Problems, Challenges, and Suggestions of Continuing Engineering Education in China

Lin CUI 1, Tingting YANG 2, Jing LIN 3
(1. School of Engineering, The Open University of China, Beijing 100039; 2. Institute of Distance Education, The Open University of China, Beijing 100039; 3. Secondary Vocational School, The Open University of China, Beijing 100039)

Corresponding Author. Email: cuilin@crtvu.edu.cn

Abstract: China is facing challenges of economic transition and modernization, which sees the urgent need to develop Continuing Engineering Education (CEE) for sustainable development in economic and social areas. The article first discusses the history and characteristics of CEE in China. By analyzing interview resources and statistic data, the author concludes five factors for the development of CEE in China, including policies, education demands, educational institutions, supply channels, and operating mechanism. Moreover, the article analyzes relationships among the five factors and current problems in Chinese CEE development, and offers solutions such as using MOOC to collect and share high quality CEE resources, constructing nationwide e-learning public service system, and supporting “Open Universities” for continuing educations etc. Last but not least, the article discusses the possible cooperation among policies, CEE customers, institutions, and management, and explores “demand-oriented” funding plan and market-oriented mechanism for the further development of CEE in China. The project is supported by Chinese national ministry of education. Some suggestions mentioned in the article have already been put into practice and received good results.

Key words: Continuing education; Educational resource; E-learning; Mechanism

1. Introduction

The development of knowledge economy and the progress of science and technology is profoundly changing the human society's production and life style. Continuing Engineering Education (CEE) directly faces industry and engineering services, plays an important role in promoting engineering talent to update their knowledge and ability, and links education scientific research institutions and enterprises. With the process of Chinese industrialization and urbanization, diverse needs for CEE accelerate the nation’s development. China has about 700 million workers, among 98000000 technicians, technical workers and senior technicians only account for 4.3%. The knowledge structure and occupation ability of many people need to be improved. Accordingly, the construction and development of CEE is closely related to industrial upgrading, economic sustainable development. However, there are still problems need to be solved in China. This paper discusses the situation, problems and challenges of CEE in China, and puts forward some suggestions to solved these problems.

2. The Situation and Problems of Chinese CEE
2.1 The history and characteristics of Chinese CEE

After decades of development and exploration, CEE has distinctive Chinese characteristics that Chinese government leads and a variety of educational institutions participate, which can meet basic social needs.

2.2 The history of CEE

The CEE has gone through several stages since the founding of the People's Republic of China.

The first stage is from the 1950s to the 1970s, which was mostly inherited from the way of the Soviet Union. The CEE operating system was that the state centrally plan and the government unified directly manage.

The second stage is from the 1980s to the 1990s. At the beginning of the stage, China began the reform and opening-up policy. The strengthening economic construction brought new development chances to CEE.

The third stage is from the 1990s to the present. The CEE policy was changing from the government leading to social school carrying to meeting the needs of the market. All kinds of social education institutions gradually began to carry on higher continuing engineering education. During the period, information technology widely application also promoted the development and popularization of CEE in China.

The three stages mean that the development of CEE is related intimately with the development of economic of China. The demands of enterprises are the basis of the happening and development of Chinese CEE. At present, the demands of CEE from the enterprise and the society is increasing in the important period of the economic growth and restructuring.

2.3 Five factors of Chinese CEE

The structure of CEE is a complicated system. We research the situation of Chinese CEE and think that CEE system in China is composed of five elements of policy and social environment, education demands, educational institutions, supply channels, operating mechanism, etc.

2.3.1 Policy and social environment

Policy and social environment is the foundation of CEE operating. The government is the important promoter of establishing and running CEE marketing. It is by law, regulations, policies and measures that the government can promote CEE operating and social environment forming.

Since the 1970s, CEE has been promoted gradually as a relatively independent education type. The state has issued a series of policies and regulations related to CEE. But until now, there are lots of problems need to be solved urgently, such as policies coming from many more departments, rights and responsibilities being not extinct, inadequate protection from the law and regulations, the incentive mechanism needing to perfect, the evaluation mechanism being relatively short, the planning implementation being not good.
2.3.2 Demands of education

Educational demands include two factors that are educational demand customer and demand contents. The educational demand customer consists of individual and enterprise. The demand contents are mainly composed by engineering technology, engineering management, engineering consultation and service, etc. The educational demands are the core and dynamic element in the hierarchy of CEE.

We surveyed 29 enterprises from Beijing, Shanghai, Liaoning province, Henan province and Gansu province, etc. and more than one thousand social on-the-job learners from more than 10 provinces and cities. And we totally collected 1257 questionnaires and found that the demand of CEE has the variety character. It shows that:

1. Educational demands contents of CEE in different regional exists differences.
2. Educational demands contents of CEE in different industries have different characteristics.
3. People of different positions and different ages for educational demand content of CEE are different.
4. People with different educational background Educational demand content of CEE have different tendency.
5. People with different work experience for educational demand contents of CEE are different.
6. Adult academic continuing education in industry fields appears sustained and steady development trend.
7. Non-academic continuing engineering education exist broad space for development.
8. State owned enterprises staff training develop well, which provides a good references for the future overall development.

Therefore, educational demands from the enterprises and individuals for higher CEE show the dynamic characteristic, that is to say, there are extinct characters of diversity and hierarchy in educational contents, selectivity and flexibility in educational mode, the industry and regional development of CEE, etc.

At present, because of the diversity characteristics and the lack of effective integration education demand cause that can’t meet the needs of a wide range of CEE from the society and economic. These problems mainly show that:

1. CEE lacks the mechanism of incentive and constraint for enterprises and individuals.
2. Education contents need to accurately grasp and rich, the target should be strengthened.
3. The level of economic development restrains the needs of CEE.
4. The contradiction of learning and on-duty affects the needs of CEE.

2.3.3 Institutions

Institutions are providers of CEE’s resources and teaching services, which include five types: regular institution of higher education, institution of higher education for adults, institution of industry training, institution of enterprise training and training institution in social sector. Various types of education institutions have different characteristics on location, service object and service
mode.

(1) The regular institution of higher education provides the education resources and multi-level academic education.
(2) The institution of higher education for adult focus on college level academic education.
(3) The engineering industry association provides the certification training on the fields of industry technology and occupation qualification.
(4) The enterprises training institution focus on the required skills training for the specific job.
(5) The institution in social sector mainly provides the general skill training and management training.

Due to the different target of educational institutions and different characteristics of the service object and service mode, CEE appears diversification. Under the condition of the state policy and market mechanism being not perfect, institution is not full of vigor and the education quality is lower. These problems show that:

(1) It lacks unified certification standards. It is difficult to form effective quality control management system. The market is a mixed bag.
(2) It lacks effective division of labor and cooperation among all kinds of education institutions.
(3) It is not clear in the field of CEE about function, status, responsibility and effect for the industry association. It is difficult to play a leading role.
(4) Enterprise training institution is not perfect.

2.3.4 Supply channels

Supply channel is the bridge between education demand and education institutions. Supply and demand can communicate and feedback demand information by the supply channels. The supply channels of CEE is wide and systematic, which means large enterprises themself have internal channels to operate CEE, some industry enterprise combining education institution co-operationally operates branch channels and the government and industry or enterprise organization implement the main channels.

The main channel is that the state administrative department of government leads and coordinates various educational institution and industry in the CEE system, which undertakes the task of integrating and sharing the social services and high-quality resources. The branch channel and internal channel formed by the industry enterprises and some educational institutions are the auxiliary channel to carry out targeted service and resource transmission. All kinds of channel interleaving in various operation modes together constitute the network of resources and services.

From the overall look of supply and demand system, there are some problems which means that:

(1) Has not yet formed to play the leading role of the national main channel.
(2) Effect of the modern information technology is inadequately.
(3) Education and teaching conditions can’t meet the demand.
(4) The lack of integration and sharing channel for high quality learning resources and effective mechanism.
(5) The lack of public service platform.
2.3.5 Operating mechanism

The operation mechanism is the collaborative method to achieve the relation of CEE supply and demand in a certain legal policy environment and organization management system. Well orderly operation mechanism can form a good policy feedback, improve environment, and regulate the supply and demand balance, improve self-perfection and development system. At present, project task oriented led by the government leading and benefit oriented led by market coexist. The educational organization system and the marketing operation mechanism of regulatory social marketing CEE have still not been established.

Now, Chinese CEE is in the stage of plan and market coexisting and gradually entering the stage of market leading. The market mechanism is still in the exploration stage, which shows that:

1. The government-led projects lack of macro-planning and effective implementation.
2. The system and operation mechanism of enterprise CEE is not smooth.
3. The college and university can’t understand and meet the needs of market, lack of competition consciousness.
4. Lack of effective market supervision mechanism.

Analysis through the current situation of each element of Chinese higher CEE, the current overall status of Chinese CEE is that:

1. Policy and social environment have been greatly improved, but it need urgently breakthrough develop.
2. Educational demands are diversity, but lack combination and integration.
3. Educational institutions are multiple, but are not vigorous and collaborative.
4. The supply channel has been established, but the main channel hasn’t been established.
5. Operation mechanism appears the coexisting situation of plan and market, the market mechanism is still at the beginning of the exploration stage.

3. Prospects and Challenges of Chinese CEE System

3.1 Prospects of Chinese CEE

At present, Chinese development is standing at a new historical starting point, which is in the new stage from big country to powerful nation. China has become the world’s second largest economy, but economic development is not balanced, coordinated, unsustainable problems which is still outstanding. Chinese economic development is still in the climbing stage, which faces the emergence of population, resources and world’s economy crisis. China is now in the road of new industrialization, informatization, urbanization, agricultural modernization with Chinese characteristics and speed up the transformation of the mode of economic development, which has become a strategic task for the healthy and sustainable development of national economy.

To make full use of the technological revolution, the application of new technology, technological transformation and innovation, promote the adjustment of industrial structure, and achieve economic growth mode relying on from increased consumption of materials to scientific and technological progress, the quality of workers, management and technology innovation. This will bring changes on jobs and employment direction, bring the adjustment of the labor force
structure and employ structure, bring the enormous demand for skilled, creative and compound talents. Therefore, there is an urgent need to train and bring up a large number of creative, master new technology and skills level engineering and technical personnel. CEE will shoulder the important basic guarantee work in the transformation of the mode of economic development, which has broad prospects for development.

3.2 Chinese CEE System Already Has a Foundation, but the Unbalanced Developments Elements is Main Factors on Restricting its Sustainable Development

In general, China CEE hierarchy is in a state of relative balance now, but the elements of developments is not balanced in the operation process. It is mainly relying on government support in the human, financial and material resources and investment to maintain balance. The socialization of the market mechanism operation is weak. The hierarchy lacks the ability of self-growth. The relationship among elements is loose. The elements lack mutual coordination, mutual promotion and unity. The elements and their relations, dynamic operation model can be described by the “CEE balance system model”, which is shown by Figure 1.

![Figure 1. CEE balance system model](image)

Because of the unbalance development factor in the hierarchy currently and the un-established mechanism of orderly operation hierarchy and crossing supply-demand channels, they cause that the CEE market demand can’t be touched. The quality of resources and targeted support service are hard to deliver. The market regulators are not perfect. The CEE can’t be effectively promoted without government support by projects.

4. Development suggestion of China CEE in the new period

CEE is a big complex system. First of all, every element of CEE can produce important influence on the overall. Secondly, each element in the currently system lacks effective communication, coordination and convergence, which result in a relatively fragile system structure. At the same time, the government has certain absence, dislocation and not in place for the CEE
projects management. Such CEE hierarchy cause the needs of economic development can’t be met in the new period.

4.1 Basic framework of Chinese CEE suited to China’s national conditions

Basing on the current major problems, we put forward the basic construction framework of Chinese CEE suited to China’s national conditions, It is shown in Figure 2, which include the several following aspects:

(1) Firstly, the important one is the government should strengthen the establishing of laws and regulations, policy and implementation strategy of CEE environment construction and create the good system environment and security mechanism for the growth of CEE talent training.

(2) Secondly, it must enable that the enterprises’ demands and educational institutions’ supply for CEE are full of vitality, those two participants can interact in a certain platform.

Therefore, at first, a main channel for communication of supply and demand should be established, which bases the national continuing education public service platform build by information technology. The platform aggregates education resources, promotes the communication and coordination between the education institutions, and is the social service channel. Such channel can realize integration and sharing of quality education resources, and integration of CEE institutions and social education resources.

Furthermore, it must strengthen the design of incentive mechanism of promoting the balance of supply and demand, strengthen the interaction of supply and demand, and orient the demand. It forms a vitality operation mechanism of resources allocated by social market.

(3) Thirdly, to guarantee the quality of CEE, the industry standard and enterprise certification should be set and designed strengthening, the third party monitor and evaluation system for quality assurance should be constructed, credit bank acknowledged by social education institutions which can accumulate and transform credit should be formed. Those can realize the stable and continuing development of CEE.

Among them, regulation environment, main channel and operation mechanism are the most important. Chinese CEE system architecture framework is shown in Figure 2.

![Chinese CEE system architecture framework](image-url)
4.2 Exploring mechanism of social market, unleashing the vitality of social education, and promoting the optimal allocation of educational resources

In order to explore the corresponding operation mechanism, we put forward a kind of social market operation mechanism model, which is based on the "mechanism of education vouchers", in order to ensure continuing education and to promote the formation of the incentive mechanism of market allocation of educational resources. Figure 3 is the social market operation mechanism model based on education voucher.

Figure 3. The social market operation mechanism model based on education voucher

The social market operation mechanism model has several characteristics:

1. It can promote the government to effectively raise education funds, and to guarantee the number of capital investment in education.

2. It can enhance the initiative of consumers, promote the educational institutions to accurately grasp and make great efforts to meet the demand, so as to improve the operation efficiency of the continuing education market. The consumers’ (individual and enterprise) choices for continuing education products will encourage competitions among education services, stimulate education institutions to pay attention to the development and services of personalized curriculum, and promote educational institutions to accurately grasp demands of the market, which consequently improve the efficiency of the continuing education market.

3. It can be used for special social groups or specific industry, help to compensate insufficient human capital investment brought about by the special environment, guarantee continuing education interests, and create a fair environment for the society. It will guarantee interests of continuing education for individual and enterprises.

4.3 The current progress of CEE in China
1. Policy: In December 2011, a national conference on continuing education was held. In the conference, the government established the "continuing education project plan (Draft)" and "several opinions on accelerating the development of the continuing education (Draft)". 

2. Main channel: In order to explore the mode of network education, in 2012, the construction of 6 Open Universities was approved for the purpose of enhancing the use of network education in continuing education. More than 600 universities in China will transit to occupation application type colleges, and gradually realize seamless docking personnel training and employment demand, more direct promotion service for the regional development and industry. Lifelong learning public service platform have been constructed in 15 cites and industries, There are tens of thousands of digital learning resources, 27000 network courses, and 225 resource libraries.

3. MOOC in China: Peking University, Tsinghua University, Fudan University, Shanghai Jiao Tong University and other colleges and universities have carried out MOOC construction, and formed a group of engineering courses, These will help social workers for online learning.

4. Credit bank: China Open University and some universities in Shanghai have done some research work on credit bank.

5. Market mechanism: CEE remains to be spread in market economy in the future.

4.4 Suggestions

For the construction of CEE system, some key breakthrough should be made in the future:

(1) Improving constructions and regulations of CEE. Implementing policies and environment for talent development. Establishing laws and regulations for national CEE development. Ensuring continuing education development rights for companies and individuals. Strengthening the training of engineers in order to adapt international competition.

(2) Improving the organization and management mechanism. Strengthening planning and coordination. Establishing of inter-departmental coordination mechanism of continuing education. Guiding the development of CEE. Dividing responsibilities of government departments.

(3) Constructing engineering and technical personnel for the growth of main channel. Promoting the application of information technology and the integration of various social resources of education. Establishing the national continuing engineering education public service system and building the continuing engineering education network platform, in order to format continuing education a force for social cooperation project.

(4) Establishing a sound operational mechanism and promoting the formation of market mechanism and efficient. Improving the formation of vitality of the resource allocation mechanism; exploring needs to choose investment mechanism oriented; increasing the capital investment and incentive mechanism design; strengthening the standards, certification, monitoring and evaluation of construction, construction quality assurance system.

(5) Speeding up the reform of training pattern of continuing education of higher engineering talents. Encouraging the cooperation between educational institutions and industries, companies in the field of CEE. Combining with social development and talent development needs, exploring projects to continue training mode reform of education content, methods, service and personnel.

5. Conclusion
The overall situation of CEE in China is still under development. There are plenty of problems in areas such as policy making and marketization. Policy and social environment have been greatly improved, but it need urgently breakthrough develop. Educational demands are diversity, but lack of combination and integration. Educational institutions are multiple, but are not vigorous and collaborative. The supply channel has been established, but the main channel hasn’t been established. Operation mechanism appears the coexisting situation of plan and market, the market mechanism is still at the beginning of the exploration stage. The policy mechanism to promote the function of market mechanism has not yet been established, adapting to market operation mechanism of educational development is still very weak. Therefore, the policy environment is in urgent need of a breakthrough.

To build up and meet the future development CEE system, the government should play an important role in policy making. To form a mechanism and to promote the market development at the policy level, the educational institutions and educational needs effective docking, the rational allocation of educational resources. Moreover, attention should be paid to the integration of educational resources, strengthen the network construction, build national continuing education public service system. To improve the continuing engineering education industry standards, to strengthen the evaluation and quality control, and finally set up to adapt to the economic development of Chinese continuing engineering education system.

References