

One Solution for Good? Systematic Analysis of Industrial Human Resource Supply Chain: Study on the Educational Dilemma and Countermeasures of Declining Birth Rate in Taiwan

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Abstract

This study uses the concept of system analysis to explore the problem of industrial human supply chain, and conducts policy research on Taiwan's educational industry. Since the industrial human supply chain is an overall social issue, it is related not only to social welfare and employment policies, but also the consequences of educational policies. Therefore, this research can make concrete contributions to both industrial development and educational plans. This research mainly explores the following questions: 1) What is the relationship between the human resource supply chain and the education industry? 2) What measures can the government take in the face of insufficient human resource supply? 3) Is there a good policy that can take into account the industry development and education industry supply chain? In response to the above problems, this study adopts the research method of systematic analysis, and puts the current situation of the educational industry and the industrial domain into the same system for analysis, and therefore systematically compares the policies proposed by the government and other feasible solutions. This research conducts research on the policies adopted by Taiwan in the past three years regarding human resource shortages, and present comparative results. The results of this study point out that (1) the educational industry and enterprises should be inseparable, so the content of education should meet the needs of the industry. (2) The government is the most important role that affects the development of the industry, and the government has the responsibility to make good policies. (3) The work-study program that takes into account the needs of the educational industry and enterprises, and the introduction of international mobile students and employment populations is a good solution help to meet the needs of industries and employment in various countries.

Keywords: Human resource, Supply Chain, Educational Policy, Low Birth Rate, Tertiary Education

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Introduction

Research background - low birthrate and university exit

According to reports, Taiwan's birth rate has continued to decline since the 1980s. In 2010, Taiwan became the country with the lowest birth rate in the world. This situation remains unchanged by 2021. The average freshman registration rate was 83.4% in 2011. Since then, the number of births in Taiwan has continued to decline. As of 2021, the registration rate of colleges and universities across the country has never reached 90%, and the registration rate of private technical and vocational colleges has maintained 80%. The impacts of low fertility and declining birthrate on education are that schools are facing a shortage of students. They are financially not able to support their sustainable development, and some of them had to face the crisis of closure.

The Ministry of Education in Taiwan has targeted tertiary education institutes with fewer enrollment numbers, encouraging them to take the initiative to propose transformation plans in advance, effectively use the resources that has already invested, and actively develop college characteristics and suitability through restructuring or adjusting the current scale and operation direction.

The Ministry of Education also expects to establish the "Tertiary College Transformation and withdrawal mechanism fund" from the year of 2016. During the transformation withdrawal period, colleges can borrow from the fund to carry out transformation planning, or to pay for the pensions of faculty and staff. Expenses such as severance payments and concessionary grants can be obtained through financing to protect the rights and interests of relevant personnel.

Importance of Research - Human Resource Supply Chain

The problem of declining birthrate is an important educational issue in Taiwan in recent years that requests for urgent solutions (Gao & Chen, 2015; Chen, 2016; Zeng, Zhang, & Guo, 2009; Yang, 2013; Shiokawa, 2006). According to statistics from the Department of Household Affairs of the Ministry of the Interior, Taiwan's total fertility rate in 2010 reached a record low, and the fertility rate dropped to 0.895, making it the country with the lowest fertility rate in the world (Chen, 2016; Wang, 2012). According to another statistic record, from 1990 to 2010, the number of newborns in Taiwan dropped from 321,932 to 196,627 in 2021, a decrease of 125,305 or 38.92%. Taiwan will lose 180,000 workers every year since 2015 on ward. After 10 years of accumulation, there will be a gap of 1.8 million workers of human resources supply (Cheng, 2015), which created a significant impact on Taiwan's future development and international competitiveness.

Previous research results

The essence of the problem is the collapse of the academic industry and the hollowing out of industrial manpower. People tend to interpret it as a natural phenomenon of industrial competition. Colleges with poor performance naturally should be abandoned by the market. The government should no longer spend money to subsidize it and should allow it to collapse and fend for itself. Under this severe situation, many inappropriate

policies followed, such as forcing the withdrawal of private schools, making a field that can create scientific and technological human capital go to waste. Therefore, in order to avoid this regret from self-repetition, it is necessary to do in-depth research on this issue.

Issues not addressed by predecessors

From a system analysis point of view, the ideal state of the supply chain is a balance between supply and demand. With a decrease in the number of births, Taiwan must face the problem of an imbalanced problem between supply and demand of industrial human resources. The chairman of MediaTek, a leader in Taiwan's high-tech industry, pointed out with great concern that due to the continuous decline of Taiwan's population, Taiwan must face three industrial crises. The first crisis is the lack of technology professionals cultivated by Taiwan itself, the second is the inability of university education to connect with high-tech education, and the third crisis is that these problems will lead to the backwardness of Taiwan's technology development (Chen, 2021).

The research question of this study

The problem with Taiwan's education supply chain is the lack of students. The problem of Taiwan's industry is the shortage of labor. The lack of students in the education supply chain has caused the collapse of the education industry. The shortage of industrial labor force has resulted in the hollowing out of the industry. Therefore, we will discuss the following research questions:

1. Can we find an effective way to solve this problem?
2. What is Taiwan's solutions to this problem? Does it work?
3. What can the cases of Taiwan's education industry policy and labor force policy tell us?
4. From the perspective of supply and demand, what kind of business strategy should be maintained in the education industry chain?

Innovation and contribution of this research

The educational industry is also a research topic in supply chain research. Technical colleges will face the impact of the low birthrate problem earlier than the industry. This problem has become an existential crisis that technical colleges must face. Colleges and universities are responsible for educating national talents and carry an important responsibility of the last mile education. After graduation from tertiary institutes, students will enter the industry service and supply the labor force required by the industry. There are as many as 160 colleges and universities in Taiwan. The number of college students admission exceeds the total number of high school graduates, and the admission vacancy has reached 20%. Insufficient admissions creates difficulties for the operation of these institutes. In the face of such an education crisis, this paper attempts to discuss the impacts of Taiwan's various educational policies on the tertiary educational institutes and its consequences.

Literature review

System Analysis Theory

System analysis, which aims to study the interaction of each part (each subsystem) in a specific system structure, the external interface and interface of the system, as well as the overall behavior, function and limitation of the system, so as to provide reference for the future changes of the system and related decisions and basis. One of the frequent goals of system analysis is to improve the decision-making process and system performance in order to achieve the overall optimization of the system.

Therefore, the development of the education industry and the human resources supply chain of the industry can be regarded as a system. The education sector needs to cultivate good-quality manpower for the industry, and for its own development, the industry must send personnel to the school for further study, and after completion, they will become high-quality manpower in the industry. The whole process is a continuous cycle system, as shown in Figure 1.

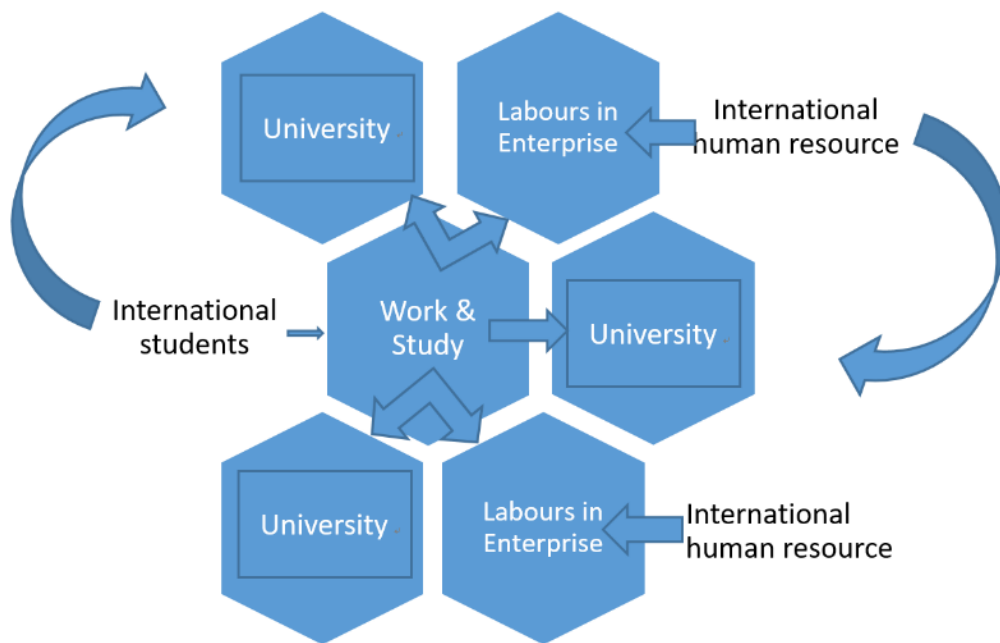


Figure 1 Viewing the education industry supply chain through systematic analysis

Education Industry Chain

We can link the supply and demand management of human resources in the education industry chain with the industry, and the dynamics of this system can be easily analyzed. The customer end of the education industry chain is students, so the education industry must be easy to operate in a place with a high birth rate. The product of the education industry is graduates, so graduates must meet the needs of the industry before customers (students) are willing to come in. Otherwise, if they can't find a job after graduation, customers (students) are reluctant to buy this kind of product.

Human Resource Supply Chain

Human resources supply chain is about supply chain manpower planning, which means that given production (or service) plans, labor costs, work procedures (such as maximum working hours) and other information, the manpower planning system can make some feasible employee plans to ensure providing the required labor at the lowest cost at any time. In order to achieve its development goals, an organization forecasts the supply and demand of human resources are required, and formulates systematic human resources policies and measures to meet its own human resource are in need.

Only when the supply chain manpower plan fully considers the changes in the internal and external environment can it adapt to the needs and truly serve the development goals of the enterprise. Internal changes mainly refer to changes in sales, development, or corporate development strategies, as well as changes in the flow of company employees; external changes refer to changes in the social consumer market, changes in government policies on human resources, and changes in the talent market. In order to better adapt to these changes, the human resource plan should make predictions and risk changes in the possible situations, and it is best to have coping strategies to face risks.

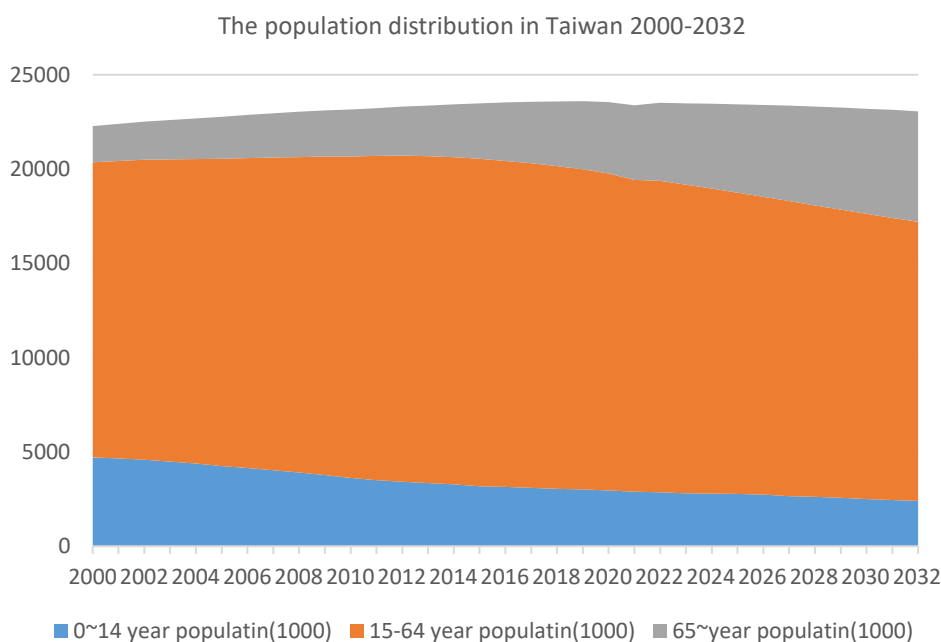


Figure 2 Distribution of population growth rate and population structure in Taiwan Source: National Development Commission Population Estimation Inquiry System
<https://pop-proj.ndc.gov.tw/chart.aspx?c=13&uid=4113&pid=60>

As can be seen from Figure 2, Taiwan has a big problem with its population structure. The workable labor force between 15 and 64 will continue to decrease in the next 10 years, which is very unfavorable for Taiwan's industrial development.

This paper adopts a case study method to analyze the policies adopted by the Taiwan government when it faced the two major crises of educational industry exit and industry hollowing caused by the declining birthrate.

Secondly, it analyzes Taiwan's industrial human supply chain policy, to explore whether education industry policy and industrial human supply chain policy can complement each other from the perspective of systematic analysis.

Taiwan's economic growth is closely related to the development of technical and vocational education, which is an important driving force for Taiwan's social progress and economic prosperity. After World War II in 1945, Taiwan's Ministry of Education actively subordinated technical and vocational education, which was listed as an important infrastructure project for national development. In the 1960s, the Ministry of Education encouraged Taiwan's private sector resources to invest in technical and vocational education to provide sufficient intermediate industrial manpower for Taiwan's economic transformation. Later on in 1974, Taiwan's first degree-granting technical college was established. At this time, a complete technical and vocational education system was then established.

The development of technical and vocational education has provided a large number of high-quality labor power for Taiwan's economic development. This educational system cultivated middle-level technical personnel with academic background and technical skills, and created a technology-oriented economic miracle for Taiwan in the 1970s and 1980s (Taiwan Labor Front, 2021). In order to build a high quality technical and vocational education equipment, the Ministry of Education continued to promote the 'Technical and Vocational Education Reconstruction Program' in 2009 and 2012, investing a good amount of resources to improve the teaching and learning quality of technical and vocational education. Technical and vocational education has undergone several transformations and reforms, in line with the focus of Taiwan's industrial development, and continuing to cultivate professionals for Taiwan's industrial development.

The development of Taiwan's vocational and technical education industry is facing a crisis due to the low birth rate

However, even though technical and vocational education has helped created a miracle for Taiwan's economic development, Taiwan's educational policy was inevitably caught in the myth of world university rankings. In order to upgrade Taiwan universities' ranks among world educational ranking, many national

universities have received extremely abundant education funds (Ministry of Education, 2014a) to improve their teaching and research facilities, which has encouraged high school graduates move towards research oriented comprehensive universities. As a consequence, technology and vocational education has become students' second choice.

For a long time in Taiwan, the allocation of educational resources to colleges and universities over technical occupations (Xu, 2012) has directly affects students' choices for further education. Under the influences of Confucianism, Taiwanese society generally attaches great importance to diplomas, and the concept of "everything is inferior, only high education is respected " is deeply rooted; coupled with Taiwan's economic development, general families' income has increased, parents do not need or want their children to work too early (graduated from 2-year colleges). Going to university has become a social ethos in Taiwan (Lai, 2013).

According to the statistics of the Ministry of Education, since 2010, the number of students enrolled in high schools has decreased from 350,000 to 320,000 each year, but the number of students in vocational colleges has dropped from 390,000 to 390,000. Reduced to 300,000 (Wu, 2020), the source of students in technical colleges is mostly coming from vocational high schools, and the number of students lost by vocational schools is three times that amount of high school students. During 2008, the proportion of vocational students in the same age group was 52.07%; by 107, the proportion of vocational students had dropped to 48.02%. The reduction of vocational students will directly affect the number of students that can be recruited by technical colleges.

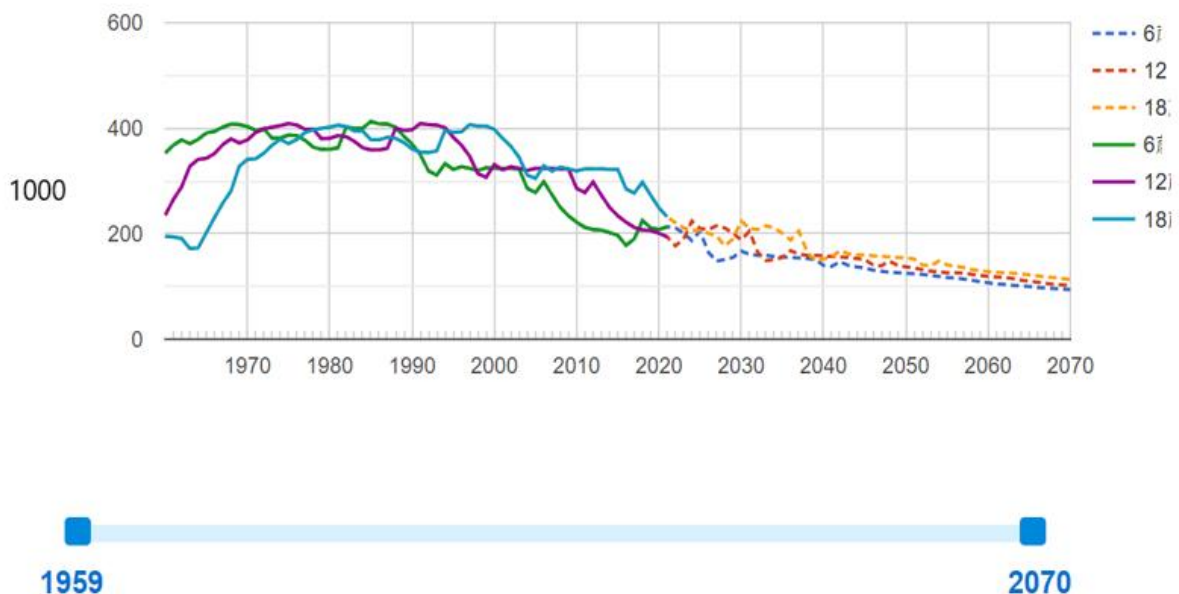


Figure 3 Demographics of Taiwan's school-age groups Source: National Development Commission Population Estimation Inquiry System <https://pop-proj.ndc.gov.tw/chart.aspx?c=13&uid=4113&pid=60>

The task of technical and vocational educational institutes is to cultivate all kinds of practical professional and technical talents. Each tertiary institute needs to construct a full range of teaching facilities and hire teachers with professional experiences. Generally, universities mainly teach theories. In contrast, technical and vocational education requires more investment. The source of students is a key indicator of the colleges' survival. The task of teachers is no longer simply to do a good job in teaching, but they also need to take the responsibility of recruiting students, as this is an immediate and obvious survival pressure.

Inappropriate policies that make the development of Taiwan's vocational and technical education industry face a crisis

Faced with the problem of insufficient amount of students, the direction of the bill formulated by the Ministry of Education is obviously difficult to respond to the industry's demands. In 2017, the Ministry of Education launched the draft of "The Regulations of withdrawing Private Senior Secondary Schools and Tertiary Institutes" (Ministry of Education, 2017). The rationale presented the legislative logic of the Ministry of Education. The Ministry of Education believes that insufficient students will lead to financial deterioration of colleges. In order to save teaching expenditures, colleges will inevitably reduce the quality of teaching (for example, combining classes and therefore affecting students' rights to education). Schools with poor teaching quality must accept the elimination mechanism from this free competition market. The task of the Ministry of Education is then to develop an exit mechanism that expels colleges that are not strong enough to survive, rather than to make these colleges continue to play their educational role.

The Ministry of Education argued that as ‘tuition and miscellaneous fees are important sources of income for colleges and universities, and the reduction of student will seriously affect the college financial structure’, the Ministry of Education further argues that it will result in unforeseen consequences on the issue of teaching quality. The Ministry of Education made another daring presumption: low enrollment rate will lead to low income of the colleges. For the purpose (merely) of saving the cost of teaching faculties’ hourly teaching fees, the college will inevitably put students from different departments of low enrolment in one classroom for saving the expenses of teaching, and that will seriously damage those students’ educational rights. This assumption, exhibits a general distrust of the college with low registration rate. The draft was submitted to the Legislative Yuan in 2016 and was approved in May 2022. In 2021, some legislators directly predicted that by 2029, at least 40 colleges and universities will be closed as there will be no students admitted to them. They called on the Legislative Yuan to review and pass the bill to release the land and property of those private colleges (Pan, 2021a). Apparently, the legislative spirit of this bill is not to continue those colleges’ educational duty. The bill fails to solve the problem of insufficient human resource supply chain.

As early as in 2014, the Ministry of Education has formulated a notice on 'Precautions on protecting students' rights and interests of education in colleges and above' (Ministry of Education, 2014b). In this notice, the Ministry of Education directly defines colleges with low enrollments are colleges with poor educational quality. The Ministry of Education claims that the purpose of this notice is to 'maintain the teaching quality of college, and ensure the rights of students to be properly taught'. The content of this bill, again, consistently

shows a distrust of the teaching quality of colleges with insufficient enrolment rate. The Article 4 of the Regulations defines that if the number of students in each grade of the college lower than 30 students or the enrollment rate is lower than 80%, they will have to accept the inspections from the Ministry of Education

The title of this notice is called 'Precautions' (Ministry of Education, 2017). it was granted with the power as an executive order from the Ministry of Education. The practice of the inspection includes requiring colleges to submit written reports every semester. The representatives from the Ministry of Education can carry out the inspection and visit colleges without prior warning (Pan, 2021b). On-campus inspections include that the inspectors can go into the classrooms in the middle of teaching for counting how many students attended the classes, for checking whether the professors are on time for class. Scholars warned that these behaviors have violated the constitutional guarantee of universities' Academic freedom (Pan, 2021b). College with poor inspection results will lead to restricted admissions of students and reduced financial subsidies from the Ministry of Education.

Facing the phenomenon of low birthrate, Taiwan can adopt the best education industry chain policy

The first step is to use fiscal and tax subsidies to assist the industry. The Taiwanese government can use fiscal and taxation methods to assist the industry, as well as subsidize a large amount of funds to colleges that are eligible to recruit overseas students.

Secondly, it is also a feasible way to introduce students because of the manpower required by the industry. Taiwan has a very good manufacturing industry, but due to the lack of labor, a large number of them have moved to China and Southeast Asia, resulting in the hollowing out of the industry. Therefore, it is a win-win strategy to recruit students to help meet the needs of industries with insufficient labor, and to help students earning their educational fees.

Further discussion

Both regulations exhibit a general distrust of the teaching quality of those tertiary technological institutes with lower student registration rate. Considering the industry's worries of the insufficient supply of industrial human resources, which directly impact the national industrial and economic development, the above-mentioned two decrees of the Ministry of Education obviously cannot fully respond to the supply shortage of human resources in the industry.

Taiwan government has invested in educational resources for a long time, and that has established a full range teaching facilities for cultivating technical professionals. Faced with the issue of insufficient supply of human resources in the local industry, the Ministry of Education should not just let technical colleges dropped out from this free market due to the lack of students. On the contrary, Taiwan should expand the opportunities for international students to study in Taiwan, formulating a friendly immigration policy, and encourage international students to stay in Taiwan to serve after completing their studies. The Ministry of Education should consider lifting the restrictions on the admissions of foreign students, providing incentives such as scholarships

and grants. The formulation of friendly immigration policies will mitigate the impact of declining birthrate and labor force to Taiwan's economy, society, and national prosperities.

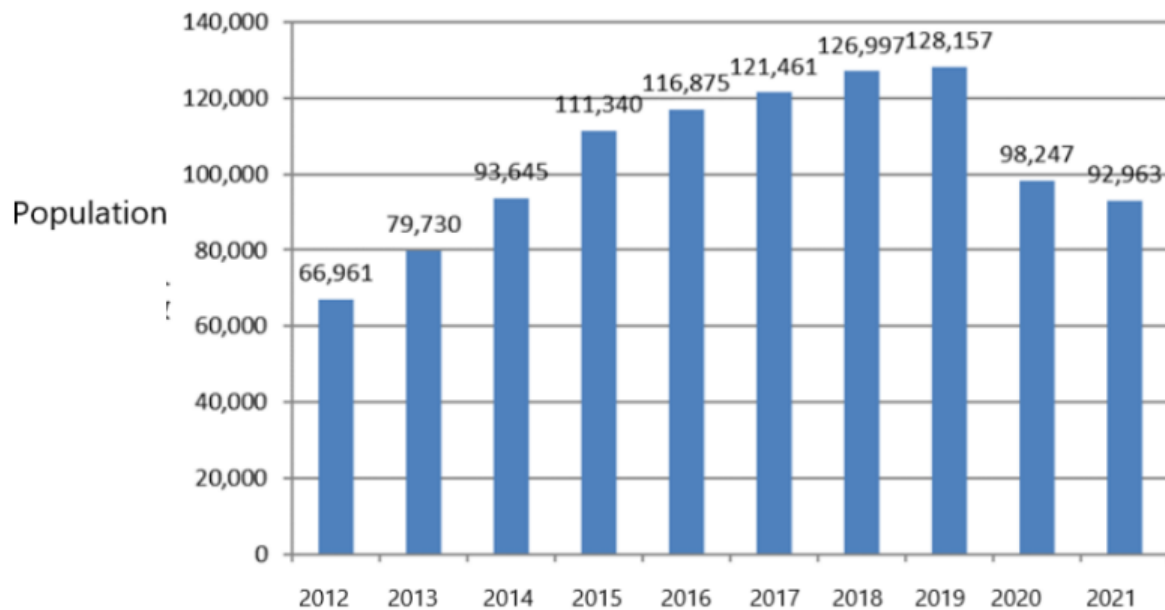


Figure 4 The number of foreign students admitted to Taiwan in the past ten years
(from Ministry of Education Statistics Database)

CONCLUSIONS AND RECOMMENDATIONS

Faced with the imbalance between working force supply and demand, the Ministry of Education, has at least two options. One option is continuing the current policy direction. The direction of the current policy is not to make the technical vocational system continue to play their educational role of training technical human resources to ensure a lower shortage of industrial talents. Rather, the policy tends to make those colleges with insufficient students to withdraw from this educational market. The disappearance of a tertiary institute means that the college teachers and the existing teaching facilities will no longer continue to play its educational role, making the problem of insufficient industrial human resources even worse.

Another option is to consolidate the tertiary vocational institutes' survival opportunities, expand the admissions of international students to study in Taiwan, to strengthen teachers' teaching capacities for teaching international students, to assist the administrative units to serve international students. After completing their college education, those international students have the advantages of bilingual ability, academic education and professional skills, that will help promote the future international development of Taiwanese industries. How to continue to make good use of existing educational resources and ensure the quality and quantity of the industrial human supply chain under the social trend of low birthrate and aging population in Taiwan will test the foresight and wisdom of the educational authorities.

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