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University-industry integration policies and practices in China: exploring policy documents and literature

First draft
(2025.06)

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Introduction

This document presents university–industry cooperation (UIC) in China with a special focus on education and skills development. It has been prepared within the framework of the research project *"University–Industry Integration Policies and Practices in China – Potential Applications in Hungary"* supported by the Hungarian government. This project is implemented by Wekerle Business School (Budapest) in collaboration with the Learning Institute of Mathias Corvinus Collegium. As its title suggests, the project has a dual aim: to examine China's experience in building strong links between universities and industry, and to explore how these insights might inform the development of higher education in Hungary (for more information, see "*Annex 1 - Short project* description").[1]

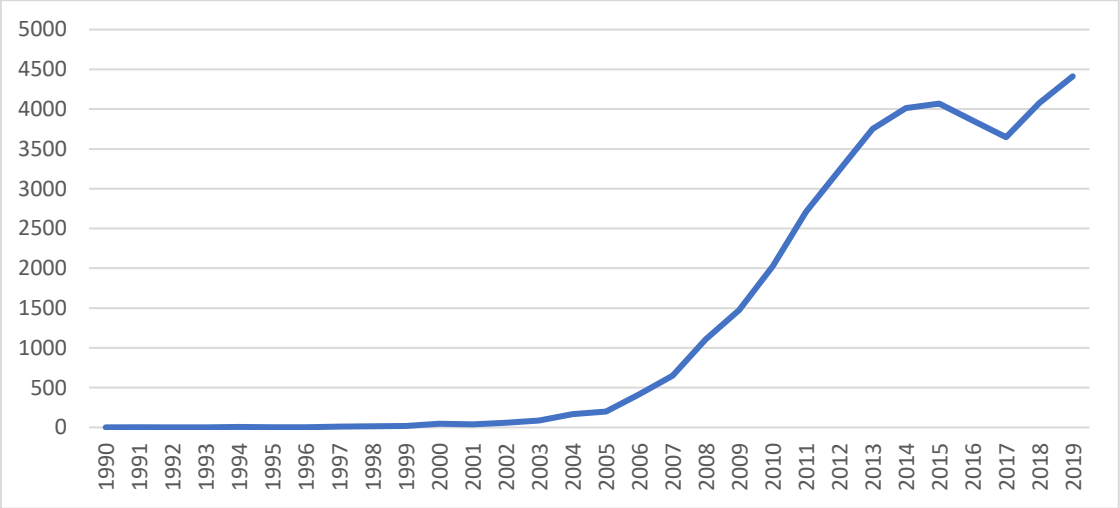
Over the past decade, China has developed an advanced form of university–industry collaboration that goes beyond simple cooperation or partnership. This new model seeks to promote the deep integration of the two sectors of education and industry. Despite its significance, China's policies and practices of university-industry integration (UII) have received relatively little attention outside the country. Yet, these developments may signal the emergence of a radically new paradigm for organizing teaching and learning in higher education, and therefore warrant systematic analysis. The research project "*University–Industry Integration Policies and Practices in China – Potential Applications in Hungary*" seeks to conduct such an analysis, with the aim of exploring what Hungary (and more broadly Europe) can learn from the Chinese experiences.

There is abundant literature about UII policies and practices within China. According to a related literature review about university-enterprise-cooperation research in China, published in 2020, the number of articles (including non-academic publications) written by Chinese authors between 1990 and 2019 rose from 1 to 4412 (see *Figure 1*). The number of articles and academic publications has certainly rose at a much higher level after 2019, due to the fact that the government policy on UII was adopted two years before this date (in 2017), which was accompanied not only by increasing academic interest for this theme but also by significant investment into related knowledge production at both national and local level. A good

[1] This document and literature review is one of the planned deliverables of the project (CVP-KÓD :73000000-2)

illustration of this increased interest is that since 2019 even a specialised journal devoted entirely to the theme of UII was created.[2]

Figure 1.
The number articles on university-enterprise-cooperation in the Chinese academic database (CNKI)) between 2010 and 2019



Source: Zhang et al.. (2020)

The authors of the literature review containing the data used for designing *Figure 1* highlighted that research on university-industry cooperation became a "hot topic" in the 2000s when the Chinese government started promoting this, and this became particularly strong in the second half of the 2010 when several concrete policy measures were made in this area. Following this "many universities and educators in China have actively utilized the high-quality resources of the companies to improve the quality of learning environment, through which the learning outcome and general quality of the graduates have been improved" (Zhang et al., 2020) and many university teachers/researcher academics involved in such activities shared their experiences in various ways. This resulted in a very high number of related publication both within China and abroad, making almost impossible to make a comprehensive review of existing literature.

Purpose, scope, methods and earlier reviews

The purpose of this document is to offer a comprehensive overview of China's university–industry integration (UII) policies and practices for readers who may be unfamiliar with the topic – particularly Hungarian and European stakeholders. This is not a traditional academic literature review intended to summarize or synthesize previous research. Rather, we have used the literature primarily as a source of information to support our presentation of the overall UII landscape in China.[3] This review of policy documents and academic literature is by no means exhaustive. It represents an initial phase of our ongoing analysis, which we intend to deepen

[2] See the website of the „Research on the integration of industry and education" here: https://www.cqvip.com/journal/2186013/2186013

[3] It might be worth noting that systematic literature reviews can currently be easily prepared using AI. As an additional element of this document (also to illustrate the AI supported way of creating literature reviews) we provide one example in the annexes (see "*Annex 4 - An AI generated literature systematic literature review*")

and expand throughout the duration of the project. In this sense, while the document is formally complete, we consider it an evolving and unfinished review.

As mentioned this document is focusing on university-industry cooperation (UIC) that aims at *improving education and skills development*. The larger part of UIC related literature, both worldwide and in China, is focusing *not* on education but on research and innovation (Ankrah & Al-Tabbaa, 2015; Zhuang & Shi, 2022). This kind of literature puts typically valorisation or commercialization into the centre of analysis. Education oriented UIC (such as joint curriculum design and delivery, lifelong learning initiatives, student internship mobility programs or other forms of industry involvement in the teaching activities of higher education) is often neglected or overlooked in the literature (Plewa et al., 2015; Rossano et al., 2016; Galán Muros & Plewa, 2016; Orazbayeva et al., 2020), strongly influenced by the Triple Helix theory which emphasizes collaboration between universities, industry and governments aimed at promoting industrial innovation (Etzkowitz, 2008; Borah et al., 2021; 2023).

The preparation of this document has been supported by earlier literature analyses prepared by the authors for various publications and for the doctoral research of one of the authors. It is important to stress that in this review not only academic literature has been used as sources but also *policy documents* and original *official texts* explaining the content of these policy documents (see especially in the section entitled "*Key policy orientations and related policy documents*"). We have been intensively using AI to identify the relevant documents and also to gain a deeper understanding of their content.

This document is naturally not the first literature review about China's UII policies and practices. We have already mentioned the one published by Zhang and his colleagues (Zhang et al., 2020). A valuable literature review has been published Bao & Lkhagva (2024) who also presented time series of statistics of relevant publications. As they write:

> "Chinese scholars' research on school-enterprise cooperative education over the past 25 years has mainly focused on the following areas: school-enterprise cooperation modes and school-enterprise talent cultivation modes; school-enterprise cooperative practical teaching systems and collaborative innovation; integration of industry and education, collaborative education, and new engineering disciplines."

Based on their literature review, these authors observed that "school-enterprise joint training has become an important trend" in China. They noted that universities and enterprises have been exploring new forms of collaboration in student education through joint curriculum development, the establishment of shared laboratories, and cooperative research initiatives. As they stressed, these efforts have fostered deeper integration between educational institutions and industry in the areas of talent cultivation, scientific research, and technological innovation. Drawing on the publications analysed, the authors identified five key thematic areas (see *Table 1*).

Table 1
Institutional mechanisms used to promote UII

Subject	Main viewpoints	author
On the Innovation of Cooperation Models between Universities and Enterprises in China	To innovate the mode of school-enterprise cooperation based on the existing foundation, it is necessary to follow certain principles, establish new concepts of school-enterprise cooperation, establish a resource exchange centered on the government, universities, and enterprises from a macro perspective, and explore as flexible and diverse a mode of school-enterprise cooperation as possible from a micro perspective. Scholars propose ten suggestions for innovating school-enterprise cooperation models based on the current situation in China.	Jiang Dan (2007)
Interactive talent cultivation model between higher education institutions and enterprises	The talent demand model of Chinese enterprises has undergone significant changes, and under the traditional model, higher education institutions still mainly rely on internal evaluation standards as the standard for talent cultivation. However, the two cannot be directly connected. Researchers have addressed the above issues by constructing an interactive talent training model between higher education institutions and enterprises, which is based on three mechanisms: talent supply and demand information exchange, human resource flow, and talent evaluation.	Tan Dan (2010)
Goal oriented talent cultivation model	The achievement of talent cultivation goals in higher education relies on a scientific talent cultivation model. The 'goal-oriented' model comprises an innovative curriculum system based on 'enterprise expert development', an innovative experimental environment mirroring real enterprise scenarios, an innovative operational mechanism to foster a 'dual teacher' team, and an innovative talent training approach with the aim of cultivating applied innovative talents.	Fan Baoxue (2010)
The school enterprise cooperation model in the entrepreneurial practice of college students	School-enterprise cooperation is an entrepreneurial practice that allows college students to fully utilize their knowledge based on their major. It addresses the two major issues of college students' lack of practical experience and lack of funds. At the same time, it links college student entrepreneurship with local characteristics, local economic construction, and enterprise development, achieving a win-win situation for the local community, enterprises, and college students.	Sun Xiuli (2011)
The "3+1" talent training model of school enterprise cooperation	The current situation of cooperative education between universities and enterprises is clarified using questionnaire survey research methods, with university teachers and students as the research subjects. This paper demonstrates the indicator system of the survey questionnaire for university teachers in school-enterprise cooperation. Based on the data collected from the questionnaire survey, quantitative analysis is conducted from multiple perspectives, such as cooperation awareness, attitude, behavior participation, interaction, and satisfaction. The existing problems in the process of school-enterprise cooperation are deeply explored, providing a scientific basis for the formation of a long-term teaching management mechanism for further school-enterprise cooperation.	Song Zuozhong ; Liu Xingli ; Guan Fengyan (2013)

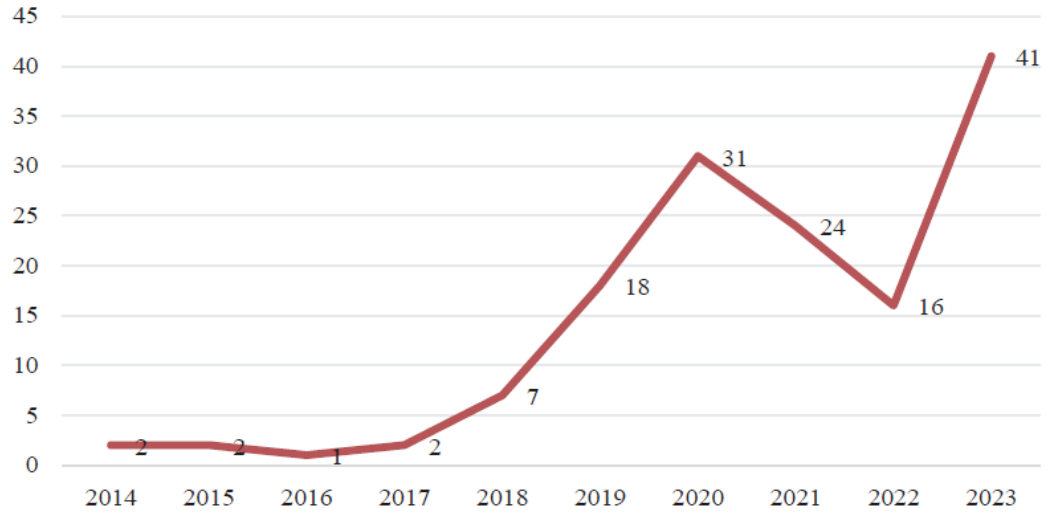
Source: Bao & Lkhagva (2024)

A recent literature review conducted by two Malaysian researchers, Xin and Ahmad (2024), based on sources from CNKI (China National Knowledge Infrastructure) and Google Scholar, examined the historical development, core components, objectives, benefits, challenges, and outcomes of UIC in China, with particular emphasis on the interaction between teaching and industry practice. Drawing on the reviewed literature, the authors emphasized that, in a constantly changing environment, the successful implementation of UIC projects demands adaptability. Both universities and enterprises, they argue, *"must keep in mind that there may be a need to change their plans and strategies to face different challenges and seize any opportunities that arise."* They stressed that only by allowing for adaptability and flexibility can such projects *"produce positive outcomes even in the face of unexpected external changes."* The authors concluded that UIC in China *"is not just a form of collaboration,"* but rather *"a continually evolving world."*

Most of the relevant literature, including earlier literature reviews, has been focusing on university-industry cooperation rather from the perspective of research and innovation oriented collaboration than from the perspective of education, training or skills development. One example is the systematic literature review by Liu at al., (2024) which analysed earlier publications (between 1994 and 2022) on university-industry collaboration for knowledge transfer and industrial innovation using search keywords such as "university technology transfer", „university spin off', „university run enterprise" „science park" and „triple helix". Using these keywords combinations these authors found 3218 publications, choosing 562 as clearly relevant and 248 as possibly relevant.

There are also several literature reviews published by Chinese authors in Chinese language. A very recent one (Guo & Zhang, 2025) is focusing on one specific area: research on sectoral industry-education integration communities, which is – as we will see later – one specific advanced forms of UII. According to these authors the number of academic publication about this specific form of UII sharply increased following the adoption of the key policy document by the Chinese government in 2017 (see more about this later in the section "*Key policy orientations and related policy documents*"), especially after UII became a key element of China's national vocational education policy in 2022 (see *Figure 2*).

Figure 2.
The number of academic publication on industry-education integration communities (2014-2023)



Source: Guo & Zhang (2025)

These authors presented this specific form of UII as a new development stage in the evolution of China's UII policy (see more about this in the section "*History and evolution of UII*"), not only though combining the territorial approach with the sectoral approach but also through strengthening the vertical integration of the education and training system (connecting secondary and higher education institutions) and through bringing in new powerful and influential stakeholders (sectoral professional and economic entities).

A more comprehensive list of relevant publication for possible further studies (beyond the list of references of this document) is provided in the annexes (see "*Annex 3 - Selected publications and documents*").

Key themes

Terminology

Understanding China's UII policies and practices requires reflection about some key related concepts. We provide a comprehensive list of key concepts generated by AI in the annexes (see "*Annex 2 - Key terms (glossary)*") but a few of them deserve some elaboration in the context of this document and literature review. Some of the relevant terms are summarized as follows:

产学研合作(chǎn-xué-yán hézu) Industry–Academia–Research Cooperation
Broader umbrella concept, often used in R&D contexts

校企合作 (xiào qǐ hézuò) (School-enterprise cooperation)

Focusing on the interaction of micro level actors

产教融合 (chǎn jiào rónghé) (Industry-education integration)

产学融合 (chǎn xué róng hé) (Industry-university integration)

These are the most important terms, both meaning "Industry-education integration" but while the first is broader the second typically is used in a higher education context

岗课赛证 (gǎng kè sài zhèng) (Job, curriculum, performance and qualification)

This concept means the integration of (1) job skills requirements, (2) curriculum and study programs, (3) the recognition of acquired competence through competitions, and (4) their recognition in certifications. into a cohesive teaching and training system.

岗(gǎng) job (job-related skills)

课 (kè) curriculum (competence-based curricula)

赛 (sài) competition (proven performance through competitions)

证 (zhèng) qualification (recognized credentials)

四链融合 (sì liàn róng hé) (Four-chain fusion)

This concept can be described as the Chinese version of the European knowledge triangle concept. It is integrating (1) education content, (2) skills supply, (3) industry's skills needs and (4) research/innovation processes in a holistic approach to education and industry collaboration

教育链 (jiàoyù liàn) (education chain) – the system of education and training

人才链 (réncái liàn) (talent chain) – the development and flow of skilled human capital

产业链 (chǎnyè liàn) (industry chain) – industrial production, value chains

创新链 (chuàngxīn liàn) (innovation chain) – research, development, and technology innovation

产教融合共同体 (chǎn jiào rónghé gòngtóngtǐ) - Industry-education integration community

This concept refers to sector specific alliances that integrate education, industry, and government resources to align talent training with industrial needs

Understanding the meaning of most of the relevant terms requires special analytical attention from western readers as translations often distort their original meaning, or their meaning is not the same in the Chinese context than in the West. One prominent example is the very often used term of "talent development" which appears in most of the original Chinese texts as "人才发展" – rén cái fā zhǎn). It is important to note that the word "人才" can also be translated as "human capital" which has a very different connotation than "talent". This is the reason why in many cases in this text we also provide the original Chinese terms together with their pinyin transcription.

History and evolution of UII

Connecting education with labour or industry has a rather long history in China. The idea of integrating education and real life practice goes back to ancient times (Di & McEwan, 2016; Ye, 2020) but this became dominant trend following the establishment of the People's Republic of China (PRC) in 1949, inspired by Marxism and the Soviet model of connecting education and productive labour. Emphasising the roots in ancient times is important because without this one cannot understand well why in China the implementation of UII has been remarkably successful. Policy design, popularisation and implementation probably would have been much less effective if the foundations of the idea and practice of "deep integration" was merely imported from outside and did not have endogenous social and cultural roots

The Soviet educational model, adopted in China in the 1950s, endorsed the idea and practice of merging of academic learning with practical labour (we shall come back to this in the section "*The broader policy of combining education and labour*"). This has been encapsulated in the various forms of the expression "the factory in the school and the school in the factory" (Molnar & Koen, 2015; The General Office…, 2022). This idea took an extreme form during the Maoist era, especially in the Cultural Revolution, when the divide between academic institutions and production units was deliberately dismantled, leading to a total disruption of universities as independent social institutions accompanied by the practice of the sending of academics and students to rural areas to do manual work.

The integration of education and industry in China typically took shape between the 1950s and mid-1990s, within the Chinese institution of Dānwèi (單位), translated into English as "Work Unit". Many Dānwèis were large state-owned companies that functioned not only as production units but also provided all kinds of social care services to their employees, such as food, medical care and education, including schools which were organisationally integrated with the company (Lü & Perry, 1997). Universities also operated as Danwei, as they often established factories or other kinds of production units which were organisationally integrated with the university. While in the nineties factory schools were separated from their founding company and put mostly under the supervision of local and provincial governments, the status of companies created by universities could remain unchanged. The institution of Xiàobàn qǐyè (校办企业), translated into English as "university-run enterprises", has been a special feature of Chinese higher education also after the restoration of the traditional university sector following the policy of opening up, and these enterprises have often been established by leading research universities (Han, 2013; Li & Tan, 2020).

In the recent history of education-industry integration different periods can be distinguished (Nan, 2019; Ouyang, 2020; Huang and Halasz, 2024; Zhao et al., 2024). There are several temporal typologies to capture the evolution of UII in China: for example Nan (2019) describes a three-stage model (early integration, separation, and new integration), while Ouyang (2020) extends this into four stages (integration, separation, cooperation, and reintegration). Both models emphasize a cyclical movement, where ideological or political imperatives initially pushed for integration, followed by a period of separation and institutional restoration, and finally a renewed push for integration informed by global innovation discourse, such as the Triple Helix and Knowledge Triangle frameworks. During the separation period the traditional education/research function of universities was restored, meaning also detachment from industry. However, the emergence of modern innovation and research policies, inspired, among others, by the ideas of Triple Helix and knowledge transfer, resulted in efforts to strengthen cooperation with industry which in the last decade led to the rebirth of the move towards (deep)

integration. This stage can be connected to emergence of the idea of innovation-driven and skills-driven economic policy in the 2010s and the related revision of the technical-vocational policy of the country (State Council, 2014; Outline…, 2016), and it took its current form in the decision of the Chinese State Council in 2017 on "deepening the integration of industry and education" (State Council, 2017).

The differences between the earlier forms of integration and the current trend of "deep integration" are significant. While early integration was driven largely by political ideology and basic material needs, contemporary UIC strategies are shaped by the logic of innovation, economic modernization, and the global knowledge economy. Today, the objective is not merely to align education with labour but to create ecosystems for knowledge transfer, industrial upgrading, and educational reform. Integration is now leveraged as a mechanism for technological diffusion, curriculum modernization, and the development of new professional standards.

In summary, following the periodisation presented by different authors the integration of labour and education in post 1949 China could be presented as going through four developmental stages: (1) early integration in a rather backward industrial environment, (2) separation or detachment and the restoration of traditions educational structures, (3) cooperation promoted by innovation policies and (4) advanced, deep integration becoming a mainstream element of state education and training policies in a highly developed technological industrial environment. These successive stages show how the Chinese approach to UIC has evolved from ideologically motivated structural fusion to a more strategic, innovation-driven model of deep integration. This transformation highlights not only the adaptability of Chinese educational policy but also the central role of the state in orchestrating a complex inter-sectoral partnership system to serve national development goals.

Zooming on the fourth development stage (advanced, deep integration becoming a mainstream element of state education and training policies in a highly developed technological industrial environment) it is possible to distinguish further stages from the perspective of growing policy elaboration and the deepening of theorization: following Li's analysis (2025b) three developmental periods can be identified:

1. In the first period (2013–2016) the strategic importance of deepening industry-education integration and university–enterprise cooperation was affirmed by high level political leaders in the broader context of educational reform and in the specific context of modernising vocational education. A key element of this was the intention to align educational resources better with industrial demand.
2. In the second period (2017–2021) institutional consolidation was in the focus with a series of key policy documents being issued, such as the Opinions on Deepening Industry-Education Integration by the General Office of the State Council, the Implementation Plan for the Reform of Vocational Education, and the Pilot Implementation Plan for the Construction of Industry-Education Integration). These policy documents promoted, among others the development of pilot cities, the recognition of integration-oriented enterprises, fiscal incentives, and creating platform (for a more details presentation of the key institutional mechanisms see *Table 3*).
3. In the third period (from 2022) the process entered the phase of legal codification and strategic upgrading, including the revision of the Vocational Education Law which explicitly incorporated the concept of "industry-education integration" in legal texts affirming the key role of enterprises, and established legal frameworks for co-

governance (involving government agencies, industry, enterprises, and universities). Strategic upgrading can be seen in the Opinions on Deepening the Reform of the Modern Vocational Education System which proposed both the establishment of provincial-level industry-education integration alliances and sectoral integration communities.

Key policy orientations and related policy documents

When analysing key policy orientations and related policy documents it is worth making a distinction between those that are directly promoting the integration of education and industry and those which are indirectly connected with the UII but can be described as part of the complex "UII policy ecosystem".

Designing and implementing the UII policy

Although China's current UII policy has took form as a longer, gradual process started in the early 2010s it has been presented as a coherent framework in 2017 in the policy document No. 95 of the State Council of China entitled "Some opinions on deepening the integration of industry and education" (State Council, 2017). This policy document laid out a strategic framework for deepening the integration of industry and education to better align educational development with the nation's industrial transformation and economic upgrading.

The "Opinions", emphasizing the need to build a high-quality "talent supply system" responding to rapidly changing industrial needs and to innovation-driven development goals, called for a thorough restructuring education through embedding enterprises more deeply into skills development at all levels of the education system. It encouraged enterprises (especially large, innovative ones) to establish and operate training institutions and collaborate with universities, especially through building "modern industrial colleges" (see more about this in the section "*The vocational education* policy"). The "Opinions" suggested the creation of a number of new institutional mechanisms. It introduced the concept of recognizing "industry–education integration-oriented enterprises" giving preferential treatment to them in land use, funding, taxation, and education programs. It encouraged local governments to create pilot cities for integration, form industry-specific cooperation alliances, and guide higher education institutions to reform disciplinary structures in accordance with industrial demands, especially in sectors applying the most advanced technologies.

Following the adoption of the 2017 "Opinions" the Chinese government released several supporting policy documents to operationalize and implement the UII strategy and to translate the general vision into actual, working institutional mechanisms. One of the first such documents was the "Measures for the Construction and Cultivation of Industry-Education Integration Enterprises" issued by the National Development and Reform Commission and MoE (NDRC – MoE (2019). This document defined what counts as a "UII-oriented enterprise" (产教融合型企业 - *chǎn jiào rónghé xíng qǐyè*) and established criteria for such enterprises to be recognized and incentivized. This made it possible make companies become the main actors and engines of UII building. As a related interpretative document explained "according to the Measures, enterprises listed in the official directory of industry-education integration-oriented enterprises will receive a combined package of incentives encompassing finance, fiscal support, land use, and credit, along with the application of relevant tax policies." (MoE, 2019a)

The second key policy document directly supporting implementation, issued in cooperation by several key government agencies[4] was the National Implementation Plan for Pilot Construction of Industry-Education Integration (NDRC (2019), giving "full play to the supporting role of cities, the aggregating function of industries, and the central role of enterprises.". This policy document launched the process of creating local, city level alliances between universities and companies under the supervision of coordinating provincial and municipal governments. This created a decentralised, localised institutional mechanism supported by various incentives and leading to a high diversity of innovative local solutions through development planning, resource allocation and effective coordination, „advancing reforms in talent cultivation, reducing institutional transaction costs, innovating the construction of major platform carriers, and exploring reforms in systems and mechanisms."

A third key document supporting the implementation of the "Opinions" that is worth mentioning here was the Guidelines about "Modern Industrial Colleges" (MIC) (MoE (2020a). These institutions, created and run together by companies and universities, typically within existing university campuses, are advanced institutional solutions to promote UII, co-managed by academic and industrial stakeholders. They aim to develop application-oriented, interdisciplinary, and innovative form or teaching, aligned with industrial needs, promoting deeper industry–higher education integration. The Guidelines defined seven core development tasks to build a Modern Industrial College:

Box 1
Core institutional and activity forms of Modern Industrial Colleges:

1. *Innovative Talent Cultivation Models* integrate teaching and production deeply by aligning curricula with industry standards, updating courses based on technological developments, and adopting multi-stakeholder collaboration (colleges, industries, enterprises).
2. *Enhanced Quality of Academic Programs* focus on nationally and regionally prioritized disciplines, especially the "New Fours" (engineering, agriculture, medicine, liberal arts), restructure majors, and promote clustered professional development.
3. *Industry-Co-developed Curricula* Encourage enterprises to co-design curriculum, courses, teaching materials, and case studies, updating content to reflect industrial innovation and standards.
4. *Practice and Internship Platforms* create shared, high-functioning environments for internship and training, based on real industrial workflows and involving multiple partners in development.
5. *High-Level, Dual-Qualified Faculty Teams* facilitate personnel mobility between industry and academia, encourage industry professionals to teach, establish joint professorships, and train faculty in dual roles (teaching and practice)
6. *Industry–University–Research Service Platforms* support the creation of joint labs and R&D centres for collaborative research, technology transfer, and incubation of innovations.
7. *Governance and Institutional Platforms* establish coordinated management structures (councils, boards) involving universities, government, industry associations, and enterprises, clarifying authority over personnel, operations, and finances to ensure efficient operation

[4] National Development and Reform Commission (NDRC), Ministry of Education (MOE), Ministry of Industry and Information Technology (MIIT), Ministry of Finance (MOF), Ministry of Human Resources and Social Security (MOHRSS), and State-owned Assets Supervision and Administration Commission (SASAC)

A key feature of China's UII policy is the combination of regional and sectors measures. While the construction of city level industry-education integration alliances has been promoting territorial level coordination and development platforms, the sectoral initiatives are leading to the development of UII institutional mechanisms in whole industrial domains. Sectoral integration communities are cross-regional, sector-wide partnerships initiated/coordinated by a leading enterprise in partnership with several educational institutions (including both universities and secondary level vocational schools) and with industry associations, research institutes, and enterprises. These platforms not only integrate industrial and educational processes across a whole sector but also link lower (secondary) and higher (university) level education. One outstanding example has been is the creation of a community of integration of industry and education in the national rail transit equipment industrial sector (MoE, 2023).[5]

Several actions and related policy documents have been designed not explicitly as UII actions and policies but were conceived as part of the broader higher education and vocational education policy. A key element of the strategy of higher education development in China is the "Double First-Class" (双一流 - *shuāng yīliú*) initiative (see more about this in the section "*The higher education policy environment*"). As we shall see, this has become a flagship of higher education reform, aimed at positioning Chinese universities and disciplines at the global frontier. It was launched in 2015 and updated with implementation elements in 2017 (see State Council, 2015; MoE, 2017). Although this initiative has primarily been focusing on academic prestige and international rankings, it has also played a strategic role in supporting the UII agenda. Both key documents explicitly promoted deep industry-education integration, promoting discipline based industry linkages not only for research and commercialization purposes but also for enhanced talent development. This line of action was strengthened further by the extension of the "double logic" a few years later to higher technical vocational education when MoE announced another initiative, the "Double High Plan" (双高计划 - *shuāng gāo jìhuà*) (MoE 2019b). This second initiative will be presented in more detail below in the section "*The vocational education policy environment*".

The broader UII policy ecosystem

Beyond the key policy actions/document presented in details in the previous section there have been many other actions and related key policy documents supporting the development, adjustments and implementation of the UII policy. The UII phenomenon has been developing as part of a broader policy ecosystem with several interconnected elements which mutually reinforce each other. These elements are more or less directly connected with the various subsystems of the formal education system or the broader system of lifelong learning. In this section the key elements of the broader policy ecosystem influencing the development of skills-development oriented UII will be explored.

The higher education policy environment

There is abundant literature about China's higher education policy and also about how university-industry cooperation is used in the field of research and innovation, although the number of international publications (in sharp contrast with domestic, Chinese language publications) focusing on skills-development oriented UIC/UII is rather low. Within this, the number of international publications that focus specifically on HE policy from the perspective

[5] See also an interview with the MoE official responsible for this area („Questions on the Notice of the Ministry of Education on Supporting the Construction of a Community for the Integration of Industry and Education in the National Rail Transit Equipment Industry" [教育部职业教育与成人教育司负责人就《教育部关于支持建设国家轨道交通装备行业产教融合共同体的通知》答记者问] (http://www.moe.gov.cn/jyb_xwfb/s271/202307/t20230714_1068858.html?utm_source=chatgpt.com)

of UIC/UII and analyse the connections between the different elements of HE policy and skills-development oriented UIC/UII policy is particularly low. One of the notable exceptions is the groundbreaking book of Zhuang Tengteng analysing on how UIC is used to modernise higher education in China in one specific field, engineering education (Zhuang, 2023a) and several other publications of this author (e.g. Zhuang & Liu, 2022; Zhuang, & Shi, 2022; Zhuang, & Liu 2022; Zhuang, T. (2023a; 2023b; Zhuang & Zhou, ; 2023; Zhuang, & Shi, 2024; Zhuang et al., 2025).

General HE policy framework

The adoption of the government decision on university-industry integration in 2017 can be directly connected to a major shift in higher education in China in the second half of the nineties. This shift is symbolized by the slogan "The Four Returns" (四个回归 - *sì gè huíguī*) announced by the education minister Chen Baosheng at a conference organised in 2018 by the Ministry of Education (MoE) about undergraduate education in colleges and universities (Chen, 2018). This can be interpreted as a call to refocus higher education on its fundamental teaching and learning mission, in response to concerns that universities were drifting too far toward quantitative expansion and research commercialization, they were too much influenced by what one could call "rankings obsession", neglecting undergraduate education, and the elite sector too much being detached from national needs.

The "Four Returns" means first turning back to the "original mission of education", that is to educate students, not merely focusing on research funding or rankings. Second "returning to the classroom", trying to improve teaching quality and classroom instruction, while placing more value on pedagogical innovation and teacher-student interaction. The third return encourages academics becoming again teachers, not only researchers or administrators, getting support for this in the form of faculty development. And the fourth return is refocusing on students, on their needs, their learning outcomes and personal growth.

In the context of this study the key assertion is that these for returns create an environment that is particularly favourable for skills-development oriented UIC and UII. Shifting the focus to teaching and learning implies that the skills-development function of universities is reinforced, making them better partners for companies that strive to improve the quality of their human resources and to satisfy their needs for skilled labour, especially in the those sectors that need the most advanced and sophisticated skills.

This new policy orientation took shape through several curriculum reform initiatives (to be discussed in the next sub-section) and in the adoption of the already mentioned "Double First-Class" policy. In the context of this study, the key message of the related policy documents (State Council, 2015; MoE, 2017; 2018a) is that efforts to achieve excellence should not focus solely on entire institutions (an approach fuelling ranking competition) but should also emphasize the development of specific academic disciplines and study programs. This shift in focus opened the door for a wide range of institutions, including lower-ranked universities, vocational colleges, and universities of applied sciences, to excel in distinct disciplinary areas by concentrating on their unique strengths. It also contributed to a more favourable environment for skills-oriented university–industry collaboration. As mentioned earlier this policy line was further strengthened by the subsequent "Double High Plan" initiative a few years later (to be presented later in the section on "*The vocational education policy environment*").

Another key aspect of the "Double First-Class" policy is the strengthening of undergraduate education in accordance with the new orientation promoted by the "Four Returns". The related

policy document (MoE, 2018a) explicitly supports both UIC and UII at this level of university education. It calls on universities to "strengthen the establishment of platforms for practical education" (often hosted by enterprises) and to "deepen reforms in key areas of collaborative education" –in this case, referring to collaboration with external partners such as companies. The document explicitly encourages the "promotion of in-depth integration between universities and enterprises", even in disciplines where the nature of such integration is more difficult to define. It clarified how "industry" should be interpreted in those contexts (such as journalism or legal education).

Parallel to these new policy orientations, a massive restructuring of China's higher education network has also significantly reshaped the institutional environment in ways that are highly favourable to UII. Following the launching of the restructuring policy by the Ministry of Education (MoE, 2015a; 2015b), several hundred local comprehensive higher education institutions were transformed into various types of vocationally oriented universities or universities of applied sciences. This transformation has altered not only the composition of the student body but also the pedagogical orientation and curricular content, leading to the development of hundreds of new, industry-oriented programs, often co-designed with industrial partners (Zhang & Chen, 2022; Tao et al., 2023). The scale of this shift is illustrated by an MoE implementation report published three years after the policy launch, which noted that "more than 20 provinces have issued support policies, 24,000 enterprise personnel have served as part-time teachers, and 16,000 industry–university collaborative education projects have been released" (MoE, 2018b).

This extensive restructuring, unfolding in parallel with the launch and implementation of the national UII policy, has unsurprisingly led to a proliferation of local UII initiatives, frequently linking universities to strategic and fast-developing industrial sectors. As noted in another MoE policy document published in the same period: "Many colleges and universities have jointly built a number of industry–education integration projects in strategic emerging disciplines with industry enterprises in key fields such as information and communication technology, Internet+, and Made in China 2025, and have carried out school-enterprise cooperation focusing on new industries, new business formats, and new technologies" (MoE, 2018c).

One further element of HE policy with high relevance in the UII context is the reform of the government of the system of higher education. A gradual but systematic decentralization of higher education started in the eighties, shifting authority over most institutions from central to provincial governments. This process was motivated by several factors, such as the expansion of the system, the recognition of the need to connect HE better to local economic needs and to regional innovation and development (MoE, n.d.; Ma, 2009). This process is often referred to as two-tier management model" (两级管理体制 - *liǎng jí guǎnlǐ tǐzhì*), where the central government retains strategic control, especially over elite institutions, while provinces assume operational and financial responsibility for the vast majority of institutions. It is important to note the strong connection between the decentralised government of HE and the decentralised approach used in the design and implementation of the UII policy.

Curriculum reform and disciplinary integration

Some of the supporting elements of the UIC/UII policies have been created in the framework of the reforms of specific disciplinary areas, especially in engineering, medicine, agriculture, and liberal arts. The key UIC/UII related policies and policy documents from 2015 to 2020 have been summarized by Zhuang and Liu (2022) focusing especially on the four disciplinary areas (see *Table 2*).

Table 2
Key UIC/UII policies and related policy documents related to engineering education (2015-2020)

No	Year	Issuing Unit	Policies and policy documents	Source
1	2015	State Council	On Deepening Innovation and Entrepreneurship Education Reform	http://www.gov.cn/zhengce/content/2015-05/13/content_9740.htm
2	2015	State Council	On Deepening Industry-education Integration	http://www.gov.cn/zhengce/content/2017-12/19/content_5248584.htm
3	2017	MOE	New Engineering Education State 1—'Fudan Consensus'	http://www.moe.gov.cn/s78/A08/moe_745/201702/t20170223_297122.html
4	2017	MOE	New Engineering Education State 2—'Tianda Action'	http://www.moe.gov.cn/s78/A08/moe_745/201704/t20170412_302427.html
5	2017	MOE	New Engineering Education State 3—'Beijing Compass'	http://news.sciencenet.cn/htmlnews/2017/6/379053.shtm
6	2017	MOE	Notifications on Carrying out New Engineering Education Research and Practice	http://www.moe.gov.cn/s78/A08/tongzhi/201702/t20170223_297158.html
7	2017	MOE	Notifications on Recommending New Engineering Education Research and Practice Projects	http://www.moe.gov.cn/s78/A08/s7056/201707/t20170703_308464.html
8	2018	MOE, MII, CAE	On Accelerating the Development of New Engineering Education for the Cultivation of Extraordinary Engineers (Plan 2.0)	http://www.moe.gov.cn/srcsite/A08/moe_742/s3860/201810/t20181017_351890.html
9	2018	MOE	On Accelerating the Development of High-quality Education and Enhancing the Quality of Talent Cultivation in Full Swing	http://www.moe.gov.cn/srcsite/A08/s7056/201810/t20181017_351887.html
10	2019	MOE	Emerging Agricultural Education State 1—'Anji Consensus'	http://news.cau.edu.cn/art/2019/6/29/art_8779_662686.html
11	2019	MOE	Emerging Agricultural Education State 2—'Beidacang Action'	http://www.moe.gov.cn/jyb_xwfb/s5147/201909/t20190923_400289.html
12	2019	MOE	Emerging Agricultural Education State 3—'Beijing Guide'	http://www.cntv.cn/p/343210.html
13	2020	State Council	On Accelerating the Innovation of Medical Education	http://www.gov.cn/zhengce/content/2020-09/23/content_5546373.htm
14	2020	MOE	Announcement on Initiating New Humanities Education	http://www.moe.gov.cn/jyb_xwfb/gzdt_gzdt/s5987/202011/t20201103_498067.html
15	2020	MOE	University-Industry Collaborative Education Program by Ministry of Education	http://www.moe.gov.cn/srcsite/A08/s7056/202001/t20200120_416153.html
16	2020	MOE	Notification on Soliciting University-industry Collaborative Education Projects in 2020 by the Ministry of Education	http://www.moe.gov.cn/s78/A08/tongzhi/202005/t20200529_460209.html

Source: Zhuang – Liu (2022)

The curriculum development in undergraduate education is key element of HE reform in China. This means the adjustment of curricula to the needs of advanced, innovation and skills driven

industry and ensuing social transformation. As *Table 2* shows, this appears as the promotion of the construction of new curricula in certain specific academic and industrial domains leading the emergence of what the policy discourse calls New Engineering (新工科 - *xīn gōngkē*), New Medicine (新医科 - *xīn yīkē*), New Agriculture (新农科 - *xīn nóngkē*), and New Liberal Arts (新文科 - *xīn wénkē*) (MOE, 2018; 2019c). In each of these domain further subdomains are included, for example the New Liberal Arts includes humanities, business studies and studies related with the cultural industries.

From the perspective of UII the most important element of this curriculum reform is that it extends beyond updating course content; it represents a fundamental reconfiguration of how teaching and learning are organized. This has several layers such as (1) *organizational innovation* (universities are encouraged to adopt flatter, domain-based structures that replace traditional disciplinary silos, promoting interdisciplinary domains (such as, for example "smart manufacturing" or "green energy systems") that integrate engineering, business, and design, often in close collaboration with industry partners); (2) *revised course content* (institutions are developing cross-disciplinary, application-rich courses that merge technical competencies (e.g., artificial intelligence) with real-world contexts (e.g., supply chain logistics), these courses often being co-designed with industry stakeholders to ensure relevance and applicability); (3) *pedagogical innovation* (emphasis being placed on student-centred approaches that support flexible, customized study pathways, transforming learning environments and leading to the integration of disciplines (e.g., robotics and business), to modular learning structures, to credit transfer systems, the emergence of credit banks, and the use of micro-credentials); (4) *assessment/evaluation innovation* (evaluation methods are being reformed through hybrid approaches that combine traditional examinations with project-based assessments, including industry project reviews – often evaluated by industry professionals – competitions, and e-portfolios, leading in some pilot programs to the total reconfiguration of assessment, such as the "40/30/30" model were the 40% of assessment is based on industry projects, 30% on e-portfolios, and only 30% on exams.

Measures to strengthen disciplinary integration in higher education deserve special attention. The breaking of traditional disciplinary silos and organising learning in interdisciplinary domains not only facilitate the opening of university education to the "real world" (including industry) but it also connects university education to the most advanced sectors of industry (Liu – Peng, 2024). Companies in these sectors often have advance strategic thinking and practices related with skills-development, and interaction with these companies often have a significant impact not only on the content of teaching but also on the way teaching and learning is organised. This is well illustrated by cases like the Shenzhen Polytechnic University's Tech X Academy,[6] co-founded by the university, the Shenzhen local government and an educational and incubation platform institution created by an entrepreneurial technology professor. This school has developed into a "teaching laboratory" focusing on advanced robotics and automation, with instructors who bringing in experience from leading high-tech companies, such as Huawei, DJI and the China Academy of Space Technology (Huang & Halász, 2024).[7]

Not only the literature we studied but also our fact-finding missions in the Greater Bay Area (Halász & Huang, 2025a) confirmed that UII is not only enhancing the interconnected

[6] See the website of this institution here: https://en.innoxsz.com/consortium/28.html.
[7] One of the leaders of this school said in an interview with the authors of this study that about 50% percent of the sources of their advanced pedagogical approaches are Chinese companies (with 30% US universities and 20% "brother universities".

curriculum and pedagogy innovations mentioned above but these innovations also create a favourable institutional environment in HEIs for deepening UII.

The vocational education policy environment

From the perspective of UII policies and practices, vocational education policy stands as a central pillar within the broader policy ecosystem, carrying weight equal to that of higher education policy. These two domains are becoming increasingly interconnected, reflecting national strategies that promote both vertical integration (blurring the boundaries between secondary and higher vocational education) and horizontal integration (bridging the gap between general academic and vocationally oriented education) (Yuan & Wang, 2021).

China's vocational education system has evolved from a subsystem seen by many stakeholders as marginal into a strategic pillar of the national modernization and innovation process. This transformation has been closely linked to the broader UII agenda, as both fields aim at strengthening skills-development, align it better with industrial development, and boost regional innovation capacity.

Although a comprehensive UII policy framework was only publicly articulated in 2017, the objective of integrating education and industry had already been established in the earlier policy document titled *"Decision on Accelerating the Development of Modern Vocational Education"* (State Council, 2014). This document marked the beginning of a systemic reform of technical and vocational education and training (TVET). In addition to promoting industry–education integration, it articulated three broader strategic goals: linking secondary and higher vocational education, enhancing the interface between vocational and general education, and advancing lifelong learning. While the primary focus may have been on secondary-level TVET, these strategic directions laid the groundwork for a broader policy environment conducive to the development of UII. The document paid particular attention to higher vocational education, emphasizing that vocational colleges and universities should "closely cooperate with industry." Given the document's strong relevance to UII, it is worth quoting at length those passages most pertinent to higher education:

> „Innovate and develop higher vocational education (…). Guide the transformation and development of ordinary undergraduate colleges and universities. Adopt methods such as pilot promotion and demonstration to guide a number of ordinary undergraduate colleges and universities to transform into applied technology type colleges and universities, focusing on undergraduate vocational education.
>
> Establish a professional degree postgraduate training model that is guided by vocational needs, focuses on practical ability training, and combines industry and academia. Study the establishment of a degree system that is in line with the characteristics of vocational education. In principle, secondary vocational schools shall not be upgraded or merged into higher vocational colleges, and specialized higher vocational colleges shall not be upgraded or merged into undergraduate colleges and universities, so as to form a clear, scientific and reasonable hierarchical structure of vocational education.
>
> Research and formulate relevant regulations and incentive policies to promote school-enterprise cooperation in running schools, deepen the integration of industry and education, encourage industries and enterprises to organize or participate in vocational education, and give play to the important role of enterprises in running schools.
>
> Enterprises above designated size should have institutions or personnel to organize and implement employee education and training, connect with vocational colleges, and set up student internships and teacher practice positions. The reasonable expenses actually incurred by the enterprise in relation to the income obtained by the enterprise due to the acceptance of

interns shall be deducted in accordance with the current tax laws and regulations when calculating the taxable income.

Various forms of support for enterprises can be used to build public training bases with both production and teaching functions. For enterprises that set up vocational colleges, if their education meets the requirements of the vocational education development plan, all localities can provide support through government procurement of services and other means. Enterprises or business activities run by vocational colleges and whose main purpose is to serve students' internship and training shall enjoy preferential tax treatment in accordance with relevant national regulations. Support enterprises to jointly cultivate and train talents through school-enterprise cooperation, and continuously improve the value of enterprises. The implementation of vocational education by enterprises is included in the corporate social responsibility report." (State Council, 2014).

As the passage above demonstrates not only undergraduate but also post-graduate higher education was targeted by the measures and important incentive mechanisms were created to motivate companies to invest in education. The 2014 strategy document, together with the measures adopted a few years later in the related implementation plan (State Council, 2019) promoted education-industry cooperation also in areas like qualification standards or teacher qualification establishing the "1+X" certificate system and "double-teacher" status combining general and vocational orientations. One of the specific targets was that the number of "double-teachers" (teachers with both theoretical teaching and practical teaching ability) should account for more than half of the total number of teachers in professional courses".

The inclusion of an increasing number of elements related to higher education into the policy repertoire of TVET policy and the blurring of the borderlines between policies targeted to the different subsystem of the education system is a key feature of the broader UII policy ecosystem. Equally important is that phenomenon of including industry related or company related elements into education policy. A good example of this is the creation of a new institutional form already mentioned: the "Modern Industrial Colleges" (MICs).

MICs, as we have seen, are cross-organizational education units jointly run by universities and industries in high-tech or strategic sectors (e.g., AI, big data, new materials) facilitating joint curriculum development, dual mentoring based on shared infrastructure. The call of MoE for the creation of such institutions (MoE, 2020a) required, among others that the number of part-time teachers (industry teachers) should be not less than the number of full-time teachers, and the number of hours of practical teaching should be no less than 30% of the total hours of the training program.

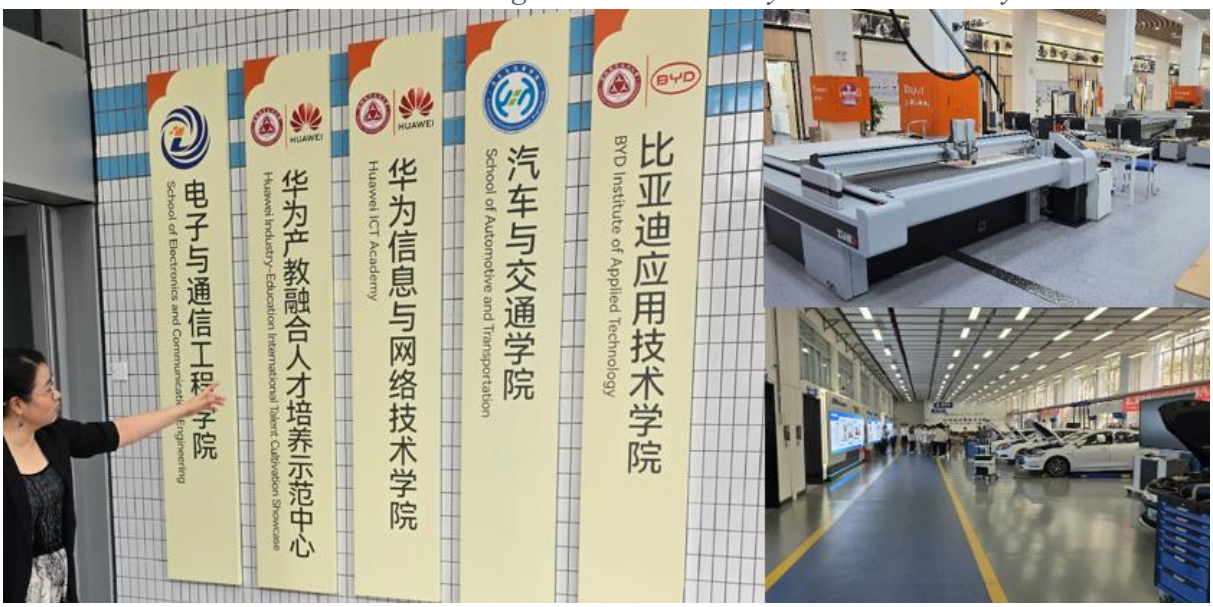
The creation of MICs within universities, as an advanced form of professional/technical education is a particularly effective institutional way to bring high level industry knowledge and capacities into higher education and use this to modernise higher education. As a Chinese researcher doing research on MICs described this vividly:

> The latest technology, the best facilities and equipment, and the most advanced laboratories are not necessarily all in universities, especially large enterprises, leading enterprises and new enterprises. The technical level, instruments and equipment, and site facilities they have are sometimes far ahead of universities (…) Huawei is the largest innovative enterprise in 5G, and the strongest technologies such as cloud computing, big data, blockchain, and the Internet are in companies such as Alibaba, Tencent, and Byte. Therefore, universities should not and cannot be a closed "ivory tower". They must be open to other social systems and fully absorb various social forces and resources. Otherwise, the quality of talent training and scientific research level will be difficult to guarantee, let alone play a role in social service and cultural inheritance. For

local undergraduate colleges with relatively insufficient resources, it is even more important to open up their schools to the greatest extent possible, break through various barriers and divisions, gather the advantageous resources of local governments, industries, sectors, and enterprises on a larger scale, and transform them into high-quality educational resources for cultivating students. If universities use obsolete equipment and facilities, outdated teaching methods, and outdated teaching content to cultivate students, students will only be eliminated by society, and it will be a luxury for universities to lead social development" (Liu, 2023).

MICs, owned and run together by universities, located typically within universities, are key institutional elements both in higher education and technical/vocational education policies. There might be several MICs in one single university, and they are typically equipped with the most advanced technology provided by partner companies as illustrated by *Figure 3* which shows the signboard of five MICs with picture about two of them in in Shenzhen Polytechnic University.

Figure 3.
Modern Industrial Colleges in Shenzhen Polytechnic University



Photos taken by the authors.

One specific form of MIC deserving special attention is the Future Technology Colleges (FTCs), targeting strategic areas of frontier technologies, such as AI, quantum computing or new materials (Huang – Halász, 2024). These institutions prioritize original innovation, interdisciplinary research, collaboration with top-tier research institutions and companies, they often apply progressive pedagogy that fosters creativity and entrepreneurship (MoE, 2020b). As already mentioned, one outstanding example is the Tech X Academy of Shenzhen Polytechnic University, which was co-founded by the university, the municipal government and an educational and incubation platform institution created by Li Ze Xiang, an entrepreneurial technology professor from Hong Kong. As mentioned earlier, Tech X Academy has become a "teaching laboratory" that focuses on advanced robotics and automation, with many instructors who bring in experiences from leading high-tech companies, such as Huawei or DJI, and the China Academy of Space Technology (SZPU, 2024).

In the TVET sector, one of the most impactful policy initiatives driving UII was the launch of the already mentioned "Double High Plan" (MoE, 2019b). Modelled after the "Double First-Class" initiative for research universities, this program introduced a competitive framework to

incentivize excellence among higher vocational institutions, backed by substantial financial support (Yang, 2020). One of the strategic goals was to overcome historic marginalization and to allow vocational institutions to develop into globally competitive, innovation-driven organisations.

The initiative sought to "innovate the operational model for integrating higher vocational education with industry" and "foster a community of shared destiny between vocational schools and enterprises" (MoE, 2019b). Through a "dynamic management" system, featuring competitive "entry and exit mechanisms", the policy aimed to elevate top-performing TVET institutions to world-class standards supporting the "survival of the fittest" (MoE, 2019b). The ambition was to allow for higher technical/vocational institutions to reach world standards, similarly to the way this has been done in the research university sector through deeply connecting technical/vocational universities with the most advanced industry sectors and through promoting radical pedagogical changes that could entirely transform the way teaching and learning is organised:

> "By 2035, a number of higher vocational schools and professional groups will reach the international advanced level, leading the modernization of vocational education and providing high-quality human resource support for promoting economic and social development and improving national competitiveness (…) Schools and enterprises jointly develop scientific, standardized, internationally referenced talent training programs and curriculum standards, incorporate advanced industrial elements such as new technologies, new processes, and new norms into teaching standards and teaching content, and build open and shared professional group course teaching resources and practical teaching bases. Establish a high-level and structured teaching innovation team for teachers, explore the modular teaching mode of division of labour and cooperation among teachers, deepen the reform of teaching materials and teaching methods, and promote classroom revolution." (MoE, 2019b)

Tech X Academy of Shenzhen Polytechnic University mentioned earlier is a perfect demonstration of the realistic nature of the ambition of the "Double High Plan" to create world-class technical/vocations higher education institutions. This university, similarly to many other TVET universities, emerged from an earlier secondary TVET school in the nineties, becoming one of China's first higher vocational colleges offering 3-year diplomas equivalent to associate degrees. It became a full university only in 2021 so that it could be selected for the "Double High Plan" and receive significant funding for further development. This made it possible for this institution to develop world-class vocational programs and to become a high prestige university, competing with traditional research universities, while retaining its TVET character and remaining deeply integrated with industry.

The broader policy of combining education and labour

Integrating education with work provides a crucial contextual foundation for understanding UIC/UII in China. Combining education and work has long been an important element of skill development and economic development in China, and this has had both direct and indirect influences on the evolution of contemporary UII policies and practices. Within this broader framework, labor education (LE) plays both ideological and functional roles in facilitating UII. From one hand, LE aims to cultivate the students' practical ability, innovative thinking, and entrepreneurship mindset, on the other, it emphasizes students' social responsibility, civic and community engagement.

Labor education traces its origins to early Marxism-inspired work-study initiatives, later evolving into a structured pedagogical approach that integrates skill development, labour ethics,

and social responsibility. While historical traditions have long emphasized the value of labour, modern LE as a formal concept emerged in the early 20th century under Marxist influence. A seminal example was the Work-Study Mutual Aid Group" (工读互助团 - *gōngdú hùzhù tuán*), established in 1919 by Li Dazhao and his contemporaries (Fang, 2022). This initiative promoted a system where learning and labour were combined, seeking to bridge education with practical employment needs. Beyond addressing individual livelihood and skill acquisition, these early programs promoted broader societal goals, such as personal autonomy, egalitarian principles, and the reconfiguration of social structures. By institutionalizing the synergy between academic study and productive work, they laid both an ideological and practical foundation for contemporary UII policies and practices. This historical trajectory underscores how LE's dual focus on human development and social transformation continues to inform modern policies promoting the integration of education and industry.

In the modern context, the Communist Party of China (CPC) has attached great importance to the labour education, especially since its 19th National Congress, as expressed in a series of important speeches and arrangements, and also in issuing relevant policy measures and implementation plans (Le, 2022). At the 2018 National Education Conference, labour education was formally incorporated into the construction of the Chinese education system for the comprehensive development of morality, intelligence, physique, aesthetics, and labour (CPC news, 2018). In March 2020, the CPC Central Committee and the State Council issued a related key policy document which classified labour education into three groups, including (1) daily life labour (self-care development) (2) productive labour (skill development and practice) (3) service-oriented labour (social and community engagement) (CPC - SC, 2020). It further emphasized that labour education should align with industry needs and emerging new forms of work. The forms of labour education and the time devoted to it also was defined ("vocational colleges carry out labour education primarily through internship and practical professional training courses, with no less than 16 class hours dedicated to special topics on the spirit model workers, and the spirit of craftsmanship. Undergraduate education institutions should explore to incorporate labour education mainly through four years courses, with no less than 32 class hours").

The way labour education has to be implemented was specified a few months later in a guidelines issued by MoE (2020d). This guidelines suggested that at the higher vocational stage emphasis should be is placed on job simulation, project training, and on-the-job internships to enhance students' professional identity and practical ability as demonstrated by the following implementation tasks:

(1) Continuously participate in daily life labour to manage their own lives and improve their awareness and ability of self-reliance and independence through labour;
(2) Regularly take part in on-campus and off-campus public service labour, contribute to maintaining campus order and environment, and apply their professional skills to provide relevant public services for society and others, thereby fostering public morality and nurturing a deep sense of patriotism and civic responsibility.
(3) Rely on internships and practical training to engage in authentic productive and service-oriented labour, strengthening their professional identity and pride in labour, enhancing their ability to transform creative ideas into practical outcomes, and cultivating a spirit of craftsmanship that values continuous exploration, precision, and excellence, along with a dedicated and professional labour attitude. Students should be guided to believe that "every trade produces its own master" and understand that no job is inferior—every profession is honourable and has the potential for success." (MoE, 2020d).

According to MoE's guidelines labour education above the undergraduate level has to be expanded through scientific research projects, innovation and entrepreneurship platforms, as well as enterprise joint training mechanisms. The related specific implementation tasks were presented as follows:

(1) Master general scientific knowledge related to labour, gain a deep understanding of the Marxist concept of labour and socialist labour relations, establish a correct outlook on career choice, employment, and entrepreneurship, and develop a strong spirit of dedication to working in challenging regions and sectors;
(2) Consolidate good daily life labour habits by consciously maintaining personal and dormitory hygiene, independently handling personal affairs, and actively participating in work-study programs to enhance self-reliance and personal growth through labour;
(3) Strengthen participation in service-oriented labour by voluntarily engaging in cleaning, landscaping, and service management of classrooms, cafeterias, and other campus facilities. These efforts should be integrated with social practice activities such as the "Three Supports and One Assistance" program, the Western China Student Volunteer Program, the "Youth Red Dream-Building Journey," and the "Go to the Countryside" campaign, in order to cultivate public service awareness and a spirit of dedication when responding to major crises such as pandemics and natural disasters;
(4) Emphasize productive labour training by actively taking part in internships, practical training, professional services, and innovation and entrepreneurship initiatives. Students should value the application of new knowledge, new technologies, new techniques, and new methods, and enhance their ability to identify and solve problems creatively in production contexts, thus generating valuable material outcomes through hands-on practice" (MoE, 2020d).

These policy documents demonstrate that the effective implementation of labour education cannot be separated from the industrial and broader social environment. Industry plays a crucial role by providing up-to-date technologies, relevant content, and real-world platforms that support labour education, especially by embedding students and younger teachers without direct industry experience into authentic work settings. As labour education becomes an integral part of official policies fostering university–industry collaboration in both schools and universities, UII is increasingly seen as a key mechanism for advancing labour education. In turn, labour education helps to consolidate and enrich the scope of UII, creating a mutually reinforcing and dynamic relationship.

A few scholars have explored specific models for integrating LE and UIC. For example, Yu and Fu (2025) proposed a three-level LE curriculum framework designed to systematically bridge education and industry needs. At the basic level, the focus lies on cultivating foundational labour values and essential skills, fostering a correct work ethic while preparing students for more advanced learning. The professional level requires deeper industry involvement, with enterprises co-designing courses, standards, and teaching materials to ensure alignment with real-world production processes and sectoral demands. This collaboration enables students to master up-to-date technologies and methodologies directly applicable to their fields. Finally, the innovation level emphasizes project-based learning, where students tackle authentic industry challenges under the guidance of sector mentors, combining personalized training with practical problem-solving. This tiered approach not only enhances vocational training but also ensures that graduate competencies align with evolving societal and economic needs, creating a seamless pipeline between education and employment.

Two other authors (Wang & Bao, 2024) proposed an integrative model – "real industry project + outcome-based evaluation + systematic reflection" – grounded in the concept of four-chain linkage. This approach aligns teaching systems with actual production demands, embedding

labour requirements into professional learning to foster students' proactive problem-solving and creativity. In this model students from diverse disciplines (spanning research and applied universities) collaborate on hands-on tasks – such as design, debugging, and operational training –aimed not only at mastering core labour skills but also at enhancing technical application competencies. The outcome-based evaluation phase extends beyond task completion metrics to incorporate multidimensional criteria, including teamwork efficacy, quality assurance, and adherence to labour regulations. This ensures that student deliverables meet both ethical standards and practical industry benchmarks. Finally, the model emphasizes structured post-project reflection, where students analyse outcomes, identify challenges, and iteratively refine solutions. This cyclical process cultivates sustained growth in critical thinking and innovative capacity, bridging theoretical knowledge with actionable industry insights.

The models suggesting active, student-centred pedagogies reflect efforts to connect LE in higher education to the dominant UII approaches, creating synergies between the two policy areas. They show the way national policies embed LE in real industrial and social contexts, making UII an essential element for its effective implementation. LE this way contributes to UII by enriching its educational dimension with lab or values, ethical practices, and hands-on experiences. In return, UIC provides LE with authentic tasks, updated technologies, and professional guidance

Science, technology and innovation policy

The third key component of the broader policy ecosystem shaping the dynamics of UII policie and practices is science, technology and innovation policy. As described in a study on the role of universities in fostering knowledge-intensive clusters in China (published one year prior to the public announcement of China's national innovation strategy) the Chinese innovation system from 1949 to 1978 largely followed the Soviet model. In this system, the government acted primarily as a financial sponsor and allocator of responsibilities among key actors: public research institutes (conducting basic and applied research), universities (focused primarily on teaching), and enterprises (responsible for development, prototyping, and other downstream R&D activities). After the launch of economic reforms in 1978, China began to adopt elements of the U.S. higher education model, positioning comprehensive and research universities as key actors within the national innovation system. The government increasingly emphasized the role of science and technology in economic development, and over time, the Triple Helix model emerged. In this model, universities (alongside public research institutes), industry organizations, and the government became the primary stakeholders, with the government assuming the roles of policy initiator, coordinator, and facilitator (Cay & Liu, 2015).

China's national innovation policy was formally articulated in the 2016 policy document titled "Outline of the National Innovation-Driven Development Strategy" (CPC–SC, 2016). This document identified innovation as the primary driving force of economic and social development and elevating it to the status of a core national strategy that will help China to gain a higher position in global value chains. It proposed a very broad definition of innovation and explicitly mentioned the goal of skills-development (labour quality improvement):

> "Innovation-driven means that innovation becomes the first driving force for leading development, and scientific and technological innovation is combined with institutional innovation, management innovation, business model innovation, business model innovation and cultural innovation to promote the transformation of development mode to rely on continuous knowledge accumulation, technological progress and labour quality improvement, and promote

> the economy to a more advanced form, more refined division of labour, and more reasonable structure" (CPC – SC, 2016).

Within this new strategic framework, not only the need for stronger collaboration among universities, enterprises, and public institutions was emphasized, but the strategy also called for a closer integration of research and development (R&D) with education and skills development. The explicit linking of science, technology, and skills development (talent development, as in the statement that "science, technology and talent have become the most important strategic resources for building a strong country", can be interpreted as an implicit endorsement of the European Union's knowledge triangle concept, which promotes synergies among education, research, and innovation, and actively supports education- and skills-oriented university–industry cooperation.

The strategy proposed, among other priorities, the "deep integration of science and the economy," which implies a deliberate effort to promote research- and technology-driven UII. By positioning university–industry cooperation as a key mechanism for achieving national innovation goals, the strategy also creates favorable conditions for skills development-oriented UII to flourish.

Moreover, the strategy included several direct references to education and skills-development. It advocated for "promoting innovation in education," "reforming talent cultivation models," "improving the talent development system based on a dual-support structure for both high-end innovative talents and skilled industrial workers," and "strengthening the articulation between general and vocational education." Each of these elements, whether directly or indirectly, could support the advancement of UII-related initiatives.

A further key dimension of the strategy relevant to UII is its strong regional focus. It promotes the development of regionally embedded innovation systems tailored to local economic and social conditions ("a regional innovation and development pattern with its own characteristics") and encourages regional-level policy experimentation, including "comprehensive regional innovation and reform experiments." These provisions created a good foundation for localized forms of UII, especially those aimed at aligning education and training with regional industrial strategies.

Skills-policy and corporate HR policy

The sixth, particularly important component of the broader policy ecosystem in which China's UII policies and practices have to be located is the country's policy related with human resources and skills which directly influences the UII-related behaviour of companies. The process of integrating education and industry cannot be understood without understanding why and how companies and national industrial sectoral bodies are actively engaged in building deep cooperation with educational institutions. In this process of two very different social subsystems (education and industry) are connected in a way that requires entirely new institutional mechanisms and behaviours at both sides, and if both behave in a positive and proactive way. Policies related with human resources and skills plays a fundamental role in creating this positive and proactive behaviour on the side of industry.

The term "skills policy" is rarely used in the Chinese context in the same way as in European or OECD contexts. The most frequently used term in English translations of relevant texts is the strategy of "talent development" (人才发展 - *réncái fāzhǎn*) which could also be translated human resources or skills strategy/policy. As over the past decade, especially since 2014, China

has increasingly framed skills as a strategic asset for industrial transformation, innovation, and national modernization. As the authors of a related paper focusing on the smart manufacturing sector formulated "people-oriented" policy emphasizes that „people are the most active factor in productive forces" and „talent resources are the first resources and the foundation of building a powerful country" (Zhang et al., 2019). This policy area has became a major element of the broader policy ecosystem in which the UII policy is designed and implemented.

The key policy document outlining China's national skills development (talent development) strategy, issued at the beginning of the last decade (The Central Government, 2010), can be described as one of the most important initiatives spurring university-industry cooperation with the aim of fostering skills and innovation led economic policy. This document defined ten related key policy actions, the second of them being the fostering of industry-university cooperation:

> "Establish strategic alliances for industry–academia–research collaboration, guided by the government, with enterprises as the main actors and market-oriented mechanisms, using various forms. These alliances should cultivate high-level talent and innovative teams through joint construction of science and technology innovation platforms, cooperative education, and joint implementation of major projects. (…) Adopt a "talent + project" training model that relies on major national talent programs and major scientific research, engineering, industrial innovation, and international science and technology cooperation projects. Emphasize the role of enterprises in gathering and training innovative talent through practice. (…) Implement preferential fiscal and tax policies for enterprises and other employers that accept university and vocational school students for internships."

This original strategy, adopted many years before the launching of the UII policy in 2017 was still focusing mostly on research cooperation and "high level talents", and did not mention UII, which appeared only in more recent documents, such as a new general skills development strategy adopted in 2022 (The General Office…, 2022). This shows well the shift from research oriented to skills oriented UIC and the shift from UIC to UII:

> Deepen the integration of industry and education, school-enterprise cooperation, carry out order-based training, package training, and innovate school-enterprise dual systems, school-in-factory, factory-in-school and other methods. For enterprises that have achieved remarkable results in jointly cultivating high-skilled talents, governments at all levels shall be praised and supported by corresponding policies in accordance with regulations. Improve the project-based training model, and implement differentiated training programs for different categories and groups of high-skilled talents. Encourage open training of high-skilled talents through famous teachers leading apprentices, skills training, on-the-job training, skill competitions, technical exchanges and other forms. Establish a continuing education system for skilled talents, promote the action of studying and realizing dreams, regularly organize and carry out research and exchange activities, and promote the updating of skilled talents' knowledge to meet the requirements of technological innovation, process transformation, and industrial optimization and upgrading.

The integration of education and industry and the blurring of borderlines between the education system and the system of industrial production system implies the emergence of new coordination mechanisms in the broader policy ecosystem. The sectoral government of the education system (traditionally assumed by ministries of education) is transformed into the government of the broad skills system (including the human resource development activities of industrial companies) which transforms the role and responsibility of ministries of education and requires high level inter-sectoral cooperation in the government. This is well illustrated by a circular of the Chinese Ministry of Education (MoE, 2020b) on measures for the management

of industry-university cooperation and collaborative education projects targeting corporate actors through calls for projects, evaluating company proposals, and certifies their participation (see *Box 2*).

Box 2
The promotion of company involvement in UII by MoE

The industry-university cooperation and collaborative education project implements project-based management, which mainly includes six categories:
(1) New engineering, new medicine, new agriculture and new liberal arts construction projects. Enterprises provide funds and resources to support colleges and universities to carry out research and practice in new engineering, new medicine, new agriculture and new liberal arts, promote school-enterprise cooperation in running schools, cooperative education, cooperative employment and cooperative development, carry out in-depth diversified exploration and practice, and form generalizable construction and reform results.
(2) Teaching content and curriculum system reform projects. Enterprises provide funds, teachers, technology, platforms, etc., introduce the latest progress of industry and technology, and the latest requirements of the industry for talent training into the teaching process, promote colleges and universities to update teaching content, improve the curriculum system, and build resources such as courses, teaching materials, teaching cases and other resources that can be shared to meet the needs of industry development and promote their application.
(3) Teacher training programs. Enterprises provide funds and resources, and universities and enterprises jointly organize and carry out technical training, experience sharing, project research and other work for teachers, so as to improve teachers' teaching level and practical ability.
(4) Practice conditions and practice base construction projects. Enterprises provide funds, software and hardware equipment or platforms to support colleges and universities to build laboratories, practice bases, practice teaching resources, etc., and encourage enterprises to accept students for internship and training, so as to improve the quality of practical teaching.
(5) Innovation and entrepreneurship education reform projects. Enterprises provide teachers, software and hardware conditions, investment funds, etc., and support colleges and universities to strengthen the construction of innovation and entrepreneurship education curriculum system, practical training system, maker space, project incubation and transformation platform, etc., and deepen the reform of innovation and entrepreneurship education.
(6) Innovation and entrepreneurship joint fund projects. Enterprises provide funds, instructors and project research directions to support college students in innovation and entrepreneurship practice.

Source: MoE (2020)

The level of skills-development oriented inter-sectoral or inter-ministerial coordination and cooperation and the impact of this on UII can also be illustrated well by the issuing of a document entitled “Guidelines for Talent Development Planning in Manufacturing” by three ministries (Ministry of Education, Ministry of Human Resources and Social Security and Ministry of Industry and Information Technology) in 2017. This document (MoE – MHRSS – MIIT, 2017), aimed explicitly at the corporate sector, not only advocates for accelerating the deep integration of industry and education, but also propose several concrete and actionable measures to achieve this goal. Given its relevance, it is worth quoting the document also at some length:

> Through authorization, entrustment, purchase of services and other means, promote manufacturing industry enterprises to deeply participate in the formulation of relevant

professional teaching standards and talent training plans, the development of teaching resources such as curriculum materials, and the implementation of teaching. Support industry organizations and industry leading enterprises to take the lead in formulating talent training evaluation standards for colleges and universities and carry out quality certification work. Relevant colleges and universities, vocational schools (including technical schools, the same below) should increase the proportion of manufacturing industry enterprise experts in professional teaching guidance institutions. Enterprises should provide positions for student internships and teacher practice, and work with schools to formulate internship and practice plans. Give play to the role of scientific and technological practice activities in talent training.

Give play to the important role of enterprises in vocational education. Aiming at the ten key areas of manufacturing, promote the modern apprenticeship system of school-enterprise joint training. For enterprises that run vocational schools, if their operation meets the requirements of the vocational education development plan, local governments can provide support through government purchase of services and other means. Promote manufacturing enterprises and applied undergraduate colleges to explore the co-construction and co-management of secondary colleges (departments) of manufacturing majors. In principle, vocational schools run by state-owned manufacturing enterprises that are consistent with the business direction of the enterprises and have good school-running benefits should be retained. Colleges and universities and vocational schools are encouraged to cooperate with enterprises to go global.

Promote the group-based operation of vocational education. Encourage relevant industry organizations in the manufacturing industry, key enterprises with capabilities and conditions, and vocational schools to jointly establish a number of advanced manufacturing vocational education groups with deep integration, distinctive characteristics, and significant benefits, and increase the coverage rate of group-based operation of manufacturing-related schools and majors. Give full play to the role of industry enterprises in the member units of vocational education groups, promote the reform of school-running models, training models, teaching models, and evaluation models, and promote the deep integration of industrial chains, job chains, and teaching chains.

Accelerate the construction of industry-university-research-application alliances. Relying on major engineering projects in the manufacturing industry, promote in-depth cooperation between enterprises and schools, give play to the role of research and development platforms such as key laboratories and engineering technology research centres, and adopt a multi-party co-construction approach to create a number of engineering innovation practice centres, teacher development centres, and employee training centres in colleges and universities and vocational schools, innovate curriculum systems, and update textbook content. Support manufacturing enterprises in various forms to build internship and training bases with both production and teaching functions to serve the construction of manufacturing innovation systems. Encourage teachers to participate in various related skill competitions. Explore the establishment of a joint training mechanism among enterprises, universities and standardization research institutions to accelerate the training of professional talents in manufacturing standardization and quality engineering technology.

Summary

The section about the broader policy ecosystem in which China's UII policy is embedded can be summarised as follows. The higher education policy environment has shifted universities toward more application, service, and innovation missions creating a favourable environment for the UII policy. The measures related with curriculum reform and disciplinary integration have encouraged interdisciplinary, practice-oriented learning aligned with emerging, high technology sectors. The broader policy of combining education and labour has enhanced the embedding of labour values and practical capabilities into all levels of education, including higher education. Science and technology policy and innovation policy has positioned innovation as the central driver of national development, promoting R&D oriented UIC/UII, which is has been enhancing also skills-development UII. The national vocational education

policy has promoted a dual-track, school–enterprise integrated vocational system, including higher vocational education. Finally, skills-policy and corporate HR policies have encouraged the alignment of "talent pipelines" with industrial demands, and have elevated the role of enterprises in training and evaluation of learning outcomes. Understanding the nature of China's UII policy can be significantly enhanced by seeing this policy area in this broader policy context.

Policy tools, institutional mechanisms and forms of cooperation

As we could see earlier in the section on "*Key policy orientations and related policy documents*" a key element of China's UII policies and practices is the creation of several, parallel new institutional mechanism that can be used as policy tools to promote the spreading of UII. The most important mechanisms have been summarized in *Table 3*.

Table 3
Institutional mechanisms used to promote UII

Name	Description
National Pilot Cities for Industry–Education Integration (国家产教融合型城市试点)	Selected cities serving as regional hubs for UII, integrating vocational and higher education with local industry to promote innovation-driven development.
Industry–Education Integration Enterprises (产教融合型企业认定)	Formal recognition of enterprises that deeply participate in education and talent cultivation, often receiving policy support.
MoE's University–Industry Collaborative Education Program (教育部产学合作协同育人项目)	A national program facilitating university-enterprise collaboration in curriculum reform, internships, and teacher training.
Supply–Demand Matching & Employment Education Program (供需对接就业育人项目)	Designed to align graduate skills with labour market demand through enterprise co-designed courses, internship placements, and job matching.
Modern Industrial Colleges (现代产业学院)	University–enterprise co-funded faculties or colleges located within campuses or industrial parks for practical training and research.
City-Level Industry–Education Integration Alliances (市级产教融合联盟)	Municipal alliances that bring together local governments, universities, enterprises, and research institutions to coordinate integration efforts.
Sectoral Integration Communities (行业产教融合共同体)	Industry-specific networks involving enterprises, professional associations, universities, and vocational schools focusing on skills, standards, and applied R&D.
Disciplinary Reforms in "New Fours" (新工科、新医科、新农科、新文科)	Reform initiatives across engineering, medicine, agriculture, and liberal arts encouraging interdisciplinary curricula and UII-aligned programs.

Source: AI generated table based on the authors instructions.

The literature review mentioned in the introduction of this paper distinguished four major forms of cooperation: (1) common course development, (2) the creation of opportunities for practical training, (3) the development of the knowledge and skills or academic staff and (4) joint research activities (Zhang et al., 2020). The analysis of the authors shows not only the increase

of the number of academic publications focusing on these four types of university-enterprise-cooperation but also which of the four types that attracts the most interest (see *Figure 4*).

Figure 4.
The number of academic publications focusing on four types of university-enterprise-cooperation in the Chinese academic database (CNKI) between 2010 and 2019

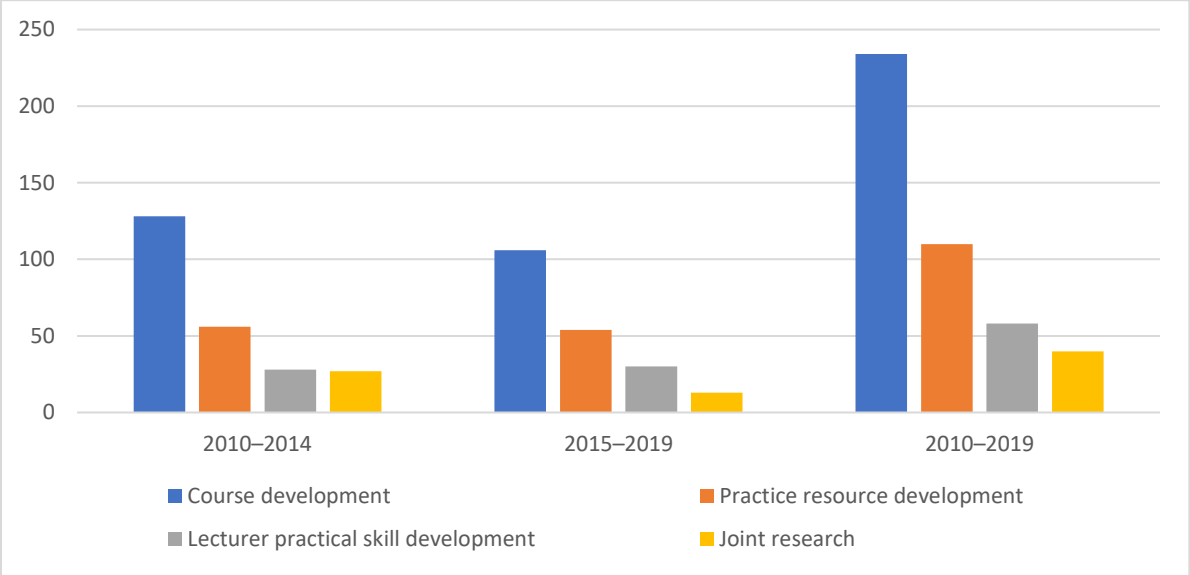


Figure designed by the authors on the basis figures provided of Zhang et al. (2020).

The emergence of Modern Industrial Colleges (现代产业学院 - *xiàndài chǎnyè xuéyuàn*) marks a recent institutional innovation in the development of UII in China. These institutions, as we have seen, represent a co-investment and co-governance arrangement between universities and firms and typically focus on areas such as curriculum development, research, and industrial training (Liu, 2022; Wang & Wang, 2024). By embedding entire faculties or training centres within industrial zones, they exemplify a more structured and scalable model of integration.

Evaluation, benchmarks and performance indicators

Although the UII-related literature often mentions as a bottleneck of weakness the lack of appropriate policy evaluation, in fact evaluation exercises, providing information about implementation achievements and challenges are quite frequent. For example two authors conducted a policy impact evaluation of the UII policy in higher vocational colleges of the Yangtze River Delta (Gao & Zhang, 2020). They selected 138 higher vocational colleges and made an evaluation using a comprehensive evaluation system including 11 evaluation indicators including the perspectives of faculty, teaching, scientific research, and service. The stated that the colleges generally do well in industry-education integration, but „the integration level varied greatly from college to college". They devoted a whole section to "Evaluation research on industry-education integration", referring to a Chinese publication which „emphasized the need to form a four-level integration system of individual, organization, inter-regional organization, and state." They stated that "the research on the industry-education integration has become one of the focuses in the academic community in recent years, including performance evaluation." These authors also suggested a number of indicators for the evaluation of UII implementation at university level (see *Table 4*). Another evaluation exercise was carried out in Chongqing by a professor of the School of Economics and Business

Administration of the Chongqing University of Education (Gong, 2024). This author mentioned that evaluations made by "third party organisations" are used by the government deliberately.

Table 4
UII evaluation indicators

No.	Index	Content
X1	Ratio of double-qualified teachers	The percentage of double-qualified teachers to the total number of full-time teachers
X2	Annual class hours of part-time enterprise teachers per student	The total amount of class hours of part-time enterprise teachers that year, based on the average level of the number of students in college
X3	Proportion of graduates staying in local employment	Percentage of local employment in the total number of graduates
X4	Employer satisfaction of graduates	Percentage of employer satisfaction with graduates
X5	The amount of vertical scientific research funds received per teacher	Vertical scientific research funds obtained for each full-time teacher
X6	The amount of technical services funds received per teacher	The technical contracts signed with natural persons, legal persons and other organizations, and the funds involved in international scientific and technological cooperation projects, based on the average level of the number of full-time teachers
X7	Number of invention patents per teacher	Invention patents that have been authorized and announced based on the average level of the number of full-time teachers
X8	Economic benefits generated by technical services per teacher	Relevant services for natural persons, legal persons and other organizations, and the economic benefits generated in internation-al scientific and technological cooperation projects, based on the average level of the number of full-time teachers
X9	The amount of non-academic training per teacher	The received funds for non-academic training for the society, based on the average level of the number of full-time teachers
X10	Daily public welfare training service per teacher	The scale of free training provided to the society according to the average number of full-time teachers
X11	The amount of technical transac-tions funds received per teacher	The government or enterprise purchases patents and technologies of universities through the technology market to the account, and the average level is calculated based on the number of full-time teachers

Source: Gao & Zhang (2020)

A major evaluation exercise was performed recently by the China National Academy of Educational Sciences (CNAES), a research institute under the supervision of MoE. (Yin et al., 2025). This report also illustrates well that evaluations often point in a critical way to challenges and bottlenecks.

> "In the process of exploration and development for many years, vocational colleges and enterprises have accumulated rich experience and formed relatively mature practices. As an innovative development model for deepening the integration of industry and education, grassroots units are often confused when promoting this new model, and it is not clear how to deal with the inheritance relationship between the old and new models. This confusion has led to a wait-and-see attitude towards the substantive construction of the industry-education integration community in many places, which makes the construction of the industry-education integration community often a mere form and lacks substance. (Yin et al., 2025)

While the CNAES evaluation report sates that "the concept of organizational form is unclear" and there is a „lack of coordination mechanism" other analysers think that this is a logical implication of the flexible implementation allowing local actors experimenting with various

institutional solution. A key conclusion (recommendation) of the CNAES report is that clear evaluation standards should be established and more performance evaluations should be performed. The report specifically mention the role of research in creating evaluation standards ("organize multiple forces, conduct in-depth research, discussions, and carry out research to form specific evaluation standards").

One further evaluation exercise worth being mentioned as an illustrative example was performed in cooperation between the researcher team of a provincial university (doing frequent evaluation research for the provincial government) and researchers of a municipal research institute (Peng - Luo, 2022). This study explored the effectiveness of enterprises' participation in vocational education in Guangdong Province, based on the annual quality reports of enterprises actively participating in vocational education between 2016 and 2019. The researcher team of the provincial university prepared several reports evaluating the implementation effect of vocational education industry-education integration policy at national and provincial level. One of these reports (Luo et al., 2023) a emphasised that the smooth progress of industry-education integration requires the strengthening of "evaluation work". This report provided a kind of evaluation of existing evaluations of UII implementation in China:

> "…some scholars have studied the evaluation standards for the practical work of industry-education integration enterprises. Some researchers have constructed evaluation indicators based on the balanced scorecard theory from four dimensions: enterprise profit and investment, school satisfaction and social impact, internal operation, learning and growth, including 'investment in school, enterprise operation, quality of student training, school cooperation construction, industry and social impact, internal operation and maintenance of enterprises, management of cooperative colleges, feedback on results, training and introduction of talents' (…) [They] have constructed evaluation indicators based on effectiveness orientation, mainly including three first-level indicators: 'effective resources provided by schools to enterprises, effective resources provided by enterprises to schools, and effectiveness of school-enterprise resource sharing.'"

Analysing the various reports containing evaluation elements one can see clearly that China's UII policy is a kind of entering an unchartered area, requiring intensive learning, permanent re-adjustments, continuous knowledge creation. . This is a cautious, experimental, and step-by-step approach to problem-solving or reform, especially when facing uncertainty or a lack of precedent.

The emerging theory of UII

Policies and practices related to UII are guided by a number of key concepts (see the section "*Terminology*" earlier and also "*Annex 2 - Key terms (glossary)"*), which shows that there might be an emerging Chinese theory of UII. While several authors seek to explain the UII phenomenon through the application of well-established and well-known Western theoretical frameworks, policy practitioners (government officials) who are responsible for implementation, tend to engage in conceptual innovations typically without explicit theoretical ambitions. These policy practitioners, embedded in policy networks and epistemic communities, tend to adopt "instrumental epistemologies", generating knowledge primarily for practical policy problem-solving (Halász – Huang, 2025b). What emerges from this is a form of "theory-embedded-in-practice" (theories-in-practice), which is continuously refined through feedback from various pilot initiatives, policy evaluations, and field-level experimentations. These evolving, practice-based theories are not recognized in global academic discourse: their value lies in their direct usefulness in policy design, policy communication, and policy implementation.

Although theories-in-practice and instrumental epistemologies seem to dominate the policy discourse there attempts to establish more general, abstract and explicit and theories to explain the UII phenomenon. One analyst, for example suggested the combination of three theoretical perspectives for a better understanding of the UII phenomenon, such as (1) human resource theory, (2) theories of institutional economics and (3) innovation theory (Li, 2025a; 2025b). The human resource theory perspective focuses on quantitative and qualitative labour demand and supply, and looks at UII as a tool to improve the matching of the skills needs of the world of work with the skills produced by universities. The theories of institutional economics help understand the emerging institutional mechanisms in which actors realising UII and the related processes are embedded. And finally innovation theory looks at UII as part of the broader innovation ecosystem with a special focus on connections and networks, crating a link particularly with the Triple Helix (Quadruple Helix) theory of innovation. As this analyst summarized: "the operating mechanism of industry-education integration can be analysed from three dimensions, namely, the accumulation and optimization of human capital, the policy regulation and incentive mechanism of institutional economics, and the knowledge sharing and technology transformation of innovation networks. These three theoretical perspectives complement each other and together constitute a systematic theoretical framework of industry-education integration." (Li, 2025a).

In a subsequent publication (Li, 2025c), the same author presents a theoretical framework explaining the evolution of UII policies and practices in China through the dynamic interplay of three fundamental factors: policy actions, market mechanisms, and knowledge building. This model posits that policy actions create the foundational conditions for UII by providing institutional support, financial incentives, and regulatory frameworks that lower barriers to entry and encourage experimental approaches. Simultaneously, market mechanisms serve as a driving force for innovation, responding to demands for skilled labour, competitive pressures, and capital investments that align educational outcomes with economic needs. Crucially, knowledge acts as both a mediating and stabilizing element in this system, not only facilitating the exchange of tacit and explicit knowledge among key stakeholders (policymakers, universities, and industry actors) but also fostering the development of shared conceptual frameworks that enable these groups to collectively navigate the complex, often uncharted territory of UII implementation. This tripartite interaction ensures that UII initiatives remain responsive to both top-down policy objectives and bottom-up market realities while maintaining the stability and continuity necessary for long-term collaboration and innovation. The theory ultimately suggests that the sustainable evolution of UII in China depends on maintaining this delicate balance between structured policy guidance, market-driven innovation, and collaborative knowledge development.

A promising avenue for theorizing is related to system governance and system integration. A key element of China's UII policies and practices is that the deep connection of education and industry leads to the emergence of a kind of "third space" and "hybridity" at both macro and micro level. At macro level an inter-sectoral governance model is emerging in which the borderlines between the different sectoral government agencies is blurred while at micro level the frontiers between organisations of different nature become permeable. A new dynamics of system integration emerges that requires entirely new governance mechanisms. One example for this approach is a paper published by three Chinese authors in 2021 describing the education-industry integration as complex adaptive system involving multiple actors (universities, enterprises, governments, intermediaries), each of them operating within different subsystems (Zhu et al., 2021). These authors use the concept of "systemic coupling" (系统耦

合 - xìtǒng ǒuhé) and "symbiosis" (共生 - gòngshēng), emphasizing that successful integration depends on aligning institutional goals, values, and incentives across subsystems and describe this as a dynamic equilibrium, where schools/universities and enterprises must continually adjust to each other and the policy environment. In this framework UII is not just coordination, but an evolving system shaped by feedback loops and co-adaptation.

Similar approaches can be found in several publications by the author previously discussed in the section on "*The higher education policy environment*", analysing education oriented UIC extensively through multiple theoretical lenses. For instance, in his analysis of the "Four New" curriculum reform, he adopts a boundary-spanning framework, highlighting how structures such as cross-sector platforms and collaborative governance models enable UII to scale and adapt across disciplines and institutions (Zhuang, 2023c). A key implication of this approach is its contribution to institutional sustainability: the institutionalization of these collaborative structures fosters durable, systemic mechanisms that allow UII to evolve into a long-term phenomenon rather than remain a transient initiative.

Action, however, are not led by such abstract theories. While key policy documents make almost always explicit reference to a "guiding ideology", the content of these document reflects a practical, pragmatic thinking that local implementers can understand relatively easily even if some suggested institutional mechanism are radically new. The limited role of abstract theories and the dominance of theories hidden or embedded in practice seems to be a key feature of UII in the Chinese context.

Conclusions

The function of this document, as stressed in the section about "*Purpose, scope, methods and earlier reviews*" is to help Hungarian (and possibly European) higher education leaders in becoming familiar with China's policies and practices related to university–industry integration. The aim is to prompt critical reflection on which elements of the Chinese experience might be adapted or incorporated into national and institutional initiatives focused on the modernization of higher education. The ultimate goal is to support policy learning in the broadest and most strategic sense.

Our analysis of key documents and relevant literature is intended not only to help non-Chinese readers and stakeholders better understand the logic and implementation of UII in China, but also to stimulate reflection on how this accumulated body of experience and knowledge might inform reforms in other national contexts, such as Hungary. In addition, this analysis offers preliminary insights that might contribute to a broader conversation about how to govern complex, lifelong learning systems in which the boundaries between formal education and the world of work are increasingly blurred.

China's UII policies and practices may be conceptualized as one of the three poles of what we refer to as an "Education Policy Triangulum." Within this model, UII policy forms a distinct pole alongside two other policy domains: higher education policy and other key education-related policies discussed earlier in the section on the broader policy ecosystem (see the section titled "*Key policy orientations and related policy documents*"). Since among these components TVET policy certainly the most important it is practical to include this in our Triangulum model (see *Figure 5*). In this conceptual model, UII policy serves as a integrative mechanism. It

connects the different subsystems of education, supporting both vertical integration (across educational levels) and horizontal integration (between education and the "real world").

Figure 5.
The three poles of the "Education Policy Triangulum"

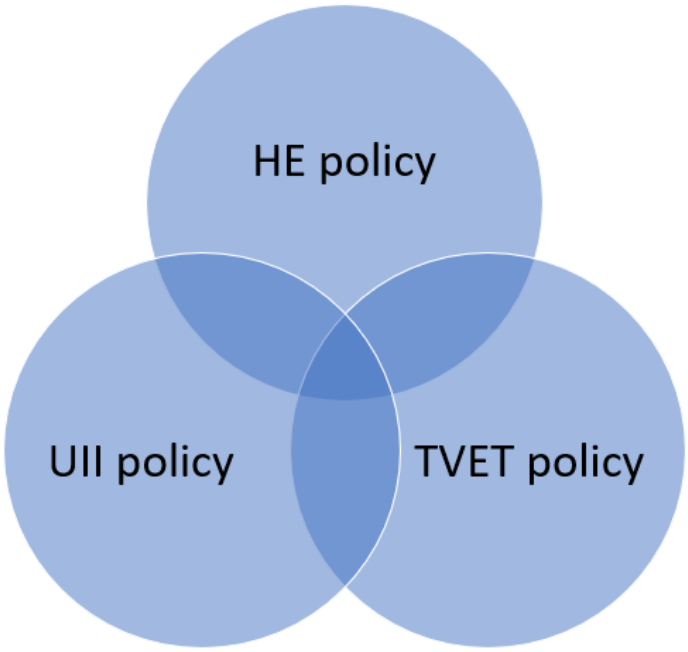


Figure designed by the authors

Within this framework, UII is not only a pathway between formal education and employment in the context of lifelong learning. It also strengthens the internal coherence of the education system, enhances governance capacity, and improves the quality of systemic coordination across diverse institutions and actors.

The key conclusion of our document and literature analysis is that China's UII policy is not simply a mechanism for connecting higher education with industry. It represents a distinct model of educational modernization and systemic transformation, one that supports the emergence of an advanced, lifelong learning–oriented education system. This may ultimately contribute to replacing the industrial-era model of formal, school-based education – rooted in 19th-century mass education – with a 21st-century paradigm grounded in the principles of lifelong learning.

Connecting higher education with industry, especially with knowledge-intensive and modern service sectors, plays a central role in this transformation. This is what Zhuang et al. (2025) described as *"modernizing higher education with industrial force"*. Their analysis underscores that this is not a uniquely Chinese phenomenon, but one observed also in other highly developed or rapidly modernizing East Asian countries. Comparing UIC in China, Japan and Singapore they come to the conclusion that in these countries "the transformative power of UIC as a central driver of innovation" is widely recognised and "higher education and industry are perceived not only as interconnected spheres but also as co-creators of the future".

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Annexes:

Annex 1 - Short project description

University-industry integration policies and practices in China - potential applications in Hungary

Project description

The research project "*University-industry integration policies and practices in China - potential applications in Hungary*" explores Chinese (national/provincial) policies and (local/institutional) practices related to university-industry integration (UII), with a special focus on leveraging university–industry cooperation (UIC) to support institutional development and reforms.

This two-year project is being implemented by Wekerle Business School (WBS), with funding from the Hungarian Government (through the "Tudás-Tér Alapítvány" foundation), in cooperation with the Learning Institute of Mathias Corvinus Collegium (MCCLI). The research is conducted under the professional leadership of a senior MCCLI researcher and is supported by an international advisory board.

The project aims to assist Hungarian higher education leaders in designing strategies and tools to strengthen UIC for institutional advancement. It also seeks to deepen academic partnerships between Chinese and Hungarian universities, promoting bilateral cooperation and mutual learning in the field of technological innovation. In addition, the project supports the upgrading of WBS – as the only Chinese-owned higher education institution in Hungary –by enhancing its role in attracting international students and advancing the internationalisation of Hungarian higher education.

The research is conceptually grounded in theories of knowledge transfer, the university's third mission, the Triple/Quadruple Helix, and the Knowledge Triangle, while also incorporating distinctive Chinese approaches to university-industry integration. Emphasis is placed on using UIC as a tool for university modernisation, including concepts such as reverse and bi-directional knowledge transfer, where knowledge flows also from industry to academia.

The project adopts a broad definition of "industry", encompassing not only traditional manufacturing but also emerging sectors such as services and the creative industries - thus addressing the full range of the university's third mission.

Methodologically, the project follows a qualitative research design, combining document and literature analysis, institutional case studies, hybrid-format workshops and conferences. Detailed case studies of UII policies and practices in various Chinese cities (with a focus on business studies, engineering, and creative industries) will provide empirical depth. Elements

of action research will also be incorporated to support the immediate application of findings to institutional development at WBS.

Through this approach, the project seeks not only to generate new academic knowledge but also to stimulate practical change within universities. Expected outcomes include a series of expert reports, detailed case studies, an analytical final report, academic publications, a toolkit for university leaders, and a concluding conference aimed at fostering new partnerships between Chinese and Hungarian universities. These outputs will contribute to developing sustainable models of UIC that support higher education innovation and bilateral cooperation.

Annex 2 - Key terms (glossary)

The following tables have been generated by AI (ChatGPT) following long iterative conversations with AI during several months. This reflects the specific interest of the authors as this appeared in a high number of queries supporting the focused learning of AI.

A. Core concepts and policy keywords

Chinese Term	Pinyin	English Translation	Function / Context
产教融合	chǎn-jiào rónghé	Industry–Education Integration	Core concept in UII policy since 2017; implies deep structural alignment
校企合作	xiào-qǐ hézuò	School–Enterprise Cooperation	Earlier and narrower concept; still widely used, esp. in TVET
工学结合	gōng-xué jiéhé	Integration of Work and Learning	Refers to dual education/training systems
协同育人	xiétóng yùrén	Collaborative Talent Cultivation	Key term in university–industry joint programs
产教融合共同体	chǎn-jiào rónghé gòngtóngtǐ	Industry–Education Integration Community	New institutional model piloted post-2022

B. Key institutional forms and models

Chinese Term	Pinyin	English	Notes
现代产业学院	xiàndài chǎnyè xuéyuàn	Modern Industrial College	Flagship UII platform in both HE and TVET sectors
应用型本科院校	yìngyòngxíng běnkē yuànxiào	Application-Oriented Undergraduate Institutions	Targeted to lead regional UII ecosystems

Chinese Term	Pinyin	English	Notes
职业本科学校	zhíyè běnkē xuéxiào	Vocational Universities	Newly emerging UII players at higher vocational level
双师型教师	shuāngshīxíng jiàoshī	Dual-Qualified Teachers	Essential human resource for UII effectiveness
校企一体化办学	xiào-qǐ yītǐhuà bànxué	School–Enterprise Integrated Operation	Refers to joint governance and funding models

C. Policy and strategic terms

Chinese Term	Pinyin	English Translation	Relevance
国家产教融合建设试点城市	guójiā chǎn-jiào rónghé jiànshè shìdiǎn chéngshì	National Pilot Cities for Industry–Education Integration	Key policy vehicle for territorial UII implementation
四链融合	sì liàn rónghé	Integration of Four Chains (education, talent, industry, innovation)	Central strategic concept in UII thinking
产教融合型企业	chǎn-jiào rónghéxíng qǐyè	Industry–Education Integrated Enterprises	Officially certified enterprises leading UII
校企命运共同体	xiào-qǐ mìngyùn gòngtóngtǐ	School–Enterprise Community of Shared Future	Politically charged expression of deep cooperation

D. Governance and operational concepts

Chinese Term	Pinyin	English	Explanation
共同治理	gòngtóng zhìlǐ	Co-Governance	Key governance model for IEICs and industrial colleges
人才链、教育链、产业链、创新链融合	réncái liàn, jiàoyù liàn, chǎnyè liàn, chuàngxīn liàn rónghé	Talent–Education–Industry–Innovation Chain Integration	Strategic alignment model across sectors
工学交替	gōng-xué jiāotì	Alternating Work and Study	Reflects sandwich model/double-track vocational education

Chinese Term	Pinyin	English	Explanation
企业导师制	qǐyè dǎoshī zhì	Enterprise Mentorship System	Used in graduate and applied education to embed enterprise guidance
校中厂、厂中校	xiào zhōng chǎng, chǎng zhōng xiào	Factory-in-School, School-in-Factory	Embodiment of space-sharing and institutional hybridization

E. Related conceptual frames and discourses

Chinese Term	Pinyin	English	Relevance
产学研合作	chǎn-xué-yán hézuò	Industry–Academia–Research Cooperation	Broader umbrella concept, often used in R&D contexts
三教改革	sān jiào gǎigé	Reform of Curriculum, Teaching Material, and Teaching Staff	Key reform area in TVET and UII-linked education modernization
创新驱动发展战略	chuàngxīn qūdòng fāzhǎn zhànlüè	Innovation-Driven Development Strategy	Macro policy that legitimizes UII as part of innovation governance
服务区域经济发展	fúwù qūyù jīngjì fāzhǎn	Serve Regional Economic Development	Strategic mission of applied universities within UII frameworks
双元育人	shuāngyuán yùrén	Dual-System Talent Cultivation	Refers to parallel involvement of schools and enterprises in talent training

Annex 3 - Selected publications and documents

These selected publications and documents are titles collected directly from published papers and earlier literature reviews. Unlike the items in the list of references the items in this section *have not been checked*. Some of them might be uncomplete and some of them might not be accurate (especially those with translated titles of papers originally published in Chinese)

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Annex 4 - An AI generated literature systematic literature review

The following Literature Review has been produced by the Elicit AI platform (see here) in June 2025 based on the following request: "*Please prepare a literature review on China's university-industry integration (UII) policies and practices with a special focus on the impact of UII on the quality of skills development or talent development and on the way teaching and learning is organised in universities*."

Abstract

Research shows that Chinese UII policies and practices lead to improved talent quality and practical competencies while transforming university teaching toward more project-based and internship-supported formats. China's university-industry integration (UII) initiatives appear to support the development of practical skills and improvements in both talent quality and instructional practices. The studies report that policies and models—such as the "3+1" and "2+1" work-based learning schemes, engineering integration, and vocational programs—are associated with enhanced employability, practical competence, and innovation. For example, several investigations note that structured integration models and flexible, practice-based curricula result in greater student engagement and skill application, with improvements noted in up to 14 studies addressing employability and eight emphasizing holistic skill development.

Evidence further shows that teaching and learning in universities are shifting toward interdisciplinary, project based, and internship-supported formats. Key success factors include robust industry–academia collaboration, stakeholder engagement, and policy alignment, as detailed in studies reporting enhanced program quality and shared visions between universities and companies. Challenges are also reported, most notably in the form of academic–industry mismatches (observed in nine studies), regional disparities, and resource constraints such as faculty shortages. Such challenges underscore an uneven implementation across different regions and sectors.

In summary, the papers indicate that when UII models are carefully structured and sufficiently supported by policy, they lead to tangible improvements in skills development and foster a more practice-oriented organization of teaching and learning in Chinese universities.

Paper search, screening and data extraction

Using your research question "Please prepare a literature review on China's university-industry integration (UII) policies and practices with a special focus on the impact of UII on the quality of skills development or talent development and on the way teaching and learning is organised in universities.", we searched across over 126 million academic papers from the Semantic Scholar corpus. We retrieved the 498 papers most relevant to the query.
We screened in papers that met these criteria:

- **Geographic and Topic Focus**: Does the study examine university-industry collaboration policies or practices within Chinese higher education institutions?
- **Educational Outcomes**: Does the study analyze educational outcomes (such as skills development, talent development, or changes in teaching/learning organization)?
- **Study Type**: Is the study either an empirical investigation (quantitative, qualitative, or mixed methods) OR a systematic review/meta-analysis?
- **Stakeholder Perspectives**: Does the study include both university and industry perspectives in its analysis?
- **Education Level**: Does the study focus specifically on higher education (university level)?
- **Evidence Base**: Does the study present evidence-based findings rather than purely theoretical arguments?
- **Generalizability**: Does the study examine broader institutional implications beyond single case studies?

We considered all screening questions together and made a holistic judgement about whether to screen in each paper.

We asked a large language model to extract each data column below from each paper. We gave the model the extraction instructions shown below for each column.

- **Study Design**:

Identify and describe the primary research methodology used in the study. Categorize as:

- Qualitative (e.g., interview-based, documentary analysis)
- Quantitative (e.g., bibliometric analysis, survey)
- Mixed methods

Provide specific details about the research approach, such as:

- Semi-structured interviews
- Policy document review
- Bibliometric mapping
- Case study approach

If multiple methods are used, list all and indicate their primary purpose in the research.

If the methodology is not clearly stated, look for clues in the methods section about data collection and analysis techniques.

- **Research Context and Setting**:

Specify the geographical and institutional context of the study:

- Specific province or region in China
- Types of universities involved (e.g., comprehensive, technology-focused)
- Sector focus (e.g., entrepreneurship education, industrial design education) Extract information about:

- Specific policy frameworks referenced
- Time period of the study
- Any unique contextual factors that might influence university-industry integration

If multiple contexts are mentioned, list all. If context is not explicitly stated, note ”Not specified” and provide any relevant contextual details found in the text.

- **University-Industry Collaboration Mechanisms**:

Identify and describe specific mechanisms of university-industry integration:

- Types of collaboration (e.g., teaching-focused, research-based)
- Stakeholder engagement strategies
- Institutional cooperation models Extract specific details about:

- Formal collaboration structures
- Interdisciplinary cooperation approaches
- Entrepreneurship education integration

If multiple mechanisms are described, list them in order of prominence or detail provided in the study.

- **Policy and Strategic Implications**:

Extract key policy insights and strategic recommendations related to university-industry integration:

- Specific policy strategies mentioned
- Challenges identified in implementation
- Recommended improvements or future directions Focus on:

- Government policy influences
- Institutional transformation strategies
- Skills development and talent cultivation approaches

If recommendations are not explicit, synthesize implied strategic insights from the study's findings.

- **Key Research Findings**:

Summarize the primary findings of the study related to university-industry integration:

- Main research outcomes
- Significant observations about collaboration models
- Insights into skills development or educational transformation Extract:

- Quantitative results (if applicable)
- Qualitative insights
- Key conclusions drawn by the authors

Prioritize findings directly addressing university-industry integration, skills development, and educational organization.

Results

Characteristics of Included Studies

Study	**Study Focus (Policy/Practice/Impact)-**	**Research Type**	**Geographic Region**	**Industry Sector**
Wang et al., 2024	Practice/Impact: ”3+1” work-based learning, skills development	Qualitative (in-depth interviews)	China (national)	Work-based learning, general
Li and Hu, 2023	Policy/Practice: Engineering education integration	No mention found (empirical)	China (national)	Engineering
Zhuang et al., 2024	Practice/Impact: Teaching-focused university-industry integration, resource dependence	Mixed methods (content analysis, interviews)	China (national)	Teaching-focused, general
Mei and Symaco, 2020	Policy/Practice: Entrepreneurship education	Qualitative (interviews, policy review)	Zhejiang Province	Entrepreneurship
Zhuang and Jiang, 2023	Policy/Practice: Symbolic capital in	Qualitative	China (national)	Teaching-focused, general

	university-industry integration	(documentary, videological, interviews)		
Eun, 2009	Practice/Impact: Horizontal university-industry linkage	Quantitative (surveys, econometric)	China (national)	General/Industrial
Bao and Ariunjargal, 2024	Policy/Practice: School-enterprise cooperation	Mixed methods (bibliometric, content analysis)	China (national)	General, engineering, innovation
Chen and Gan, 2021	Impact: Internship program, employability	Mixed methods (surveys, interviews)	Zhejiang Province	General, employability
Qiu et al., 2024	Practice/Impact: Software engineering talent training	No mention found (empirical)	No mention found	Software engineering
Wang et al., 2015	Practice/Impact: Holistic industry simulating model	Case study (reflective)	Shanghai (Tongji University)	Industrial design, engineering

Study	Study Focus (Policy/Practice/Impact)	Research Type	Geographic Region	Industry Sector
Liu, 2022	Practice/Impact: Vocational college integration	Mixed methods (surveys, interviews, qualitative comparative analysis)	Greater Bay Area	Vocational, engineering
Liu et al., 2024	Policy/Impact: Vocational education integration	Quantitative (panel data)	31 provinces (national)	31 provinces (national)
Li, 2024	Practice/Impact: Civil aviation vocational education	Quantitative (survey)	China (national)	Civil aviation
Yi and Tang, no date found	Practice/Impact: Engineering master's partnerships	Qualitative (case study)	China (national)	Engineering
Wang et al., "Employment Skills Revisited"	Practice/Impact: "3+1" employment skills	Qualitative (interviews)	China (national)	Work-based
Zhao et al., 2016	Practice/Impact: Multidimensional cooperative education	Qualitative (case study)	Jilin	Entrepreneurship
Zhu et al., 2011	Practice/Impact: Employability, talent management	Qualitative (interviews)	China (national)	Engineering,
Zhang et al., 2020	Policy/Practice: University enterprise cooperation research trends	Quantitative (bibliometric)	China (national)	Human resource
Fang et al., 2021	Policy/Practice: National human resource development, triple helix	Qualitative (semi-narrative review)	China (national)	Innovation, general
Zhuang, 2023	Policy/Practice: "Four New" project, boundary-spanning	Qualitative (policy/practice review)	China (national)	Innovation, general

Study	Study Focus (Policy/Practice/Impact)	Research Type	Geographic Region	Industry Sector
Li et al., 2023	Policy/Practice: Industrial design education	Mixed methods (bibliometric, policy analysis)	China (national)	Industrial design
Jian and Cao, 2023	Policy/Practice: Collaborative talent training	Quantitative (bibliometric)	China (national)	General, talent cultivation
Sun and Yao, 2022	Practice/Impact: Vocationalundergraduate collaboration	Qualitative (case study)	Guangdong Province	Vocational, talent training
Yang, 2024	Practice/Impact: ”2+1” model, talent cultivation	Mixed methods (case study, quantitative)	China (national)	Vocational, trade colleges
Liao and Liao, 2022	Practice/Impact: Applied undergraduate integration	Quantitative (survey)	South China	Applied undergraduate, general

Study Focus:

- 23 studies addressed Practice, 16 addressed Impact, and 10 addressed Policy. Many studies covered more than one focus area.

Research Type:

- 10 studies used qualitative methods.
- 6 studies used quantitative methods.
- 6 studies used mixed methods.
- 4 studies were described as case studies (a subset of qualitative).
- For 2 studies, we didn't find mention of the research type.

Geographic Region:

- 16 studies were conducted at the national level in China.
- 8 studies were conducted in specific provinces or regions: 3 in Zhejiang, 1 in Shanghai, 1 in Greater Bay Area, 1 in Jilin, 1 in Guangdong, and 1 in South China.
- For 1 study, we didn't find mention of the geographic region.

Industry Sector:

- 11 studies focused on general sectors.
- 6 studies focused on engineering.
- 4 studies focused on vocational education or colleges.
- 3 studies focused on employability.
- 2 studies each focused on entrepreneurship, innovation, industrial design, teaching-focused, work-based learning, and talent cultivation.
- 1 study each focused on talent training, software engineering, civil aviation, human resource development, trade colleges, applied undergraduate, and industrial sectors.

Geographic Scope:

- We didn't find mention of studies outside China or its provinces/regions.

Policy and Implementation Framework

Evolution of University-Industry Integration Policies

China's university-industry integration (UII) landscape is shaped by strong government policy support, including initiatives such as the ”Mass Entrepreneurship and Innovation” strategy, the ”Four New Project,” and the ”3+1” and ”2+1” models. National and regional policies have promoted the expansion of UII, with government, industry, and universities collaborating to address skills gaps and align education with economic needs.

Implementation Models

Study	Theme	Key Findings	Success Factors
Wang et al., 2024	Work-based learning, skills	Holistic skills, employability	Industry-academia collaboration, flexible curriculum
Li and Hu, 2023	Engineering talent	Practice, innovation ability	Multi-path models, tailored integration
Zhuang et al., 2024	Teaching-focused university-industry integration	Resource-driven quality	Resource sharing, company engagement
Mei and Symaco, 2020	Entrepreneurship	Legitimacy, faculty shortage	Interdisciplinary, stakeholder engagement
Zhuang and Jiang, 2023	Symbolic capital	Shared vision, ecosystem	Policy alignment, recognition
Eun, 2009	Horizontal university-industry linkage	Positive firm views	Formal contracts
Bao and Ariunjargal, 2024	School-enterprise	Innovation, practical teaching	Policy influence, collaborative modes
Chen and Gan, 2021	Internship, employability	Improved skills, attractiveness	Internship program, business engagement
Qiu et al., 2024	Software engineering	Talent advancement	Deep integration, industry-specific classes
Wang et al., 2015	Holistic model	Effective, transferable	Integrated curriculum, partnerships
Liu et al., 2024	Vocational integration	Regional disparities	Policy support, resource allocation
Li, 2024	Civil aviation	Quality issues	Strategy development

Yi and Tang, no date found	Engineering master's	Partnership models	Practice base, project matching
Wang et al., "Employment Skills Revisited"	"3+1" skills	Holistic, practical, soft skills	Stakeholder input, comprehensive education
Zhao et al., 2016	Multidimensional	All-round development	Shared resources, practice bases
Zhu et al., 2011	Employability	Skills/talent alignment	Civic partnerships, master's program
Zhang et al., 2020	University enterprise cooperation research	Competence, innovation	Course/practice resource development
Fang et al., 2021	National human resource development, triple helix	Regional disparities	Collaboration, leadership
Zhuang, 2023	"Four New"	Macro/micro change	Boundaryspanning, innovation
Li et al., 2023	Industrial design	Steady growth	Interdisciplinary, policy
Jian and Cao, 2023	Collaborative training	Policy-research alignment	Demand-oriented, curriculum
Sun and Yao, 2022	Vocationalundergraduate	Quality improvement	Collaboration, policy
Yang, 2024	"2+1" model	Satisfaction, skills	Multi-scale integration
Liao and Liao, 2022	Applied undergraduate	Reduced anxiety, mutual benefit	Symbiosis, resource integration

Policy Types:

- 2 studies on work-based learning models (including "3+1" skills)
- 2 studies on engineering integration or engineering master's programs
- 2 studies on vocational integration
- 1 study each on teaching-focused university-industry integration, entrepreneurship education, symbolic capital, horizontal university-industry linkage, school-enterprise cooperation, internship programs, software engineering, industry-simulation, civil aviation, multidimensional cooperation, employability, university-enterprise cooperation research, national human resource development/triple helix, "Four New" project, industrial design, collaborative training, vocational-undergraduate, "2+1" model, and applied undergraduate models Implementation Mechanisms:

- Collaboration-based mechanisms (industry-academia, school-enterprise, university-industry, collaborative innovation): 10 studies
- Policy-driven or policy-aligned mechanisms: 6 studies
- Curriculum integration or similar approaches: 3 studies
- Resource sharing, allocation, or dependence: 3 studies

- Bibliometric, literature review, or mapping approaches: 4 studies
- Survey, interviews, or field investigation: 4 studies
- Practice base, internships, or labs: 4 studies
- Innovation or boundary-spanning mechanisms: 3 studies
- Other mechanisms (qualitative comparative analysis, symbiosis theory, university-enterprise dual innovation and open talent training alliance, etc.): 5 studies Outcomes:

- Positive outcomes (improved employability, skills, innovation, quality improvement, engagement, growth, effectiveness, mutual benefit, etc.): 14 studies
- Mixed outcomes (positive and challenges, such as resource challenges, staff shortages, social costs, disparities, instability, research gaps, etc.): 10 studies
- Negative outcomes (quality issues, policy obstacles): 1 study Most common positive outcomes:

- Improved employability/skills/talent: 6 studies
- Innovation/advancement: 4 studies
- Quality improvement/progress: 4 studies
- Growth/effectiveness/robust effects: 4 studies
- Mutual benefit/shared vision/ecosystem: 3 studies Most common challenges:

- Resource or staff shortages: 2 studies
- Disparities or instability: 3 studies
- Policy obstacles or research gaps: 2 studies
- Partnership challenges: 1 study

We didn't find mention of missing outcome information for any study in the table.

Thematic Analysis

Skills Development and Quality Enhancement

Key Findings:

- Skills and employability outcomes: 8 studies
- Innovation or innovation ability: 4 studies
- Practice or practical teaching: 4 studies
- Quality, progress, growth, or improvement: 7 studies
- Alignment, shared vision, or policy-research alignment: 8 studies
- Regional disparities: 2 studies
- Wellbeing or mutual benefits: 3 studies
- Other findings: satisfaction (1), legitimacy/faculty issues (2), change (1), effectiveness/transferability
  (2), demand/attractiveness (2), perception (1), ecosystem (1), soft skills

(1) Success Factors:

- Collaboration, partnerships, or stakeholder engagement: 16 studies
- Curriculum, integration, or interdisciplinary approaches: 12 studies
- Policy, strategy, or policy support: 7 studies

- Resource sharing or allocation: 6 studies
- Practice bases, joint training, or practical experience: 7 studies
- Programs or models: 3 studies
- Recognition, leadership, or complementary benefits: 3 studies
- Other factors: contracts (1), project matching (1), boundary-spanning or symbiosis (2)

Challenges:

- Alignment, consensus, or academic-industry mismatch: 9 studies
- Variation, fluctuation, instability, or research gaps: 4 studies
- Resource distribution or allocation: 5 studies
- Policy, sector primacy, or reform/innovation: 4 studies
- Employment rates, supply-demand, or related issues: 3 studies
- Collaboration or cooperation gaps: 2 studies
- Other challenges: feedback mechanisms (1), institutional thickness or social costs (2), implementation (1), deliverables (1), clustering (1)
- We didn't find mention of challenges in 8 studies

Discussion

- Reported impacts: Most studies report that university-industry integration, when implemented with structured models and strong collaboration, is associated with improved skills development, employability, and talent quality.
- Success factors: Structured integration models, industry-academia collaboration, flexible and practice-based curricula, and active stakeholder engagement are frequently cited as important.
- Challenges: Misalignment between academic and industry needs, lack of faculty with industry experience, and regional disparities are commonly reported challenges.
- Evidence quality: The quality of evidence varies, with some studies using robust mixed methods or quantitative approaches, while others rely on qualitative or case study designs.

Teaching and Learning Transformation

- Studies report that university-industry integration has contributed to changes in teaching and learning organization in Chinese universities.
- Models such as ”3+1” and ”2+1” integrate academic study with practical, industry-based training, supporting holistic skill sets and adaptability.
- Project-based learning, internships, and interdisciplinary approaches are increasingly common, often supported by government policy and institutional transformation.
- Implementation is uneven, with some regions and sectors facing resource constraints, policy obstacles, or insufficient industry engagement.

Industry-Academic Alignment

Theme	Key Findings	Success Factors	Challenges

Alignment of curricula with industry needs	Improved employability, practical skills	Industry input, flexible curriculum	Academic-industry mismatch, limited exposure
Stakeholder engagement	Enhanced program quality, shared vision	Recognition, policy alignment	Sustaining engagement, aligning interests
Regional and sectoral disparities	Uneven integration, skills gaps	Policy support, resource allocation	Economic development, employment rates
Faculty and institutional transformation	Improved teaching, innovation	Professional development, interdisciplinary teams	Faculty shortages, resistance to change

Key Findings:

- Each theme is associated with a distinct key finding, as reported by the studies:
  - Improved employability and practical skills
  - Enhanced program quality and shared vision
  - Uneven integration and skills gaps
  - Improved teaching and innovation Success Factors:
- Each theme identifies unique success factors, including industry input, flexible curriculum, recognition, policy alignment, policy support, resource allocation, professional development, and interdisciplinary teams.

Challenges:

- Challenges reported include academic-industry mismatch, limited exposure, sustaining engagement, aligning interests, economic development, employment rates, faculty shortages, and resistance to change.

Discussion

- Alignment: Studies highlight the importance of industry input in curriculum design, practice-oriented teaching, and recognition of stakeholder contributions.
- Challenges: Persistent challenges include mismatches between academic and industry expectations, limited industry exposure for students, and difficulties in sustaining engagement.
- Regional disparities: Regional and sectoral disparities complicate alignment, and targeted policy and resource interventions are frequently mentioned as necessary.

Summary

- The included studies on China's university-industry integration policies and practices report a range of positive impacts on skills and talent development, as well as on the organization of teaching and learning.
- Many studies identify structured integration models, collaboration, and flexible curricula as important for success.

- Reported challenges include misalignment between academic and industry needs, faculty shortages, resource constraints, and regional disparities.
- The quality of evidence varies, with some studies using robust methods and others limited by methodological constraints or lack of detailed reporting.
- The organization of teaching and learning in Chinese universities is reported to be evolving toward more practice-based, interdisciplinary, and industry-aligned models, but implementation remains uneven across regions and sectors.

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