

# Exploration and Practice of Mechanical Innovation and Entrepreneurial Talents in Chinese Local Colleges and Universities under Modern Industrial Form

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## Abstract

Modern industries are gradually developed after the economic develops to a certain stage. The inherent innovation, crossover and integration of modern manufacturing industry determine that the innovative and entrepreneurial talents play a key role in the industry development. The innovation and entrepreneurial talent training of machinery major in local colleges and universities must consider actively the demands of local or surrounding areas' modern manufacturing industry. At the same time, innovation and entrepreneurial talent training should take university-enterprise coupling mechanism construction as the starting point, a community creation of cultivating innovative and entrepreneurial talents as the emphasis point, ability enhancement of students as the key point. And then for the local economic and social development, local colleges and universities can cultivate manufacturing innovation talents who understand theory, master technology and dare innovation.

## Keywords

Modern industry; Innovation and entrepreneurship; Local colleges and universities.

## 1. Introduction

Modern industry usually refers to the industry with advanced production technology and equipment, more capital intensive, high production efficiency, fast growth. Modern industry also has the characteristics of innovation, openness, integration, agglomeration and sustainability. Modern industry emerges and develops gradually when the economy advances to a certain stage. The increasing proportion of modern industry in the economic structure will gradually transform the social economy from dual, even multiple, economic structure to modern economic structure. At present, China is in a critical period of industrial transformation and upgrading. The country has clearly stated in the file, the 14th Five-Year Plan and the outline of the long-term goals for 2035: the development of modern industrial system should be accelerated, the foundation of the real economy should be strengthened. The inherent characteristics of modern industry and the needs of China's economic and social development determine that the market needs a large number of innovative and entrepreneurial talents who understand theory, master technology and dare to innovate. The file, Opinions of the Central Committee of the Communist Party of China and the State Council on Promoting High-quality Development in the Central Region in the New Era, clearly points out that the innovation capacity of the central region of China needs to be strengthened. Local universities, especially those in central and western regions of China, relatively lack teaching resources and lag behind introducing advanced concepts and technologies. It is very necessary to carry out exploration and practice in the construction of the coupling mechanism among university, government and enterprise, and in the creation of the innovation and entrepreneurship talent training community.

## **2. Main Problems Existing in the Training of Mechanical Innovation and Entrepreneurship Talents in Chinese Local Universities**

Since the Ministry of Education of the People's Republic of China held the video conference on the training of innovative and entrepreneurial talents in colleges and universities in 2010, local colleges and universities have made in-depth exploration on how to cultivate students of mechanical majors in the innovative spirit, entrepreneurial consciousness, innovative and entrepreneurial ability. And some achievements have also been made. Due to various reasons, local colleges and universities mostly carry out innovation and entrepreneurship talent training based on their own resources. This means they are not strongly connected with the actual demand of modern manufacturing industry and not adequately coupled with enterprises. As a result, the students fostered in this mode have the imperfection of "calcium deficiency and zinc deficiency".

### **2.1. Inpertinence in Personnel Training System**

Generally speaking, machinery related majors in local universities can actively respond to the call and decision of the government. Based on local and surrounding regions' manufacturing industry needs, local universities formulate related documents for talent training of machinery innovation and entrepreneurship, such as talent training programs, curriculum teaching standards, etc. However, through in-depth study of these materials, it is found that they do not well combine the characteristics of the universities themselves with the features of local modern manufacturing industry. Many contents and measures in these materials are formulated from the practices of research-oriented universities, or even copied directly. As a result, the training objectives and mode of mechanical innovation and entrepreneurship talents in local colleges and universities are not clear, the guaranteed measures and evaluation mechanism are not clear, and the tracking feedback and continuous improvement are not specific. Finally, the mechanical talents cultivated cannot well meet the needs of the development of local manufacturing industry.

### **2.2. Inadequate Construction of Teaching Staff**

At present, many colleges and universities regard innovation and entrepreneurship education as offering several relevant theoretical courses to the students, such as Foundation of Entrepreneurship etc.. This thought leads to the results that local colleges and universities don't pay much attention to the construction of innovation and entrepreneurship education teacher teams. Studies have shown that 62.5% of innovation and entrepreneurship teachers in Chinese universities are under 35 years old, 39.5% have been engaged in innovation and entrepreneurship work for less than 2 years, 24% are teachers in non-entrepreneurship field, and 35.3% are counselors [1]. The foundation of innovation and entrepreneurship in local universities is relatively weak, and the value identification of innovation and entrepreneurship by different groups within them has not been formed. At the same time, among innovation and entrepreneurship teachers there is a lack of advisors from industry. Therefore, there is much room for improvement in the ability structure, age structure, knowledge structure and competence level of innovation and entrepreneurship teachers in local colleges and universities.

### **2.3. Unsmoothed Operation in Quality System**

At present, Chinese higher education has being in the stage of popularization. The quality viewpoint of higher education should be adjusted to the corresponding development situation. That is, higher education should enhance student ability to adapt to the needs of social development through its own reform and innovation. Some local colleges and universities still adhere to the quality concept of elite education, which leads to the obstruction or even inability to implement the quality system of innovation and entrepreneurship education. In addition,

due to the lack of innovation and entrepreneurship teachers and other reasons, many local colleges and universities have not constructed a quality evaluation and safeguards system being well matched with modern manufacturing industry. It's much valuable if the quality evaluation and safeguards system is created based on the properties of these university's own conditions. The teaching supervisors of different tiers in a university are limited to the teachers from the university itself and are not from external organizations. The supervision work only stays at the "supervision", focusing on the inspection of students' attendance rate, rise rate and participation rate. However, the supervisor can't bring forward a feasible "supervision" scheme on how to carry out effective innovation and entrepreneurship education.

### **3. Main Characteristics of the Multiagent Coupling Community of Mechanical Innovation and Entrepreneurship Talent Training**

The training of mechanical innovation and entrepreneurship talents in local colleges and universities must be coordinated and unified among science and education institutes, industrial enterprises and governments at all levels. The establishment of innovation and entrepreneurship talent training community, which is multiply connected and coupled among multiagent, aims to form a lasting, continuous, long-term, stable, win-win cooperation situation. The essential characteristics of the multiagent connected and coupled mechanical innovation and entrepreneurship talent training community lie in the common goals and visions, common strategic plans and programs, and common organizational forms and structures formed among the various mainbodies.

#### **3.1. Common Value Identification and Coupling**

It is one of the four functions of colleges and universities to cultivate talents with innovative spirit for social division of labor and development. An important goal of the training of mechanical applied talents in local colleges and universities is that students can master the basic knowledge and technology in the field of machinery, and have pioneering and innovative spirit and ability to solve problems. At the same time, modern manufacturing enterprises are also in great need of mechanical talents with the abilities mentioned above. Therefore, in the field of talent training, universities and enterprises have the same value identification. In terms of human resource construction, colleges and universities focus on talent cultivation and education, while enterprises play emphasis on talent mining and utilization. Although the emphasis is different, both colleges and enterprises need to focus on innovative talent development. On congress of academicians of the Chinese Academy of Sciences and Chinese Academy of Engineering held in 2014, Xi Jinping said: "If China wants to lead the world in science and technology innovation, we should find talents in the innovative practice, cultivate talents in innovation activities, gather talents in innovation enterprise. We must vigorously foster innovative talents in science and technology, and form the talent situation large in scale, reasonable in structure, good in quality" [2]. To sum up, universities and enterprises have multiple coupling in the goal of talent training.

#### **3.2. Common Functional Composition and Functional Coupling**

Economic function is the most primitive function of higher education [3]. For local universities, "application-oriented" talent training is the main paradigm of talent training. As the direct beneficiaries of application-oriented innovation and entrepreneurship talents, enterprises, while giving full play to the economic functions, gradually realize the responsibility and importance of cultivating innovative and entrepreneurial talents. With the rapid development of science and technology today, China's experience in the development of higher education in nearly half a century shows that "application-oriented" talent training can only be an empty talk without the extensive and in-depth participation of industrial enterprises. On the one hand,

as a knowledge production workshop, colleges and universities continuously provide human resources for the development of enterprises. These "fuel" and "power" will ensure that enterprises will not "run out of food" in the fierce market competition. On the other side, enterprises should participate in colleges and universities talent training, provide the real learning environment for students. At the same time, enterprises should impart the engineering experience, entrepreneurial experience and other tacit knowledge to students and inject "accelerator" and "catalyst" for the cultivation of talents in colleges and universities. Only in this way, talents cultivated by colleges and universities can satisfy demand for the enterprise transformation and upgrading, develop and grow. Through this functional coupling, colleges and universities can actively adopt enterprise resources to improve the quality of talent training. Meanwhile enterprises can take the initiative to participate in the process of talent training and be one of the main bodies of talent training from a simple employer.

### **3.3. Common Dynamic Drive and Dynamic Coupling**

With the rise of new economy and new industry, industry enterprises must change the development mode, speed up the transformation and upgrading, and rapidly integrate into the scientific and technological revolution and industrial revolution wave. This will change the cost benefit pattern of enterprises involved in education. According to the advancement of the transformation and upgrading, the dynamic level of industry enterprise participating in higher education will continuously rise. In order to promote economic development, governments at all levels will also take the initiative to encourage enterprises participating innovation along with universities through policies such as land and taxation. On the other hand, modern science and technology represented by the Internet, big data, 5G technology and artificial intelligence are profoundly changing the way of human thinking and learning. And these new techniques also have a profound impact on the organization and management of manufacturing industry. Only by integrating into enterprise production and operation process with the strength of "vertical to the end and horizontal to the side", can local colleges and universities realize the effective docking between the supply side of talent training and the demand side of industrial development, and ensure the effective connection between the education chain, talent chain, industrial chain and innovation chain. Therefore, the emergence and wide application of modern science and technology will certainly change the governance mode of the government, universities and enterprises. The dynamic coupling among multiple subjects enables them to form a joint force and provide all-round guarantee for the cultivation of innovative and entrepreneurial talents to meet social needs.

## **4. Build Community Practice Path for the Training of Mechanical Innovation and Entrepreneurship Talents**

For most developed countries, manufacturing is their pillar industry. And machinery manufacturing is an important part of the manufacturing industry. China is in the process of building a "manufacturing power". And China is in urgent need of a large number of mechanical talents with innovative spirit, creative consciousness and entrepreneurial ability. The coupling within government, university and enterprise is the process of realizing common value of government, education and industry. Under the social demand for mechanical innovation and entrepreneurship talents, a symbiotic ecology can be formed among governments at all levels, colleges and universities, industries and enterprises. Through mutual stimulation and complementation among various main parts, a "coupled industry and education community of innovation and entrepreneurship" can be developed.

#### **4.1. Establish Value Coupling Mechanism and Form Resource Symbiosis Ecology**

Whether the students trained meet the needs of employers is an important index to measure the level and quality of a university. Modern manufacturing enterprises favor talents with innovative and entrepreneurial ability. In order to meet the society needs for the human resources, the government, universities and enterprises must reach a consensus on educational value under the coupling view of multi-element values [4]. For example, colleges and universities can make full use of enterprise resources in teaching basic unit, curriculum, construction. Multiple subject jointly set up reasonable course teaching objective, and transform industry enterprise technologies or achievements into course or project cases. In classroom teaching, course experiment, course design and course practice, teachers can firstly teach the students the related basic theories. And then, they use the industrial cases to train the students to master relevant practical technology. Through this teaching mode, the students can even make innovative achievements. At the same time, the construction process of curriculum teaching resources is not only the process of value fusion and synergistic improvement between enterprise employees and university teachers, but also the process of co-construction and sharing of resources.

#### **4.2. Establish Synergetic Coupling Mechanism and Form Symbiosis Organization Ecology**

The training organization community of innovation and entrepreneurship talents of machinery majors take the local and regional manufacturing industries, such as the key industries, pillar industries and emerging industries, as the object of cooperation. In the community colleges and universities closely connect with the operation chain and innovation chain of industrial enterprises. And the community is built by the government, colleges and universities, industries, enterprises and society together. The community will be a new kind organization form with the function of "educating and teaching, skills training, technology services, cultural heritage "and so on. Modern industrial college is the embodiment of organization innovation and organization symbiosis for application-oriented personnel training. Located at the junction of education chain, talent chain, industrial chain and innovation chain, the organization can accurately meet the development needs of modern industry in the field of machinery manufacturing. At the same time, through introducing running resources of schools by non-governmental sectors and advantageous resources of industries and enterprises, the organization can promote and realize the structural coupling and dynamic balance between the supply side of education and the demand side of industry.

#### **4.3. Establish Dynamic Coupling Mechanism and Form Innovation Symbiotic Ecology**

The goals of university and enterprise community are to integrate industry and education, to reshape the innovation chain, to establish the symbiotic ecology of knowledge innovation and technology innovation. Most of modern manufacturing systems are innovation-driven, knowledge-intensive and technology-intensive industries, which usually possess the characteristics of large initial investment, high risk and long cycle. Generally speaking, universities and scientific research institutions are the main bodies of knowledge innovation. The main body of technological innovation is primary industry enterprises. And innovation is the source of enterprise development. In the modern industrial system, it is almost impossible for enterprises to own all the innovative and intellectual resources needed. Moreover, most enterprises in the emerging industrial system are weak in technological accumulation. And this makes them difficult to carry out effective technological innovation and obtains sustained driving power by themselves. Through establishing an effective, collaborative innovation

mechanism with colleges and universities and forming a joint innovation community, industrial enterprises can improve their innovation ability in product, technology, management, marketing and other aspects from the input of superior innovation elements, which are from colleges and universities, such as manpower, scientific research, equipment and knowledge [5]. By this means, enterprises can also increase their own hidden knowledge inventory, so as to achieve the purpose of enhancing core competitiveness.

#### **4.4. Establish Coupling Evaluation Mechanism and Form Quality Symbiosis Ecology**

In the era of planned economy, many colleges and universities in China have strong industrial background, and state-owned enterprises are more active in the process of talent training. Consequently the talent demand chain of enterprises is perfectly connected with the talent training chain of colleges and universities, and the quality of talent training in colleges and universities is normally recognized by enterprises. At present, many local colleges and universities are in the stage of application-oriented transformation, and are engaged in docking and integration with regional industries. It indicates that the current industrial enterprises have low participation in the improvement of college and university talent training quality. Therefore students have few real practice opportunities in enterprises. One of the consequences is that a large number of local ordinary undergraduate students do not match the standards of innovation and entrepreneurship application-oriented talents recognized by the industry, enterprises and society. And so, the employment competitiveness of these students is obviously insufficient. So the establishment of symbiotic ecology about quality evaluation and improvement among the universities, industries, enterprises and society is the inevitable choice for the training of mechanical innovation and entrepreneurship talents in local universities in the new era.

#### **4.5. Establish Coupling Development Mechanism and Form Symbiotic Governance Ecosystem**

In order to better serve the modern machinery manufacturing industry, the governance system of local colleges and universities, especially the governance system of departments closely related to the training of mechanical talents, should be modernized. Through the construction of symbiotic governance ecosystem with mutual trust and common interests, common vision, common value pursuit, colleges and universities can establish common governance network based on their won priority. While ensuring stakeholders' equal participation in university governance, the common governance system will realize the value of university and the rights and interests of other stakeholders. The application of new technologies in the COVID-19, such as big data, artificial intelligence, internet of things and 5G, played an important role in the epidemic prevention and control. Colleges and universities should take this as an important opportunity to put special emphasis on speeding up the digital management system construction, building multi-elements digital information feedback mechanism of common governance. At the same time colleges and universities should guarantee the enthusiasm of common governance among the multiple subjects by breaking the information asymmetry situation. Meanwhile colleges and universities also should improve the ability to "smoothly switch in two-way" between normal and emergency conditions.

### **5. Conclusion**

General Secretary Xi urges Chinese youth to be innovative, to be pioneers and to break things. At present, China has encountered unprecedented external resistance on its journey to build a modern power. Only through innovation can enterprises master the "hard skills" and "killer punch" to overcome obstacles. Only when the collaborative, coupled innovation and

entrepreneurship talent training community is built among governments at all levels, local universities, industries and enterprises and other mainbodies, a good atmosphere and pattern for innovation and entrepreneurship can be formed. Then governments, universities and industries can calmly cope with challenges in the face of many uncertain factors in the future.

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