

Vision and Reality: The Development Routing of Technical Undergraduate Universities

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Abstract—China's technical undergraduate universities are confronted with quite a lot of realistic problems and obstacles, such as policies and system, social recognition, connotation construction and theoretical research and so on. At the mean while, we are still confident that technical undergraduate universities have a hopeful future. They should persist in their development dream. But at present, our focal point of the works is to link the realistic difficulties with the dream. Under the guide of dream, we work hard. Through considering realistic difficulties, we work down-to-earthly.

Index Terms—Technical undergraduate universities, field engineer, vision.

I. INTRODUCTION

The history of technical undergraduate universities in China is pretty short. In a strict sense, these universities which called themselves technical undergraduate universities are mostly newly-founded undergraduate colleges. To this extent, the history of technical undergraduate universities in China is about twenty years. So technical undergraduate education is a type of brand-new higher education institutes. This situation decides there must be plenty of realistic problems and obstacles in theory research and school-running practice. These issues deserve careful and deliberate consideration and find a way to solve these problems. Only so, technical undergraduate universities can develop healthily and scientifically.

II. THE BACKGROUND

It is mentioned in the Guidelines of the National Program for Medium- and Long-Term Educational Reform and Development(2010-2020) that modern vocational education system should be set up before 2020, which would adapt the style of economic development and the need of industrial structure adjustment, embody the ideal of life-long education, and the coordinated growth of secondary vocational education and higher vocational education so as to meet the need of the masses for accepting vocational education. Mr. Lu Xi, China's vice secretary of Minister of Education, ever said constructing the modern vocational education system is an important strategy of the future 10-year vocational education development in China. So we can see modern vocational system has been the strategic key aim of China's

vocational education development.

Modern vocational education system should include not only the articulation between secondary vocational education and higher vocational education, but also the vocational education at the undergraduate level, even the graduate level [1]. But in China, vocational education at undergraduate level is a great taboo, which is often related to the upgrade from junior college to university. So just because of this, authorities of education departments require all National Demonstrative Higher Vocational Schools must not upgrade from junior college to university before 2020. In the beginning of 2011, Ministry of Education adjusted the schools administration system, which is to incorporate the Bureau of Higher Vocation Education and Junior College Education and the Bureau of Further Education into the Bureau of Vocational Education and Adult Education. But

The administration responsibilities of a mass of applied undergraduate colleges are not adjusted. From this, it seems that education authorities do not think explicitly over vocational education at the undergraduate level, and get it arranged well. In fact, vocational education at the undergraduate level has great significance for us. On the basis of historical and international perspective, technical undergraduate education is the most suitable educational type of bring about vocational education at the undergraduate level. Actually, this paper will just discuss the development of technical undergraduate education in China, especially the vision and reality difficulties.

III. THE REASONS FOR DEVELOPING VOCATIONAL EDUCATION AT THE UNDERGRADUATE LEVEL

A. The Need for Improving Modern Education System with Chinese Characteristics

Improving modern education system with Chinese characteristics is one of most important guiding ideologies of the Guidelines of the National Program for Medium- and Long-Term Educational Reform and Development (2010-2020). From the educational levels, the modern education system with Chinese characteristics includes preschool education, primary school education, junior high school education, senior high school education, junior college education, undergraduate education and graduate education. From the educational forms, the modern education system with Chinese characteristics includes the education with and without record of formal schooling, and vocational education and general education. So it is a precise educational system with distinct gradations and complete types. But in the system of the Guidelines of the National Program for Medium- and Long-Term Educational Reform

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and Development(2010-2020), higher education does not refer to higher vocational education, and vocational education does not refer to higher vocational education too. From the view of the current situation, there exists higher vocational education in junior colleges. There is no vocational education at the undergraduate level, much less vocational education of higher level. Therefore, in the view of the need for improving modern education system with Chinese characteristics, the system is integrated only the vocational education at the undergraduate level and even higher level are set up.

B. The Need for Constructing Modern Vocational Education System

In China's undeveloped area, secondary vocational education is not well developed. In China's economical developed area and cities, there is no vocational education at the undergraduate and higher level which corresponds with advanced technology industry and modern service industry. So it is obvious that the system is not complete. From what we see, many students in junior vocational colleges hope to get the opportunities of studying in university. So if vocational education has no promotion channels, these students will have to join the general university which mainly focuses on disciplinary knowledge system. This will cause the confusion of talents cultivating. And it must be surely a great waste of human resources, economics and material resources.

C. The Need for the Transformation of the Pattern of Economic Development and the Adjustment of Industry Structure.

Nowadays, science and technology change with each passing day. The speed of industry upgrading accelerates. The mode of economic development changes from extensive form to intensive form. Emerging creative industry and modern service industry propose higher-standard demands for workers' personal qualities, which are the technically applied standard and the service skills and technologies so as to improve the EVA (economic value added) of products and services. The final aim is to strengthen the competitiveness of China's economics in the world. So we should enhance workers' quality to a very high level so that China's manpower resources can support the development and utilization of science and technology, and the promotion of products quality.

D. The Need for Strengthening the Attraction of Vocational Education

The history of China's vocational education is relatively long. But it is after the Reform and Openness, especially after 1990s, that vocational education was taken seriously and became an independent conception. So just because of this, the attraction of vocational education is extremely low. A large amount of students do not want to go to vocational education colleges. Many people relate vocational education to lower quality, lower level, lower standard and other debased words like these. But after the more than 20-year vigorous propaganda and support from the authorities, vocational education is gradually accepted by more and more people, and the attraction of it is also improving. Even though, if vocational education is limited under undergraduate level, it will surely weaken students' enthusiasm for studying in

vocational education colleges.

E. Vocational Education at the Undergraduate Level Exists Commonly in Other Countries

USA, German and Japan are publicly considered developed country of vocational education. Though the national conditions and education system of these three countries are different, they have many things in common on the experience of vocational education at the undergraduate level. Vocational education at the undergraduate level has tens-year history in developed countries. After the development of these years, the vocational education at the undergraduate level has cultivated large members of technical talents, at the meanwhile, it also promotes the competitiveness and position of their vocational education in the world. That is to say, vocational education at the undergraduate level can not only meet the society's need for technical talents, but can motivate the development of vocational education itself. So vocational education at the undergraduate level play a pretty important role in these countries' economical development and global competitiveness. In this sense, China should learn from the experiences of these developed countries on vocational education at the undergraduate level.

IV. THE REASON FOR CHOOSING TECHNICAL EDUCATION AT THE UNDERGRADUATE LEVEL AS THE CARRIER OF VOCATIONAL EDUCATION AT THE UNDERGRADUATE LEVEL

A. What Higher Vocational Colleges Mainly Carry out Is Technical Education

In terms of talents types, there is an extensively accepted viewpoint that talents are divided into four types: academic talents, engineer talents, technical talents and skilled talents. Among them, technical talents and skilled talents are cultivated by vocational education. But there are many differences between technical talents and skilled talents. Technical talents are also called industrial art talents or medial talents. They work at the front line or job site. It is only by them that the designs, plans and decisions from engineer talents are changed into physical forms. Technical talents should have some extent theoretical basis. But they do not need to get to the theoretical standard of engineer talents, which pay attention to the practical utilization. Skilled talents are also called operational talents. They also work at the front line or job site. But the main difference between these two types of talents is that skilled talents work by mainly using operational skills.

It is obvious that skilled talents should be mainly cultivated by secondary vocational education, while technical talents are cultivated by higher vocational education. So in this sense, higher vocational education mainly carries out the cultivating of technical talents, which is technical education.

B. The Historical Experience of Technical Universities

From the situation of technical universities at the undergraduate level, most of them were founded since 1990s, which are now called Newly Constructed Undergraduate Institutions. These institutions were combined with a few higher vocational colleges. Before their combination, they have formed several distinct characters of employment oriented, which are to cultivate applied talents for the front

line of producing, construction, management and service. They made somewhat great contributions to local community and economical construction. Their characteristics of schooling were widely recognized by employers. But after their combination, many newly constructed undergraduate institutions have difficulties with how to orient their development direction. Because they have to compete with elder undergraduate universities by undertake dislocation competition [2]. So many newly constructed undergraduate institutions choose technical education at the undergraduate level as their development direction. Just because of this, most of technical universities at the undergraduate level have the historical experience of vocational education. Then, the traditional inheritance and connection between higher vocational education and technical education at the undergraduate level are pretty smooth and natural. And there will be plenty of common points and bonding points in their communication.

In a conclusion, there are practical foundation and historical accumulation if we make technical education at the undergraduate level as the carrier of vocational education at the undergraduate level.

C. The Potential to Develop Graduate Education of Professional Degree

As we have proposed in the previous content, modern vocational education system should include not only the undergraduate level but also graduate level. Therefore, technical education at the undergraduate level is the main carrier of graduate education of professional degree in the modern vocational education system in the future.

As we know, graduate education of professional degree pays greatly attention to practice. Its cultivating-talent aim is applied talents of high level. They cater directly to social demands. And their occupational orientation is clear. Graduate education of professional degree emphasizes on the practice training which relates to some specific occupations. It requires that the graduates have the qualifications to do some specific occupation after they finish their graduate education of professional degree. The occupational feature permeates the overall process of graduate education of professional degree. So technical universities at the undergraduate level have extreme advantages in cultivating applied talents. From the hardware capacities to instructor faculties, from the program construction to the discipline construction, technical universities are more suitable to carry on graduate education of professional degree. And, many technical universities have the background of industrial, which is an important condition for graduate education of professional degree [3].

In consideration of the advantages of technical universities in implementing graduate education of professional degree, technical universities should be chosen as the carrier of applied graduate education. So if modern vocational education system needs to develop from undergraduate level to graduate level, technical universities are the appropriate realization route.

V. REALISTIC DIFFICULTIES THAT TECHNICAL UNDERGRADUATE UNIVERSITIES ARE FACING WITH

Technical undergraduate universities may confront a great many of obstacles, such as policies and system, social

recognition, connotation construction and theoretical research and others. These issues deserve our careful and deliberate consideration. Nowadays, realistic difficulties that technical undergraduate universities are facing with are the following.

The first one is the government policies. Which position do technical undergraduate universities stand in China's education system? What are their functions? These two questions should be firstly answered when we talk about technical undergraduate universities. Some researchers think technical undergraduate education is vocational education in undergraduate level, because most technical undergraduate universities are vocational colleges before upgrading to undergraduate level. Other researchers believe that technical undergraduate education is one type of undergraduate education. So it must obey the normal theoretical level and basic requirements of undergraduate education. It should belong to higher education system. The blurring is affiliation result in the disorder during the administration. In china, the administration of vocational education and higher education pertain to two different government departments. In the end, no government departments would like to manage them so that the policies environment in front of technical undergraduate universities is pretty execrable. There will not be relevant development policies and not receive the attention from the government.

The second realistic difficulty is its low social reputation. Technical undergraduate universities have a low social reputation. This contributes to two reasons. One lies in its short history. The academic facilities are bad and its academic output is not high. Another reason is there being lots of bias in people's mind. Many people think technical undergraduate education does not exist, or is unscientific. They think technical undergraduate education is neither higher education nor vocational education. All these controvertible viewpoints look at only one side of the coin.

They do not have a Comprehensive view of technical undergraduate education. Objectively speaking, these social biases have some objectivity. After all, many people do not know technical undergraduate education very well. In addition, the social acceptance of technical undergraduate education has something to do with its geographical location. At present, the place where technical undergraduate education is best accepted is Shanghai. Because higher education in Shanghai has a nice policy development environment and strong spirit of innovation. And its internationalization of higher education is pretty high.

The third realistic difficulty is its weak theoretical research. China's researchers began pay attention to technical undergraduate education after the 21st century. The most early paper about technical undergraduate education is in 2002 with the title of The strategy Research of Developing Technical Undergraduate Education in China (2002, Yang Guo). One year later, another paper with the title of the Meaning and Strategy of Developing Technical Undergraduate Education in Present in China is published (2003, Weiping Shi, Guoqing Xu). This paper discusses the necessity of developing technical undergraduate education in China through the angle of technology development and growth of talents. Then it analyzes the independent structure of technical undergraduate education through the angle of technology. In the end the paper comes up with the

development path for technical undergraduate education. The emergence of the two papers initiates the precedent of technical undergraduate education research in China. They play a role of lighthouse and guide. After the two papers, academic papers about technical undergraduate education begin to plentifully emerge, especially after 2007. But when we check the geographical distribution of researchers, conclusion can be made that researchers are pretty concentrated. Researchers from Shanghai are the most. From this, we can conclude that the research about technical undergraduate education does not get enough attention. In addition, there are not a few basic problems that are needed to be resolved quickly in theory construction, for instance, logical starting point, structure affiliation and so on [4]. Furthermore, we need research more deeply and systematic the mode of talents cultivating, academic development and connotation construction.

The fourth realistic difficulty is connotation construction. Newly-founded undergraduate colleges firstly upgrade in extension. But the more difficulty work is the upgrade of connotation. The first task in front of newly-founded undergraduate colleges when upgrade is the faculties. Most newly-founded undergraduate colleges are lack of high level discipline pacesetter and faculty team.. Some instructors do not use suitable teaching methods when teaching. For students, the style of study is not good. Their enthusiasm for study is pretty weak. The level of internationalization is very low. In campus culture, the infrastructure is not so completed, the use ratio is not high. The academic culture and technical culture is not inspissated. All these problems existing now must be resolved within technical undergraduate universities. This need technical undergraduate universities pay attention to their inner development and focus on connotation construction.

VI. THE VISION OF TECHNICAL UNDERGRADUATE UNIVERSITIES

The exist of technical undergraduate universities has its own objectivity and rationality. The first reason lies in its unique function. That is cultivating technical talents. Though the fulfillment is not so good, technical undergraduate universities still need persist in their own principle and dream to fulfill the goal.

The first dream of technical undergraduate universities is to be important support to building China into an innovative country. China has determined a strategic objective that China will be constructed into an innovative country before 2020. To fulfill this goal, one of the most important work is provision of plentiful technical talents. Among these work, higher education plays an import role. Without doubt, technical undergraduate universities which act as the principal part of cultivating technical talents is extremely important to technical innovation [5]. As we know, the speed of technical innovation is accelerating sharply. So the industrial upgrade is accordingly accelerating. This raises new and higher requirement to technical innovation. In recent years, we have work hard to solve the problem of being lack of technical innovative talents including attracting talents. But the gross lack of technical innovative talents has a strong impact on the competence ability of technical innovation of

China's enterprises. Constructing innovative country need higher level technical innovation. So technical undergraduate universities should undertake the historical mission to provide a plenty of technical innovational talents for social and economic development.

The second dream is the mature theoretical research. Besides reaching approved achievement in educational practice, an important character for one mature kind of education is that its theoretical research should be relatively intact and mature. As we know, theoretical research is the abstract and sublimation of educational practice. If there is no multiple educational practice, there will not be mature and systematic theoretical system.. At the mean time, mature and systematic theoretical research can play a role of guiding the educational practice. Even some theoretical research can be antecedent to educational practice. So the theoretical research of technical undergraduate education in our dream should be relatively systematic and mature system. As I mentioned early in this paper, the theoretical research of technical undergraduate education in China is not much mature now. The theoretical research is still in its infancy. The research contents, methods, researchers and other aspects can not meet the need of technical undergraduate education development. And this goes against the dream of technical undergraduate education.

The third vision of technical undergraduate universities is to become the cradle of field engineer. In terms of the goal of talents cultivating, the talents that technical undergraduate universities cultivate are technical talents. Technical talent is one general term with wide-range coverage extension. We generally call them field engineers in present work site. Actually, technical talent is the intermediate link between engineer and skilled worker. Technical talents act like a bridge. On the one hand, technical talents could understand and implement the design and conception from engineers. On the other hand, technical talents could convey those design and conception to skilled workers [6]. Technical undergraduate universities have the advantage of cultivating this type of intermediate talents. Because technical undergraduate universities often have a close relationship with local enterprises. Besides, they have the tradition and condition to cultivate technical talents. So technical undergraduate universities should focus on cultivating the type of high level technical talents who have the basal knowledge of engineering and technology, innovative spirit and strong practice operation abilities, and can serve work-site production and management. This type talent is just field engineer. That is to say, technical undergraduate universities should be the cradle of cultivating field engineers.

VII. THE JOINING BETWEEN VISION AND REALITY OF TECHNICAL UNDERGRADUATE UNIVERSITIES

Actually, technical undergraduate education has all kinds of problems and difficulties. But we should still be confident of it. We should believe technical undergraduate education will get sufficient development in the future sooner or later. To achieve this goal, we should link the reality with the vision of technical undergraduate education. On the one hand, the dream can guide us the road to the future. On the other

hand, the reality can urge us work down-to-earthly.

Firstly, government should pay attention to the development of technical undergraduate universities, especially consider them when making policy decisions. As the major driving force of cultivating applied undergraduate talents in higher technical education, technical undergraduate universities should have the same right with other type of universities in resource planning and Improving school conditions. So we suggest that local government and related educational administration should strengthen the management of technical undergraduate education. There are four aspects to do.

Governments should plan all types of education as a whole. That can make the development of technical undergraduate education match the development of local economy and social development. Then technical undergraduate education and other types of education can achieve harmonious development.

Governments should encourage various kinds of organizations conducting technical undergraduate education. Besides insisting in the responsibility to technical undergraduate education, governments should permit and encourage industries departments, enterprises and social funds conducting technical undergraduate education.

Governments should distribute scientifically educational resources. That need us break the bounds between departments and school types. Then synthesize and use present resources of technical education [7]. Only by this, governments can optimize the layout structure of schools on the basis of local economy development.

Governments should make policy decision as a whole, such as enrollment policy and employment policy, programs setup and the funds' raising and managing. Under these relatively fair policies, technical undergraduate education can get a appropriate external environment which is suitable to the development of technical undergraduate education.

Secondly, we should strengthen the research and spread of technical undergraduate education theory. Theoretical innovation based on practice precedes social development and changes. Nowadays, the development of technical undergraduate education is beset by the research breakout technical undergraduate education theory, for instance, standards and orientation of talents of technical undergraduate education, the system affiliation and other problems. If these theoretical problems can not be well resolved, it will surely affect the benign development of technical undergraduate education. So we should attach importance to the theoretical research of technical undergraduate education. In allusion to the lack of researchers and the utility of researcher structure, we should attract more researchers into theoretical researchers of technical undergraduate education. That means not only scholars from educational theoretical cycle are needed, but also structures and administrators from technical colleges, even personnel from enterprises and educational administration are needed. The expansion of researchers troops will surely promote the further development of technical undergraduate education. In allusion to the too wideness but no deepness of theoretical research range, one the one hand, we should do our research from viewing angle of multidisciplinary not just from the viewing angle of

education. On the other hand, we should deep our the problem research of technical undergraduate education. Besides the research methods of document research and comparative research, we should strengthen empirical research, investigation, action research and other research methods.

Thirdly, we should focus on the connotation construction of technical undergraduate universities. As the paper mentioned earlier, the development of technical undergraduate universities in China has met all kinds of hinders in policy system, and the incomplete theoretical research. Indeed, these problems restrict the development of technical undergraduate universities to certain extent. But it is better to strengthen connotation construction, improve the quality of talents cultivating, innovate and transform achievements in scientific research rather than waiting for the policy making and the deepening of theoretical research. These endeavors could accumulate plenty of social resources and reputation for technical undergraduate universities. Accordingly, the policy circumstance maybe get improved. The connotation construction is the key question in the process of technical undergraduate universities development. How to embody the character of technical undergraduate education in talents cultivating, discipline and program construction, and teaching reform is one of the key success factors. So the construction of instructors personnel need be treated earnestly and scientifically through thesis seminar. Teaching abilities of instructors should be deeper researched so as to improve their practical teaching abilities. The cooperation between technical undergraduate universities and enterprises should be strengthened. More enterprises and industrials are introduced to undergraduate teaching to provide more opportunities for instructors communicating with experts from enterprises. In the process of teaching quality management and quality insurance, different academic departments and administration departments should work harmoniously so as to guarantee the teaching quality. Besides, we should study the countermeasure in scientific research and its transformation, the construction of campus culture, students' management. In this way, the connotation construction of technical undergraduate universities can be deepened. And the ability and standard of technical undergraduate universities to serve the development of society and economy would be improved.

VIII. SUMMARY AND PROSPECTS

Figures and Tables

At present, the construction of China's modern vocational education system is lacking of a sally port or induction. The articulation between secondary vocational education and higher vocational education has been discussed for many years in academia. And in practice, the articulation between secondary vocational education and higher vocational education has already existed for years. From these situations, the articulation between secondary vocational education and higher vocational education is not a fangle any more. So the articulation between secondary vocational education and higher vocational education is not suitable to chosen as the sally port of the construction of China's modern vocational

education system.

Because of the emphasis from the authorities in national level, the voice of the construction of China's modern vocational education system is pretty loud. But it is lack of a hot sally port or induction. In this situation, we could explore the innovation of education system of technical education at the undergraduate level. In the innovation, technical education at the undergraduate level can naturally link up with higher vocational education. The ascending channel of modern vocational education will open soon. And the technical education at the undergraduate level will surely be the bright spot of modern vocational education.

However, the development of technical undergraduate education need not only the confidence of its vision but also think cautiously about its reality difficulties. Only we give an all-sided consideration, technical undergraduate education can develop healthily and fastly.

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