University-industry integration in Different Types of Universities in China
——Case Studies of Dongguan University of Technology and Xi'an Jiaotong University

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1 Introduction：The Broader Context

Since the beginning of the 21st century, and particularly in the last decade, fostering university-industry collaboration (UIC) for synergistic talent cultivation, which means developing skills of students and faculty members, mostly students, has become a broad consensus in China's political and academic spheres. (The Beijing News, 2022) Governments at all levels, together with higher education institutions (HEIs), have issued a series of policy documents designed to guide and incentivize enterprise participation in developing faculty and students' skills. These initiatives range from forward-looking top-level designs to concrete operational guidelines.

A landmark policy, the 2017 'Several Opinions of the General Office of the State Council on Deepening the Integration of Industry and Education' (hereinafter referred to as the 'Opinions'), articulated this strategic direction. It stated: 'Deepening the integration of industry and education, and promoting the organic connection of the education chain and talent chain with the industrial chain and innovation chain, is an urgent requirement for advancing the structural reform of the human resources supply side. It is of great significance for comprehensively improving education quality, expanding employment and entrepreneurship, promoting economic transformation and upgrading, and cultivating new drivers of economic development.' While the document uses the term 'integration of industry and education,' its core objective aligns with promoting enterprise engagement in the educational processes of HEIs and vocational colleges. To ensure its implementation, the State Council further decomposed these principles into 26 specific key tasks, assigning them to various national ministries and provincial governments. These tasks encompass building a coordinated development framework, strengthening the primary role of enterprises, advancing talent cultivation reforms, facilitating supply-demand alignment, and improving the policy support system. (General Office of the State Council of the People's Republic of China, 2017)

Guided by this national strategy, China has adopted a multi-layered and increasingly sophisticated approach to university-industry integration. This evolution has moved from isolated project-based initiatives towards multi-stakeholder collaboration and, more recently, the development of comprehensive ecosystems. Key measures include:

Collaborative Education Projects: Led by the Ministry of Education, these projects use policy guidance and financial support to foster deep university-enterprise cooperation in talent cultivation and research innovation. (Ministry of Education of the People's Republic of China, 2020).

Modern Industrial Colleges: These entities strengthen university-enterprise partnerships by leveraging industry resources and market trends to jointly cultivate

high-quality, application-oriented professionals. (Ministry of Education General Office & Ministry of Industry and Information Technology General Office, 2020).

University-industry integration Communities: These bring together diverse stakeholders—including industry associations, enterprises, universities, and research institutions—to promote seamless alignment between industrial development and educational training.

Pilot Cities and Enterprises for Integration: This designation encourages local economic growth, innovation, and entrepreneurship by stimulating collaborative innovation and talent development between local governments and universities. (National Development and Reform Commission et al., 2019).

City-Level Industry-Education Alliances: These alliances further enhance the alignment between regional educational offerings and local industrial demands, deepening the implementation of regional collaborative development. (Jilin Municipal People's Government, 2025)

Collectively, these initiatives signify a deepening and diversification of China's approach to university-industry integration. They not only reinforce the interaction between education and industry but also contribute to the construction of increasingly complex and comprehensive collaborative ecosystems. This report examines two case studies within this national landscape of skills development-focused university-industry integration: Dongguan University of Technology, which is a university of applied sciences, and Xi'an Jiaotong University (XJTU), a top-tier 'Double First Class' comprehensive research university.

2 Case Description

2.1 University of Applied Sciences: Dongguan University of Technology

2.1.1 About Dongguan University of Technology[①]

Founded in 1992, Dongguan University of Technology is situated in Dongguan, a major advanced manufacturing hub in the Guangdong-Hong Kong-Macao Greater Bay Area. As one of the first batch of high-level polytechnic universities designated for construction in Guangdong Province, it has consistently ranked first among China's application-oriented universities for eight consecutive years. The university maintains close alignment with regional industrial demands, engaging in deep collaboration with leading enterprises such as Huawei and Siemens, as well as major innovation platforms including the China Spallation Neutron Source. It has established ten modern industrial colleges, among which two have been approved as Ministry of Education Modern Industrial Colleges and six as Guangdong Provincial Demonstration Industrial Colleges. Since 2011, the university has sustained its exploration of university-industry integration models for talent cultivation, constructing a 'three importations, five co-engagements' collaborative mechanism to achieve iterative innovation in modern industrial colleges from Version 1.0 to 3.0. To date, it has cultivated approximately 170,000 graduates, with 95% remaining in the Greater Bay Area for employment or entrepreneurship; employer satisfaction exceeds 93%. This makes the university an ideal case for studying practical models of university-industry integration.

① Dongguan University of Technology. (2026, January). *东莞理工学院简介*. Retrieved April 30, 2026, from https://www.dgut.edu.cn/info/1012/76772.htm

Table 1 Phases of UII at DUT

Time	2011-2017	2018-2022	2023 to present
Stage	Phase 1.0	Phase 2.0	Phase 3.0
Carrier	College of Modern Industry	College of Modern Industry	Academy of Engineers of Excellence
The connotation of the education model	'Three, five, four, three' (3541)	'Three focuses, six strengthenings'	'Endeavor Plan' and 'Implementation Plan'
Nine colleges	1. Guangdong-Hong Kong Robotics College 2. Siemens Institute of Intelligent Manufacturing 3. Advanced Manufacturing College (Changan) 4. Guangdong-Taiwan Industrial Science and Technology College 5. Huawei Institute of Information and Network Technology 6. Dongguan Institute of Technology (Changping) School of Intelligent Manufacturing and Creative Design 7. Dongguan Institute of Intellectual Property 8. Zhihui Modern Internet Business School 9.360 Cyberspace Security Industry College		

2.1.2 Model I: Modern Industrial College Version 1.0 Stage

2.1.2.1 Overview of Modern Industrial College 1.0

Modern Industrial College 1.0 refers to the initial exploratory phase of industrial college construction carried out by Dongguan University of Technology from 2011 to 2017. The core idea was to break the traditional single-education model of universities through school-enterprise collaboration, university-industry integration, and collaborative talent cultivation. It proposed the "Three Integrations, Five Collaborations, Three Directions" model. The "Three Integrations" refers to integrating advanced technology systems, advanced production equipment, and advanced training models. The "Five Collaborations" are: first, school-enterprise cooperation in jointly planning professional development, establishing a joint professional construction steering committee, jointly formulating talent cultivation plans and professional core competency standards; second, jointly researching project-based courses, integrating enterprise advanced technologies, real cases, and projects into the curriculum system; third, jointly forming teaching and research teams, having teachers reside in enterprises for training, having enterprise backbone personnel participate in teaching, and forming joint teams for collaborative problem-solving; fourth, jointly building practice teaching platforms that align with industrial technology frontiers, creating laboratories and practice bases close to engineering reality; and fifth, jointly creating technological

innovation platforms and carrying out collaborative technological project research and achievement transformation. The “Three Directions” means that during the enterprise learning stage, to meet students’ individual needs, three directions are offered: “technical service, technical management, and technical research and development.” (Ma. H.W. 2024) Under the “3543” industry-education collaborative talent cultivation model, multi-actor and diversified cooperation takes place, forming four cooperation modes: “school-enterprise cooperation, school-government cooperation, school-school-enterprise cooperation, and school-school-institute cooperation.”

2.1.2.2 representative examples

(1) Advanced Manufacturing College (Chang’an College)①

The Chang’an College was established on December 30, 2016. Targeting the future economic development objectives and directions of Chang’an Town, Dongguan University of Technology and the Chang’an Town Government co-established the Advanced Manufacturing College (Chang’an). It was among the first batch of featured industrial colleges prioritized for construction in Dongguan University of Technology’s high-level polytechnic university initiative, and the first featured industrial college established through university-local government collaboration. Serving as a critical focal point for supporting the transformation and upgrading of Dongguan’s pillar industries, it engages in deep collaboration with the Chang’an Town Government, industry associations, and leading enterprises, comprehensively integrating resources from the university, government, industrial parks, enterprises, and associations. It focuses primarily on addressing transformation and upgrading demands in pillar industries such as mold manufacturing and 3C products (Ma. H.W. 2024).

As a representative exemplar of university-government cooperation, the Chang’an College receives teaching premises, infrastructure, and partial teaching instrumentation from Chang’an Town, together with annual operational funding support of 7.5 million yuan. As a university-government collaborative model, the Advanced Manufacturing College (Chang’an) also undertakes the mission of local manufacturing industry transformation and upgrading. While cultivating enrolled students, it annually provides over 1,000 person-times of high-end technical training for Chang’an Town’s 3C and mold industries, furnishing sustained intellectual support for industrial transformation and upgrading (China Education Daily, 2018). Guo Rongxin, Head of Chang’an Town and Director of Chang’an New District Management Committee, stated that Chang’an Town would ensure comprehensive support for the construction and development of the Advanced Intelligent Manufacturing College, cultivating a cohort of high-quality

① School of Mechanical Engineering, Dongguan University of Technology. (2019, February 8). *长安先进制造学院*. https://jxx.dgut.edu.cn/info/1025/4052.htm

application-oriented talent for Chang'an Town while infusing Dongguan University of Technology's advanced scientific research and innovation capabilities into Chang'an Town's industrial development process, thereby propelling Chang'an Town's manufacturing industry toward higher-level development from an elevated starting point (LEI, 2018).

In organizational management, the Chang'an College implements a presidential office responsibility system. The presidential office comprises three commissioners: the Dean and Vice Dean for Academic Affairs from Dongguan University of Technology's School of Mechanical Engineering serve as President and Vice President of the Advanced Manufacturing College, with an additional president appointed by the Chang'an Town Government focusing exclusively on fiscal matters without interfering in academic administration. The presidential office assumes responsibility for comprehensive institutional management, with subordinate departments including Administration, Teaching Services, and Science-Technology-Industry Services. The Science-Technology-Industry Services department primarily interfaces with enterprises to transform student achievements into productive forces and organizes recruitment fairs on a regular basis (SUN & HUANG, 2019).

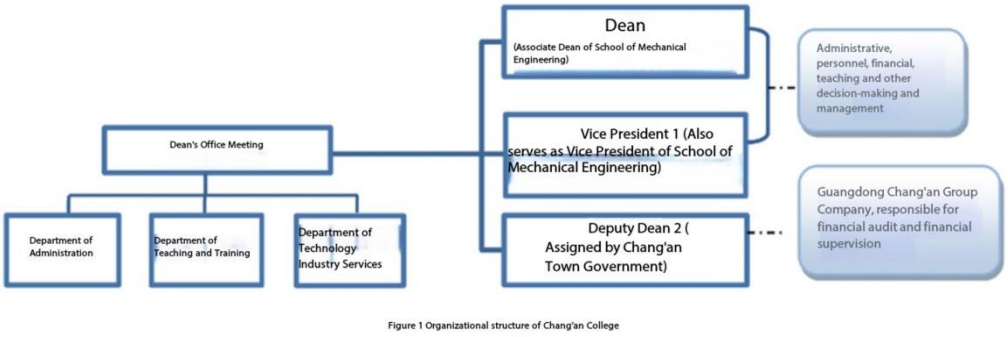

Figure 2.1-1

Chang' an College Organization Structure Chart

Source

Translated from "现代产业学院协同共建的新模式——以东莞理工学院先进制造学院(长安)为例" by Z. Sun and H. Huang, 2019, Research in Higher Education of Engineering, (4), p. 43.

In terms of talent cultivation, Chang'an College focuses on developing application-oriented talents, emphasizing the application of knowledge. It advocates the construction of a dynamic curriculum system that adapts to the 3C manufacturing industry chain, promotes interdisciplinary integration and cross-border synergy, and achieves positive interaction between the teaching process and industrial development. In this way, it seeks to realize a seamless connection between education and industry, as well as between talent and the market, cultivating competencies in 'knowledge, attitude, skills, and entrepreneurship' (SUN & HUANG, 2019). The training model

follows the '3+1' undergraduate program of the School of Mechanical Engineering, i.e., the 'dual-campus' cultivation model combining 'campus + industrial park.' Within the industrial environment of 'campus + industrial park,' students are introduced to corporate internship instructors and can choose practical modules oriented toward different career paths. During the first three years, students study on the main campus under the OBE (Outcome-Based Education) framework, which features a comprehensive and distinctive curriculum system. They complete three years of higher engineering education, supplemented by six months to one year of practical training involving hands-on engagement with industrial production. These practical activities focus on three major industry chains—intelligent manufacturing, product molding, and lean production—through modular engineering practice courses, thereby bridging the 'last mile' from university to enterprise. Furthermore, the selection of graduation project topics is based on real practical experiences (Dongguan University of Technology, 2023). To enhance students' practical competencies, the College integrates university and enterprise resources, collaboratively establishing five training platforms, introducing four resident enterprises, creating a refined R&D and production platform, and developing over 60 high-quality off-campus internship bases. A multi-level, multi-stage practical training system has been established, with joint guidance provided by enterprises and the university. The curriculum is structured into three modular components: compulsory engineering courses, competency development courses, and innovation and entrepreneurship education courses. To ensure the successful completion of the 'last mile,' students are required to complete a certain number of courses in 'competency development' and 'innovation and entrepreneurship' in addition to compulsory courses (SUN & HUANG, 2019).

After two years of development, the College has developed three distinctive features: first, it has established an innovative multi-party collaborative education model involving 'university, government, enterprise, and association,' creating a long-term mechanism for the collaborative cultivation of application-oriented talents; second, it has constructed a complete educational service chain encompassing 'education, training, employment, and entrepreneurship,' successfully bridging the 'last mile' from university to enterprise; third, it adheres to an industry-demand-oriented approach, deeply integrating 'university, government, enterprise, and association' throughout the entire talent cultivation process, thereby 'tailoring' practical talents for Dongguan and effectively addressing the disconnection between existing application-oriented university talent cultivation and societal needs (School of Mechanical Engineering, Dongguan University of Technology, 2019). Throughout its development, the College has achieved significant accomplishments. Students have won over 100 awards in various national and provincial competitions and have been granted more than 20

patents. Many graduates have founded their own companies upon graduation, and both employment relevance and employment quality have greatly improved. Huang Huiyu, Dean of Chang'an College, cited an example of a student from the class of 2017 during an interview. This student independently developed an 'automatic desktop labeling machine' during the graduation project process, which was subsequently put into mass production on the enterprise's automated production line. The machine significantly improved efficiency and reduced the enterprise's costs by 30% (LEI, 2018). Building on the foundation of the 1.0 version of the modern industrial college, the School of Advanced Manufacturing (Chang'an) has continued to explore and develop its 2.0 version, establishing itself as a distinctive industrial college of Dongguan University of Technology.

(2) Guangdong-Taiwan Institute of Industrial Science and Technology ①

Founded on May 14, 2015, the Guangdong-Taiwan Institute of Industrial Science and Technology is the first university-level Guangdong-Taiwan joint cultivation project in Guangdong Province. It is jointly established by Dongguan University of Technology, the Dongguan Taiwanese Seedling Foundation, and partner universities in Taiwan, with an independent admissions code of 89009 (Guangdong-Taiwan Institute of Industrial Science and Technology, DGUT, College Introduction). In September of the same year, the inaugural ceremony for the Institute was held, attended by the first cohort of 277 students from Guangdong and Taiwan. The Institute initially offered six undergraduate programs: Mechanical Design, Manufacturing and Automation (Precision Manufacturing), Automation, Industrial Design, Computer Science and Technology (Multimedia Design), International Economics and Trade (Cross-Border E-Commerce), and Economics and Finance. The Institute integrates the higher education advantages of both sides of the strait, facilitating a synergy of strong disciplines and programs, and innovates a talent cultivation mechanism combining 'new engineering and new liberal arts.' Leveraging the advantages of the Guangdong-Hong Kong-Macao Greater Bay Area, it adheres to an industry-oriented and cross-integration approach, establishing a distinctive educational model centered on innovative practical abilities, resource integration, and industrial convergence (Guangdong-Taiwan College of Science & Technology, DGUT, 2015).

In terms of cooperation model, the Institute adopts a 'university-university-enterprise' collaboration model, involving cooperation between Dongguan University of Technology, the Dongguan-Taiwan Seedling Foundation, and partner universities in Taiwan. During the collaboration, the Dongguan Taiwanese Seedling Foundation is

① Guangdong Taiwan College of Industrial Science & Technology. (n.d.). *粤台产业科技学院*. Dongguan University of Technology. Retrieved April 30, 2026, from https://yt.dgut.edu.cn/index.htm

responsible for introducing high-quality educational resources from relevant universities and enterprises in Taiwan. Combining the respective curricular and faculty strengths of DGUT and Taiwanese universities, the Institute jointly establishes programs tailored to cultivate application-oriented talents for Dongguan's traditional and strategic emerging industries (Ma, H. W, 2024). Based on market research into the demand for application-oriented talents in the Pearl River Delta's traditional and strategic emerging industries, the Institute determined its initial six jointly cultivated programs. Subsequently, the Dongguan Taiwanese Seedling Education Foundation sought representative partner universities in Taiwan in fields related to the Institute's programs. In 2015, the first three partner universities were confirmed: Chaoyang University of Technology, Lunghwa University of Science and Technology, and Minghsin University of Science and Technology (Guangdong-Taiwan College of Science & Technology, DGUT, 2015).

Regarding organizational management, the Institute operates under a director responsibility system led by a board of directors. It implements a two-tier university-college management system under the authorization of the university, granting greater autonomy in management and maximizing resource advantages (Development Planning Department, DGUT, 2017).

In talent cultivation, the Institute aims to cultivate high-quality application-oriented innovative talents, strengthens the integration of new engineering and new liberal arts, and comprehensively introduces high-quality higher education concepts, educational objectives, curriculum design, interdisciplinary credit-based programs, course selection systems, open course systems, and tutorial systems, among other innovative educational management models from Taiwan. The proportion of courses taught by faculty from partner Taiwanese universities exceeds 34.5%, including 74 proposed full-time faculty members (2015, August 18). The Institute offers six undergraduate programs and utilizes the 'dual-campus' resources through the 'university-university' cooperation model, adopting a '3+1' and '1+N' cooperative education model for talent cultivation. Under this model, students study on the mainland for the first three years after enrollment. In the fourth year, they may choose to study at a partner university in Taiwan for one year, with the program also incorporating international professional education accreditation (IEET). Exceptionally outstanding students are recommended by the Institute to study in advantageous programs at high-level overseas universities, thereby achieving a one-to-many connection with prestigious institutions (Dongguan University of Technology Official Website, accessed March 20, 2026). Regarding the curriculum system, the Institute has developed industry-education collaborative curriculum systems, including project-based courses, micro-courses, and micro-programs. 'Micro-programs' refer to courses

co-developed by the university and enterprises, with teaching teams composed of university-industry partners. During their final year, students intern at partner enterprises for one year, aiming for employment prior to graduation. 'Micro-courses' involve enterprise projects being integrated into university classrooms, where enterprise projects serve as course units, with classroom discussions and hands-on work used to conduct research, project operations, and product development, ultimately yielding project outcomes (Dongguan University of Technology, 2023)。.

There are many rich and representative practical examples and Chinese-language publications in China regarding "micro-programs" and "micro-courses." "Micro-programs" are a widespread and well-established system of short-term programs within Taiwan's higher education system. They consist of multiple related courses, typically totaling 6–12 credits, and encourage interdisciplinary and cross-departmental participation[①]. Their content is designed to align with employment trends and meet workplace demands. Many universities in Taiwan have successfully implemented such programs, such as National Sun Yat-sen University's "Micro-course on Taiwanese Culture in English" and National Taiwan University of Science and Technology's "STEM/STREAM Interdisciplinary Micro-course." Publications on "micro-courses" in China are primarily divided into three categories: theoretical and practical research, design and development practices, and comprehensive applications combining various teaching models. Examples include *Introduction to Micro-courses*, *Micro-course Design and Production (2nd Edition) *, and *Practical Guide to Micro-courses, Flipped Classrooms, and MOOCs*. While these publications on "micro-courses" primarily focus on instructional techniques to help teachers quickly master the technology, the "micro-courses" introduced by the Guangdong-Taiwan Institute of Industry and Technology in developing its industry-education collaborative curriculum system are used more as tools to promote a learning-outcome-oriented educational philosophy. By incorporating corporate projects into the classroom as course units through "micro-courses," the institute enhances students' ability to solve complex problems. [②]Following the introduction of "micro-programs" and "micro-courses," in early 2025, the Ministry of Education launched the "Double Thousand" Plan to enhance university students' employability, aiming to establish 1,000 "micro-majors" and 1,000 vocational skills training courses nationwide. In late October of the same year, in response to the industry's demand for multidisciplinary talent and to deepen innovative practices in

① Center for General Education, Tzu Chi University. *(n.d.).* 微學程. *Retrieved May 1, 2026, from https://gedu.tcu.edu.tw/?page_id=2895*

② International Exchange and Cooperation Department (Hong Kong, Macao and Taiwan Affairs Office), Dongguan University of Technology. (n.d.). *粤台产业科技学院以学习成果为导向凝炼办学特色*. Retrieved May 1, 2026, from https://dgut.edu.cn/info/1075/28018.htm

university-industry integration, the Guangdong-Taiwan Institute of Industry and Technology integrated multiple courses to achieve in-depth cultivation of specific competencies, launching its first "micro-major" in Low-Altitude Intelligent Manufacturing Technology and Applications.[①]

(3) Guangdong-Hong Kong-Macao Robotics Institute[②]

Established in July 2015, the Guangdong-Hong Kong-Macao Robotics Institute was jointly founded by the Dongguan Songshan Lake International Robotics Industry Base, Dongguan University of Technology, Guangdong University of Technology, and the Robotics Institute of the Hong Kong University of Science and Technology, aiming to explore training models for China's new engineering education (Southern Metropolis Daily, 2019).

As a typical representative of university-university-institute cooperation, the Institute is based at the Songshan Lake International Robotics Industry Base, leveraging the comprehensive resources of Guangdong University of Technology. It enrolls students from six colleges, including the School of Mechanical and Electrical Engineering, the School of Automation, the School of Computer Science, the School of Information Engineering, the School of Art and Design, and the School of Mathematics and Statistics. The Institute realizes a 'cross-university, cross-college, cross-discipline, cross-major' university-industry collaborative talent cultivation model, effectively integrating university and enterprise resources to create a new pattern of multi-stakeholder collaborative education (Guangdong University of Technology, 2022).

In talent cultivation, the Robotics Institute aims to cultivate interdisciplinary talents with innovation and entrepreneurial capabilities, adopting advanced models and innovating talent cultivation approaches. It employs a '2+2' cultivation model, where students spend the first two years at their home university studying mathematics, foundational sciences, basic professional knowledge, and receiving engineering skills training. The subsequent two years are spent at the Dongguan Songshan Lake International Robotics Industrialization Base, where students leverage the faculty resources of the Hong Kong University of Science and Technology, high-end industry talent, and the base's industrialization capabilities. They deeply engage with robotics enterprises, focusing on courses closely related to robotics across various disciplines and participating in interdisciplinary practical development projects. They also receive

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① Guangdong-Taiwan College of Industrial Science & Technology. (2025, October 28). 粤台产业科技学院低空智能制造技术与应用微专业开班. https://yt.dgut.edu.cn/info/1069/8560.htm

②Guangdong-Hong Kong Robotics Institute, Dongguan University of Technology. (n.d.). 东莞理工学院粤港机器人学院典型案例. Retrieved May 1, 2026, from https://xdcylm.dgut.edu.cn/__local/5/65/69/6FCA5E4F5CBB517237EFE4D9D40_CBE34ECD_1799D5.pdf

training in finance and entrepreneurship courses oriented toward industry, culminating in their graduation projects (Admissions Office, Academic Affairs Department, DGUT, 2017).

The 'five-cross' model in its 1.0 phase was expanded to a 'five-cross' model in its 2.0 phase, targeting majors such as mechanical engineering, automation, and electronic software. This model explores new engineering talent cultivation across borders (Hong Kong and Macao), across universities (Guangdong University of Technology and the Robotics Institute of the Hong Kong University of Science and Technology), and across disciplines (electronics, mechanical engineering, computer science) (Ma, H. W, 2024)

(4) Siemens Smart Manufacturing Institute①

The Siemens Smart Manufacturing Institute at Dongguan University of Technology is the result of in-depth cooperation between Dongguan University of Technology and Siemens (China) Co., Ltd. In 2012, Dongguan University of Technology and Siemens (China) Co., Ltd. signed an educational cooperation agreement. In 2013, the jointly established Advanced Automation Technology Joint Demonstration Experimental Center was completed and inaugurated (Dongguan University of Technology, 2013). In 2014, Yang Zhenning, Honorary President of Dongguan University of Technology, along with his wife Weng Fan, and Zhang Ke, Deputy Mayor of Dongguan City, unveiled the 'Dongguan University of Technology – Siemens Automation College' (Dongguan University of Technology, 2014). Responding to the strong demand from enterprises in the Pearl River Delta for automation transformation through machine replacement, Dongguan University of Technology and Siemens jointly established the Smart Manufacturing Institute (Siemens Smart Manufacturing Institute), which was formally established in 2018. This is a modern industrial college established by Dongguan University of Technology in collaboration with Siemens Industrial Software (Shanghai) Co., Ltd., under the context of 'Industry 4.0' and 'Intelligent Manufacturing 2025,' integrating functions such as talent cultivation, scientific research, technological innovation, enterprise services, and skills training to cultivate specialized interdisciplinary talents in intelligent manufacturing, intelligent equipment, and modern manufacturing services (Guangdong Education, 2021).

In terms of cooperation model, the Institute's collaboration with Siemens Co., Ltd. represents a typical case of university-enterprise joint education. During the collaboration, Dongguan University of Technology is responsible for daily

①Siemens Smart Manufacturing College, Dongguan University of Technology. (n.d.). *东莞理工学院-西门子智能制造学院 --- 智能制造工程专业〖本科，学制 4 年〗*. Retrieved May 1, 2026, https://ee.dgut.edu.cn/info/1061/1740.htm

management, teaching, and talent cultivation. Siemens Co., Ltd., as a multinational corporation with industry influence capable of setting standards and possessing leading technology, provides advanced technology systems, production equipment, and advanced training models. In addition to this university-enterprise collaboration, there are also the ZTE NC College, Huawei Network College, Microsoft IT College, and others. Cheng Hongbo, Secretary of the Party Committee of Dongguan University of Technology, mentioned in an interview that university-enterprise cooperation allows the advanced knowledge and technology of enterprises to complement the classic knowledge systems of university disciplines, thereby creating optimal teaching resources. In this process, real-world industrial issues become specific propositions for teaching and research, thus better achieving the integration of industry and education (LEI, 2018).

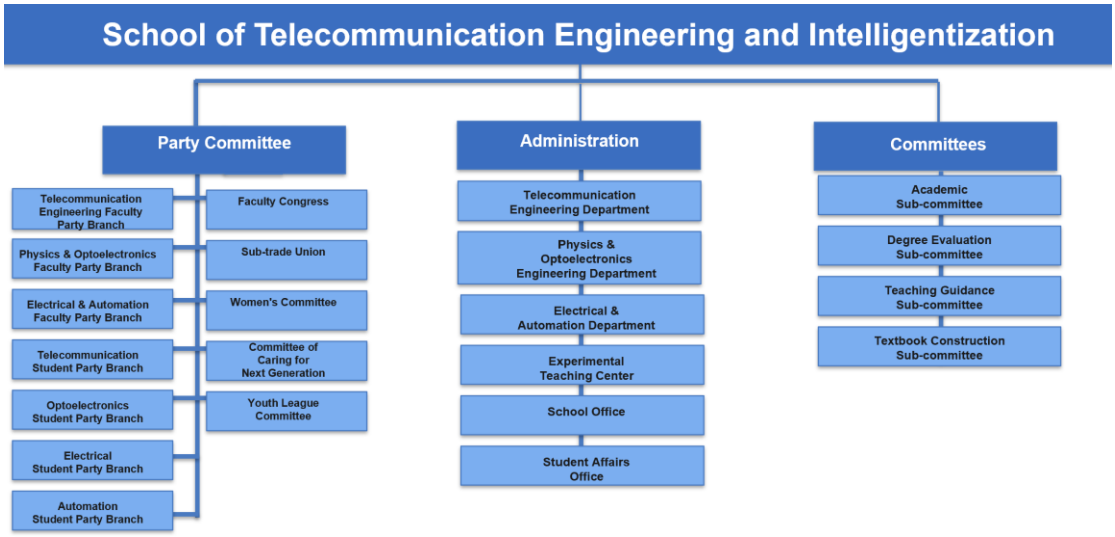

Figure 1.1-2

Organizational Structure of the School of Telecommunications Engineering and Intelligentization (Siemens Smart Manufacturing Institute)

Source

Adapted from the original Chinese version published by DGUT (Year). Translated into English by the author.

https://ee.dgut.edu.cn/xygk/zzjg.htm

In terms of the cultivation model, the Institute leverages its disciplinary advantages to construct a disciplinary structure characterized by multi-disciplinary and multi-program (direction) integration, achieving the interdisciplinary and multi-program integration of 'new engineering.' It strengthens the foundation in mathematics and physics, forming an innovative professional curriculum system for intelligent manufacturing. It enhances the integration of industry and education, implementing a talent cultivation model combining theory with practical project training. It emphasizes practical development, creating comprehensive and well-equipped experimental training platforms (Guangdong Education, 2021). The Institute organizes its

disciplinary structure based on the university's existing advantageous discipline clusters, integrating programs such as automation and mechanical engineering to achieve the interdisciplinary and multi-program integration characteristic of 'new engineering.' In terms of the curriculum system, while retaining the core courses in mechanical engineering, automation, electronic information, and software, the Institute has introduced 12 core courses in Siemens Smart Manufacturing Engineering Software. This has initially formed a 'dumbbell-shaped' theoretical curriculum system combining foundational and shared elements, emphasizing personalized student learning while achieving a curriculum system that integrates foundations, cutting-edge developments, and interdisciplinary approaches. Based on this, the Institute adopts a '3+1' talent cultivation model. Under this model, students spend the first three years at the university primarily studying foundational professional courses, guided by practical projects and emphasizing core courses, multi-disciplinary integrated project design, and practical engineering projects. In the final year, students go to enterprises, where they participate in practical engineering project training and complete their graduation projects in deep integration with the enterprises. Engineering software, as the core of intelligent manufacturing, is fully integrated into the Siemens industrial software curriculum system, 'bringing enterprises into education' by incorporating enterprise project cases into classroom teaching. In this way, students can learn engineering software while being exposed to Siemens' most advanced intelligent manufacturing solutions. Dongguan University of Technology and Siemens have also jointly established an Intelligent Manufacturing Innovation Center. This platform, with a total investment of over 114.7 million RMB and covering an area of 4,700 m², includes 12 laboratories, such as the Mechatronics Laboratory (Digital Twin Official WeChat Account, 2023).

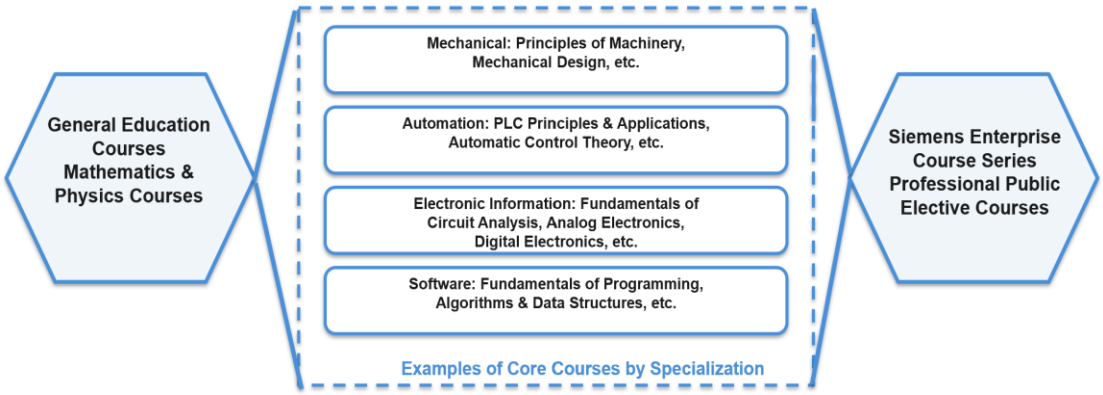

Figure 2.1-3

The "dumbbell" theoretical course system of the college

Source

Guangdong Education, 'Typical Experiences of Guangdong Demonstration Industrial Colleges' Series Report, 2021.*https://static.nfapp.southcn.com/content/202104/23/c5159214.html*

Figure 2.1-4

Curriculum System for Engineering Software

Source

.*https://static.nfapp.southcn.com/content/202104/23/c5159214.html*

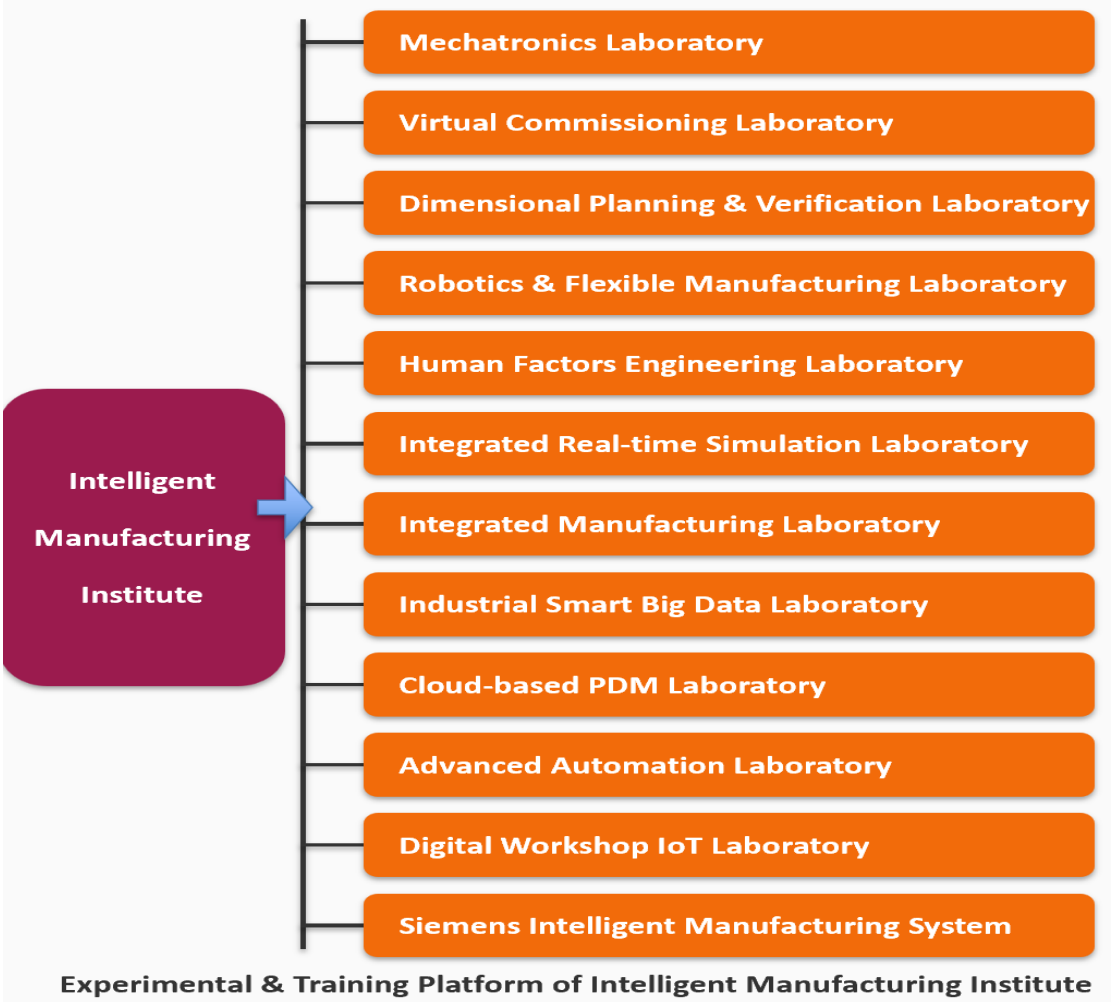

Figure 2.1-5

Experimental and Practical Training Platform of the School of Smart Manufacturing

Source

https://static.nfapp.southcn.com/content/202104/23/c5159214.html

2.1.2.3 Achievements and Limitations

Following the exploration of the 1.0 version of modern industrial colleges, Dongguan University of Technology has achieved 14 national-level and 14 provincial-level first-class undergraduate programs; won 2 second prizes for National Teaching Achievement Awards and 10 provincial-level teaching achievement awards; established 2 modern industrial colleges recognized by the Ministry of Education and 6 provincial-level demonstration industrial colleges; developed 5 national-level first-class courses and 23 provincial-level first-class courses; won 2 gold, 4 silver, and 5 bronze medals at the national level and 17 gold, 10 silver, and 7 bronze medals at the provincial level in the 'Internet+' Competition; undertaken 5 new engineering projects and 1 new liberal arts project from the Ministry of Education; and was selected as a pilot for the 'Three Comprehensive Education' initiative in Guangdong Province, delivering a

representative speech at a national conference. Additionally, graduates from industrial colleges achieved higher initial employment salaries compared to their peers from the same cohort who did not participate in industrial colleges, with students from the 20th cohort of the Guangdong-Hong Kong Robotics Institute achieving an increase of even 8.11% compared to their peers.

While the modern industrial college 1.0 achieved a series of significant accomplishments, certain limitations also emerged. With the transformation of the external technological environment and the comprehensive advancement of building new high-level polytechnic universities, the positioning of modern industrial colleges appeared somewhat singular, focusing predominantly on talent cultivation with insufficient attention to functions such as social and technological services. Furthermore, the interdisciplinary integration between new liberal arts and new engineering was not sufficiently evident, In the initial exploration phase, the construction of "New Engineering" industrial colleges has achieved a series of results. Compared with the development of New Engineering Education, the development of 'New Liberal Arts' has lagged behind, and the intersection between the two is not obvious. In this regard, how should 'New Liberal Arts' develop industrial colleges to deepen interdisciplinary integration with New Engineering Education is a concern now. Finally, issues such as insufficient alignment between curriculum content and technological development, inadequate integration between teaching processes and production processes, low efficiency in transforming industrial resources into teaching resources, and insufficient introduction of industrial elements became increasingly prominent [11] (Digital Twin Official WeChat Account, December 14, 2023)

Based on these shortcomings, Dongguan University of Technology, after 2018, continued its exploration of the modern industrial college 2.0 version in accordance with the connotations outlined in the Ministry of Education's 'Guidelines for the Construction of Modern Industrial Colleges.'

2.1.3 Model 2: Modern Industrial College 2.0 Phase

2.1.3.1 Overview of Modern Industrial College2.0

The Phase 2.0 of the Modern Industry College refers to Dongguan University of Technology's continued exploration of a new phase for the Modern Industry College from 2018 to 2022, addressing the shortcomings of Phase 1.0 and aligning with the principles outlined in the Ministry of Education's Guidelines for the Development of Modern Industry Colleges. This phase introduces a new framework known as the "Three Focuses and Six Strengthening's" The 'Three Focuses' refer to the sharing of high-quality resources in industrial colleges, the agile alignment of industry–program–curriculum clusters, and the value-added evaluation of talent cultivation capabilities.

The ‘Six Intensifications’ refer to the intensification of the revision of talent cultivation plans, the optimization and adjustment of program structures, the development of industry-education integrated courses, the construction of agile alignment systems, the development of institutional mechanisms, and the value-added evaluation of student capabilities.

The functional positioning has become more diverse, expanding from a singular focus on talent cultivation to encompass talent cultivation, scientific research, social services, and regional linkage. Discipline and curriculum integration have been enhanced to maximize resource sharing and co-construction, shifting from a primary emphasis on ‘new engineering’ to the cross-integration of ‘new engineering + new liberal arts.’ The evaluation paradigm has achieved breakthroughs and innovations, including value-added capability evaluation, practical hands-on capability evaluation, and complex problem-solving capability evaluation.

2.1.3.1 representative examples

(1) Dongguan University of Technology (Changping College) Smart Manufacturing and Creative Design College①

In 2019, Dongguan University of Technology signed a cooperative construction agreement with the Changping Town People’s Government to establish a new-type modern industrial college based on new mechanisms and models. The construction of Changping College was officially initiated in 2020 and officially opened in September of the following year. Covering an area of approximately 11,000 square meters, the College adopts a new operational model of ‘campus + base + industrial park,’ encompassing talent cultivation, technical training, social services, technological services, and the commercialization of scientific and technological achievements. The College is committed to building three core platforms: first, a multi-level talent cultivation system and an interdisciplinary integration base oriented toward Changping’s industrial clusters; second, a multifunctional training base integrating continuing education, skills training, and science education outreach; and third, an industry service platform for technological innovation and achievement commercialization based on the industrial chain, a Guangdong-Hong Kong-Macao educational resource sharing platform, an intelligent cross-border e-commerce service platform, and industrial demonstration platforms for smart manufacturing, cultural exchange, etc., in the Greater Bay Area. Adopting a joint teaching model of ‘college + enterprise,’ the College selects elite faculty from the university and collaborates with mid-level and senior professionals from enterprises to build a high-level teaching team, dedicated to cultivating a large number of high-quality application-oriented,

① Dongguan University of Technology (Changping) School of Intelligent Manufacturing and Creative Design. (n.d.). *东莞理工学院（常平）智能制造与创意设计学院*. Retrieved May 2, 2026, https://chp.dgut.edu.cn/

interdisciplinary, and innovative talents that meet industrial needs. The College aims to become a landmark for education and scientific research and a benchmark for technological innovation in the Guangdong-Hong Kong-Macao Greater Bay Area, providing an industry-university-innovation platform for Dongguan University of Technology's development into a high-level polytechnic university, while simultaneously offering talent and technological support for Changping Town, promoting the deep integration of the education chain, innovation chain, and industrial chain (Dongguan University of Technology (Changping) School of Intelligent Manufacturing and Creative Design, n.d.).

Changping College is a typical representative of university-government-enterprise collaboration, jointly established by Dongguan University of Technology and the Changping Town People's Government, representing a significant attempt by the university to co-construct modern industrial colleges. Changping Town, with its prominent geographical advantages and strong industrial foundation, collaborated with Dongguan University of Technology to leverage the university's disciplinary strengths, talent advantages, and scientific research achievements to address shortcomings in industrial development, talent cultivation, technological innovation, and urban construction (Dongguan University of Technology, 2021). Zhai Jiuhong, Deputy Secretary of the Changping Town Party Committee, once stated that Changping Town attaches great importance to the co-construction of a modern industrial college with Dongguan University of Technology, hoping that Changping College will fully play its role as a talent cultivation center, R&D collaboration platform, and local enterprise think tank, providing high-quality talent support for regional economic and social development (Dongguan University of Technology Education Development Foundation, 2021). In September 2021, a 'University-Enterprise Exchange Symposium' was held at Dongguan University of Technology, where various university curriculum teams engaged in in-depth exchanges with relevant enterprises. Team leaders shared their experiences and thoughts on curriculum development, indicating that they would subsequently conduct further research by visiting enterprises to investigate the framework, content, and format of curricula, striving to co-develop a batch of high-quality industry-education integrated courses and bridge the 'last mile' of university talent cultivation (Dongguan University of Technology, 2021).

In terms of talent cultivation, the College aims to cultivate high-quality application-oriented, interdisciplinary, and innovative talents that meet industrial needs, serving the industrial development of Changping Town and the broader Guangdong-Hong Kong-Macao Greater Bay Area. Between 2017 and 2019, the College conducted autonomous explorations in the development of 'new liberal arts' based on 'new engineering.' Since 2020, the university has officially and comprehensively launched

the construction of 'new liberal arts,' breaking down the original departmental and disciplinary barriers in higher education. In the current context where 'new liberal arts' construction emphasizes interdisciplinary integration and convergence, the College is exploring a cultivation model that integrates 'new engineering + new liberal arts,' breaking away from traditional teaching models in liberal arts programs (Nanfang Daily, 2021). In 2020, Ma Hongwei, Deputy Party Secretary and President of Dongguan University of Technology, mentioned in 'The Construction of New Liberal Arts in Polytechnical Universities' that there are four important levers for developing new liberal arts in polytechnic institutions: first, establishing modern industrial colleges that integrate arts and engineering; second, developing new liberal arts micro-course clusters, reforming the general education system, and deeply embedding the integration of arts and engineering characteristics based on the OBE (Outcome-Based Education) concept to promote the humanistic responsibility and value guidance of 'new liberal arts' in polytechnic universities, cultivating 'well-rounded individuals'; third, creating new liberal arts platforms that co-prosper and co-exist with industries and local cultures; fourth, empowering and enhancing the capabilities of new liberal arts faculty (Yangcheng Evening News, 2020). Based on these four levers, the College connects with the disciplines of the School of Mechanical Engineering, the School of Electronic Engineering and Intelligence, the School of Literature and Media, and the School of Economics and Management. Through interdisciplinary and cross-disciplinary courses, it aims to build a comprehensive interdisciplinary talent cultivation base, focusing on promoting the development of industry-education integrated courses and establishing four course teams: Mechanical Engineering, Intelligent Manufacturing, Digital Media and Cultural Creativity, and Cross-Border E-Commerce. These four types of courses correspond to four industrial sectors: machinery manufacturing, intelligent manufacturing, cultural creativity, and e-commerce. Within this framework, combining three types of industry-education integrated courses—public courses, interdisciplinary micro-course clusters, and activity-based courses—talent cultivation is carried out relying on multiple industry-education integrated training bases (Dongguan University of Technology Education Development Foundation, 2021).

(2) Dongguan Intellectual Property Institute[①]

The Dongguan Intellectual Property Institute, jointly established by Dongguan University of Technology and the Dongguan Municipal Market Supervision Administration (Intellectual Property Office), was founded on September 15, 2019. Its purpose is to integrate university and local resources through university-government-

① College of Law and Social Work (College of Intellectual Property), Dongguan University of Technology. (n.d.). *东莞理工学院法律与社会工作学院（知识产权学院）*. Retrieved May 2, 2026, from https://zfx.dgut.edu.cn/

enterprise collaboration to cultivate interdisciplinary intellectual property talents bridging arts and sciences. It is the first intellectual property industry college jointly established by a government and a university in South China (School of Law and Social Work, 2020). The Dongguan Intellectual Property Institute is committed to becoming a distinctive platform and base for intellectual property talent cultivation, scientific research, and social services, characterized by 'technological innovation + advanced manufacturing,' based in Dongguan and radiating throughout the Greater Bay Area. It aims to establish governance and intellectual property protection as its distinctive directions, while also serving as a key component of the university's innovative service discipline cluster (Dongguan Time Network, 2023).

The Institute is a typical example of university-government collaboration. It collaborates with the Dongguan Municipal Market Supervision Administration (Intellectual Property Office), the Guangzhou Intellectual Property Court, the Dongguan Intermediate People's Court, Guangdong Downgauging Pharmaceutical Co., Ltd., and others to construct a multi-stakeholder collaborative education mechanism involving 'university, government, law, and enterprise.' Dongguan University of Technology serves as the main entity for talent cultivation, integrating university-wide resources and leveraging disciplinary strengths for daily teaching and management. The Dongguan Municipal Market Supervision Administration (Intellectual Property Office) integrates the Institute's development into the Dongguan intellectual property operation service system, providing policy support and resource coordination. In terms of practical teaching, leveraging the extensive government, court, and enterprise resources gathered under the 'Dongguan Intellectual Property Institute,' students are fully engaged in participating in faculty research projects (School of Law and Social Work, 2021).

In terms of talent cultivation, the Institute focuses on the national strategy for strengthening intellectual property rights and the economic and social development needs of the Guangdong-Hong Kong-Macao Greater Bay Area. Leveraging Dongguan University of Technology's disciplinary advantages in science, engineering, law, management, and others, it strengthens the characteristic development path of 'science/engineering + law + intellectual property + foreign language (management),' striving to cultivate high-quality, application-oriented, and interdisciplinary intellectual property legal professionals (School of Law and Social Work, 2022). Three cultivation directions have been established: (1) Intellectual Property Protection; (2) Intellectual Property Operation and Management; and (3) Preparatory Patent Attorney. The types of students cultivated include regular undergraduates, top-up undergraduates, minor program students, and second-degree students (Dongguan Time Network, 2023). In terms of faculty, as of 2022, there were 24 full-time intellectual property faculty

members, with 60% holding senior professional titles. Fifty percent of the faculty had practical experience, serving as part-time lawyers, legal advisors, or holding qualifications such as patent engineer, lawyer, or experience in intellectual property adjudication. The overall faculty team demonstrates outstanding advantages in terms of high professional titles, high academic qualifications, and a dual-qualification structure (School of Law and Social Work, 2022). The Institute possesses abundant educational and teaching resources and research platforms, such as the Guangdong Provincial Patent Examiner Practice and Innovation Promotion Base, the Dongguan Municipal Local Legislation Research, Evaluation, and Consulting Service Base, and the China Intellectual Property Distance Education Platform (Dongguan University of Technology) sub-platform.

Regarding the characteristics of talent cultivation, the Institute promotes university-local government collaboration through university-enterprise collaborative education mechanisms, establishing teaching platforms with off-campus institutions. It engages off-campus industry experts to jointly determine cultivation objectives, co-design curriculum systems, co-develop high-quality teaching materials, co-organize teaching teams, and build practice bases, forming a cooperative education model characterized by ‘faculty participation in planning, student participation in activities, and expert guidance in practice.’ An innovative talent cultivation model of ‘promoting teaching through competition, promoting learning through competition’ has been formed. Leveraging professional competitions, it creates a ‘professional-brand’ effect, developing a mature ‘three-in-one’ talent cultivation mechanism comprising the regular classroom, extracurricular activities (second classroom), and campus culture. Here, the ‘second classroom’ refers to activities such as debate competitions, mock trials, and professional knowledge competitions, aimed at enhancing students’ comprehensive abilities (Dongguan University of Technology, 2020). In 2022, the Institute launched the ‘Action Plan for Joint Cultivation of Outstanding Engineers through University-industry integration,’ establishing an ‘Outstanding Patent Talent Class’ for fourth-year students, with an initial intake of 70 students. It collaborates with Shenzhen Chuangyi Talent Service Company, Huazhong Yuechuang Intellectual Property Management Company, the Songshan Lake Science City International Intellectual Property Center, and other entities to jointly build the Dongguan University of Technology Intellectual Property Collaborative Operation Center, introducing a group of elite intellectual property industry mentors, striving to cultivate higher-level intellectual property talents (Dongguan Time Network, 2023).

2.1.4 Model 3: Outstanding Engineers College Phase

2.1.4.1 Overview of Outstanding Engineers College[①]

The Outstanding Engineers College serves as the core carrier of the modern industrial college 3.0 version. Established as an independent second-level college under a new model, it aims to integrate high-quality resources and create a leading area for new engineering construction and a demonstration zone for engineering education reform. The Ministry of Education has approved multiple universities in successive batches to establish Colleges of Excellence in Engineering as the core vehicles for educational reform. In 2010, Dongguan University of Technology was selected as one of the first institutions to participate in the Ministry of Education's "Outstanding Engineer Education and Training Program," but it was not included in any of the four batches of "National Colleges of Excellence in Engineering." The "Implementation Plan for the Joint Industry-Education Training of Outstanding Engineers in the New Era" is a local document issued by Dongguan University of Technology in 2022. On May 16, 2023, the university also released the "Work Notice on Implementing the 2023 Key Points for the Joint Industry-Education Training of Outstanding Engineers in the New Era at Dongguan University of Technology."In 2023, the Outstanding Engineers College was inaugurated. On July 3, 2025, the university held a seminar on the promotion of outstanding engineer talent cultivation and the construction of modern industrial colleges, issuing the 'Declaration on Deepening and Advancing the Joint Cultivation of Outstanding Engineers through University-industry integration in the New Era,' officially announcing its entry into the 3.0 phase of outstanding engineer cultivation, committed to building an outstanding engineer cultivation system characterized by 'international influence, Greater Bay Area characteristics, and DGUT identity' (Education Online, 2025). Addressing the urgent needs of national strategies and the industrial demands of the Guangdong-Hong Kong-Macao Greater Bay Area, the College has established three undergraduate programs: Computer Science and Technology, Intelligent Manufacturing Engineering, and Robotics Engineering. It engages in deep cooperation with leading enterprises such as Tencent and iFlytek to promote university-industry integration. Implementing the cultivation philosophy of 'emphasizing fundamentals, strengthening interdisciplinary integration, enhancing practice, highlighting application, and fostering comprehensive development,' the College constructs a new learning ecosystem featuring 'engineering-oriented environments, project-based carriers, team-based guidance, and collaborative learning.' It promotes integrated undergraduate-master's-doctoral cultivation. Following the principle of 'work logic and industrial demand orientation, university-industry integration as the pathway, and integrated science and engineering design as the core,'

① 卓越工程师学院 https://gcs.dgut.edu.cn/

it establishes a four-level project-based curriculum system that integrates theory and practice with progressive capability development, integrating industrial resources throughout the talent cultivation process, with a focus on cultivating students' innovation, entrepreneurship, and application-oriented characteristics.

In terms of talent cultivation, 'always being oriented towards the industry front line and adhering to deep integration with industry' remains the consistent hallmark of outstanding engineer talent cultivation at Dongguan University of Technology. Facing the urgent societal and economic demand for outstanding engineers, the university practices the innovative concept of university-industry integration, creating an open innovation ecosystem that integrates the 'education chain–industry chain–innovation chain.' Agile university-enterprise collaboration and multi-stakeholder synergistic education represent the path of continuous exploration and innovation in the university's reform. The College actively responds to enterprises' technological upgrading and product iteration trends. It promotes the 'Fenji Plan' for students and the 'Duxing Plan' for faculty respectively. Across 10 key areas and 7 characteristic areas, a total of 108 'Fenji Plan' classes have been established, fully implementing a dual-tutor system in engineering education consisting of 'on-campus academic tutors + off-campus industry tutors.' Over the past three years, the outstanding engineer talent cultivation reform at the College has become a benchmark for university-industry integration in many local application-oriented universities (Dongguan University of Technology Alumni Association, July 21, 2025).

Establish the School of Distinguished Engineers, implementing a "four-in-one" industry-education collaboration model that integrates industry-education curriculum, combines internships with employment, leverages high-quality platforms for training, and employs a dual-qualified faculty [10]. Develop a new, structured "1+6+1" engineering education system; build an industry-education collaboration consortium; implement the "123444" high-quality development action plan for graduate students; and carry out the professional degree reform initiative.

"1+6+1" refers to the initiative to shape a knowledge framework based on engineering characteristics, plus the following six initiatives: the initiative to build a progressive project-based curriculum system; the initiative to form cross-disciplinary teams comprising all faculty and staff; the "Fenji" initiative to integrate undergraduate, master's, and doctoral programs across the entire academic journey; the initiative to reform comprehensive evaluation systems with a focus on engineering literacy; the initiative to build a full-chain community integrating science, education, and industry; and the initiative to develop a multidimensional, integrated innovation and entrepreneurship education system—plus the institutional innovation initiative to establish an empowering engineering paradigm. The "123444" framework for graduate

education stands for “one goal, two mechanisms, three systems, four initiatives, four plans, and four major tasks.” “One goal” refers to cultivating high-level talent who are both morally upright and highly capable; “two mechanisms” refer to tiered and categorized training and competency-oriented development, with professional degrees focusing on enhancing professional skills and occupational literacy, and academic degrees focusing on enhancing innovative capabilities; “Three Systems” refer to the distinctive curriculum system, the ideological and political education system, and the quality assurance system; “Four Projects” refer to initiatives involving students, mentors, universities, and enterprises; “Four Plans” refer to the Integrated Undergraduate-Graduate Excellence Training Plan, the Science-University-industry integration Plan, the Curriculum Adjustment Plan, and the Professional Practice Reform Plan; “Four Major Tasks” refer to reforming training models, establishing interdisciplinary platforms, building mentor teams, and fostering a culture of quality.

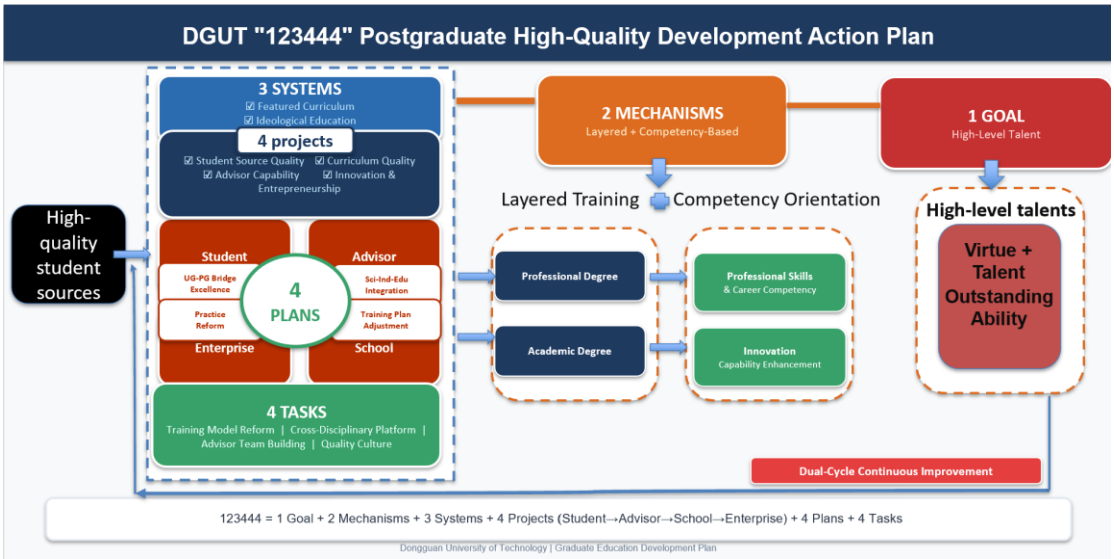

Figure 2.1-6

DGUT “123444” Postgraduate High-Quality Development Action Plan

Source

https://mp.weixin.qq.com/s/fNXTRoAMpOpjBY8L1AtDbQ

Figure 2.1-7

"1+6+1" model

Source

https://mp.weixin.qq.com/s/fNXTRoAMpOpjBY8L1AtDbQ

2.1.4.2 representative examples

(1) 'Fenji Plan' Classes

The 'Fenji Plan' is one of the core initiatives of Dongguan University of Technology's 'Action Plan for the Implementation of Joint Cultivation of Outstanding Engineers through University-industry integration in the New Era.' Officially launched in July 2022, the first cohort established 27 Outstanding Engineer 'Fenji Plan Classes,' with nearly 1,300 students selected to participate. Through one year of practice, joint cultivation models were formed, including the development and delivery of industry-education integrated courses, integrated internship and employment cultivation, cultivation relying on high-quality platforms, and teaching by dual-tutor teams. Graduates from the first cohort of the 'Fenji Plan' classes demonstrated 'three high characteristics' in further education and employment: high employment and further education rate, high initial salary, and high level of employment (Office of Employment, Entrepreneurship and Alumni Affairs, 2023). In 2025, the School of Literature and Media issued a notice regarding the selection and recruitment for the 2024–2025 academic year 'Fenji Plan' university-industry integration outstanding classes, stating that the School planned to establish four university-industry integration outstanding classes: the 'Digital Media Marketing Outstanding Class,' the 'Convergence Media Communication Outstanding Class,' the 'Cross-Border E-Commerce Outstanding Class,' and the 'Intangible Cultural Heritage Outstanding Class' (School of Literature and Media, Dongguan University of Technology, 2024).

(2) 'Duxing Plan' Classes

The ‘Duxing Plan’ is also one of the core initiatives of Dongguan University of Technology’s ‘Action Plan for the Implementation of Joint Cultivation of Outstanding Engineers through University-industry integration in the New Era.’ Alongside the ‘Fenji Plan,’ it targets students and faculty respectively, aiming to rapidly respond to the urgent societal and economic demand for outstanding engineers and related professionals, improve the capability structure of the faculty, and holistically advance discipline and program construction, talent cultivation, technological breakthroughs, and innovation services (Dongguan University of Technology, Guangming Daily Client, 2022). The ‘Duxing Plan’ focuses on building a ‘dual-qualification, dual-ability’ faculty. Through a combination of recruitment and training, it has introduced the ‘Management Measures for the Appointment of Visiting Professors and Adjunct Professors at Dongguan University of Technology (Trial)’ to construct a dual-tutor team in engineering education consisting of ‘on-campus academic tutors + off-campus industry tutors,’ enhancing the engineering practice teaching capabilities of young faculty and providing solid faculty support for the cultivation of outstanding engineers (Office of Employment, Entrepreneurship and Alumni Affairs, 2023).

(3) ‘Wu Zhonghua Class’ and ‘Yang Zhenning Innovation Class’

The ‘Wu Zhonghua Class’ and the ‘Yang Zhenning Innovation Class’ are two major programs at Dongguan University of Technology in the 3.0 phase of outstanding engineer cultivation, focusing on the cultivation of top-notch innovative talents at the postgraduate and undergraduate levels respectively, together constituting an ‘integrated undergraduate-master’s’ outstanding engineer cultivation system.

The ‘Wu Zhonghua Class’ focuses on postgraduate cultivation. Jointly established by Dongguan University of Technology and the Institute of Engineering Thermophysics, Chinese Academy of Sciences, it is named after Mr. Wu Zhonghua, a renowned engineering thermophysicist and academician of the Chinese Academy of Sciences. It is dedicated to cultivating outstanding talents in the fields of energy and power, and power engineering and engineering thermophysics (Education Online, 2024). The ‘Wu Zhonghua Class’ is also based on university-institute collaboration, representing a new attempt at cultivating talents through cooperation between ‘local universities and national teams.’ Postgraduate students have the opportunity to participate in major national scientific research projects. Different from regular classes, the ‘Wu Zhonghua Class’ features a joint tutor group led by academician teams, employing a dual-tutor system with one on-campus tutor and one off-campus tutor providing joint guidance. Furthermore, in terms of talent cultivation model, the ‘Wu Zhonghua Class’ uses projects as the teaching driver, focusing on the advantageous areas of both parties. On-campus tutors are responsible for academic cultivation, while off-campus tutors guide students in scientific research projects and engineering projects, jointly conducting

technological breakthrough research. The cultivation model explores the use of 'production–learning–research–application' to guide students in conducting research based on problems (Dongguan University of Technology, Nanfang+, 2024).

The 'Yang Zhenning Innovation Class' is an undergraduate top-notch innovative talent cultivation program established at Dongguan University of Technology in 2018, the first of its kind in China named after Mr. Yang Zhenning, a Nobel laureate in Physics. It emphasizes research-based teaching as a fundamental approach, adopts small-class teaching, creates a seminar-style, interactive classroom teaching ecology, and facilitates students' early entry into laboratories and research teams. Since 2018, the 'Yang Class' has been offered for eight cohorts, cultivating a total of 269 students across 20 engineering disciplines at the university, becoming the core carrier for interdisciplinary talent cultivation at Dongguan University of Technology (Nanfang Daily, 2025).

President Ma Hongwei stated that by the end of 2028, the university will strive to establish 30 high-quality joint cultivation bases for outstanding engineers; create 100 'golden courses' featuring deep university-industry integration; cultivate 30 high-level 'dual-qualification, dual-ability' teaching and industry tutor teams; and cultivate 10,000 reserve outstanding engineers with outstanding engineering practice capabilities and innovation capabilities (Dongguan University of Technology, 2025).

2.1.5 Summary of Dongguan University of Technology's UII Model

DGUT embraces a model of university-industry integration that is fundamentally defined by "rootedness in the local ecosystem and symbiotic co-evolution." As a regional polytechnic university, its strategic posture is inextricably tied to Dongguan's modern industrial system, positioning itself as an integral component of the city's industrial upgrading. To operationalize this vision, DGUT has established a closed-loop system spanning education, research, and commercialization. On the pedagogical front, the university has built specialized modern industrial colleges (such as the Chang'an Advanced Manufacturing Institute) and a School of Outstanding Engineers, embedding "real-problem, real-solution" project-based curricula throughout the four-year program. In partnership with industry giants like Siemens and Tencent, students are trained to tackle complex, on-the-ground engineering challenges and are immersed in real corporate R&D projects from their early years. In research and technology transfer, DGUT has developed a "full-chain commercialization system for first-class outcomes." Beyond contributing to major national scientific infrastructure like the China Spallation Neutron Source, the university has co-established joint R&D platforms with 29 townships/districts and 95 enterprises. Through proactive outreach initiatives, research teams are directly stationed within companies, creating a rapid-response mechanism

where “research proposals originate from industrial pain points, and technological solutions flow directly to the production line.”

Beyond its symbiotic local embedding and full-chain commercialization, Dongguan University of Technology (DGUT) distinguishes itself through a deliberate “Iterative Evolution of Applied Engineering Education” pattern, a pedagogical philosophy that treats curriculum design, talent cultivation, and industrial feedback as a continuously self-reinforcing cycle. Rather than adhering to static, theory-heavy syllabi, DGUT adopts a “dynamic curriculum refresh” mechanism, wherein course content is systematically revised every academic cycle based on real-time intelligence gathered from its corporate partners, alumni tracking, and emerging technological trends in the Greater Bay Area's manufacturing sector. This iterative loop is operationalized through its “project-driven semester” structure, where students progress through successive levels of industry-sponsored design challenges, from fundamental prototyping to full-system integration, with each project phase explicitly informed by the outcomes and shortcomings of the previous one. Crucially, faculty members themselves participate in this evolution through mandatory “enterprise sabbaticals,” spending dedicated periods on factory floors and R&D departments, then returning to classrooms with updated case studies, revised lab exercises, and recalibrated competency benchmarks. The resulting feedback loop ensures that the university's educational offerings do not merely react to industrial changes but proactively co-evolve with them: graduate employability data, enterprise satisfaction surveys, and technology adoption rates in partner firms are systematically fed back into the next iteration of program design. This pattern transforms DGUT's engineering education from a one-time knowledge transfer into a living, adaptive system, one that perpetually recalibrates itself to stay ahead of the region's rapidly shifting industrial landscape, producing graduates who are not just job-ready but innovation-ready for the next wave of manufacturing transformation.

2.2 Comprehensive University: Xi’an Jiaotong University

2.2.1 About Xi’an Jiaotong University[①]

In recent years, China’s ‘Double First-Class’ universities have demonstrated comprehensive and multi-level approaches to promoting university–industry collaboration, ranging from project-based cooperation under Collaborative Education Programs to in-depth

① Xi‘an Jiaotong University. (2026). *交大简介* [University introduction]. https://www.xjtu.edu.cn/jdgk/jdjj.htm

partnerships with enterprises, as well as strategic collaborations with provincial and municipal governments. Many of these universities have established joint university–enterprise training mechanisms through Collaborative Education Programs, engaging in deep cooperation in curriculum design, research innovation, and practical training. Relying on project-based models, they have enabled students to enhance their practical abilities in real-world industry contexts. Some leading universities have also formed deeper partnerships with well-known enterprises, not only providing high-level talent support but also driving technological innovation and industrial upgrading through the establishment of joint research platforms for frontier technology development and product innovation. Furthermore, several top-tier universities have entered into comprehensive strategic partnerships with local governments, leveraging policy support and resource advantages to promote regional economic and industrial development.

Xi'an Jiaotong University (XJTU), one of China's oldest and most prestigious institutions of higher education under the direct jurisdiction of the Ministry of Education, stands as a comprehensive research university spanning 11 disciplinary fields: science, engineering, medicine, economics, management, humanities, law, philosophy, art, education, and interdisciplinary studies. The university currently comprises 34 schools (departments and centers), 9 undergraduate colleges, and 3 affiliated hospitals. As of March 2024, its academic excellence is reflected in numerous national accolades, including 61 undergraduate programs designated as national first-class disciplines, 100 national teaching achievement awards, 12 Ministry of Education virtual teaching pilot projects, 129 national first-class undergraduate courses, 8 national-level teaching and training bases, 12 national experimental teaching demonstration centers (including virtual simulation centers), and 9 national teaching teams. (Xi'an Jiaotong University,2026.)

Table 2　Profile of Xi'an Jiaotong University

Category	Description / Statistic
Institutional Overview	
Institutional Status	One of China's oldest and most prestigious universities; under direct jurisdiction of the Ministry of Education
Institutional Type	Comprehensive Research University
Disciplinary Fields	11 fields: Science, Engineering, Medicine, Economics, Management, Humanities, Law, Philosophy, Art, Education, and Interdisciplinary Studies
Academic Structure	34 Schools (departments and centers); 9 Undergraduate Colleges; 3 Affiliated Hospitals
National Accolades (As of March 2024)	
National First-Class Undergraduate Programs	61 programs
National Teaching Achievement Awards	100 awards
Ministry of Education Virtual Teaching Pilot Projects	12 projects
National First-Class Undergraduate Courses	129 courses
National-Level Teaching and Training Bases	8 bases
National Experimental Teaching Demonstration Centers	12 centers (including virtual simulation centers)
National Teaching Teams	9 teams

Source：XJTU Official Web *https://www.xjtu.edu.cn/jdgk/jdjj.htm*

In the new era, XJTU has embraced a strategic vision centered on 'fulfilling national missions, building a global center of science and education, driving regional development in Shaanxi, fostering innovation, and serving as a model of intelligent academic urbanization.' (Xi'an Jiaotong University News, 2020) The cornerstone of this vision is the Western China Science and Technology Innovation Harbor (hereinafter referred to as 'the Innovation Harbor'), an ambitious initiative comprising eight major platforms, thirty research institutes, and over 400 research bases and think tanks across the four major fields of science, engineering, medicine, and humanities. (Xi'an News Network, 2024) This ambitious project serves as a physical and conceptual hub for integrating teaching and research, promoting interdisciplinary collaboration, and pioneering innovative models of deep university-society integration for the 21st century. Through these efforts, XJTU has positioned itself as a key driver in shaping a new pattern of Western China's development.

In recent years, XJTU has demonstrated a comprehensive and multi-level approach to promoting university-industry collaboration, achieving remarkable results in advancing research-education-industry integration to meet societal needs. The university's leadership in this domain was prominently recognized on March 16, 2025, at the 16th China Industry-

Academia-Research Cooperation Innovation Conference in Beijing, where XJTU received multiple honors. Party Secretary Lu Jianjun was named one of the 2024 ‘Top 10 Innovation Leaders,’ two faculty teams led by Professor Guo Liejin (Academician of the Chinese Academy of Sciences) and Professor Rong Mingzhe were recognized among the Top 100 Innovation Teams in China, and XJTU-led projects won two first prizes, one second prize, and one third prize for innovation achievements. (Xi’an Science and Technology Bureau, 2025) These accolades underscore the university’s leading role in advancing China’s university-industry collaboration ecosystem.

2.2.2 Expanding Uni–Gov and Uni–Enterprise Networks

XJTU has established strategic cooperation agreements with multiple provincial governments and engaged in comprehensive collaborations with twelve municipalities. For example, since October 2014, XJTU and the Xiangyang Municipal Government have launched a strategic partnership to accelerate industrial transformation and regional economic development. Together, they established the Xiangyang–XJTU Industry–University–Research Collaboration Office to promote technology transfer and the local application of the university’s research achievements.

In October 2014, Xi’an Jiaotong University (XJTU) and Yan’an City officially launched a comprehensive strategic collaboration. Both parties conducted multiple exchanges focusing on accelerating industrial transformation, structural adjustment, and regional economic development (Xi’an Jiaotong University News, 2017). The Yan’an Science and Technology Bureau and the university jointly established the Xi’an Jiaotong University (Yan’an) University-Industry Collaboration Office as a key platform to empower Yan’an’s technological and industrial advancement. Furthermore, in May 2017, XJTU and the Yan’an Science and Technology Bureau signed an agreement to jointly establish the Xi’an Jiaotong University (Yan’an) University-Industry Collaboration Office. Since then, representatives from the Yan’an Science and Technology Bureau have made multiple visits to XJTU for discussions and exchanges. Based on close communication, the Bureau surveyed the needs of Yan’an enterprises and incorporated them into the office’s key projects aimed at serving the local government’s science and technology industry development (Xi’an Jiaotong University News, 2018).

In October 2014, XJTU and Tongchuan City also launched a comprehensive strategic collaboration, engaging in extensive cooperation in talent cultivation, scientific and technological problem-solving, continuing education, and healthcare (Xi’an Jiaotong University Office of the Party Committee and President’s Office, 2014). In June 2017, the Tongchuan Science and Technology Bureau and XJTU jointly established the Xi’an Jiaotong University (Tongchuan) University-Industry Collaboration Office to create a long-term communication mechanism, provide services and guarantees for comprehensive cooperation

between the university and the local government, and ensure effective follow-up and supervision.

Since October 2014, when XJTU and Yulin City initiated their strategic collaboration, the two parties further signed the 'Strategic Cooperation Agreement on Jointly Building a Science and Technology Innovation Base' on April 7, 2016 (Xi'an Jiaotong University Office of the Party Committee and President's Office, 2014). In May 2017, the Yulin Science and Technology Bureau and XJTU jointly established the Xi'an Jiaotong University (Yulin) University-Industry Collaboration Office. Based on this, the two sides carried out cooperative initiatives in scientific and technological innovation, emerging industry development, and talent cultivation, promoting the transfer of XJTU's advanced technological and entrepreneurial achievements to Yulin, thereby contributing to the city's economic development. The establishment of the office further facilitated university-local collaboration in industrial transformation, structural adjustment, and regional economic growth (Xi'an Jiaotong University News, 2016, para. 4).

In December 2016, a signing ceremony and achievement promotion conference were held between XJTU and the People's Government of Baoji City to jointly build a university-industry collaboration platform (Xi'an Jiaotong University News, 2016, para. 1). As one of Shaanxi Province's major industrial bases, Baoji hosted more than 100 entrepreneurs, as well as municipal officials, at the event. During the meeting, XJTU's Research Institute and the Baoji Science and Technology Bureau signed an agreement to establish the Xi'an Jiaotong University (Baoji) University-Industry Collaboration Office and unveiled its plaque. Reportedly, projects involving XJTU accounted for one-fourth of Baoji's total scientific cooperation initiatives. Since signing the strategic cooperation agreement, both sides have conducted a series of matchmaking activities. This initiative represents an important step in implementing the strategic collaboration between XJTU and twelve municipalities, as well as a concrete measure to advance cooperation between Baoji and the university.

Their cooperation included platform construction for university-industry collaboration, participation in the China Western Innovation Port, appointment of XJTU professors as chief engineers in Baoji enterprises, creation of XJTU research columns on existing collaboration platforms, and organization of specialized technology achievement release events. During one such meeting, XJTU recommended over 30 cutting-edge technological achievements to more than 100 Baoji enterprises. In April 2017, under the organization of the Xi'an Jiaotong University–Baoji University-Industry Collaboration Office, Baoji enterprise representatives visited XJTU's School of Energy and Power Engineering to discuss cooperation opportunities. The companies presented their technical challenges in aviation refrigeration and expressed a desire to leverage XJTU's expertise to overcome R&D limitations and achieve mutual benefit. XJTU scholars shared their research capabilities in low-temperature refrigeration and discussed technological development trends in the aerospace and defense sectors, formulating a joint roadmap for future product development.

In July 2017, XJTU's Vice President led a delegation to Baoji for on-site visits to major enterprises, including Shaanxi Aerospace Times Navigation Equipment Co., BaoTi Group, Baoji Machine Tool Group, and Qin Chuan Machine Tool Factory. Local industry leaders and government departments—such as the Science and Technology Bureau and the Bureau of Industry and Information Technology—engaged in discussions on deepening collaboration, particularly in electronics, automation, equipment manufacturing, and materials science. Accompanied by Baoji's top municipal leaders, the delegation reaffirmed mutual commitments to scientific innovation, technological transfer, R&D collaboration, and talent cultivation to enhance the competitiveness of Baoji's enterprises and open a new chapter of university-local collaboration (Xi'an Jiaotong University News, 2017).

Since 2016, XJTU has developed a new model of university-industry collaboration through an 'Administration–Finance–Industry–Academia–Research + Alumni' ecosystem. In this model, 'Administration' and 'Finance' refer to government and financial institutions, while 'Alumni' represents the university's distinctive resource network. This approach integrates administrative guidance and alumni resources to expand pathways for technological innovation and achievement transformation.

Following this, XJTU's local collaboration strategy expanded beyond Shaanxi Province to multiple cities nationwide. In October 2016, XJTU and the People's Government of Nantong, Jiangsu Province, signed a 'Strategic Cooperation Framework Agreement' to deepen university-local collaboration, promote technology transfer, and enhance industrial development in Nantong (Xi'an Jiaotong University Suzhou Research Institute, 2016). In August 2017, the 'Nantong–XJTU Technology Transfer Service Center' conference was held, during which both sides signed an agreement to further strengthen cooperation. The center focuses on Nantong's industrial transformation needs, enhancing collaboration in technological innovation, emerging industry cultivation, and talent exchange, and facilitating the transfer of XJTU's technological and entrepreneurial achievements to Nantong to support its goal of becoming an innovation hub.

In November 2016, XJTU signed a university-industry project cooperation agreement with the Wujiang District Government of Suzhou City, Jiangsu Province. Wujiang, located at the junction of Jiangsu, Zhejiang, and Shanghai, is among the most dynamic innovation cities in the Yangtze River Delta. The two parties jointly established the Xi'an Jiaotong University (Wujiang) University-Industry Collaboration Office to serve as a foundation for cooperation in scientific innovation, new industry development, and talent cultivation (Xi'an Jiaotong University Suzhou Research Institute, 2016).

In June 2019, XJTU and the Science and Technology Bureau of Jianghai District, Jiangmen City, Guangdong Province, signed an agreement to jointly establish the Xi'an Jiaotong University (Jiangmen High-Tech Zone) University-Industry Collaboration Office. Leveraging Jiangmen's six national innovation platforms and XJTU's disciplinary strengths,

both sides aim to foster collaboration in high-end electromechanical manufacturing, new materials, and next-generation electronic information industries, jointly promoting regional economic development (Xi'an Jiaotong University News, 2019).

In addition to university-local collaborations, XJTU has also engaged in extensive partnerships with leading enterprises across China to advance university-industry integration, collaborative education, and scientific research.

For example, in March 2016, XJTU and Haier Group signed a strategic cooperation agreement and unveiled the 'Haier–Xi'an Jiaotong University Joint Innovation Center' during the university's 120th anniversary celebration. This marked Haier's first such partnership with a university, initiating joint work in strategic planning, refrigeration technology, big data processing, intelligent control, image processing, capacitors, power systems, and motor engineering (Xi'an Jiaotong University News, 2016).

In August 2016, XJTU and Lanzhou LS Group signed an agreement to establish the 'Digital High-End Equipment Research Institute.' This collaboration integrates XJTU's expertise in mechanical and chemical engineering with LS Group's industrial strengths in design and manufacturing, addressing key technical challenges and fostering co-development (Xi'an Jiaotong University News, 2016).

In September 2016, XJTU and Huawei Technologies Co., Ltd. signed a long-term cooperation framework agreement, followed in June 2017 by the establishment of the 'Huawei–Xi'an Jiaotong University Joint Research Center for Mathematics and Information Technology,' marking a milestone in their collaborative research in applied mathematics and wireless communications (Xi'an Jiaotong University News, 2016).

Similarly, XJTU's School of Energy and Power Engineering and Xi'an Huaxin New Energy Co., Ltd. jointly founded the 'Xi'an Jiaotong University–Huaxin Physical Energy Storage Technology Institute' in June 2017 to enhance cooperative research and talent cultivation. That same month, the School of Mathematics and Statistics and Xiangyi Weilian Technology Co., Ltd. established the 'Xi'an Jiaotong University–Xiangyi Big Data Industrial Research Institute,' focusing on smart manufacturing, environmental protection, and data-driven innovation.

In March 2017, XJTU, ZTE Corporation, the Xi'an Science and Technology Bureau, and the Xi'an High-Tech Zone Management Committee jointly founded the 'ZTE–Xi'an Jiaotong University Joint Innovation Center,' aiming to accelerate Xi'an's information technology sector through enterprise-led innovation (Xi'an Jiaotong University Alumni Network, 2017).

The same month, the School of Electrical Engineering signed a cooperation agreement with Suzhou Thermal Engineering Research Institute Co., Ltd. on advanced nuclear power monitoring and inspection technologies, and the Artificial Intelligence and Robotics Research Institute established the 'Xi'an Jiaotong University–Hongwei Intelligent Information Processing Research Center' with Shanghai Hongwei Information Technology Co., Ltd (Xi'an

Jiaotong University Alumni Network, 2017).

In April 2017, XJTU also partnered with Xi'an 1896 Incubator Co., Ltd. to establish the 'Xi'an Jiaotong University 1896 Innovation and Entrepreneurship Base,' fostering technology transfer and alumni-driven entrepreneurship.

Moreover, XJTU led the creation of the Collaborative Innovation Center for High-End Manufacturing Equipment, uniting renowned universities such as Zhejiang University, Dalian University of Technology, and Huazhong University of Science and Technology, as well as leading enterprises like Shenyang Machine Tool, Qin Chuan Machine Tool, and Huazhong CNC. The center focuses on high-speed and precision manufacturing, 3D printing, and aerospace engineering, achieving breakthroughs that have disrupted foreign monopolies and supported major national projects.

After nearly a decade of sustained effort, XJTU has achieved remarkable results in university-industry collaboration. Its diverse and multi-tiered collaborative education initiatives have earned national recognition. On March 16, 2025, at the 16th China University-Industry Cooperation and Innovation Conference in Beijing, XJTU received multiple honors, including the 'Top Ten Outstanding Innovation Figures' award for Party Secretary Lu Jianjun and a large number of first, second, and third prizes for innovation achievements, showcasing the university's leading role in advancing China's university-industry collaboration ecosystem (Peking University News, 2025).

2.2.3 Building a University-industry integration Ecosystem

2.2.3.1 "Project 6352"

"6352" specifically refers to the goal of integrating "government, academia, industry, research, application, and investment" resources into the Innovation Park, establishing three colleges (incubators) namely "Modern Industry, Future Technology, and Silk Road International", creating and improving five major ecosystems including "policies, finance, services, support, and laws (intellectual property and production)", building two supporting platforms of "venture capital and transactions", cultivating innovative talents suitable for the development needs of the new era, and exploring effective measures and innovative paths for the deep integration of industry-university-research (Xi'an Jiaotong University [XJTU], 2021). The core of implementing the "6352" project lies in gathering innovation resources in the Innovation Park, introducing financial capital, meeting the demands of enterprises, establishing an industrial ecosystem, and integrating into the local emergency social development (Shanxi Science and Technology News, 2021).

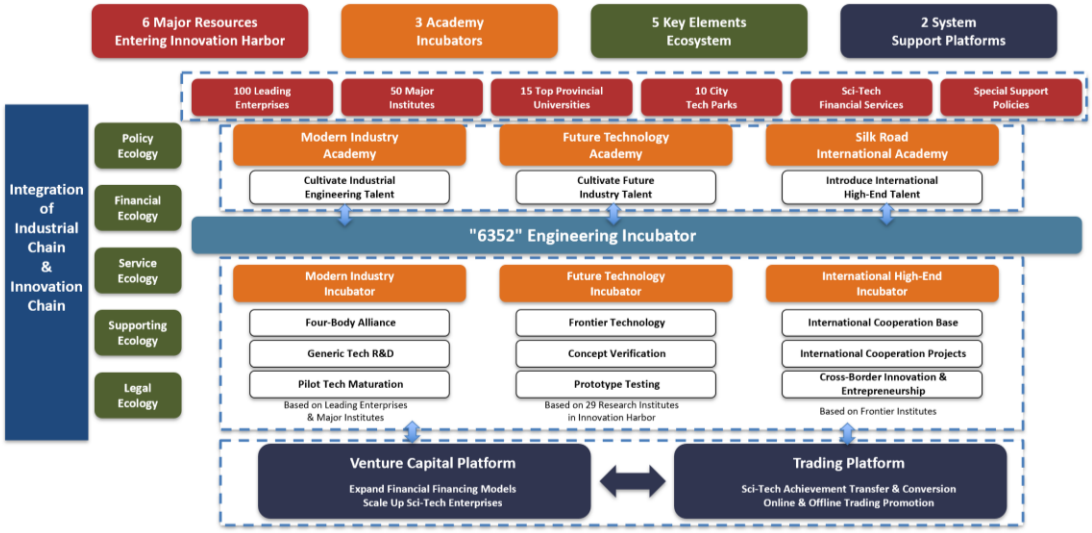

Figure 2.2-1 '6352' Project: A Key Initiative for Integrating "Two Chains"

Source

Shaanxi Science and Technology News, June 8, 2021, p. 8

https://news.xjtu.edu.cn/info/1033/135450.htm

On April 8, 2021, on the occasion of the 125th anniversary of the establishment of XJTU and the 65th anniversary of its relocation, the "Integration of Industry and Education, Collaborative Education" innovation project was launched at China West Innovation Port. At the same time, the signing ceremony of the "6352" project, the launch ceremony of the Global Alumni Collaborative Innovation Center, the signing ceremony of deepened strategic cooperation with 12 districts of Xi'an, and the school-enterprise cooperation signing ceremony were also held. At the launch meeting of the innovation project, XJTU established two industrial colleges: the Future Technology College and the Modern Industry College (Shanxi Science and Technology News, 2021). XJTU's Party Secretary Lu Jianjun said, "XJTU is selecting 901 candidate projects and 232 equity investment projects from over 20,000 scientific and technological achievements, forming a conversion list, and has established a 71-person technology manager team to conduct two-way connection with local development." 5 The core of XJTU's implementation of the "6352" project is to gather innovation resources at the Innovation Port (Zhang, 2021).

2.2.3.2"1121 Model"

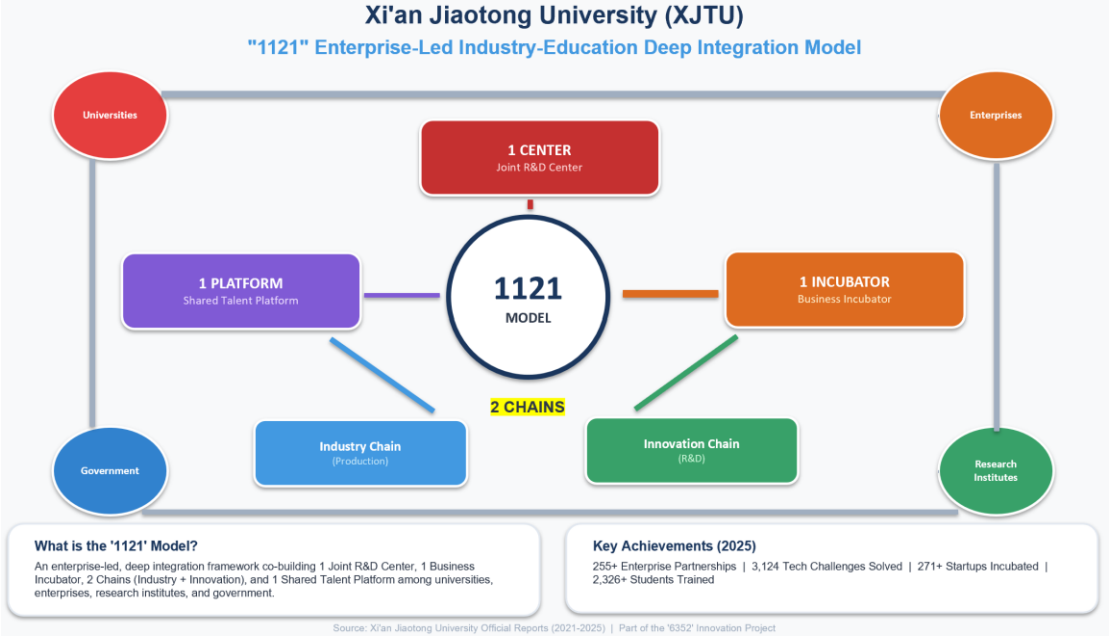

Figure 2.2-2: "1121 Model"

Source: Original artwork developed for this study

The "1121" Model is a university-enterprise collaboration model implemented by Xi'an Jiaotong University in its exploration of the China Western Science and Technology Innovation Harbor. It constitutes an important component of the "6352" university-industry integration project. The full name of the model refers to: "One Center," "One Incubation," "Two Orientations," and "One Sharing." "One Center" refers to a new type of R&D center jointly established by universities, enterprises, governments, and research institutes. Through a "Four Duals" management mechanism — dual leadership, dual teams, dual evaluation, and dual funding — it enables collaborative innovation among multiple stakeholders. "One Incubation" refers to the establishment of a platform for the incubation of scientific and technological achievements, supported by large enterprises. It introduces financial capital, seed funds, angel funds, etc., to promote the transformation of university research outcomes and patents, forming a cycle of "maturing one batch, transforming one batch," thereby helping enterprises identify new drivers for high-quality growth. "Two Orientations" emphasize the alignment of innovation chains with industrial chains, while also using innovation chains to drive industrial chains, achieving mutual reinforcement between the two. "One Sharing" highlights leveraging the exemplary role of state-owned enterprises and attracting leading enterprises in their respective industries, fully utilizing the talent appeal of "Double First-Class" universities. In this context, the "chain" in "industrial chain" and "innovation chain" represents a sequence of interlinked steps, where each preceding step initiates the next, and each succeeding step continues the previous one. No step in the sequential order can be broken. The 20th

National Congress of the Chinese Communist Party made strategic arrangements to "strengthen enterprise-led deep integration of industry, academia, and research" and to "promote the deep integration of innovation chains, industrial chains, capital chains, and talent chains." The "deep integration of four chains" refers to opening up the innovation chain, integrating the industrial chain, introducing the capital chain, and sharing the talent chain. The industrial chain consists of enterprises and their upstream and downstream partners. However, questions remain as to where the innovation chain comes from, how to open it up, and how to integrate innovation with industry. Opening up the innovation chain means solving the problem of scientific and technological innovation — a task that can only be accomplished through the synergy between universities and enterprises.

In response, the new enterprise-led model for deep integration of industry, academia, and research — the "1121" Model — has emerged. This model follows the principles of "dual management, dual chief experts, dual signatures, and entrepreneurial mentors." It establishes a mechanism of "enterprises posing problems; universities and enterprises jointly refining research topics; inviting solutions through open competition ('revealing the list and appointing leaders'); teachers and students jointly solving problems; and universities and enterprises jointly evaluating outcomes." In doing so, it opens up the entire chain of scientific and technological innovation, from basic research and applied research to technology development and industrialization.

Once the innovation chain is opened, basic research in universities and industrial innovation in enterprises can be integrated, allowing the capital chain to follow. This promotes the high-level creation and efficient transformation of scientific and technological achievements. After top-tier enterprises and universities achieve deep integration, it becomes possible to cultivate outstanding engineering talents in an environment characterized by entity-based operations, engineering contexts, hands-on projects, dual mentoring, organized research, full-chain innovation, and diversified evaluation. Only then can the "shared talent chain" be connected (Xi'an Jiaotong University, 2025).

From the perspective of talent cultivation, the innovative talent cultivation system of the "1121" Model is characterized by deeply involving enterprises in the training process. Under the "dual mentorship" system, on-campus academic advisors and off-campus industry mentors jointly guide students. The "project-based" approach implements the mechanism of "enterprises posing problems; universities and enterprises jointly refining research topics; inviting solutions through open competition; teachers and students jointly solving problems; and universities and enterprises jointly evaluating outcomes (Xi'an Jiaotong University, 2024)." The "diversified evaluation" breaks away from the sole criterion of "paper publication" to achieve collaborative

talent cultivation. This leads to the integrated development of education, science and technology, and talent, cultivating future leading talents capable of solving complex real-world scientific and technological problems, effectively alleviating the shortage of high-level corporate talent, while also strengthening university professional research teams and graduate student management.

In terms of outcomes, as of 2026, Xi'an Jiaotong University has signed agreements with 255 leading enterprises to establish joint research institutes, including 59 Fortune Global 500 companies and 78 China Top 500 companies. It has established over 100 deeply integrated university-enterprise innovation consortia, solved 3,124 technical problems for enterprises, and incubated 281 "science and technology innovation enterprises." A number of major scientific and technological achievements have achieved breakthroughs internationally, advancing from "following" to "running alongside" and then to "leading" in their respective fields (Lyu, 2026).

2.2.3.3 Three Industry Colleges

(1) Modern Industry College

The Modern Industry College is a secondary-level college affiliated to XJTU. It was officially established on April 8, 2021. As part of the "6352" project, it aims to serve the national and social economic development by tackling "critical technology" issues faced by enterprises. It plays a leading role in enterprises and promotes scientific innovation and the incubation of achievements. It is the core carrier for this purpose.

In terms of course design, the courses of the Modern Industry College are highly industry-oriented based on the college's positioning, closely integrating with the current industry demands. During the preparation stage of the Modern Industry College, XJTU initiated the cooperation project of building the Modern Industry College with Huawei in 2020. A school-enterprise course integration and Connection meeting was held. Huawei mainly provided technical experts to sort out the training system for Kunpeng/Tianxin (two chips of Huawei)，and conducted one-on-one communication with the 23 course directors of XJTU. They also proposed suggestions for course integration based on the existing course system of XJTU. After reaching an agreement for cooperation，23 courses were jointly constructed and a complete system was formed (Lu, 2025). In September of the same year, the world's first "Ministry of Education–Huawei 'Intelligent Base' Collaborative Education Center for Industry–Education Integration" was established at XJTU. At that time, 12 of the 23 jointly developed courses had already been formally offered. These courses systematically incorporated application-oriented content related to Huawei's ARM CPUs, the Kunpeng platform, operating systems, and AI platforms into the curriculum (Xi'an Jiaotong University, 2020).

By 2023, the cooperation between XJTU and Huawei under the "Intelligent

Base" initiative had been further upgraded. The collaboration evolved from a single driving mechanism centered on industry–education integration to a more comprehensive model combining industry–education integration with science–education integration. Within this framework, 55 frontier courses were developed, among which 20 were identified as key jointly developed courses at this stage. By bringing Huawei's real-world project cases and latest technical standards into the classroom, this cooperation substantially enhanced the practical orientation of teaching and reduced the limitations of purely theoretical instruction (Ren, N, 2026).

In this regard, a representative of the Practical Teaching Center at XJTU emphasized that "courses constitute the core of talent cultivation." The course Principles of the Internet of Things provides a representative example of the dual-integration model of industry–education integration and science–education integration. In this course, university-based theoretical instruction is closely integrated with enterprise-based practical cases, while students are able to use the latest software toolkits developed by Huawei in class. This reflects, in a concentrated manner, the collaborative achievements of XJTU and Huawei in the "Intelligent Base" Collaborative Education Center for Industry–Education Integration (Ren, N, 2026).

In addition to its collaboration with Huawei Technologies Co., Ltd., XJTU has also promoted in-depth cooperation with a number of Fortune Global 500 enterprises, including China Unicom and Haier Group. Through these partnerships, the university and enterprises have engaged in mutual resource sharing in areas such as teaching materials, faculty development, and system construction, and have jointly explored approaches and practical experience for cultivating talent under the New Engineering initiative (LAI & ZHANG, 2021).

By 2026, XJTU had established cooperative relationships with 59 Fortune Global 500 enterprises and 78 China Top 500 enterprises. It had also formed 100 deeply integrated school–enterprise innovation consortia with leading enterprises such as State Grid, CHN Energy, and Genertec. On this basis, the university developed a collaborative working mechanism characterized by joint enrollment, joint cultivation, joint topic selection, shared outcomes, interconnected faculty resources, integrated curricula, interoperable platforms, and coordinated policy support.

At the level of faculty development, the teaching staff of the modern industrial college is primarily characterized by the dual-mentor model, in which enterprise mentors and university mentors jointly participate in student cultivation in a deeply integrated manner. This model emphasizes close collaboration between industry and academia, and seeks to enhance the practical and engineering-oriented quality of talent training.

In 2022, XJTU launched the "Hundred-Thousand-Ten Thousand

Project." Through cooperation with one hundred leading enterprises, the university established a team of one thousand enterprise mentors and promoted the cultivation of ten thousand engineering master's and doctoral students. This initiative was designed to address several major problems in engineering education, including the insufficient availability of practice-based training environments, the weak coordination of the dual-mentor collaborative education mechanism, and the overly single evaluation standards for talent cultivation. In this way, the university aimed to foster a large number of outstanding engineers for key national industries and strategic fields (LU, 2026).

In 2023, XJTU, together with 243 enterprises, jointly established 78 innovation consortia and selected 667 enterprise mentors. On this basis, the university developed dual-mentor teams featuring the combination of scientists and engineers, and organized 177 teams composed of both on-campus and off-campus mentors to support the cultivation of students (ZHOU, 2023).

By 2026, XJTU had worked with 255 leading enterprises and 1,091 enterprise mentors to jointly cultivate more than 2,300 engineering master's and doctoral students. At the same time, this university–enterprise collaboration had contributed to solving 3,124 technical problems encountered by enterprises. These outcomes indicate that the dual-mentor model has not only strengthened the practical capacity of engineering talent cultivation, but has also promoted the effective integration of higher education with industrial innovation needs (Xi'an News Network, 2023).

(2) Future Technology College

The School of Future Technology is a second-level school of XJTU. In 2020, the Ministry of Education issued the Guidelines for the Construction of Schools of Future Technology (Trial), proposing the establishment of a number of Schools of Future Technology in Chinese universities. In May of the following year, the first group of universities selected for this initiative was announced, and the School of Future Technology at XJTU was among the first batch of national-level Schools of Future Technology (LI & WANG, 2024).

As an experimental platform for reform and innovation in talent cultivation, the School of Future Technology differs from modern industrial colleges, which are mainly oriented toward overcoming enterprise "bottleneck" technologies. Instead, it is guided by the principles of future-technology orientation, interdisciplinary support, industry–education integration, and open inquiry-based teaching. Its goal is to cultivate leading scientific and technological innovators with forward-looking interdisciplinary thinking and strong scientific literacy, who are capable of leading developments over the next 10 to 15 years (Graduate Admissions Website, XJTU, 2022).

With regard to curriculum design and teaching mode, the School of Future Technology places greater emphasis on forward-looking course arrangements, covering

emerging interdisciplinary subjects and fields while encouraging students to engage in cross-disciplinary learning. Its curriculum system focuses on four interdisciplinary areas: artificial intelligence, energy storage science and engineering, intelligent manufacturing engineering, and medical engineering. Around these focal areas, the school has carried out targeted reform and exploration.

In response to a series of problems commonly observed in Chinese higher education, such as the lack of practical courses, insufficient interdisciplinary integration, limited participation of enterprise mentors in classroom teaching, and inadequate integration between theoretical instruction and industrial practice, the school established a ”school–enterprise dual-teacher” teaching team characterized by interdisciplinary collaboration and industry–education integration. On this basis, it innovatively developed a new teaching model featuring ”multiple teachers teaching the same course” and ”university teachers and enterprise experts co-teaching the same course.”

By 2024, among 113 undergraduate courses, 101 had already been taught jointly by multiple instructors, and this number later increased to 118. Among the courses taught by multiple teachers, 61 involved enterprise experts in teaching. In this model, university teachers are mainly responsible for explaining theoretical knowledge, while enterprise experts introduce corresponding industrial cases and practical applications. In this way, the school has effectively connected the knowledge chain from theoretical foundations, to key technologies, and finally to practical applications.

To support this model, the school built a dual-qualified teaching team featuring interdisciplinary integration and school–enterprise collaboration. This mechanism broke through traditional barriers between schools and departments, integrated the university’s internal strengths, and invited 284 internal teachers from 15 schools, including academicians, leading scholars, and other outstanding faculty members, as well as 86 enterprise experts from 21 leading enterprises and first-class research institutes, including the China Aerospace Science and Technology Corporation, Huawei, Northwest Electric Power Design Institute, and China Telecom, to participate in undergraduate teaching. Through this collaboration between internal and external teachers, the school seeks to jointly cultivate future leaders in scientific and technological innovation (Academic Affairs Office & Future Technology College, Xi’an Jiaotong University, 2025).

The course Design and Drive Control of New-Form Robots provides a representative example. As a foundational project-based course in the direction of intelligent manufacturing, it was designed to meet the needs of interdisciplinary integration and industry–education collaboration. The course invited 14 interdisciplinary internal teachers from the schools of mechanical engineering,

chemistry, electrical engineering, artificial intelligence, and computer science, together with enterprise experts from a soft robotics technology company in Beijing, to teach collaboratively. This arrangement enabled the integrated and continuous design of both the course teaching system and the practical teaching system. Through the process of theoretical instruction, project discussion, and hands-on practice, students' relevant capabilities were further enhanced.

This model is also reflected in courses such as Fundamentals of Medical Engineering, Mathematical Analysis for Engineering, Development and Application of Energy Storage Technology, and Intelligent Manufacturing Processes and System Control, and it has been promoted nationwide. On this basis, in response to the national digitalization strategy, the school also developed a collective learning platform based on a knowledge graph, guided by the educational Concept of constructivist learning and student-centered education. Up to now, 17 courses and 5 projects have been piloted on the platform, with a cumulative trial usage of 24,710 participants/times.

In addition, the school has established a dual-qualified mentoring team characterized by interdisciplinary integration and school–enterprise collaboration. Complementing the teaching team, this mentoring team is specifically oriented toward guiding students in scientific research activities around major projects, participating in enterprise engineering project research, and carrying out practical internships. At present, the total number of internal and external mentors has reached 214. Among the 96 enterprise mentors, 80% come from large state-owned enterprises or research institutes, Fortune Global 500 companies, and leading high-tech enterprises in the industry. The combined role of the teaching-oriented school–enterprise dual-teacher team and the mentoring-oriented school–enterprise dual-teacher team has formed a complete education chain of "classroom + project + practice" (Xi'an Jiaotong University News Network, 2024) (Xi'an Jiaotong University News Network, 2025).

In its cooperation with Huawei, senior Huawei experts have been appointed as members of the Degree Committee, supervisors for master's students, and participants in key training stages such as thesis proposal defenses and mid-term assessments. The inclusion of enterprise representatives in the university's sub-committee for degree evaluation has also ensured that enterprises exercise substantive authority in talent evaluation (Xi'an Jiaotong University News Network, 2025).

No.	Project Phase Name	Hours	Instructor	Instructor Affiliation
1	Bionic Robot Design	8	Peng Jun, Li Bo, Zhu Zicai, Guo Yanjie, Gu Guying, Dong Xuefeng	School of Mechanical Eng., External Experts
2	Material Selection & Preparation	8	Peng Jun, Li Bo, Zhu Zicai, Guo Yanjie, Zhang Zhicheng	School of Mechanical Eng., School of Chemistry, External Experts
3	Robot Drive Mode Design	8	Peng Jun, Li Bo, Zhu Zicai, Guo Yanjie, Du Shaoyi, Zhang Wenming	School of Mechanical Eng., School of AI, External Experts
4	Motion Control Algorithm	8	Peng Jun, Li Bo, Zhu Zicai, Guo Yanjie, Liu Qingfang, Fang Hongbin	School of Mechanical Eng., External Experts
5	Electrical & Electronic Technology	10	Peng Jun, Li Bo, Zhu Zicai, Guo Yanjie, Zhao Huichan	School of Mechanical Eng., External Experts, School of Electrical Eng.
6	Computer Language Programming	12	Peng Jun, Li Bo, Zhu Zicai, Guo Yanjie, Shi Chaoyang	School of Mechanical Eng., External Experts, School of Computer Sci.
7	Signal Processing & Systems	10	Peng Jun, Li Bo, Zhu Zicai, Guo Yanjie, Zhao Zhibin, Wang Shibin, Wang Fan	School of Mechanical Eng., External Experts

Figure 2.2-3

Teaching Calendar of the Course "Design and Drive Control of New-Form Robots"

Source

Xi'an Jiaotong University News Network, teaching calendar of the course "Design and Drive Control of New-Form Robots" *https://news.xjtu.edu.cn/info/1003/216893.htm*

"Principles and Frontier Applications of Energy Storage"

▶ **Course Information:**

2 Credits
40 Theory Hours, 8 Lab Hours

▶ **Cross-disciplinary Campus Experts:**

School of Chemistry
School of Electronic & Information
School of Energy & Power
School of Electrical Engineering

▶ **Industry Experts:**

AVIC Lithium Battery Technology Co., Ltd.
Shenzhen Bitwatt Co., Ltd.
Shaanxi Seraph Energy Technology Co., Ltd.
213 Research Institute
Northwest Electric Power Design Institute

No.	Project Phase Name	Hours	Instructor	Instructor Affiliation
1	Introduction	2	Ding Shujiang	School of Chemistry
2	Li-ion, Flow Battery, & Hydrogen Storage	6	Ding Shujiang, Zhu Suran, Xiao Chunhui	School of Chemistry, AVIC Lithium Battery
3	Na-ion Battery & Supercapacitor	4	Xu Youlong	School of Electronic & Information
4	Thermal Energy Storage & Cool Storage	8	Li Mingjia, Qian Suxin	School of Energy & Power
5	Power Energy Storage System Applications	8	Wang Jianxue	School of Electrical Engineering
6	Power System, Electromagnetic, & Thermal Energy Storage: Frontier Technology Practice	10	Song Zhengxiang, Xie Guohui, Xu Youlong, Li Jiebin, Yang Hong, Li Yinshi, Fan Tao	School of Electrical Eng., School of Electronic & Info., School of Energy & Power, Shenzhen Bitwatt Co., 213 Research Institute, Shaanxi Seraph Energy, Northwest Elec. Power Design Inst.
7	Info-Physical Fusion Distributed Energy System	4	Xu Zhanbo, Wu Jiang	School of Electronic & Information
8	Energy Storage Innovation & Entrepreneurship: PPT Defense & Discussion	4	Li Yinshi	School of Energy & Power

Figure 2.2-4

Joint Teaching by School-enterprise Experts| Development and Application of Energy-storage Technology, Northwest Electric Power Design Institute

Source

Xi'an Jiaotong University News Network, "University and Enterprise Experts Co-teaching a Class" *https://news.xjtu.edu.cn/info/1007/218501.htm*

In terms of the talent cultivation model, the school has comprehensively reformed its training scheme, curriculum system, and teaching content. With projects serving as the main driver, and teaching reform projects functioning as an important lever, it has advanced the reform of talent cultivation modes. By 2025, 53 teaching reform projects

for industry–education integrated courses and 11 teaching reform projects for industry-integrated textbooks had been approved.

The university regards the jointly established innovation consortia with leading enterprises, major institutes, and large research organizations as the principal platform for talent cultivation. Under this project-driven cultivation model, school–enterprise mentors are guided by concrete technological needs and focus on the development of frontier, revolutionary, and disruptive technologies over the coming decade. Within project-based courses, they supervise students in conducting scientific and technological research projects and guide them, as project leaders, in applying for various innovation competitions. Through the integrated model of ”course–project–competition,” this educational philosophy runs through the entire process from undergraduate to postgraduate education, with the aim of strengthening students’ organizational leadership and research-practice capabilities (Academic Affairs Office & Future Technology College, Xi’an Jiaotong University, 2025).

As this model has progressed, a series of significant achievements has been obtained. In 2024, the school–enterprise innovation consortia involved in the initiative had secured more than RMB 100 million in total funding, involved more than 300 enterprise engineers, and supported the cultivation of over 400 students. In addition, with funding introduced from Wuxi Municipality, the school established the Future Technology Taihu Innovation Fund, a special fund dedicated to supporting collaborative scientific and technological innovation and the transformation and incubation of research results by teachers and students. Through this mechanism, 15 frontier and leading projects were selected. Six undergraduates published high-level academic papers as first authors. Among 113 undergraduates, 101 participated in various innovation, entrepreneurship, and disciplinary competitions, accounting for 89%, and 49 students won national- or provincial-level awards (Xi’an Jiaotong University News Network, 2025).

Relying on the project course Design and Drive Control of New-Form Robots, Peng Zhikang, a second-year undergraduate student, published an SCI-indexed paper as first author on the topic of a soft universal gripper with rigid–flexible coupling. Xu Jiaxiu from Class Intelligent 2201 stated: ”Based on the project course, I carried out related research with the guidance of my supervisor and had the opportunity to present theresults at an international conference. This experience not only strengthened my academic confidence, but also enabled me to realize more deeply the close connection between scientific research and practical application.”

Driven by projects, the new talent cultivation model integrating courses, projects, and competitions has deepened interdisciplinary integration, industry–education integration, and collaborative education, while encouraging students to combine their

learning and research with frontier scientific and technological issues and key industrial problems. By breaking through the traditional disciplinary boundaries, the school has formed five core characteristics: 100% interdisciplinary integration through multiple teachers teaching the same course; 100% industry–education integration through the collaborative cultivation of students by university and enterprise experts; 100% project-driven talent cultivation; 100% joint guidance by school–enterprise mentor teams; and 100% integration between undergraduate and postgraduate education.training programs, curriculum system, and teaching content. Guided by project-based learning and using educational reform projects as key drivers, the College has promoted innovation in talent cultivation models. By 2025, it had launched 53 university-industry integration curriculum reform projects and 11 university-industry integration textbook reform projects. The College relies on innovation consortia jointly established with leading enterprises and major research institutes as the primary platforms for talent cultivation. Under the project-driven talent cultivation model, university and enterprise mentors, guided by real technological needs, focus on cutting-edge, revolutionary, and disruptive technologies that will shape the next decade. They guide students in conducting scientific and technological research within project-based courses and support students in applying, as principal investigators, for various innovation competitions. Through a model and educational philosophy that integrates "courses, projects, and competitions" across undergraduate and graduate education, the College cultivates students' leadership, research, and practical abilities.

As this model has advanced, a series of notable outcomes have been achieved. In 2024, the total funding received by jointly established university-enterprise innovation consortia exceeded 100 million RMB, with over 300 enterprise engineers participating and more than 400 students trained. External funding from the city of Wuxi was introduced to establish the "Future Technology Taihu Innovation Fund," a special fund dedicated to supporting faculty-student collaborations in technological innovation and achievement incubation. Fifteen cutting-edge, leading projects were selected. Six undergraduate students published high-level academic papers as first authors. Among 113 undergraduate students, 101 (89%) participated in various innovation, entrepreneurship, and disciplinary competitions, with 49 winning national or provincial awards.

Drawing on the project-based course *Design and Drive Control of New-Form Robots*, second-year undergraduate student Peng Zhikang published an SCI-indexed paper as first author on the topic of "Soft Universal Gripper with Rigid-Flexible Coupling." Xu Jiaxiu, a student from Class 2201 (Intelligent Manufacturing Engineering), remarked: "Based on the project course, I conducted related research with my advisor and had the opportunity to present our findings at an international

conference. This experience not only strengthened my academic confidence but also gave me a deep understanding of the close connection between research and real-world applications."

The new talent cultivation model, which is project-driven and integrates "courses, projects, and competitions," deepens interdisciplinary integration, university-industry integration, and collaborative talent cultivation. It encourages students to align their learning and research with technological frontiers and key industrial challenges, breaking through traditional disciplinary barriers. This has resulted in five core distinctive features: 100% interdisciplinary integration (multiple teachers co-teaching one course), 100% university-industry integration (university-enterprise expert collaboration in training), 100% project-driven talent cultivation, 100% dual mentorship (university and enterprise mentors), and 100% undergraduate-graduate articulation.

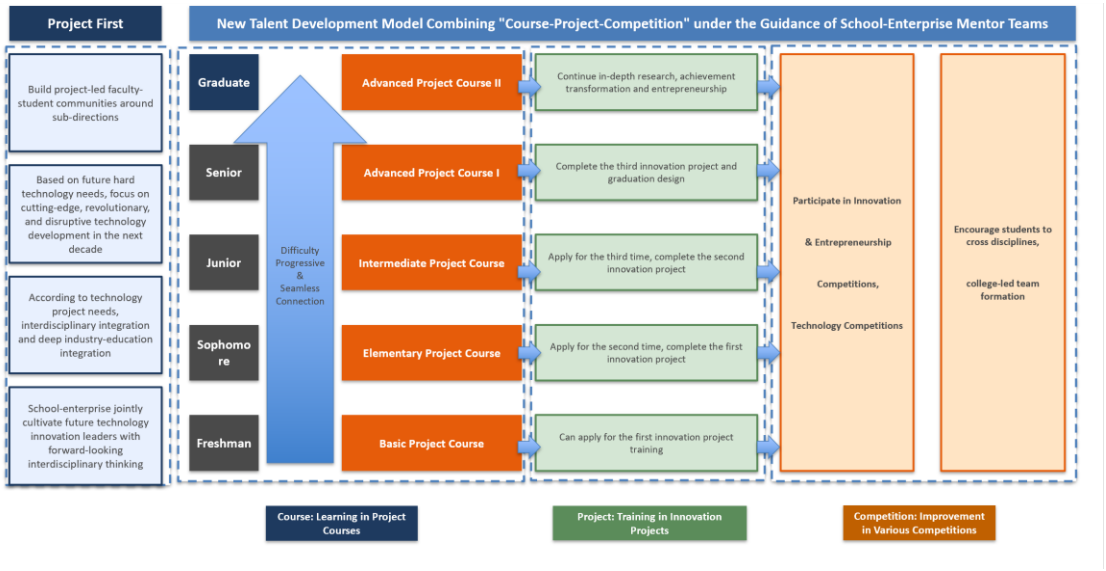

Figure 2.2-5 The "Course-Project-Competition" Integrated Talent Cultivation Model

Source *https://news.xjtu.edu.cn/info/1007/218294.htm*

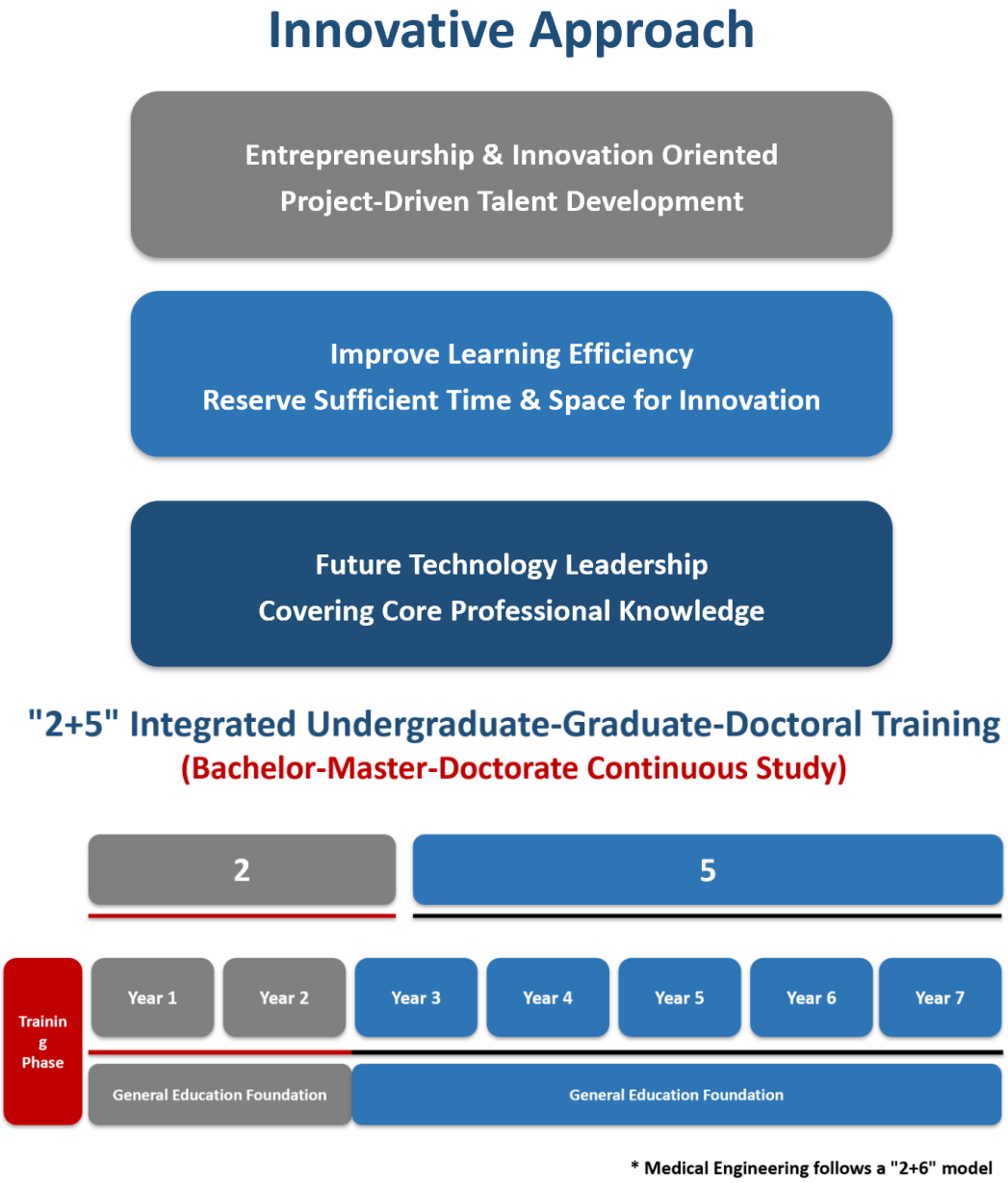

Figure 2.2-6

Project-led integrated talent development spanning bachelor's and master's programs

Source

https://news.xjtu.edu.cn/info/1007/218294.htm

At the level of evaluation, Wang Xiaohua, Executive Dean of the School of Future Technology at XJTU, introduced that the school has developed a multi-dimensional, multi-level, and multi-stage admission and assessment system. It adopts multiple assessment methods, such as written examinations, comprehensive interviews, and project practice, and also invites enterprises and venture capital experts to participate deeply in such key admission and assessment processes as question design and interviews, so as to comprehensively evaluate students' overall capabilities (LI & WANG, 2024).

In 2023, XJTU issued the Guiding Opinions of XJTU on Degree Application for Professional Degree Postgraduates in Engineering (Revised Edition) [(2025) No. 37]. According to this document, the forms ofresults that may be used to apply for a degree include: invention patents or software copyrights that have been transformed and generated significant benefits; science and technology awards at the provincial/ministerial level or above (second prize or higher); and research results appraised by authoritative bodies as reaching the domestic leading level. In December 2025, a doctoral student from the School of Mechanical Engineering of XJTU successfully passed the degree defense through practical achievements.

Allowing graduates to apply for degrees on the basis of patents, scientific and technological results, and other practical outputs, rather than relying exclusively on the traditional thesis, represents a landmark advancement in the classified cultivation and evaluation of talents (Xi'an Jiaotong University News Network, 2025).

(3) Silk Road International College

Together with the School of Future Technology and the Modern Industrial College, the Silk Road International College serves as one of the core schools (or incubators) within XJTU's "6352" Innovation Project for Collaborative Talent Cultivation through Industry–Education Integration. It is positioned to provide internationalized talent cultivation for countries along the Belt and Road, relying on XJTU's high-level leading talent and research platforms, introducing international high-level talent teams, incubating and fostering a number of science- and technology-based enterprises with international competitiveness, and enhancing the momentum of industrial development (LU, 2025).

Unlike the other two schools, the Silk Road International College is not organized as a second-level school directly under XJTU. Rather, its operation relies more on several institutional entities, including the School of International Education, which is responsible for the comprehensive management of international students across the university; the School of Continuing Education, which serves as the principal unit responsible for the Silk Road training base of the UNESCO International Knowledge Centre for Engineering Sciences and Technology (IKCEST); and the Silk Road International Institute of Engineering. In May 2017, The Hong Kong Polytechnic University and XJTU jointly initiated the establishment of the Silk Road International Institute of Engineering, with the aim of promoting higher education and scientific research cooperation among countries and regions along the Belt and Road, as well as between the Chinese mainland and Hong Kong, so as to cultivate diversified talent for global development. The two universities signed a memorandum of understanding and officially launched the preparation of the institute. In September of the same year, the jointly established Silk Road International College was formally inaugurated in Xi'an

by Wang Shuguo, President of XJTU, and Chan Tsz-ching, Chairman of the Council of The Hong Kong Polytechnic University.

In addition, the University Alliance of the Silk Road serves as an important supporting platform. This alliance was first proposed and initiated by XJTU in 2015. By 2022, it had attracted more than 150 universities from 37 countries and regions, thereby promoting exchanges and cooperation among universities along the Silk Road and other world-renowned universities in such areas as talent cultivation and scientific research (MEI, 2017).

At the level of curriculum provision, the college mainly focuses on internationally advanced fields such as big data, cloud computing, intelligent manufacturing, and biomedicine. At the 2017 Summit Forum on Lifelong Learning and the Modern Education Service Industry, Zheng Qinghua, then a member of the Standing Committee of the Party Committee, Vice President of XJTU, and Changjiang Scholar, delivered a speech entitled Taking Internet Education to the Belt and Road. The core educational idea of the Silk Road International College is to integrate the internet with education and embed this approach comprehensively into the cultivation of internationalized talent. In this view, "Internet + Education" is regarded as the key approach for building a talent cultivation mechanism characterized by government guidance, demand orientation, school–enterprise cooperation, and industry–education integration, with the aim of cultivating both professional and technical personnel and senior management talent (Xi'an Jiaotong University News Network, 2022).

The Silk Road special training program represents a concrete practice jointly carried out by IKCEST and XJTU in response to the needs of countries along the Belt and Road. Through the Silk Road training base, it promotes educational cooperation and talent cultivation (Sohu.com Inc., 2017). As an important carrier of talent cultivation within the Silk Road International College, the IKCEST Silk Road training base had launched 19 sessions of special training in science and technology by the end of 2017, covering 1,458 international students from 90 countries. Taking the Training Program on Frontier Aerospace Technologies as an example, this program, as one of the thematic training projects under the Silk Road Engineering Science and Technology Development Initiative, attracted 142 international students from multiple Belt and Road countries, including Pakistan and Angola, to participate in a five-day intensive training program (Xi'an Jiaotong University News Network, 2017). The training mainly focused on specialized lectures on such topics as the application of lightweight and ultra-lightweight materials in aerospace engineering, unmanned aerial vehicles, aerospace propulsion systems, the mechanical behavior of high-temperature materials in fuel turbines, and an introduction to the mechanics of intelligent materials. It also included lectures on Chinese culture and on the history and culture of the Belt and Road.

To further implement the goal of talent cultivation for countries along the Silk Road, the School of International Education, on the basis of a well-developed formal curriculum, has also established a second classroom characterized by multi-channel understanding of China. Through interactions and exchanges with scholars, frontline teachers, and peer students, it has organized theoretical learning and sharing activities for international students. These activities include programs such as "Counselors Talk with You about China," "International Students at XJTU Reading China," expert lecture series, and "Chinese Culture Classroom" practical experience activities. In this way, education on China's national conditions has been carried out for international students through multiple levels, dimensions, and channels (Xi'an Jiaotong University, 2022).

With regard to mentor team building and student learning models, the Silk Road International College generally adopts a dual-mentor system composed of mentors from both partner universities. In 2017, the Silk Road International Institute of Engineering, jointly established by XJTU and The Hong Kong Polytechnic University, adopted such a dual-mentor model. In response to the talent needs of countries and regions along the Belt and Road, as well as those of the Chinese mainland and Hong Kong, it promoted international dual-degree education programs (Xi'an Jiaotong University News Network, 2017). Students from Belt and Road countries enrolled in the institute study for two years at XJTU and two years at The Hong Kong Polytechnic University. On the basis of gaining an understanding of both the mainland and Hong Kong, they receive dual degrees from the two universities, thereby providing future talent support for Belt and Road development. Wen XJTU, Dean of the Faculty of Engineering at The Hong Kong Polytechnic University, also pointed out that the Silk Road Institute of Engineering is mutually beneficial to both Hong Kong and the mainland, as it enables more young people in Hong Kong to better understand mainland development and to see the development opportunities created by the Belt and Road Initiative.

In addition to dual-degree programs, the college has also carried out exchange-student and joint-training programs with many overseas universities through the University Alliance of the Silk Road, thus providing diversified international learning pathways. As noted above, it also offers five-day intensive short-term courses through the Special Training Program for Silk Road Engineering Science and Technology Development (Xi'an Jiaotong University, 2019).

2.2.3.4 Management and Operational Mechanisms of Joint Research Institutes

XJTU continuously explores ways to optimize the management and operational mechanisms of its Joint Research Institutes. As non-legal-entity R&D centers under enterprises, the institutes operate under a management committee co-led by both university and enterprise representatives, with a dean (core management team) responsible for daily operations and a technical committee composed of experts and

scientists from both sides. (National Energy Group & Xi'an Jiaotong University, 2024) Research institutes are established according to enterprise R&D needs, and both parties jointly construct basic research laboratories. The enterprise issues R&D projects to the institute, which, after expert review and approval, are publicly announced for open competition within the university and beyond under a 'challenge-based' selection system. Teams composed of scientists and engineers undertake these projects following organized R&D processes under institute supervision, while the co-established basic laboratories provide continuous support for fundamental research.(Guangming Online, 2024)The institutes conduct performance evaluations for each team, with newly generated intellectual property jointly shared by both parties, and researchers' benefits distributed through a 'research funding + performance bonus + intellectual property income' mechanism. For projects suitable for incubation, the core technology team may convert its achievements into equity, following an 'enterprise + venture capital' model to cultivate new growth drivers and foster new productive forces. (Shaanxi Science and Technology News, 2026)

2.2.3.5 Pathways for Technology Transfer and Practical Training Bases

XJTU has accelerated the transfer and commercialization of scientific and technological achievements. The university actively builds channels enabling enterprises and financial institutions to promptly access its latest technological outcomes, forming an integrated system by assembling teams of internal and external technology brokers. This mechanism rapidly delivers the newest laboratory research findings to industry and finance, guiding early-stage investment and ensuring that basic research outcomes enter the commercialization pipeline. According to the maturity of results, XJTU designs differentiated transformation pathways: for mature, high-quality patents, enterprises may directly adopt technologies via licensing or transfer; for results requiring further prototyping or iteration, transfer occurs through deep integration consortia; for projects demanding jointly built pilot environments, transformation is again advanced through such consortia. For projects involving venture-backed incubation of start-ups, university teams leverage enterprise-supported incubator platforms to address deficiencies in management, marketing, and financing, thereby enhancing incubation success rates. (Zheng, 2025, para. 2)

Overall, XJTU has attached great importance to building a systematic ecosystem for deepening university-industry integration. It strives to integrate global innovation resources, serve national strategic needs, align with regional industrial upgrading, attract diversified financial capital, foster an enabling innovation environment, and cultivate top-tier innovative talent. (Fang et al., 2025) Centered on the Innovation Harbor, XJTU has consolidated six key resources—policy support, leading enterprises, top universities, research institutes, regional platforms, and science-finance

integration—while developing three major innovation platforms: the Modern Industry Academy, the Future Technology Institute, and the Silk Road International Incubator. Simultaneously, by strengthening five dimensions—policy, finance, infrastructure, legal, and comprehensive services—and building two major platforms for technology achievement exchange and venture incubation, XJTU has driven innovation-led development across Western China, becoming a strong engine for regional high-quality growth. The university integrates education, science, and talent development, advancing university-industry and science-education integration to inject new momentum into national and regional strategies.

To date, XJTU has signed agreements with 227 leading enterprises (including 53 Fortune Global 500 and 70 China's Top 500 enterprises) to establish Joint Research Institutes (Centers), formed 85 deep integration innovation consortia, appointed nearly 1,000 enterprise mentors, and trained more than 2,000 engineering master's and doctoral students. The university has organized 71 professional technology brokerage teams, selected 1,400 easily transferable achievements from 30,000 research outputs for enterprise application, introduced over 200 seed and angel funds and 300 financial institutions, transferred or licensed more than 1,400 patents, and successfully incubated 214 enterprises, providing strong momentum for regional high-quality development. (Xi'an News Network, 2025)

It is worth noting that XJTU has established several specialized university-industry collaboration practice bases for talent cultivation. These include five 'Top Student Training Program 2.0' bases in fundamental disciplines, eight national teaching (talent cultivation) bases, eight National Undergraduate Off-Campus Practice Education Bases, nine National Experimental Teaching Demonstration Centers, three National Virtual Simulation Experimental Teaching Centers, six Shaanxi Provincial Undergraduate Off-Campus Practice Bases, and thirty Shaanxi Provincial Experimental Teaching Demonstration Centers. Among these, national teaching bases include the National Engineering Fundamentals Mathematics Teaching Base, National Engineering Fundamentals Electrical and Electronics Teaching Base, National Engineering Fundamentals Physics Teaching Base, National Integrated Circuit Talent Training Base, National Life Science and Technology Talent Training Base, National Undergraduate Cultural Quality Education Base, National Demonstration Software College, and National Basic Science Research and Teaching Talent Training Base.

The National Undergraduate Off-Campus Practice Education Bases serve as vital platforms for deepening university-industry integration and promoting collaborative education. They include joint practice centers established between XJTU and leading enterprises such as Shaanxi Qinchuan Machinery Development Co., Ltd., Shaanxi Heavy Duty Automobile Co., Ltd., Dongfang Electric Corporation, and Lanzhou LS

Group Co., Ltd. Focusing on strategic industries like advanced manufacturing and energy equipment, these centers offer students hands-on engineering experience, fostering the deep integration of theory and practice and cultivating highly qualified engineering and technical professionals suited to modern industry development.

In the medical field, XJTU's Clinical Skills Comprehensive Training Center and Dental Clinical Skills Training Center focus on enhancing medical students' practical competence through simulated instruction combined with real clinical cases, strengthening their professional abilities and ethical standards to supply high-quality healthcare talent.

In law, XJTU has established the Applied and Interdisciplinary Legal Talent Education and Training Base and the International Legal Talent Training Base, which integrate university-enterprise cooperation, practical mentorship, and case-based teaching to cultivate legal professionals with both expertise and international vision, supporting China's rule of law construction and the Belt and Road Initiative.

The construction of these practice bases reflects XJTU's precise alignment of its disciplinary layout with national strategies and industrial demands and demonstrates its innovative exploration of university-industry integration models. Through deep cooperation with leading enterprises, XJTU has built an integrated 'teaching–practice–innovation' educational system that connects the education, talent, industry, and innovation chains, providing solid intellectual and talent support for national economic and social development. Meanwhile, these bases serve as bridges for collaborative innovation between universities and enterprises, promoting technology transfer and industrial upgrading, and fostering a virtuous cycle of mutual empowerment and shared progress between education and industry.

2.2.4 Reforming the Talent Recruitment System by Implementing 4 Types of University-Enterprise Joint Appointment Models

Xi'an Jiaotong University has established a university-enterprise joint talent appointment system through four appointment models: the "joint appointment model," the "overlay model," the "secondment model," and the "part-time appointment model." These differentiated appointment models target different types of talents, with the aim of enabling full mobility of talents between universities and enterprises.

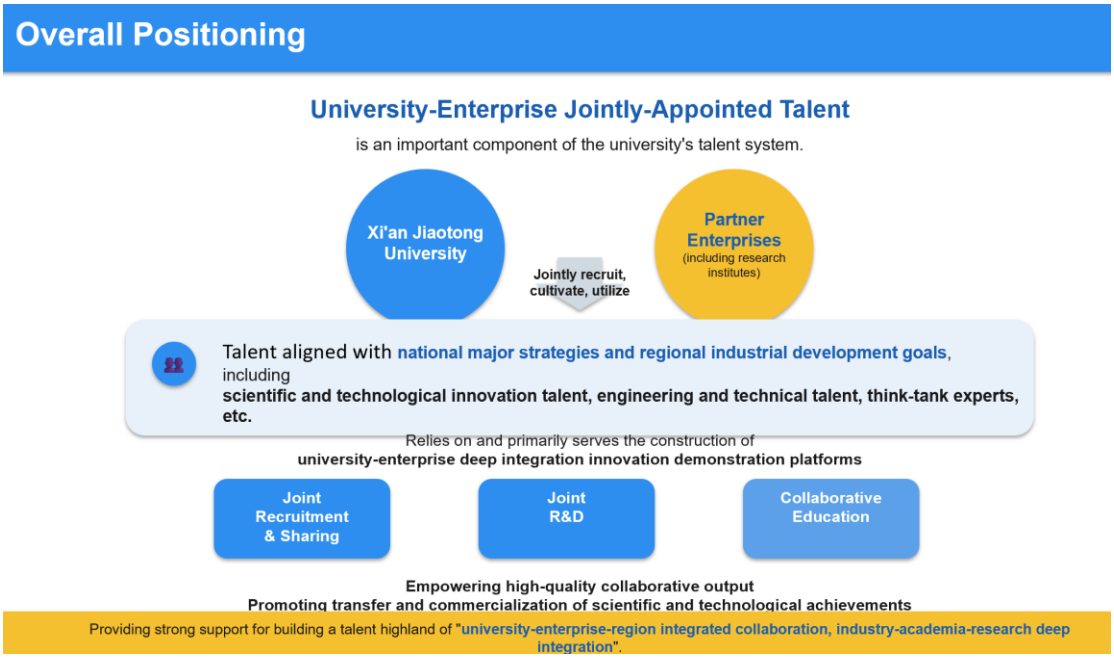

Figure 2.2-7

Overall Positioning of University-Enterprise Joint Recruitment

Source

https://news.xjtu.edu.cn/info/1033/220981.htm

Joint Appointment Model[①]**:** This model refers to "university recruitment, enterprise funding, and collaborative utilization." Its core mechanism is that the university is responsible for talent recruitment, while the enterprise bears the salary cost. The appointed talent works full-time for the enterprise or a jointly established platform. This is a typical example of "university recruitment for enterprise use." It establishes two types of positions: university-enterprise jointly appointed young top-notch talents and postdoctoral fellows.

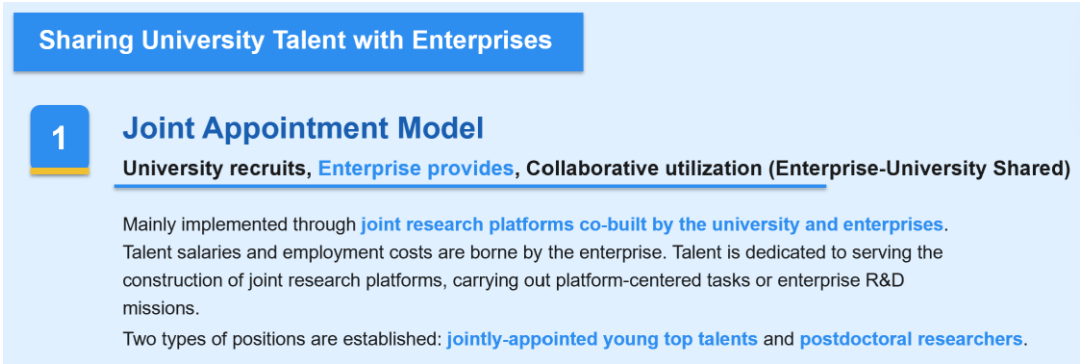

Figure 2.2-8: Sharing University Talent with Enterprises

① Xi'an Jiaotong University News. (2025, April 22). *图解《西安交通大学校企联聘人才队伍建设举措》* [Infographic: "Measures for Building a University-Enterprise Jointly Hired Talent Team at Xi'an Jiaotong University"]. http://news.xjtu.edu.cn/info/1033/220981.htm

Stacking Model: This model primarily targets university talents holding associate professor or higher professional and technical positions. Under this model, the university recruits and the enterprise funds. The talent retains their position at the university while taking on additional responsibilities for enterprise technology development and receives stacked compensation. This enables "dual-career development." Enterprises may also name their collaborative talent programs or positions after the appointed talent.

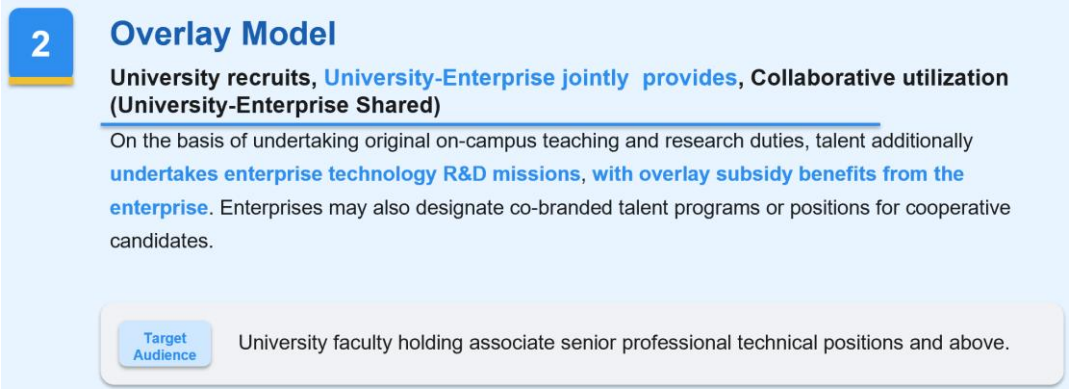

Figure 2.2-9: Overlay Model

Secondment Model: This model also mainly targets university talents with associate professor or higher professional and technical positions and those in long-term appointments. It refers to the secondment of on-campus talents to frontline production and practice positions in leading enterprises or major research institutes aligned with their disciplines, based on the requirements of the enterprise and the relevant academic department. The duration of secondment is determined according to enterprise needs or project R&D cycles.

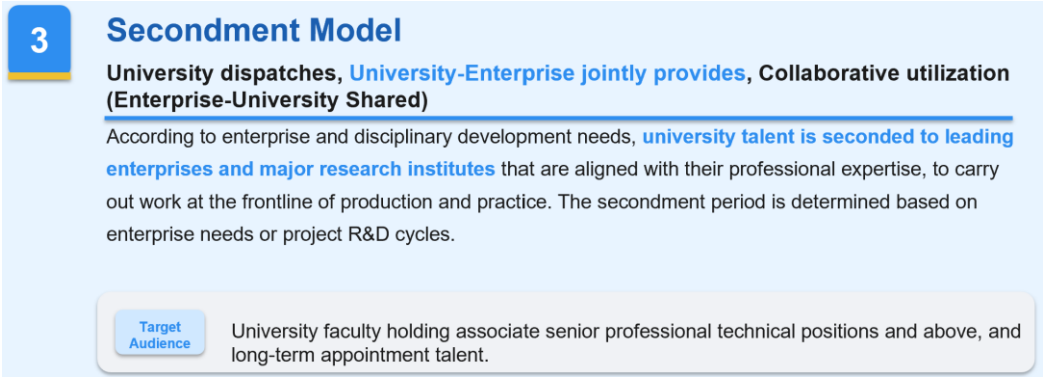

Figure 2.2-10: Secondment Model

Part-time appointment Model: This model targets high-level talents. It refers to enterprises independently recruiting talents. Those selected as Changjiang Scholars under the university-enterprise joint appointment are appointed as "leading scholars" at the university. Others are appointed to positions such as chair professors or part-time faculty, aligned with specific university position requirements. They undertake joint

project research, talent cultivation, and faculty recruitment and development tasks. In short, enterprises independently recruit talents and then flexibly appoint them to part-time positions at the university.

Figure 2.2-11: Part-time Appointment Model

By the end of 2025, the number of enterprise mentors engaged under this system had increased from 667 in 2023 to 1,091. (Xi'an Daily, 2025) More than 400 "university-enterprise shared talents" have been fostered, and a large number of engineering master's and doctoral students have been cultivated. This enterprise-serving innovation model has been recognized as one of "China's Top Ten Good Cases of Industry-University-Research Collaboration."

The key of the appointment models is the student. Through the "university recruitment, enterprise funding, government support, collaborative use, and multi-party win-win" model of "university recruitment for shared use," the system achieves a seamless connection between talent cultivation and industry demand. It also helps enterprises introduce urgently needed high-end talents, ultimately forming a closed-loop ecosystem characterized by "demand-driven, platform-supported, collaborative research, and achievement transformation." More than 260 "university-recruited, shared-use" talents at Xi'an Jiaotong University are currently playing leading roles in key positions at multiple domestic enterprises in deep collaboration and in jointly established university-enterprise research platforms.

Through these four appointment models, a "dual-mentor + dual-platform" cultivation model has been realized. In 2020, in response to the demand for 5G talent, Xi'an Jiaotong University and ZTE Corporation jointly established the "5G Wireless Communication Elite Class," cultivating talents with a "demand-oriented" approach. (Guangming Daily, 2025) Enterprise mentors conduct technical seminars and explain knowledge application through engineering case studies, while on-campus mentors focus on constructing theoretical frameworks. (China Education Daily, 2025) The

“Elite Class” primarily recruits cross-disciplinary undergraduate students in their early years. Enterprise experts participate in curriculum design, breaking down job competencies into modules such as wireless communication protocols and network optimization, complemented by practical courses. By 2025, three cohorts of the “Elite Class” have cultivated 121 students who understand industry development trends, master key communication technologies, and possess problem-solving abilities. (China Youth Daily, 2025)

The appointment models not only optimize the university’s faculty and strengthen enterprise research capabilities but also have a significant impact on the talent cultivation process. They deepen communication between enterprises and universities and facilitate the full flow of talent, enabling university-industry integration to directly influence student development. Through enterprise mentors, students gain direct exposure to real-world technological challenges faced by enterprises, helping them integrate quickly into their jobs after employment and providing comprehensive support for their development.

2.2.5 Summary of Xi’an Jiaotong University’s UII Model

Xi'an Jiaotong University (XJTU), presents a different paradigm from DUGT, with its core essence being “an open innovation ecosystem that places enterprises at the center and breaks down institutional walls.” Leveraging the China Western Sci-Tech Innovation Harbour, XJTU has implemented its “6352” initiative and “1121” model, aiming to build an open innovation hub that synergizes government, industry, academia, research, users, and finance. The defining feature is the transformation of enterprises from mere “clients” into genuine “innovation partners.” This partnership is operationalized primarily through joint research, which XJTU regards as the very engine of its entire UII machinery, not a supplementary activity, but the primary vehicle through which theoretical knowledge meets industrial urgency.

Through co-established joint research institutes and a large number of innovation-driven joint research teams and consortia, XJTU has developed collaborative mechanisms featuring “dual management, dual chief scientists” and an “open-bidding-for-leadership” approach to tackle critical national bottlenecks. Unlike conventional contract-based research that terminates upon project delivery, XJTU's joint research model emphasizes long-term strategic partnerships, often formalized through long-term framework agreements, that allow for sustained exploration of foundational and next-generation technologies. Within these co-located laboratories, corporate R&D engineers and university faculty operate side by side, sharing not only physical infrastructure but also data streams, experimental protocols, and patent strategies. The

“dual-chief-scientist” system ensures that scientific rigor and commercial viability are balanced from the outset, while the open-bidding mechanism infuses constructive contestation into the collaborative process by inviting multiple teams to compete in solving industry-defined challenges. Crucially, XJTU views joint research as a talent incubation pipeline as well: postgraduate and doctoral students are embedded in these joint projects from their first year, conducting dissertation research that addresses real-world problems under co-supervision by academic advisors and industry mentors, with outcomes—patents, prototypes, standards, or spin-offs, jointly owned and commercialized through clear revenue-sharing protocols. On talent flow, XJTU has pioneered a “joint recruitment and shared employment” model, where recruited PhDs hold concurrent positions at the university and core R&D roles in enterprises further breaking down institutional barriers to talent mobility. Complementing these efforts, the university has built a large team of technology brokers and a nationwide network of innovation bases, serving as bridges that connect the “ivory tower” to the “marketplace,” enabling the systematic, scaled, and localized commercialization of research outcomes. In XJTU's philosophy, joint research thus transcends traditional boundaries of university-industry interaction; it becomes a symbiotic knowledge-production ecosystem where academic curiosity and industrial pragmatism constantly challenge, enrich, and refine each other, ultimately producing not just market-ready technologies but also a new generation of researchers equally fluent in the languages of science and commerce.

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