An Analysis of the Development Path of China's New Higher Engineering Education

From a Perspective of New Institutionalism on the Basis of Organizational Research

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Abstract—**In the worldwide, a new round of technological revolution and industrial change has promoted China to accelerate the transformation and development of higher engineering education. Higher engineering education is closely linked with industrial development. It is of great significance to support and service China's economic transformation and upgrade. From the perspective of new institutionalism, the policy orientation of the government, the expectation of social culture, the orientation of higher education institutions and the continuous improvement of professionalism and specialization of teacher groups have promoted the transformation of higher engineering education. China should speed up the transformation and development of higher engineering education. And it should continue to strengthen the policy guidance. It should establish the modern university system in the Chinese context. And it can learn from the international advanced engineering education experience.**

Keywords—higher engineering education; new institutionalism; transformation; path

I. INTRODUCTION

The current rapid changes of new technologies are rapidly infiltrated into all aspects of the human economy and social life. And it has constantly promoted the revolution of science and technology and industrial changes in the worldwide. In the face of this situation, China has implemented major strategies of the innovation-driven development, "made in China 2025", "Internet +", "The Belt and Road" and other major strategies. It should accelerate the development of new high-level engineering education, and cultivate technological personnel of new engineering. At present, it has serious challenges in the engineering personnel. For example, it has structural contradictions. It lacks engineering talent, leading talents and the top talents. The training of engineering and technical personnel is detached from the production and innovation practice and so on. How to transform the development of higher engineering education and serve the major national development strategies? How to accelerate the development of advanced engineering education in the world? It has aroused widespread social concern in society and academia. With the

practical problem as the starting point, this paper discusses the path of improving the quality of higher education in our country from the perspective of new institutionalism theory of organizational research.

II. ANALYSIS ON NEW HIGHER ENGINEERING EDUCATION FROM THE PERSPECTIVE OF INSTITUTIONAL SCHOOL

A. The Definition of New Institutionalism of Organizational Research

The institutionalism has a long history. Since the 1940s, the institutional theory school in organizational analysis has undergone two major stages. First, it is the old institutionalist school represented by the Colombian school of Serznik. Second, it is the new institutionalist school represented by Meyer, Ron, Scott and other scholars in the 1970s. In 1977, Meyer and Ron published "institutionalized organization: the formal structure of myths and rituals" in the American journal of sociology. It has opened new institutionalism study in the field of organizational sociology. In the field of institutional analysis, the two important figures of Margie and Orson created a new vocabulary in an article in 1984— new institutionalism. [1] Hall and Taylor's division of the new institutionalism is the most classic. They think that the new institutionalism mainly includes rational choice institutionalism, historical institutionalism and sociological institutionalism. [2]

B. The Main Points of the New Institutionalism of the Organization

The central proposition of the new institutionalism school is to emphasize the important role of the legitimacy mechanism in the organizational structure and in the interaction between the organization and the institutional environment. For a long time, the logic of the interpretation of the efficiency mechanism is prevalent in the field of organization. The observed organizational phenomenon is the result of organizational pursuit of efficiency. However, Meyer and Ron put forward the mechanism of legitimacy

which is very different from the efficiency mechanism from the macro point. They think that the organization pursues technical aspects. And the organization is subject to the institutional environment. Many organizational systems and organizational behavior are not driven by efficiency. And they are driven by the development needs in contemporary society with the pursuit of legitimacy. The legitimacy mechanism often leads to "institutionalized organization" and organizational convergence.

The new institutionalism in organizational analysis began with educational organization research. Meyer was deeply influenced by Weber. He thought that the theory of organization at that time had ignored Weber's question of the legitimacy of the "rational" formal structure. In his view, the school plays an important role in the legitimacy of society. It is highly affected by the system of organizations with a strong ritual. At the same time, the school is also an organization with loosely connection. The loosely internal structure of the organization just buffers the impact from the outside. And it protects the core of the organization in the teaching activities. In addition, there is a ritual logic of trust between school organization and the external environment. And the school organization is considered to incorporate a large number of new projects and services. At the same time, a lot of innovation is also produced in the environment with the legalization into the school. [3] At the same time, Meyer also has noted that the organization tends to take the leading organizational model in the environment. It leads to the existence of homogeneity between the organization and the other organizations in terms of form and organizational structure. [4]

After Meyer and Ron, Dimaggio and Powell have studied the legitimacy and convergence. They have studied the same phenomenon. And they also have tried to explain the convergence of the system. And they have talked about the basic mechanism. In a broad sense, it is the mechanism of the legitimacy. However, Meyer and Ron have emphasized the importance of a large institutional environment that affects the behavioral patterns of people and organizations, leading to a top-down institutionalization process. And DiMaggio and Powell have emphasized the relationship between the organization and the network and the interdependence among organizations. That is the level of the organization field.

DiMaggio and Powell believe that three forces have promoted the system of homogeneity. And the first is mandatory force. It comes from its formal or informal pressure of the organization of the other organizations and social and cultural expectations. The second is the imitation power. The organization faces a vague goal. And the technology is difficult to understand. The environment of the organization has produced symbolic uncertainty. The organization may shape the images in accordance with the ways of other organizations. And it often imitates the structure and practice of organizations that are considered more legitimately or more successful by them. The third is normative power. It is mainly derived from the two major aspects of specialization and specialization—the formal education and legalization of the professional production of

the university, and the growth and in-depth development of the network of experts across the organizations—it is the important power to promote organizational convergence.

Scott argues that institutions include the elements of cultural awareness, norms and controls. With related behaviors and resources, it has provided stability and meaning for social life. [5] Regulatory elements emphasize legitimate control authority and coercive means, such as effective supervision, sanctions and penalties for the organization, etc. Normative elements emphasize on the deeper ethical norms and moral constraints. It has reflected the specification of professionals' networks and the expansion of values. And it hasn't just included the regulatory policy changes. With culture - the cognitive elements, it thinks that obedience is "a matter of course, consistent understanding". And it emphasizes the logic of shared behavior. And institutional scholars in these factors emphasize the focus and analysis of different levels. However, they recognize that social behavior and related resources are regulated by the rules and cultural patterns.

C. Institutional Logic and School Reform

The concept of "organizational field" is firstly proposed by Dimaggio and Powell. They argue that the organizational field is a group of organizations. And they engage in similar activities and succumb to similar reputations and rules. [6] The school as an organization exists in a specific organization field. The organization field is a relationship system of the school, all levels of government management, business, teacher education (training) institutions, the community, publishing and other organizations.

All organizations in the organization field have their formal and informal values, rules, customs and interests. And they continue to collide and interact in a common living space. For a long time, the organization field, as well as the internal structure of organization will develop a system to control and manage the communication among different organizations. The systems in the organization field, just as the systems other levels contain three elements of Scott's regulatory, normative and cultural-cognitive. These elements use different mechanisms of action to structure and model the various organizational behaviors. The system is developed in the school's organizational field. And it is actually a shared symbolic meaning system. It provides organizations with a set of cognitive templates and symbols on how to interpret behaviors and phenomena. This is the logic of the system. The so-called institutional logic refers to a set of belief systems that control the behavior of the particular organization. [7] Institutional logic is also a set of "organization principles" that provide guidance to the organizers of the organization field on how they should act.

From the above analysis, it can see that all kinds of school education behaviors are actually the results of the "programmed" logic of the system. Institutional logic is the mysterious force behind the school. Any deep-seated school reform is bound to make changes to the logic of the system. Historically, the reforms aimed at improving school education have never stopped. And the school has little

changes. It seems that the stability and resistance of the school in a variety of overwhelming reform initiatives are far beyond the expectations of the reformers. And the logic of the system can be self-deified. Then, it may avoid the rational question and impact. Once the logic of the system is formed, it will produce strong stability. It is very difficult for any group or individual to change the logic of the system. The schools would implement the reforms. It will also feel that there is something like Weber's "iron cage". It shrouds and tries to pull the school back to its original position. [8] In addition, the formation of institutional logic is collective action. And any unilateral change is difficult to succeed. In an organizational field maintained by the logic of the system, institutional logic links the parties effectively. And many behavioral habits and cognitive hypotheses have shown the power of institutional logic. And the results caused by any small changes will be led by the movement and the whole body. It is also recognized that some of the researchers have suggested that the government, schools, various professional institutions and the public should make discussion on the responsibilities and identity of school education in-depth. Otherwise, real school reform is difficult to achieve. Even if occasionally, it can't last for a long time. [9]

The new institutionalism theory in organizational analysis can help us understand the difficulties and opportunities of China's higher engineering education transformation and development. From the perspective of organizational sociology of new institutionalism, the transformation and development of colleges and universities isn't the factors to promote. It is the results of multi-party combination of multi-strength. The government's policies, regulations, social and cultural expectations, the pursuit of the goal of the university, and the continuous improvement of professionalism and professionalism of the teachers group have promoted the transformation and development of colleges and universities. The new institutionalism expands the connotation of the organizational environment. It focuses on the influence of the system on the organizational structure and how the organizational actors change the system in the organization field with network links. It lays a cognitive foundation for us to promote the reform of higher engineering education.

III. THE POSSIBILITY OF DEVELOPING NEW TYPE OF HIGHER ENGINEERING EDUCATION

A. The Needs of National Innovative Development Strategy

Institutions of universities are institutional organizations. And only in line with national policies and strategic arrangements, the universities will get the support of government for its development path and model. And only with "legitimacy", it can obtain more resources allocation. The new economy is characterized by new technologies, new forms and new industries. And it has provided both the policy opportunity for the connotation development, transformation and development of Chinese universities. And it requires the colleges and universities to construct the disciplines and professional systems that are compatible with the national and regional economic and social development.

It should cultivate high-quality talents to meet the needs of different levels. With the continuous improvement of laws and regulations of higher education, the government could innovate various types of the allocation of educational resources. The expectations of the government on the reform of higher education have been improved. The formal and informal pressure has promoted the development of higher engineering reform. It is the mandatory force. And it has directly or indirectly affected the objectives and behavior of colleges and universities.

B. The Needs for University Organizations to Gain Broad Social Recognition

Cohen and Marggio argue that the ambiguity of goals and uncertainty of technology are two notable features of educational organization. [10] It determines that the organization's technology is difficult to understand. And the target is ambiguous. With the symbolic uncertainty of environment, the organization will shape itself according to other organizations. For the imitation of colleges and universities, Dimaggio and Powell give an explanation. There is disagreement in the organization. The decision-making participants make decisions that mimic other organizations. It is easier to make decision than that on the basis of comprehensive and in-depth analysis of organizational goals. The comprehensive and in-depth analysis of organizational goals is often proved to be painful or devastating. [6] It can be seen that imitation is a reaction to uncertainty. Organizations tend to mimic the same groups in their fields, which they believe are more legitimate or more successful. [6] "first-class universities", "first-class subjects" and "special universities" are undoubtedly the cognitive symbols of the reputation of modern university organizations and the symbols of the social status of university organizations. The new institutionalist school attaches great importance to the influence of reputation on organizational legitimacy. And it believes that social recognition is the foundation of reputation. [11] When different types of colleges and universities have clear objectives and proper measures, the quality of "products" will be well received and recognized by a wide range of societies. And this kind of practice, procedure and the similarity of structure will be more convenient to communicate with other organizations in colleges and universities. It is easy to attract excellent teachers and students. They are more likely to get the benefits of government's policy and donations of enterprise and individual.

C. The Need for the Professional Development of Organizations of University

According to the definition of Larsen and Collins, they would make the collective struggle to clarify their working conditions and methods to control the products of producers for their professional autonomy. And it could establish cognitive basis and legitimacy. [6][12] In many cases, professional activity creates as much professional strength as the professional power of the state. Since the competition between organizations is mainly based on the competition of organization's position in the field. For a large number of

professionally trained labor force in this field, the organization's reputation and resources as key factors could attract them. The organization makes efforts to provide the same benefits and services for competitors. The process would promote the system. [6], [12] The similarity of specialization can make it easier for organizations to trade with other organizations. And it also can attract aspiring employees. Then, it can be recognized as legitimate and prestigious. With the rapid development of network information technology and the accelerated pace of internationalization of higher education in China, the results of latest research can be spread rapidly in a global scale. The frequent interaction between the academic community and the deepening of cooperation with each other make the influence of the academic community grow. China's universities take the initiative or passive in requirements and reference contrast of academic community. And the universities with various characteristics have attracted more and more attention of the public in the worldwide. And Chinese university organizations have a clearer direction for the construction of national strategy, development demand and self-positioning standards and efforts. And the relevant system rules and values also have been further spread in the field of university organization.

IV. THE COUNTERMEASURES

With the arrival of a new round of technological revolution and industrial change, some major disruptive technological innovations have created new industries and new formats. It has brought new opportunities for greater leaps in social productivity and labor productivity. The innovation and development of engineering education in each country has brought unprecedented opportunities and challenges. The governments at all levels, various social organizations and the public have an ardent expectation for the export of high-quality land products. It hopes that universities will provide targeted training to organize meaningful cultural and technological activities to meet the needs of social development of the local community. It expects colleges and universities to serve the regional economic and social development, to output the high-quality talent and to create significant economic and social benefits. It hopes that colleges and universities have a good social reputation. It can provide help for foreign investment, publicity and exchange of business and so on. The formal and informal norms have promoted the transformation of the school. It will inevitably lead China's higher engineering education to seize the opportunity to deepen the reform. And then, it could accelerate the transformation. It provides strong talent protection, intellectual support and innovation support for the country's economic transformation and social development.

A. *To Strengthen Policy Guidance and Innovate Design System*

National development and social needs are the primary considerations for universities in China to carry out new project education. As the organizer and the actual manager of the higher education, the government dominates the resource

allocation and rank order in the field of higher education through the top-down power system and governance system with using administrative order, policies and regulations and financial appropriations. The institutional theory emphasizes the important role of inter-organizational dominance structure and collusion pattern. [13] It will directly or indirectly affect the college goals and behavior. And then, it can gain more social resources, reputation and greater autonomy. Specifically, one is to refine reform measures on the development of higher education in the "National Innovation-driven Development Strategy", "on the development of talent mechanism reform" and other documents. It should guide the educational resources to serve professional clusters of countries, regional leading industries and specialty industries. It should build the professional system to match national and regional economic and social development to adapt to school positioning and school characteristics. At the same time, it could upgrade the traditional disciplines and adjust the traditional disciplines to expand the connotation and focus. Then, it will form a new curriculum system. The second is to improve the personnel training standards of higher education. It can formulate and publish the national standards of teaching quality of engineering, promote the industry sector to develop industry personnel standards, and revise the teaching quality standards of school professional. And then, it would form legitimacy mechanism basis to adapt to the development of three quality standards system of the country, industry and school. Thirdly, it can establish third-party evaluation system. It should regularly publish the teaching quality reports to the community, etc. It should establish the funding system of the performance on the basis of quality construction capacity assessment. In the end, it can promote the quality of colleges and universities through public opinion and supervision. Fourthly, it can strengthen institutional innovation. Through a series of organizational system changes, it should establish the system of the right, responsibility and profit between government, schools, scholars and other stakeholders in the process of building the university. It could encourage colleges and universities to cooperate with industry enterprises to educate people, build a common business and share the responsibility of engineering education. And it should promote industry-teaching cooperation, production and education, science and education coordination.

B. *To Build a Modern University System Actively*

Institutionalization is also affected by the imperfect market. And if the market is transparent and open, some irrational systems will be discovered and eliminated. The subjectivity of the organization, management and evaluation system of Chinese universities determines the incompleteness of the higher education market, which may lead to the development of higher education to form the so-called "institutional path dependence". [14] And the establishment of the system of modern university has provided guidance for the transformation and development of colleges and universities. University system is an important part of national system. It is a kind of institutional arrangements for the university. It is inevitably affected by the national political, economic and cultural system. There

are significant differences in political systems, economic development and cultural traditions. The universities have established different university management systems and higher education systems. And the universities have high degree of consistency in basic nature and ideals—University is an academic and cultural institution, is an organization of cultural heritage and knowledge production, and is the education and personnel training institution. [15] It has mentioned the modern university system in "National long-term education reform and development plan (2010-2020)". And the modern university system can be summarized into four sentences: "to run school by law, self-management, democratic supervision, social participation." It can be seen that it should expand the autonomy of colleges and universities to establish modern university system. To match with the empowerment and ability, it chooses a number of colleges and universities with perfect self-discipline and perfect running rules. And they have obvious school-running characteristics. They also have given more autonomy to school. And it confirms and guarantees that universities are legal entity which is oriented to society. It runs the school according to law. Secondly, it should make efforts to reform and improve the relationship between universities and society. The university has entered the center of society. And it has produced a large number of stakeholders. Under the new normal condition, it can reform and perfect the relationship between universities and society. It should introduce the complete market competition mechanism under the premise of establishing the university as an independent autonomous legal entity. And then, it would shift the university from facing the government to the society and the market, from government evaluation to social evaluation and market evaluation in the higher education quality. Then, it can establish new competition and development order of university. Thirdly, it could make efforts to improve the governance structure of modern university. With the establishment of the security system of management and evaluation, it can form pluralistic governance pattern of government macro-management, university autonomy and wide participation in the community. Then, the university as an independent autonomous subject would pursue market competitiveness. It may enhance the goal.

C. To Learn from the International Experience of Higher Engineering Education, and Strengthen International Exchanges and Cooperation

The managers and members of organization participate in industry associations and professional societies. The likelihood of organizational convergence is greater. The network between organizations and their members is denser, and the collective organization of the environment is more powerful. [4] It means that we should speed up the pace of opening up higher education and strengthen international exchanges and cooperation. Firstly, it should take the "excellent engineer training program" as a model to lead. It should study the education standards and experience in international mainstream process, and clear the future capacity of engineering personnel system. It should learn from the CDIO engineering education concept, and implement the integration of production and education,

science and education, school-enterprise cooperation and education model. Secondly, it can start and implement engineering education professional certification. China has now officially become the 18th member states of project education "Washington agreement". It marks that China's engineering education has integrated in the world of engineering education. It should take advantages of this opportunity to promote China's advanced engineering education to learn international advanced concepts and quality standards, to speed up the exchange of engineering education and international engineering education and cooperation. In the end, it can promote the engineering education reform. Thirdly, it should participate in the global process of international education. With the deepening of the reform in China, especially in the national strategy "the Belt and the Road", it should serve more and more Chinese enterprises "going out". And it should require Chinese universities to focus on international universities between the joint training models. It could absorb, optimize, integrate and share the resources of higher engineering education in the world. And it could continuously enhance the global competitiveness of China's higher engineering education.

V. CONCLUSION

At present, China's industrial transformation has entered into a critical stage. The different types of innovative engineering and technical personnel needs are very urgent. In the next period, China would deepen the reform and development of higher engineering education and cultivate innovative engineering science and technology talents. In the process of "advanced engineering education power", it should be closer to the government policy. It can learn from international outstanding peers. The characteristic university should gradually form a kind of convention. It penetrates into all aspects of the daily behavior of the university. Undoubtedly, these are most direct expression of the system in the university organization. Of course, different levels of colleges and universities should implement new engineering education. And the reality of the foundation, the goal of positioning, teachers and students are different. So, it should adapt the different strategies. Engineering colleges and universities should play a leading role in engineering science and technology innovation and industrial innovation. The comprehensive colleges and universities could play a leading role in new technologies and nurture new industries. The local colleges and universities will play a supporting role in regional economic development and industrial transformation and upgrading. Therefore, the "convergence" is not the simple copy of each other in a "one side of thousand schools" situation. It should be in the guidance of the overall national strategy and the higher education classification development policy system. According to the national strategic development goals, local industrial development needs and the school's own position, it would combine with advanced educational philosophy. It would learn and imitate the same level of domestic and foreign colleges and universities to make innovation. And then, it would surpass others.

It also needs to note that many scholars concerns about how the new system exists and expands in a field. And the organizations get "legitimacy". Diamazio and Powell have also discussed the problem "to make the organization more similar without efficiency". For China, it is in the new normal transformation. It should emphasize the active role of the university organization as the actors. It should encourage institutions to carry out institutional entrepreneurship. It should be major trend of China's future development of higher education.

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