



# How Do Engineering Application-oriented Universities Position And Strategize with External Actors? A Relational Dynamics Perspective

**Yingying Qiao**

Yingying Qiao is a PhD student at College of Public Affairs, Zhejiang University. Her interests include research in engineering education and engineering science.

**Guangpei Chen**

Ph.D. candidate at the School of Public Affairs, Zhejiang University; Major: Educational economics and management; Research interests: Industry-College Partnership, Asymmetric Innovation (State-owned enterprises, Institution-based views, Public-private interaction).

# **How Do Engineering Application-oriented Universities Positioning And Strategizing with External Actors? A Relational Dynamics Perspective**

## **Abstract**

The breakpoints of innovation chains, especially those between basic and applied research caused by imperfect systems and underlying mechanisms, has remained an outstanding problem in the transfer and transformation of scientific and technological achievements. This is partly because industries and universities can not achieve smooth coordination and deep integration as they share different functional architectures and value propositions. Henceforth, China has set up a large number of so-called “Application-oriented Universities (AOUs)” in recent years, with an aim to solve aforementioned deficiencies and to promote local industrial economies. Nevertheless, while the central government has set a clear vision when proposing this term of AOUs, it failed to give an clear definition and connotation. As a result, AOUs were stuck with problems such as a lack of resources, vague positioning, homogeneous development with “Research-oriented Universities (ROUs)” directly affiliated to the central government and weak local embeddedness in their early stage of development and performed far below expectations. Until recently, AOUs has gradually found their positioning and ways of strategizing during the process of integration and experiment with industries, ROUs, and governments by forming a symbiotic and complementary relationship, and thereby made up for the breakpoints of innovation chains to a great extent.

Based on this, from the perspective of relational dynamics, this study focuses on how Chinese engineering AOUs participate in the process of transfer, transformation and diffusion of scientific and technological achievements. Taking Shanghai University of Engineering Science and Anhui Institute of Information Technology as research cases, this study discusses how AOUs in China manage to find suitable ways of positioning and strategizing with the policy guidance and resource support of two tiers of governments - central and local respectively. Also, this study explores the dynamic

mechanisms underlying the change of relationships between AOU and ROU in the same region from competition to commensalism. This study clearly depicts the “bridge” function served by AOU as well as the complementary effects between AOU and ROU in the process of transfer and transformation of scientific and technological achievements. After these, the conceptual connotation and functional architectures of AOU can be further clarified, which can provide reference for the development of AOU in China and even all over the world.

**Key Words:** Relational Dynamics, Engineering Application-oriented Universities, Case study, Commensalism

## **I. Introduction**

The breakpoints of innovation chains, especially those between basic and applied research caused by imperfect systems and underlying mechanisms, has remained an outstanding problem in the transfer and transformation of scientific and technological achievements. Henceforth, China has set up a large number of Application-oriented Universities in recent years, with an aim to solve aforementioned deficiencies and to promote local industrial economies. Under this circumstance, we select Shanghai University of Engineering Technology and Anhui Institute of Information Engineering, two educational entities with significant differences in resource endowment and operating models, as case objects. In particular, we discuss how application-oriented universities (AOU) in China manage to find suitable ways of positioning and strategizing with the policy guidance and resource support of two tiers of governments - central and local respectively. We also explore the dynamic mechanisms underlying the change of relationships between AOU and ROU in the same region from competition to commensalism. In sum, our research target two core questions as follows:

**RQ1:** How do engineering AOU position themselves under the guidance of governments both at central and local level?

**RQ2:** How do engineering AOU co-evolve with ROU in the transfer and transformation of scientific and technological achievements?

## **II. Research review**

### **1. The Evolution of Chinese Application-oriented Universities**

As a long-standing university type, AOUs have been included in many university classification systems at home and abroad. Different from the dual-track system of higher education classification adopted by European countries such as Germany and Finland, as indicated by "Opinions on the Setup of Higher Education Institutions during the 'Thirteenth Five-Year Plan' period" released by the Chinese Ministry of Education in 2017, China's higher education as a whole can be divided into three types: research type, application type and vocational skill type[1]. A considerable part of the academic community also points out that Chinese universities can be roughly divided into three categories: research universities, application universities, and vocational colleges[2-3]. Among them, application universities often refer to new undergraduate colleges, which are termed *vis à vis* established undergraduate colleges [4]. New undergraduate colleges and universities generally fall into the definition of AOUs. It can be said that, at least to some extent, the current trend of building AOUs is spurred by the advent of new local undergraduate colleges upgraded in 1999.

The evolution of China's AOUs is typically "practice-driven" as the demand for local economic development constitutes the core driving force. According to the new institutional economics theory, China has followed a bottom-up approach of designing educational institutions starting from local exploration and pilots at provincial level, and culminating with final decision made by the central[5].

Since the Reform and Opening up, the imbalance of China's higher education system is reflected in the unevenness of internal resource distribution and the mismatch of supply and demand in the external market relationship. Due to limited resources, China has long implemented the system of building key universities, namely, concentrating resources on a few elite universities with favorable bases. In practice, the key universities are mainly research universities directly affiliated to the central government with a focus on cultivating academic talents. In addition, China's higher education system bear a "open secret", that is there exists a status pyramid where AOUs and other local universities have long been at the bottom of the whole higher education structure. Therefore, in a rather long period, AOUs and other local universities that cultivate applied talents are absent in the rosters of central government subsidies. Under such circumstances, some AOUs spontaneously started seeking new development paths.

Through bottom-up exploration routes, they eventually become an integral part of the national higher education structure. In recent years, many provincial-level AOUs in China have built pilot demonstration schools to cultivate application-oriented talents, vigorously build applied disciplines and majors, and gradually develop new properties that define today's AOUs. However, it was not until the arrival of the 21st century that the relationship between local universities, applied talents and applied disciplines was integrated through national policies, and the concept and status of AOUs were officially determined[6].

Since China made the strategic decision of "guiding a group of ordinary undergraduate colleges and universities to transform into application-oriented colleges and universities" in 2014, under the promotion of a series of policies of governments at all levels, a number of local colleges and universities have implemented application transformation, and relevant research results have continued to emerge. However, transformation is a systemic change process. It not only concerns implementing macro policies, but also require coordinating and adapting policy goals with its own traditions. As a result, more attention needs to be paid to the coordination between internal elements within the organization[7-8]. Among the newly-built AOUs in past decades, many have the problems of unclear positioning, vague characteristics, and instability. For example, in the process of transformation and development, colleges and universities lack clear cognition and correct guidance, face the dislocation of the school-running goal of "emphasizing learning and ignoring skills" and path dependence problems. There are also problems such as high homogeneity with less prominent characteristics[9].

## **2. The unique role of AOUs in the transfer and transformation of scientific and technological achievements**

China clearly proposes to establish a technological innovation system with deep integration of production, education and research to promote the transformation of scientific and technological achievements. As the main front of cutting-edge basic research and application development research, colleges and universities have gathered a large number of innovative "think tanks", and the output of their scientific and technological and knowledge achievements has laid the foundation for promoting regional innovation[10-11].

The transformation of scientific and technological achievements mainly comes

from colleges and universities and scientific research institutions. Colleges and universities are the gathering pool of innovative talents and resources, as well as an important source of scientific and technological achievements. However, while the transformation efficiency of scientific and technological achievements in foreign universities is relatively high[12], its efficiency in Chinese universities is comparatively low. In addition to the insufficient supply of effective technological achievements provided by the scientific and technological evaluation system, the fact that scientific and technological innovation model less follows the laws of the scientific and technological innovation value chain is also an important reason. That is to say, China's scientific research process and enterprise R&D process are two independent development processes. From the perspective of the scientific and technological innovation value chain, the market demand drives enterprise R&D, and then enterprise R&D drives technological innovation and scientific research. However, in present China, scientific research organizations and research universities are the main body of research and development, and their scientific and technological innovation models are mainly theory-driven or discipline-driven With exploring scientific laws and solving theoretical propositions as their main motivations.

In comparison, local AOUs are an important force for local economic and social development. Generally speaking, local AOUs have their own distinct characteristics and some local advantages, making them better meet the needs of local industries and serve the regional economy and social development.

In AOUs, applied scientific research is the main choice of scientific research activities [13-14]. The scientific research of AOUs is driven by social and regional needs [15]. In this regard, AOUs are highly committed to transforming the intellectual achievements, even more than ROUs[16]. Through "industry-university-research" cooperation, the advantages of the application technology are used to obtain social and economic benefits, the scientific research achievements are transformed into productive forces, and the scientific research and production practice are combined[17]. It can be seen that the nature and characteristics of scientific research in AOUs also determine that they are different from ROUs in that they attach more importance to the transformation of scientific research results into real productivity, and can closely follow the national policy orientation and local governments, rapidly integrate technical talents and resources to engage in the transformation of scientific and technological achievements[18]. Therefore, AOUs have unique advantages in the transfer and

transformation of scientific and technological achievements in colleges and universities.

### **III. Case Study: Zhejiang University City College and Anhui**

#### **Institute of Information Technology**

##### **1. Research Design**

###### **(1) Research Method**

In social science research, the case study method is a widely used research method. Shanghai University of Engineering Science(SUES) and Anhui Institute of Information Technology(AIIT) are two different types of Chinese engineering AOU. In the process of transferring and transforming scientific and technological achievements, how do these two universities position themselves with the guidance by local governments (external intervention), and their own resource base constraints constitute an interesting question. Also, we explore the dynamic mechanisms underlying the change of relationships between AOU and ROUS in the same region from competition to commensalism.

###### **(2) Research Objectives and Objects**

The main purpose of this case study is to explore how engineering application-oriented universities participate in the process of transfer, transformation and dissemination of scientific and technological achievements, and to provide reference for the development of engineering universities in China and even around the world, as well as the hierarchical classification construction of different types of universities.

This article focuses on the practices and experiences of SUES and AIIT for the following reasons:

- 1) SUES and AIIT are engineering application-oriented universities with distinctive characteristics and typical development models among Chinese application-oriented universities. In recent years, both of them have made steady progress in various rankings, showing a relatively vigorous development trend.
- 2) SUES is a full-time general institution of higher learning established with the approval of the Ministry of Education and the Shanghai Municipal People's

Government and organized by the Shanghai Municipal People's Government. It implements the principal responsibility system under the leadership of the SUES Committee of the Communist Party of China. AIIT is a non-profit private AOU. It was established with the approval of the Ministry of Education and the People's Government of Anhui Province. It is fully funded by iFlytek, a well-known intelligent voice and artificial intelligence listed company in the Asia-Pacific region, and is in charge of the Anhui Provincial Department of Education. The university implements the principal responsibility system under the leadership of the board of directors. It can be seen that the two have significant differences in the form of organization and management system, respectively representing two types of engineering AOUs with their own characteristics in China.

- 3) SUES is located in Shanghai and AIIT is located in Wuhu City, Anhui Province. Shanghai is a provincial-level administrative region, municipality directly under the Central Government, a national central city, and a mega city in China. In 2021, Shanghai's GDP will be 4,321.485 billion yuan. Wuhu City is a prefecture-level city under the jurisdiction of Anhui Province, with a GDP of 430.263 billion yuan in Wuhu in 2021. There are significant differences between the two in terms of industrial structure, economic development level, and educational resources. Therefore, from the perspective of the school's geographical location and local resource endowments, the experience summary of how the two universities serve the local economy and promote the transfer and transformation of scientific and technological achievements has certain reference significance for a certain type of university to which they correspond. The representativeness and generalizability of case studies are further enhanced.



Table 1. Comparison of the Basic Situation of the Two AOU

University Name	Time of Establishment	Geographical Location	Organizer	Management System
SUES	Year 1978	Shanghai	Shanghai Municipal People's Government	the principal responsibility system under the leadership of the SUES Committee of the Communist Party of China
AIIT	Year 2003	Wuhu City, Anhui Province	fully funded by iFlytek and in charge of the Anhui Provincial Department of Education	the principal responsibility system under the leadership of the board of directors

### (3) Data Collection

The data for this study came from a variety of sources, including:

1) Face-to-face interviews with SUES and AIIT teachers, their scientific research teams, and administrative staff. These semi-structured interviews provide a lot of first-hand information on how universities participate in the transfer and transformation of scientific and technological achievements.

2) Collect, integrate and summarize the two universities' development plans, annual work summaries, project scientific and technological achievements transfer and transformation contracts and other documents.

3) Collect and organize public data such as official website information and news reports.

## 2. Internal system construction is an important guarantee for the construction of applied universities in China

SUES has set up a Scientific Research Office responsible for the transformation of scientific and technological achievements. In 2013, a Technology Transfer Center was established, which was the first pilot unit for technology transfer and achievement transformation commissioned by the Shanghai Municipal Education Commission. The center is positioned as a professional service management department for the transformation of scientific and technological achievements of the school, with full-time personnel and full-time posts. In order to make the technology transfer work more efficient, the school has always adhered to the top-level design work of system construction, and formulated the "Administrative Measures for the Transformation of

Scientific and Technological Achievements of Shanghai University of Engineering and Science", "The Interim Measures for the Disclosure of Technological Inventions of Shanghai University of Engineering and Science's Planned Science and Technology Projects", and "Shanghai University of Engineering and Science". The University of Engineering and Technology has more than ten systems such as the Detailed Rules for the Implementation of Investment in the Evaluation of Technical Achievements for Jobs in Engineering and Technology. In order to cooperate with the effective implementation of the system, the Technology Transfer Center, together with the school's financial, legal and other relevant functional departments, has formulated a whole-process management service process from application for achievement transformation, review, and pricing announcement to on-campus issuance of documents and awards.

AIIT has specially set up a Science and Technology Office responsible for the centralized management of scientific and technological work, foreign scientific and technological development and cooperation, academic exchanges, scientific research achievements, scientific research funds, scientific research institutions, scientific and technological information, intellectual property protection and other aspects of management. Also, AIIT promulgated the "Anhui Institute of Information Technology Teaching and Research Incentive Measures" to carry out industry-university-research cooperation, research and development of new products, new technologies, new processes, new equipment or patents and other intellectual property achievements, and achieved significant social and economic benefits. The "Interim Measures for the Management of the Transformation of Scientific and Technological Achievements of Anhui Institute of Information Technology " also clearly stipulates the transformation methods, implementation procedures, and income distribution of scientific and technological achievements, so as to promote the promotion and transformation of scientific and technological achievements in the school, and to further standardize the organization and management of the transformation of scientific and technological achievements of the college. .

In view of the fact that there are few scientific and technological achievements that can be transformed and promoted in Chinese universities, the theoretical scientific

and technological achievements of schools often stay in the laboratory "small test" stage, most of which are research results of scientific research projects, and the recognition of enterprises is not high. The "last mile" landing bottleneck of productivity. SUES gives full play to the advantages of application-oriented universities in local development, and deploys 8 technology transfer sub-centers (technological workstations) in the Yangtze River Delta region. At the same time, it has a team of part-time technical and economic personnel through external employment. The technical needs of enterprises are solicited and feedback through various channels.

### **3. Government support to promote the construction of local application-oriented universities**

According to Etzkowitz, the government is an important pole in the "triple helix"[19]. The government has played an important role in providing policy support for the development of universities. However, the degree of governmental support varies drastically across different types of universities, and this discrepancy is originated from a deep-rooted cognition embedded in thousands of years of traditional Chinese culture, which is that academic talents are better than skilled talents, and accordingly, ROUs are superior to AOUs. Such cognition not only affects the judgment of society, parents, and enterprises on universities and talents, but also profoundly influences the choice of the government and universities themselves on university construction. As a result, Chinese AOUs are long absent from the national-level "211" project, "985" project, and "Double First-Class" plan as key universities. Nevertheless, as the value of AOUs has been increasingly recognized, the way how governments at various level treat and support them is changing. As the governor of China's higher education system, the government has carried out various policy experimentation in the process of promoting the construction of AOUs. For example, the construction of AOUs and the training of application-oriented talents have been repeatedly emphasized in relevant central documents concerning further development of educational, economic and social processes. And in these new policy attempts, an equal status and recognition has been given to both AOUs and ROUs.

In addition to the central government, local governments in China have also given guidance and support to local AOUs in various aspects. As far as the case universities in this study are concerned, the District Party Committee and District Government of

Wanzhuo District, Wuhu City, Anhui Province strongly support the construction of AIT. In addition to financial support, the government has given high support in terms of campus construction planning, implementation of industry-university-research cooperation policies, enrollment of faculty and staff's children, talent training and employment. They are committed to building an inclusive community to achieve a win-win outcome for both the university and the society as a whole. Moreover, the cooperation between the local government and university has also greatly promoted the development of AOs. Such as Shanghai Municipal People's Government Development Research Center, Shanghai Human Resources and Social Security Bureau, Shanghai Songjiang District People's Government, Shanghai Changning District People's Government, Shanghai Baoshan District People's Insurance Bureau, Shanghai Baoshan District Tourism Commission, Shanghai Baoshan District, Wusonggang, Baoshan District, Shanghai are all units of the Industry-University-Research Alliance of Shanghai University of Engineering Technology, forming a good interactive relationship and further clearing the institutional barriers to the transfer and transformation of scientific and technological achievements.

#### **4. Serve local economic development and fully participate in industry-university cooperation**

Judging from the successive introduction of programs such as China's "Excellence Plan", "Industry-Education Integration Project" and "New Engineering Project", an important feature of the benchmark of AOs - the integration of industry and education emerges. These AOs take the road of "industry-university-research" cooperation in scientific research and technological development and transformation. In the process of construction, Chinese AOs that implement the integration of industry and education have chosen different approaches according to their own and regional characteristics. Long-term exploration and practical experience have proved that the in-depth integration of industry and education between local economic development and the development of AOs is a win-win method with low cost and high returns. Deep integration of industry and education is an inevitable outcome of social and economic development and the best way to cultivate applied talents, which is conducive to improving the reputation of universities and enhancing the attractiveness of enrollment[20].

At present, Chinese AOs are building their strategies and institutions around the

needs of regional economic development. In terms of talent training goals, AOUs focus on cultivating compound, professional and applied talents with front-line production, management and service capabilities and qualities. In the setting of disciplines and majors, they focus on adapting to the needs and changes of local economic, social and industrial development. Regional economic and social development and industrial structure are also an important driving force for AOUs to adjust their positioning, plan and set disciplines, and research directions, and have obvious industrial and local characteristics. Full integration with local industries is also an important way for AOUs to form their own characteristic development models.

AiIT actively cooperates with local enterprises in scientific research, and realizes a flexible, mutually beneficial, long-term and stable industry-university-research in-depth cooperation model with enterprises. The school's scientific research is closely centered on the application-oriented school-running orientation, and the three main directions of scientific research have been clarified: one is the horizontal topic facing the actual production problems of enterprises; the second is intellectual property rights based on patents; and the third is an engineering technology center that integrates innovation and product R&D for enterprise transformation and upgrading.. The Science and Technology Office actively carries out exchanges with local enterprises. Through extensive and in-depth exchanges, the school actively cooperates with local enterprises by virtue of its academic advantages. For example, it cooperates with Wuhu Zhongchi Machine Tool Manufacturing Co., Ltd. in the research and development of intelligent remote detection systems and joint application for scientific research projects. , co-construction and sharing of scientific research teams, etc.; and Anhui Tianrui Electronic Technology Co., Ltd. in product big data application, product tracking management system development, etc.

SUES has always adhered to the school-running purpose of relying on Shanghai's modern industry and actively serving economic and social development, and built a school-running model that takes the industry-university-research strategic alliance as a platform, and the discipline chain and professional chain are connected to the industry chain, creating a true education of "industry-academic cooperation and engineering-academic alternation". Create a cradle of outstanding engineers and engineering service talents. The school's majors are mainly engineering technology. The school actively carries out basic science and applied scientific research. Through the construction of high-level scientific research bases and innovative teams, it promotes discipline

construction, talent training and scientific and technological progress, enhances the school's scientific and technological innovation capabilities and serves the society. ability. Adhere to collaborative innovation, closely focus on the national strategy and the needs of Shanghai's transformation and development, further consolidate and expand the strategic alliance of production, education and research, continuously enhance the school's ability to serve the society, and provide talent, technology and intellectual support for national and regional economic and social development. Shanghai Engineering University School of Mechanical and Automotive Engineering, relying on its New Energy Vehicle Industry Technology Research Institute, the provincial and ministerial platform Shanghai Large Component Intelligent Manufacturing Robot Technology Collaborative Innovation Center, etc., focuses on the development of Shanghai International Port (Group) Co., Ltd. Collaborative control of safety equipment, intelligent analysis of automated processes, automatic driving of forklifts, power exchange equipment and other sectors of the technical needs of enterprises, in-depth cooperation in intelligent machinery manufacturing, automatic driving and other fields. In the form of projects, priority will be given to cooperation in the fields of "video decoding technology" and "automation control", which will lay a good foundation for the later transformation of scientific and technological achievements.

Since iFlytek took the lead in running schools in 2012, AIIT has clarified the application-oriented school-running orientation of serving regional economic and social development, with the school's vision of "the cradle of industrial engineers and entrepreneurial entrepreneurs" established by the school board. The school's majors are based on advantageous engineering, and information technology and artificial intelligence are used to promote the cross-integration of interdisciplinary majors, focusing on information technology, artificial intelligence, intelligent manufacturing and other related industries, and strengthening engineering majors such as computer, electronic information, and machinery. Its scientific research is closely centered on the application-oriented school-running orientation, focusing on horizontal topics oriented to the actual production problems of enterprises, intellectual property rights based on patents, integrated innovation oriented to enterprise transformation and upgrading, and the construction of engineering technology centers (platforms) for product research and development as the three main attacks. direction.

## **5. Working closely with Research-oriented Universities to form Commensalism relationships**

For a long time, the concept and orientation of Chinese AOU have been deeply influenced by traditional universities. Some AOU with distinctive university-running characteristics, such as normal universities, finance and economics, political and legal universities, and science and technology universities, have also transformed into comprehensive universities. They all unfortunately became one of the many homogeneous universities in China, which further caused their lack of uniqueness in terms of talent training and scientific research. The orientation and development model of running a university similar to that of ROU have made Chinese AOU and ROU develop homogeneously under the same standard. In the traditional track where ROU have long dominated, AOU are positioned disadvantageously.

With the guidance of the Chinese government in the later period and the continuous exploration and adjustment of AOU, the positioning of AOU has gradually become clear. They more clearly serve local economic and social development, cultivate applied talents, carry out applied research, and attach importance to the transfer and transformation of scientific and technological achievements. China has also gradually formed a different evaluation system for AOU, such as the "Guangzhou Daily Applied University Ranking" initiated by the Guangzhou Daily Data and Digital Research Institute; Special evaluation of the scientific research dimension - "China's New (Applied) Undergraduate Universities Scientific Research Competitiveness Ranking"; and the application-oriented university ranking in the Chinese university evaluation system of the iResearch Alumni Association Network. The dislocation development further makes the two types of universities begin to seek cooperation and give play to their strengths. In particular, engineering AOU have shown significant and unique advantages in the transfer and transformation of scientific and technological achievements. As a result, AOU and ROU have gradually changed from an initial competitive relationship to a symbiotic relationship in which competition and cooperation coexist. AOU can give full play to their own advantages, complement the advantages of ROU, and jointly promote the transfer and transformation of scientific and technological achievements.

The School of Computer and Software Engineering (School of Big Data and Artificial Intelligence) of Anhui University of Information Engineering and the Yangtze

River Delta Information Intelligence Innovation Research Institute (a research institution jointly established by the University of Science and Technology of China and the Wuhu Municipal People's Government) Industry-university-research cooperation, jointly carry out horizontal project cooperation and vertical project joint declaration and other work, focusing on cooperation in cross-domain applied research and integrated innovation, and jointly promote the transfer and transformation of scientific and technological achievements.

Shanghai University of Engineering and Technology, together with ROUs such as Shanghai Jiaotong University, Donghua University and Shanghai University, joined the Yangtze River Delta G60 Science and Technology Innovation Corridor New Materials Industry Technology Innovation Alliance led by Hengdian Group DMC Co., Ltd. The alliance has played an important role in promoting the deep integration of the new material industry chain, innovation chain and capital chain, and focusing on solving key technical problems and transforming scientific and technological achievements. In addition, Shanghai University of Engineering and Technology, Shanghai Ocean University, Shanghai University of Science and Technology and other ROUs have shared many experiences and exchanges on the transfer and transformation of scientific and technological achievements.

#### **IV. Conclusion, Limitation and Future Work**

This study introduces how SUES and AIIT participate in the process of transfer, transformation and dissemination of scientific and technological achievements. In the process of transferring and transforming scientific and technological achievements, Chinese engineering AOU, with the support of local government policies and funds, and based on the needs of regional economic and social development, industrial structure, and their own resource endowments, define and constantly adjust their own development orientation. In scientific research, AOU focus on applied research and the urgent needs of urban development and the needs of industrial transformation, and form a multi-subject collaborative industry-university-research collaboration with government departments, large state-owned enterprises, industry leading companies, and local ROUs. In particular, AOU achieve dislocation competition with ROUs and gradually form a symbiotic relationship in which competition and cooperation coexist, which is beneficial to make up for the breakpoint in the innovation chain.





Figure 1. Influencing Factors of Chinese engineering AOU's Participating in the Transfer and Transformation of Scientific and Technological Achievements

However, this article is only a preliminary summary of the practice and experience of Chinese engineering AOU's participating in the transfer and transformation of scientific and technological achievements. More research is needed on the mechanism and path of the transfer and transformation of scientific and technological achievements in different types of AOU's with more detail presentation.

## References

- [1] Ministry of Education of the People's Republic of China. Opinions of the Ministry of Education on the establishment of higher education institutions during the "13th Five-Year Plan" period [EB/OL]. [2017-02-04]. [http://www.moe.gov.cn/srcsite/A03/s181/201702/t20170217\\_296529.html](http://www.moe.gov.cn/srcsite/A03/s181/201702/t20170217_296529.html).
- [2] Pan Maoyuan, Che Rushan. A Brief Discussion on the Positioning of Applied Undergraduate Universities [J]. Higher Education Research, 2009, 30(5): 35-38.
- [3] Chu Changlian. The practice and thinking of building a new model of local applied higher education [J]. Applied Higher Education Research, 2016,1(01):33-37
- [4] Fu Dayou. New stage, application type, locality: key words for the transformation and development of new undergraduate colleges and universities [J]. China Higher Education, 2010(22):25-27.
- [5] Li Jun, He Weiguang. 40 Years of Applied Undergraduate University: History, Characteristics and Transformation [J]. Journal of Nanjing Normal University (Social Science Edition), 2018, (5): 43-49.

- [6] Liu Yourong. Research on the Development of Newly-built Applied Undergraduate Universities in my country[D].Nanjing University,2011.
- [7] Zhu Jianxin. Institutional Dilemma, Causes and Mechanism Construction of the Transformation of Local Universities to Applied Universities [J]. Higher Engineering Education Research, 2018(05):117-122.
- [8] Xun Yuan, Xu Mingbo. Transformation to an application-oriented university: the transformation of goals, majors and courses: An analysis based on five case universities [J]. Heilongjiang Higher Education Research, 2019,37(08):134-140.
- [9] Chen Bin.The logic and dilemma of building a university of applied technology[J].China Higher Education Research,2014(08):84-87.
- [10] Wang Chujun, Xu Zhi, Chen Liyu. Evaluation of the transformation efficiency of scientific and technological achievements in Chinese research universities based on benchmarking management——Application of network ranking method[J].Research Management,2020,41(3).
- [11] Dong Huizhong, Zhang Renjie. Spatial pattern and evolution characteristics of innovation efficiency in China's high-tech industries [J]. Statistics and Decision, 2021, (3).
- [12] Qi Yong, Zhu Tingting, Guo Yi. Research on the market transformation mode and efficiency evaluation of scientific and technological achievements[J]. China Soft Science, 2015(06):184-192.
- [13] Liu Zhentian. Academic dominance or market access: Advances, retreats and swings in the construction of applied universities [J]. Higher Education Research, 2019,40(10):21-28.
- [14] Shi Wei. The Cultural Orientation and Construction Path of Applied Universities[J].China Higher Education Research,2016(09):83-86+92.
- [15] Pan Maoyuan. What is an applied undergraduate degree? [J]. Higher Education Exploration, 2010(01):10-11.
- [16] Chen Xiaohu."Applied Undergraduate Education": Connotation Analysis and Construction of Talent Training System[J].Jiangsu Higher Education, 2008(01):86-88.
- [17] Zheng Guoqiang. Creating a New Application-oriented University Facing the 21st Century [J]. Higher Education Research, 1999(05):93-95.
- [18] Zhang Yu, Hu Xun. "Changes" and "No Changes" in the Transformation of Scientific and Technological Achievements in Local Application-oriented Universities: A Case Study of Some Application-oriented Universities in Shanghai [J]. Science and Technology in Chinese Universities, 2021(03):90-93.
- [19] Etzkowitz, H. The Norms of Entrepreneurial Science: Cognitive Effects of the New University-industry Linkages [J] . Research Policy, 1998( 27) : 823.
- [20] Jin Lan, Gao Jun. Exploration on the path of deepening the integration of production and education in the construction of first-class undergraduates in applied universities [J]. University, 2021(51):17-19.