Research on the contribution rate of vocational education to social and economic development

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Abstract. This paper makes a quantitative research on the promotion of vocational education to social and economic development. Taking the population of a village in Tianjin as the research sample. This paper makes a quantitative design on the role of education in the social and economic development for the village in the next 10 years, and obtains that vocational education has a relatively obvious role in promoting the economic development of the village, which provides scientific data support for the future education mode of the village population. So as to provide effective theoretical suggestions for the economic development for the village, the whole Tianjin, even the whole nation.

1. Introduction
Vocational education is the kind of education let the educated to obtain the professional knowledge, skills and professional ethics education required by a certain occupation or productive work. The vocational education can promote the utilization efficiency of social resources by improving labor productivity, that is very important to promote the social and economic development, the optimal allocation of social resources. While vocational education promotes economic development by increasing employment, and the modernization reform of production relations by promoting technological progress, finally, guides the effective allocation of social resources [1-3].

In China, with the accelerating process of urbanization in China, more young person from countryside choose vocational education as their further education in recent yeas. So, this paper intends to analyze the contribution rate of vocational education to the national economy by taking a village as an example, that will provide a theoretical basis for further improving rural endogenous productivity in developing countries.

2. The calculation for the contribution rate of vocational education to economic development
In this paper, we will analyze the research object accurately based on the micro sample, and take a village in Tianjin, China as the research object. There are 191 adult workforce in the village at 2019, as shown follows, Fig.1a is the cultural level distribution of the registered residence in the village, Among them, there are 19 people with university degree, including junior college and undergraduate talents, 16 from senior high school, 13 from secondary school, 74 from junior middle school, 106 from primary school, 8 from illiterate, and the rest are preschool children. From the above histogram distribution, it
can be found that the number of people with primary school education accounts for a large proportion in the village, followed by junior high school. The number of these two types of personnel is far larger than that of high school, secondary vocational school and college. The percentage of various types of talents is shown in the Fig.1b as shown below:

![Figure 1. a. Number of people with different educational background, b. Percentage distribution of people with different educational background, c. Percentage distribution of people over 18 years old with different educational background](image)

Fig.1c shows the distribution of educational background of the person over 18 years old with working ability. It can be clearly seen from the above figure that 71% of the village's labor force population has primary school and junior high school education, and 10% was university educated. In the labor force, the number of highly educated person is relatively fewer, although it is higher than the national average level, while, it is far lower than the average level of developed countries.

In order to calculate the role of Vocational Education in the development for national economy better, this paper estimates the contribution rate of education to the economy in the village for the next 10 years. As for the contribution rate of education to the economy, the Denison method is widely used in the world. The method used in this paper does not revise its reliability, applicability, accuracy and other aspects, but only makes basic estimation and the related comparative study.

The comprehensive index of education is used to represent the labor input brought by the improvement of education level. The simplified rate of homogeneous labor force of employees with primary, junior, high school, secondary vocational, higher vocational educated experience, university and graduate education is determined as 1.28, 1.38, 1.51, 1.81, 2.25 and 2.83, from which the labor force conversion number of employees with different education levels can be calculated, and then the average educated years of labor force is regarded as the weight, and then the comprehensive index of per capita education of labor force is calculated[4,5].

In table 1, The enrollment rate was calculated according to the birth situation of newborns from 2004 to 2013. According to the enrollment rate of Tianjin, the number of students in each education stage is calculated, meanwhile, the mortality will be considered. In this way, the real percentage data will be obtained in 2019 and the calculated percentage data will be obtained in 2029.

Thus, based on the calculation formula of years of education is as follows:
Table 1. Percentage of employees' education level in 2019(%).

| Year | Illiterate & semi illiterate | primary school | junior middle school | high school | vocational education | university | graduate student |
|------|------------------------------|----------------|----------------------|------------|----------------------|------------|-----------------|
| 2019 | 4.12 | 39.79 | 30.37 | 8.38 | 10.47 | 6.28 | 0.52 |
| 2029 | --- | --- | --- | --- | 23.47 | 7.51 | 0.94 |

\[
\sum_{i=1}^{n} S_i \times n \times 100 = N
\]  

(1)

\( S_i \) is the Percentage of employees' education level of each education stage, \( n \) is years of education, \( N \) is years of education of the whole village.

Years of primary education per employee in 2019 could be calculated as:

\[
\frac{(39.79 + 30.37 + 8.38 + 10.47 + 6.28 + 0.52) \times 6}{100} = 5.7486
\]  

(2)

Years of junior high school education per employee in 2019:

\[
\frac{(30.37 + 8.38 + 10.47 + 6.28 + 0.52) \times 3}{100} = 1.6806
\]  

(3)

Years of senior high school education per employee in 2019:

\[
\frac{(8.38 + 6.81 + 6.28 + 0.52) \times 3}{100} = 0.6597
\]  

(4)

Years of vocational education per employee in 2019: \( \frac{10.47 \times 3}{100} = 0.3141 \)

Years of undergraduate education per employee in 2019: \( \frac{6.28 \times 4}{100} = 0.2512 \)

Graduate education is ignored and the data level is too low.

Years of Education of each villager in 2019 is as follows:

\[
5.7486 + 1.6806 + 0.6597 + 0.3141 + 0.2512 = 8.6542
\]  

(5)

The comprehensive index of per capita education of the village in 2019 is as follows:

\[
E_{c,2019} = \sum_{i=1}^{n} E_{i,2019} = \sum_{i=1}^{n} Y_{i,2019} \times L_{i,2019}
\]  

(6)

\( E_c \) is the comprehensive index of per capita education, \( Y_i \) is Years of each education stage per employee, \( L_i \) is the simplified rate of homogeneous labor force of employees.

\[
i.e. \quad 5.7486 \times 1 + 1.6806 \times 1.28 + 0.6597 \times 1.38 + 0.3141 \times 1.66 + 0.2512 \times 2.25 = 9.8968
\]  

(7)
Years of primary education per employee in 2019 could be calculated as:

\[
\frac{(35.68 + 27.23 + 7.51 + 23.47 + 7.51 + 0.94) \times 6}{100} = 6.1404
\]  
(8)

Years of junior high school education per employee in 2019:

\[
\frac{(27.23 + 7.51 + 23.47 + 7.51 + 0.94) \times 3}{100} = 1.9998
\]  
(9)

Years of senior high school education per employee in 2029:

\[
\frac{(7.51 + 16 + 7.51 + 0.94) \times 3}{100} = 0.9588
\]  
(10)

Years of vocational education per employee in 2029: \(\frac{(23.47) \times 3}{100} = 0.7041\)

Years of undergraduate education per employee in 2029: \(\frac{(6.28) \times 4}{100} = 0.3004\)

Years of Education of each villager in 2029 is 10.1035:

The comprehensive index of per capita education of the village in 2029 is as follows:

\[
6.1404 \times 1 + 1.9998 \times 1.28 + 0.9588 \times 1.38 + 0.7041 \times 1.66 + 0.3004 \times 2.25 = 11.868
\]

For calculating the average annual growth rate of per capita education composite index of employees in the decade, geometric average method is used as follows:

\[
e = \left( \frac{E_n}{E_0} \right)^{1/n} - 1
\]  
(11)

\(e\) the average annual growth rate, \(n\) is the years of education, \(E_n\) is the comprehensive index of per capita education at 2029 in our study, \(E_0\) is the comprehensive index of per capita education at 2019 in our study.

\[
\begin{align*}
  e_{p.e.} &= \left( \frac{6.1404}{5.7486} \right)^{1/10} - 1 = 0.0066 \\
  e_{j.h.s.} &= \left( \frac{1.9998}{1.6806} \right)^{1/10} - 1 = 0.0175 \\
  e_{s.h.s.} &= \left( \frac{0.9588}{0.6597} \right)^{1/10} - 1 = 0.0381 \\
  e_{v.e.} &= \left( \frac{0.7401}{0.3141} \right)^{1/10} - 1 = 0.0895 \\
  e_{u.e.} &= \left( \frac{0.3004}{0.2512} \right)^{1/10} - 1 = 0.018 \\
  e_{e} &= \left( \frac{10.1035}{8.6542} \right)^{1/10} - 1 = 0.0156
\end{align*}
\]  
(12)

\[
\begin{align*}
  e_{c} &= \left( \frac{11.868}{9.8968} \right)^{1/10} - 1 = 0.0183
\end{align*}
\]  
(13)

The increment of comprehensive education index of employees is as follows:
Taking the increment of various education indexes as weights, the percentages of the growth rate of each type of teaching station in the total education storage index could be calculated:

\[ \gamma_i = \frac{\Delta E_{C_i}}{\Delta E_C} \times 100\% = \frac{\Delta E_{C_i}}{\sum_{i=1}^{n} \Delta E_{C_i}} \times 100\% \]  

The data of Vocational Education is, 52.47%.
The data of Undergraduate education is, 10.61%.
The contribution rate of education to the economy can be calculated as:

\[ R_e = \gamma_i \beta e \]  

\[ R_e = \frac{0.7 \times 1.83\%}{6.2\%} \times 100\% = 20.66\% \]

The contribution rate of vocational education to the economy: 0.5247*20.66%=10.84%
The contribution rate of vocational education to the economy: 0.10.61*20.66%=2.19%

Figure 2. a. Percentage of vocational education and undergraduate education b. yeas of vocational education and undergraduate education c. average annual growth rate of vocational education and undergraduate education d. contribution rate of vocational education and undergraduate education
The abscissa of Fig. 2 is time, unit is year. From Fig. 2a, it can be seen that the population of vocational education is gradually expanding, and the growth rate is far greater than that of undergraduate education. Similarly in Fig. 2b, not only the number of people studying vocational education has increased, but also the time of participating in vocational education has also been greatly increased. Fig. 2c shows that the average time for Vocational Education in this village has been improved greatly in the past ten years. Especially, in Fig. 2d, from 2019 to 2029, when the average annual growth rate of GDP of the village is 6.2%, 1.28% is brought by education, accounting for 20.66%. The contribution rate of vocational education to economy is about 5 times that of undergraduate education.

3. Conclusions
From the above analysis, vocational education plays a more and more important role in the development of the village's per capita economy. Compared with the undergraduate education, the number of people receiving vocational education is increasing and the number of years of receiving education is continuously extended. By 2029, 0.67% of the economic growth of the whole village is caused by vocational education, while only 0.13% is brought by undergraduate education. Therefore, vocational education is effective in promoting economic growth especially for countryside in China.

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