barriers.

4.3 The Contradiction Between the Intensification of Population Migration and the Poor Adaptability of Higher Vocational Education

The spatial distribution of the population and the regional structure of higher vocational education do not fully correlate, given the population's mobility, particularly the cross-regional schooling of higher vocational education.

Table 5. National population distribution and higher vocational education layout (some provinces)

Region	Proportion of population (%)		Higher (junior)vocational institutions		Enrolment of higher (junior)vocational institutions	
	2020	2010	Quantity (institution)	Proportion (%)	Quantity (10,000 people)	Proportion (%)
Liaoning	3.02	3.27	51	3.47	42.8	2.94
Jilin	1.71	2.05	27	1.84	22.6	1.55
Heilongjiang	2.26	2.86	41	2.8	26.5	1.81
Zhejiang	4.57	4.06	49	3.34	48.7	3.34
Anhui	4.32	4.44	74	5.04	65.8	4.51
Jiangxi	3.2	3.33	60	4.09	63.1	4.33
Hunan	4.71	4.9	76	5.18	72.9	5.00
Guangdong	8.93	7.79	87	5.93	117.8	8.07
Shaanxi	2.8	2.79	39	2.66	48.8	3.34

The current spatial distribution of the population and the regional distribution of higher vocational education clearly diverge significantly. As shown in Table 5 (data from National Bureau of Statistics and Liu et al., 2021), through the comparison of the distribution of the country's population and higher vocational education, it can be observed that Zhejiang and Guangdong provinces continue to have concentrated populations and relatively low levels of higher education; in contrast, the three northeastern (Liaoning Jilin Helongjiang) provinces and other central China provinces, including Anhui and Jiangxi, are experiencing population outflows and relatively high levels of higher education The following conclusions can be drawn because of the growing population imbalance in spatial distribution: the "attenuation area" of higher vocational education will be the area with a small population base and continuous outflow, and the "enhancement area" will be the area with a large population base and continuous inflow. This implies that in order to preserve a rough equilibrium, China's regional distribution of higher vocational education will need to adapt to the ongoing changes in population spatial distribution.

Building additional schools and fostering the growth of higher vocational education are necessary if there is a significant demand for such education in a region with a big and dense population, and vice versa. Furthermore, considering from a dynamic perspective, regions are open and constantly exchange energy with the outside world through population migration; therefore, dynamic college and major layouts are also necessary for higher vocational education. However, there is now a spatial mismatch between the population's demand and the region's provision of resources for higher vocational education in China (Zhao, 2020).

The first is a lack of supply. Eleven provinces and cities, including Beijing, Inner Mongolia, and Liaoning, demonstrate that the demand for higher vocational education resources is greater than the supply available in both directions. Taking junior colleges as an example, at the end of 2018, the population of permanent residents in Beijing made up 1.5% of the country's total population, and its GDP accounted for 3.3% of the country. In contrast, the number of students enrolled in regular junior colleges was just 74,000, or 0.7% of the total population. Similar circumstances exist in the provinces of Jilin, Liaoning, Inner Mongolia, and others. In terms of relative quantity, it is possible to say that these provinces and cities represent the low-lying land of higher vocational education. Secondly, excess. Nine provinces, including Shandong, Henan, and Jiangxi, have a two-way demand for resources related to higher vocational education that is less than their supply capability. Using Jiangxi Province as an example, its GDP was 2.4% at the end of 2018, its population of permanent residents made up 3.3% of China's total population, and 4.5% of its students were enrolled in regular junior colleges. From a quantitative standpoint, these provinces offer more resources for higher vocational education than they require, making them the ultimate highlands of such resources. Third, there is not enough supply to meet the need for economic growth. Resources for higher vocational education are more abundant in Tianjin and Jiangsu than in other parts of the region, but they are insufficient to satisfy the demands of the region's economic growth. By the end of 2018, the GDP of Tianjin was 2.1%, the population of permanent residents was 1.1%, and the enrolment in regular junior colleges was 1.5% of China's total population. This is also the case in Jiangsu. That is to say, compared to the needs of their population, Tianjin and Jiangsu offer more resources for higher vocational education, but not enough in relation to the demands of their economic development. Fourth, there is not enough supply to meet the population's demand. On the other hand, nine provinces, including Hebei, Shanxi, and Heilongjiang, offer resources for higher vocational education that can satisfy their needs for economic development but not for meeting the demands of their large population base.

4.4 The Contradiction between the Improvement of Population Quality and the Low Overall Quality of Higher Vocational Education

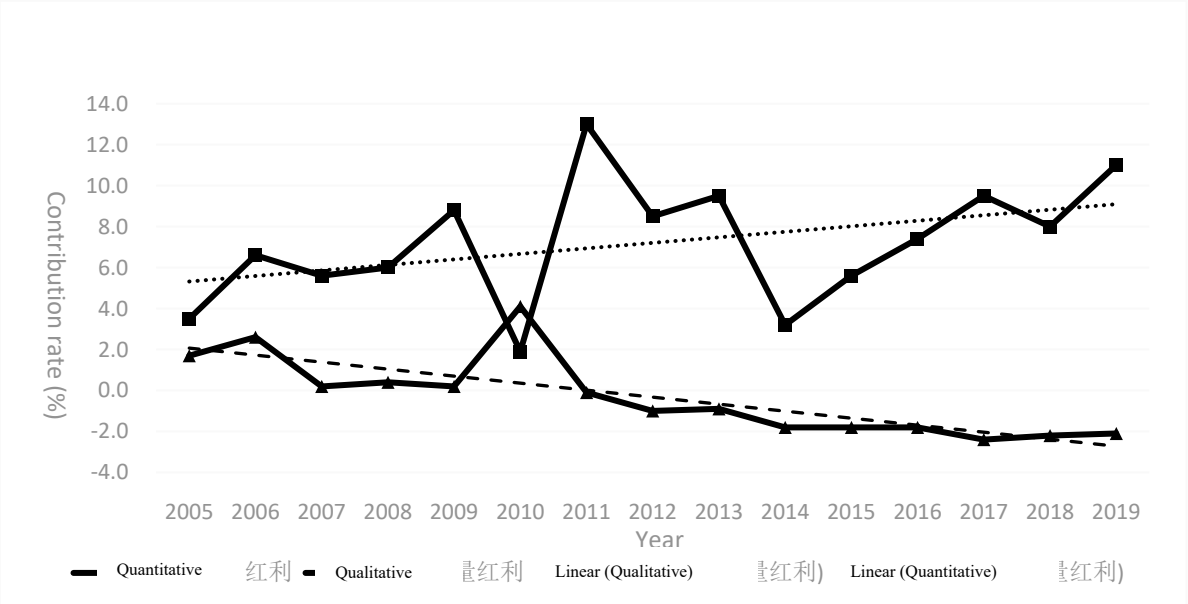

Figure 8. Contribution of demographic dividend and demographic quality dividend from 2005 to 2019

Figure 8 (Huang &Duan, 2022) illustrates how, between 2005 and 2010, the demographic quantity dividends—which have contributed more positively to economic development—have gradually given way to the demographic quality dividends. In the future, the percentage of the working-age population and employees will continue to decline, the dependency ratio will rise, and the population's level of education and health will continue to improve, according to the population trend shown by the data from the seventh national census in 2020. The demographic dividend will gradually decrease as the population structure changes, but the demographic quality dividend's influence on economic growth will

only grow.

From 1999 to 2023, the gross enrollment rate of higher education increased from 10.5% to 60.2%, which fully shows that the continuous improvement of China's population quality is compatible with the current high-quality economic development. However, in order to give further play to the positive role of education in social development, we need higher quality education to support talent cultivation, but at present, higher vocational education in China still faces practical problems of low quality and extensive development.

The area of universities per student fell from 59.75 square meters to 58.32 square meters in 2020, the area of teaching and administrative buildings per student fell from 14.13 square meters to 12.91 square meters, the amount of books per student fell from 77.13 to 71.74, and the amount of instruments and equipment per student increased from 13,800 yuan to 16,600 yuan, based on a comparison of national data from 2016 (Ministry of Education, 2017). to 2020 (Ministry of Education, 2021). The improvement of school conditions in China generally cannot keep up with the rate of expansion due to ongoing expansion and long-term insufficient investment, and the majority of the main indicators of university conditions are falling.Some vocational colleges had to convert 4- and 6-person student dormitories into 6- and 8-person dormitories; some converted young faculty dormitory buildings into student dormitories; some were forced to rent temporary houses outside the school; and some temporarily constructed teaching and training facilities for emergencies. These actions were necessary to meet the needs of students in their studies and lives as well as the fundamental requirements for education and teaching. As a result, a number of new everyday management issues arose (He &Wang, 2022).

In terms of teaching quality, data show that (Research Group on Higher Education Satisfaction, 2023) 41.9% of college students believe they do not fully understand the principles of practical operation and are dissatisfied with the quantity of experimental and practical courses offered by the institution. 48.37% of college students believe that few businesses engage in developing student talent in schools.

5. Development Strategy of Higher Vocational Education with the New Demographics

5.1 Optimizing the Development Plan of Higher Vocational Education

The future growth of higher vocational education will be directly influenced by the changed demographics at this stage. For higher vocational education to continue developing sustainably over the long run, it must actively adapt. The fundamental information needed to compile educational planning is changes in the population, particularly in the population of school age (Zhou, 2014).

It is not possible to compute or estimate the higher vocational education scale directly due to the lack of relevant statistical data. We may use the overall scale of higher education to roughly evaluate the overall scale of higher vocational education in the future because the trend in higher vocational education is essentially the same as that in overall higher education. The base of the school-age population and the gross enrolment rate at this level of education are the elements that influence the educational scale.

When it comes to estimating the population of school age, "the methods of population prediction include inference algorithm, cohort method, linear regression method and nonlinear simulation method, among which cohort method is the most commonly used, mainly considering the age distribution of population. "(Zhao, 2019) Using China's birth data from the last 20 years, we can use the cohort technique to roughly compute the data and changes of the school-age population of higher education in the future (the population aged 18-22) (Xinhua News Agency, 2017). Because the growth of higher education and national macro-planning are closely associated, the gross enrollment rate can be calculated, and the yearly value may be estimated by linear fitting to the target value of the gross enrollment rate established by the development planning (Zhou, 2018). The Ministry of Education's "14th Five-Year Plan" suggested that "the gross enrollment rate of higher education will strive to increase to 60% in 2025," based on China's higher education sector's 2020 gross enrolment rate of 54.4% (Ministry of Education, 2021). As a result, it can be determined that throughout the 14th Five-Year Plan period, the gross enrolment rate in higher education will rise by 1.12% annually. We can determine the gross enrollment rate of higher education in the corresponding years, assuming that the same gross enrollment growth rate can be maintained.

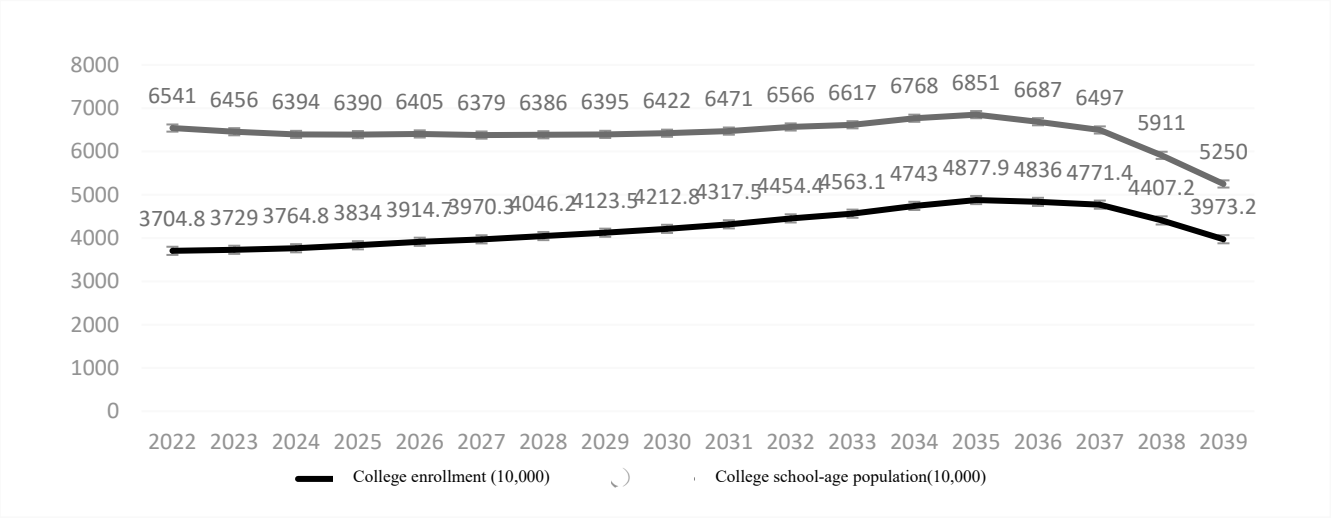

Figure 9. The total enrollment of higher education in China from 2022 to 2039

As Zhang and Liu (2022) demonstrated,the total enrolment in higher education can be calculated using the formula (see Figure 9) based on the annual gross enrollment rate and the school-age population. The overall change trend in higher vocational education enrollment can also be evaluated. In the future, there will be three phases to higher vocational education in terms of scale: the expansion period (before 2035), the peak period (2035), and the contraction period (after 2035).

According to the latest data released by the Ministry of Education, the gross enrollment rate of higher education has reached 60.2% in 2023 (Ministry of Education, 2024), and it can be inferred that the three phases to higher vocational education mentioned above may accelerate.

Population has a direct impact on higher vocational institutions' ability to recruit students, survive, and grow. The population should be the primary determinant of higher vocational schools' medium- and long-term development. They must scientifically position the school's future goals and development strategies in order to take advantage of the opportunities and better meet the challenges presented by the quantitative characteristics of the new stage of population development.

5.2 Innovating the Development Direction of Higher Vocational Education

The age distribution of the seventh national census indicates that China will most likely eventually fall into the "inverted pyramid" demographic structure. This will have a significant impact on how effectively China's vocational education expands in the future. Higher vocational education should take the lead in reforming and transforming, gaining new roles, and pursuing new development in response to the changing demography.

5.2.1 Building a More Open Higher Vocational Education System

The idea of inclusion has gained popularity as a result of the increased popularity of higher education. According to this theory, education should be tailored to each student's unique needs and should be available to all citizens. All citizens are eligible to apply for higher education at any point in the future, regardless of their age or status, provided they are willing to do so in light of specific learning requirements (Lin, 2016). According to foreign experience, the more open higher education will be mainly provided by higher and junior vocational colleges, rather than research-oriented undergraduate universities (Riphahn &Trübswetter, 2006). Higher vocational education is currently expanding its enrollment to include social candidates like migrant workers, laid-off employees, retired military personnel, new professional farmers, etc. This shows that higher vocational education is generally adopting "inclusive" education. Currently, the expansion of enrollment is focused not only on previous ordinary high school graduates and secondary vocational graduates (Lai &Lo, 2006).

Higher education vocational schools will provide "inclusive" education in the future, which will have two clear features: "Strict exit and lenient entry" is the first. Access to schools can be improved, and admissions can occur without a test. However, higher vocational schools also have a duty to maintain the standard of instruction; therefore, before granting graduation approval, all students must fulfill the credits and evaluation requirements of systematic courses. The "diversified" development following graduation is the second. Higher vocational education ought to be "horizontally" and "vertically" integrated to other forms of education in the future. Following graduation, students can effectively transfer to undergraduate universities by using their higher vocational education as a "springboard" in addition to finding employment or starting their own business. Undergraduate and junior college education should create more

seamless connections with improved mutual recognition, as well as simple pathways for residents who wish to pursue higher education (Wu-Xia, 2012).

5.2.2 Creating Majors and Directions in Accordance with the Population's Shifting Trend

According to the current situation of "fewer children" and "aging population" in China, higher vocational colleges should aim at the elderly and children to create new majors and directions.

The next course of action for policy is to create an inclusive nursery system and lower the cost of parenting, as the overall fertility rate has dropped below the danger line and population growth is about to reach a critical turning point. From the standpoint of developing talent, higher vocational schools ought to assist in the development of an inclusive early childhood and education service system in the future. First and first, it's important to cultivate the talents of preschool students aged three to six. The extension of majors in preschool education is expanding more quickly than the construction of their connotations because these fields have a short history and weak accumulation; curriculum development, classroom instruction, and teacher preparation still have many issues, and talent cultivation needs to be of higher quality (Yingyue, 2017). Second, it's imperative to cultivate early childhood talent well, starting at age 0 to 3 years old. China's nursery service for children aged 0 to 3 is currently uncontrolled, and the corresponding professional standards, industry norms, and qualification requirements are in their infancy. The majority of practitioners lack professional training, expertise, and knowledge regarding the early development of newborns and young children. Higher education institutions should encourage the creation of industry standards for early care and enhance university-enterprise collaboration, even as the state speeds up industry access and standardization (Bailey &Lee, 1992).

The aging population in China has led to a rise in the need for elder care, making the development of a strong system of elder care services the most pressing issue both now and in the future. Higher education institutions should strengthen their capacity to serve an aging society by expediting the training of talent in geriatrics, rehabilitation, nursing, nutrition, psychological and social work, operation and management, rehabilitation AIDS configuration, etc (Villanueva, 2000).

5.3 Optimizing the Spatial Layout of Higher Vocational Education

Population agglomeration and spatial imbalance remain major trends in China. Higher vocational education should be based on population distribution, further adapt to this imbalance, improve spatial adaptability, and provide support for the balanced spatial development of the population.

5.3.1 Building a "Highland for Vocational Education" and improving the Geographical Distribution's Flexibility

The dispersion of the population should be actively reflected in education. There is a need for education wherever people congregate, so educational resources ought to be placed there. The regional pattern should be further improved by higher vocational education in accordance with the distribution of the population both now and in the future. China's national center cities are spread throughout its eastern, central, and western areas. Regional equity in higher education will often be supported by seizing the chance presented by national center cities to fortify the development of higher education." The development of a "vocational education highland" in national center cities should be supported by government agencies providing more resources and policies. This type of "vocational education highland" can satisfy the higher vocational education wants of the local populace in addition to being numerous and expansive. It should also be of the highest caliber, serve as a model for the superior advancement of vocational education, and spearhead the establishment of a cutting-edge system of vocational education.

5.3.2 Organizing "Specialized Colleges" and Supporting the Formation of a Balanced Population

Unlike traditional undergraduate colleges, higher vocational schools are primarily managed by province and local governments, and they are more obviously characterized locally as "based on local resources and serving local development." Higher vocational institutions must be given full play in light of the uneven spatial distribution of the population. In order to achieve full coverage of higher education in prefecture-level cities across the nation, government departments should continue to improve the national layout of higher vocational institutions during the expansion period of higher vocational colleges and make sure that each prefecture-level city has one higher vocational institution. The development of local higher vocational institutions in the direction of "high quality" and "specialization" should be encouraged by non-central cities in the central and western regions. On the one hand, it's important to keep things under control and preserve a steady campus, enrolment, and teacher and departmental numbers without going through with mindless growth and development. However, in order to foster local economic and social development, it is imperative to combine local advantages and characteristics in order to create characteristic majors, train characteristic talents, and concentrate on meeting the needs of the local population's future in terms of higher education as well as the needs of local economic and social development in terms of talents and technical services. The higher education institutions in the area should be proactive and take the initiative to train and retain talent as well as provide effective support for the long-term growth of the community's economy and society.

5.4 Improving the Development Quality of Higher Vocational Education

Excellent vocational training may quickly convert human resources into human capital, increase labor productivity, and promote economic growth by effectively transforming students into workers with excellent abilities. Theoretically, the excellent growth of vocational education represents both the application of a novel idea in educational development and a quality revolution in the field of education.

The following internal and external laws can be used to determine the high-quality development of vocational education: First, when it comes to the connection between skills and education, vocational training need to be student-centered and emphasize the holistic development of individuals. Second, about the connection between education and society, career education needs to focus on developing individuals who can both somewhat exceed and adapt to the demands of social progress. The high-quality development of vocational education can be understood as a development mode, structure, and dynamic state of vocational education to improve the quality of talent cultivation and better meet the actual needs of the times, based on the consideration of the internal and external relations of vocational education.

"Post-scale development" is the new era that China's education is entering, vocational education must evolve from high-quality development to meaningful, highly efficient, and sustainable development. Connotative development, among others, refers to the quantitative requirement in the expansion of vocational education and the quality requirement in the connotation. The development of vocational education is implied by qualitative shift, and achieving quality improvement is essential to bringing this development to fruition. The growth of significant groups, the development of talent, the faculty, and culture are other important aspects of the connotative development of higher vocational education, and they are also challenging issues(Shen &Sun, 2020)

6. Conclusion

Within the national multi-level education system, vocational education is the branch of education most directly aligned with the demands of the labor market; it is the intermediary that transforms the "demographic dividend" into the "skilled personnel dividend." On the one hand, it reserves talents for national development, plans majors and cultivation programs around long-term objectives, and satisfies the needs of national development for talent. However, it also helps employees locate high-quality positions and trains the highly skilled workforce that businesses desperately require, all in response to the labor market's latest demands. Vocational education fulfills the role of lifelong learning in this age of rapidly changing information and skills, allowing employees and students to acquire broader, more adaptable, and constantly updated abilities through skill development. Additionally, vocational education and skill development can assist young and old people participate more in the labor force and mitigate the detrimental effects of population aging on social and economic growth. As a result, we must work tirelessly to provide vocational education that takes into account the changing demographics. It is imperative that we take all reasonable steps to enhance the caliber and technical proficiency of the labor force as well as augment the quantity of excellent laborers and technically proficient and skilled individuals within the labor force. We can only take advantage of this inevitable trend of "decreasing birth rate" and "an aging society" in China by transforming crisis into opportunity.

Acknowledgments

Not applicable.

Authors contributions

Not applicable.

Funding

This work was supported by Chinese Association of Higher Education 2022 Higher Education Scientific Research Foundation [project number 22GG0403].

Competing interests

Not applicable.

Informed consent

Obtained.

Ethics approval

The Publication Ethics Committee of the Redfame Publishing.

The journal's policies adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

Provenance and peer review

Not commissioned; externally double-blind peer reviewed.

Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.

Open access

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (http://creativecommons.org/licenses/by/4.0/).

Copyrights

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

References

Bailey, B., & Lee, G. H. (1992). Early childhood education in Korea. *Child Development*, 25.

Cheng, L., Zhang, Y., & Shen, K. (2015). How does education affect people's health? -- Evidence from the elderly in China . *Economics (Quarterly)*, 1, 305-330.

Deng, G. (1992). The key to population control is to popularize compulsory education. *Southern Population*, 2: 40.

Dong, Z. (2009). On the relationship between population problem and education in China. *Journal of Central China Normal University: Humanities and Social Sciences Edition*, 3, 116.

Education statistics for 2022, December 29, 2023, http://www.moe.gov.cn/jyb_sjzl/moe_560/2022/quanguo/202401/t20240110_1099531.html, October 14, 2021.

He, L., & Wang, Z. (2022). Crisis and challenges faced by the future development of vocational education from the perspective of birth population and student source structure -- Based on Hunan and national statistical data analysis and strategic thinking. *China Vocational and Technical Education*, 33, 76-83.

He, Q., & Qi, W. (2000). Review of the research on the relationship between education and population in China . *Jiangxi Social Sciences*, 2, 101.

Huang, F., & Duan, C. (2022). From demographic dividend to demographic quality dividend -- Based on the analysis of the data of the seventh national census. *Population and Development*, *1*, 117-126.

Lai, M., &Lo, N. K. (2006). Decentralisation and the Development of Vocational Education in China. *China: An International Journal*, *4*(2), 287-301. https://doi.org/10.1353/chn.2006.0014

Li, Y. (2012). Advantages of economic development. *China Circulation Economy*, *12*, 65-68.

Lin, X. (2016). Barriers and Challenges of Female Adult Students Enrolled in Higher Education:A Literature Review.*Higher Education Studies*, 2. https://doi.org/10.5539/hes.v6n2p119

Liu, X. et al. (2021). *Blue Book of Higher Education: China Higher Education Development Report (2020-2021)*. Beijing, Social Science Literature Publishing House.

Liu, Z. (1992). Population modernization and priority education. *Population Research*, *2*, 2.

Mansouri, F. (2013). *Schooling, education ,and migration*. Blackwell Publishing Ltd. https://doi.org/10.1002/9781444351071.wbeghm473

Mark, G., & et al. (2004). Aging population and education finance. *Journal of Public Economics*.

Ministry of Education. (2017). *Statistical Bulletin on the Development of National Education in 2016* . Retrieved from http://www.moe.gov.cn/jyb_sjzl/sjzl_fztjgb/201707/t20170710_309042.html

Ministry of Education. (2021). *Statistical Bulletin on the Development of National Education in 2020*. Retrieved from http://www.moe.gov.cn/jyb_sjzl/sjzl_fztjgb/202108/t20210827_555004.html

Ministry of Education. (2021). *Striving to increase the gross enrollment rate of higher education to 60% by 2025*. Retrieved from http://www.moe.gov.cn/jyb_xwfb/moe_2082/2021/2021_zl25 /bd/202104/t20210401_523926.html

Ministry of Education. (2023). *Statistical Bulletin on the Development of National Education in 2022*. Retrieved from http://www.moe.gov.cn/jyb_sjzl/sjzl_fztjgb/202307/t20230705_1067278.html

Ministry of Education. (2024). *Ministry of Education: In 2023, China's higher education enrollment opportunities to increase the gross enrollment rate of more than 60%.* Retrieved from

http://www.moe.gov.cn/fbh/live/2024/55831/mtbd/202403/t20240301_1117707.html

National Bureau of Statistics, Office of the Leading Group for the Seventh National Census of the State Council. (2021). Bulletin of the Seventh National Census (No.6)-Population Education. *China Statistics*, *5*, 11-13.

National Bureau of Statistics. (2020). *China Population and Employment Statistics Yearbook 2020*. Beijing, China Statistics Publishing House.

National Bureau of Statistics. (2021). *Office of the Leading Group for the Seventh National Census of the State Council. Bulletin of the Seventh National Census (No.1) -- Basic Information of the Seventh National Census*. Retrieved from http://www.stats.gov.cn/tjsj/tjgb/rkpcgb/qgrkpcgb/ 202106/t20210628 _ 1818820. html

National Bureau of Statistics. (2022). *In 2021, the national population will increase by 480,000*. Retrieved from http://v.people.cn/GB/n1/2022/0117/c413792-32333064.html.

Nimer, K. (1990). Cultural Diversity and Its Effect on Education.*Cultural Differences*, *33*.

Office of the Leading Group for the Seventh National Census of the State Council. (2021). *Main data of the Seventh National Census in 2020*. Beijing, China Statistics Publishing House.

Pan, M. (1990). Discrimination of the laws of external relations of education. *Journal of Xiamen University: Philosophy and Social Sciences Edition*, *2*, 1.

Research Group on Higher Education Satisfaction. (2023). An empirical study on the present situation and problems of higher education development -- Based on the satisfaction survey and analysis of national higher education in 2021. *Journal of East China Normal University (Educational Science Edition)*, *5*, 16-25.

Riphahn, R. T., & Trübswetter, P. (2006). Population aging and continued education. *IZA Discussion Papers*. https://doi.org/10.2139/ssrn.947058

Serban, C. A. (2012). Aging Population and Effects on Labour Market. *Procedia Economics&Finance*, 1, 356-364. https://doi.org/10.1016/S2212-5671(12)00041-X

Shen, P., & Sun, C. (2020). Theoretical basis of vocational education type attribute. *China Adult Education*, *4*, 35-37.

Smith, A. (2008). *An Inquiry into the Nature and Causes of the Wealth of Nations*. John Wiley & Sons, Ltd.

Theodore, W. S. (1990). *On Human Capital Investment*. Trans: Wu Zhuhua. Beijing, Beijing Institute of Economics Press.

Tian, J. (2000). *Educational Demography*. Beijing, People's Education Press, 95.

UNDESA. (2001). Population Division United Nations. Dept of Economic and Social Affairs. Population, education and development: the concise report. *New York United Nations*.

United Nations. (2022). *World Population Prospects 2022: Summary of Results*. Retrieved from https://doi.org/10.18356/9789210014380

Villanueva, A. B. (2000). Review essay: Population aging and retirement issues in the next millennium. *Social Science Journal*, *2*, 321-325. https://doi.org/10.1016/S0362-3319(00)00070-7

Wang, P. (1980). The Changing Ethnic Population and Its Impact on School Districts in California. *Change Strategies*, 15.

Wei, X., & Zhang, J. (2010).Research on the threshold effect of human capital on total factor productivity growth. *China Population Science*, *5*.

Western Australia. Department of Training. (2002). The ageing population and the vocational education and training sector in western australia. discussion paper.*WA Department of Training*.

World Bank, International Monetary Fund. (2015). *Global Monitoring Report 2015/2016:Development Goals in an Era of Demographic Change*. Washington, DC: World Bank.

Wu-Xia, L. U. (2012). The concept shackle and its breakthrough for the connection of higher vocational education and application-oriented undergraduate education. *Journal of Higher Education*.

Xinhua News Agency. (2017). *Changes in the number of births in China from 2000 to 2016*. Retrieved from http://www.gov.cn/xinwen/2017-01/22/content_5162356. htm.

Xinhua News Agency. (2022). *Vocational Education Law of the People's Republic of China*. Retrieved from https://www.gov.cn/xinwen/2022-04/21/content_5686375.htm

Yingyue, T. (2017). Discussion on the training mode of higher vocational preschool education majors.*The Guide of*

Science & Education.

Zhang, L., Shi, Y., & Hu, Y. (2022). Trends and characteristics of urban and rural school-age population from 2021 to 2035 -- Forecast based on the data of the seventh national census. *Education Research*, *12*, 101-112.

Zhao, J. (2019). *Population change and forecast of educational resource demand: Taking Beijing as an example*. Beijing, Social Science Literature Publishing House, 17.

Zhao, J., Zhang, Z., & Sheng, Y. (2020). Research on Dynamic Factors and Adaptability Characteristics of Regional Layout of Higher Vocational Education in China. *Journal of National School of Education Administration*, *10*, 78-85.

Zhong, S., Zhao, Y., & Ren, J. (2016). Study on the substitution effect of "education Dividend" on "demographic dividend". *Chinese Population Science*, *2*.

Zhou, Z. (2014). *Educational Demography*. Beijing, Social Science Literature Publishing House, 47.

Zhou, Z. (2018). *Winning education dividend: A Preliminary discussion on the change of population quality in China*. Beijing, Social Science Literature Publishing House, 99.

Zhu, M., & Xu, J. A. (2019). Literature Review on China's Population Aging, Human Capital and R&D Capital Stock. https://doi.org/10.20448/2002.51.29.35

Notes

Note 1. Data from National Bureau of Statistics, of which the data for 2010 and 2020 are estimated from the census data of the current year and the remaining years are the projected data of the annual population sample survey.