Engineering Educators Bringing the World Together
2025 ASEE Annual Conference & Exposition
Palais des congrès de Montréal, Montréal, QC • June 22–25, 2025 ASEE
Paper ID #46164

BOARD # 193: How do research universities in China pivot from basic research to industrial outreach: a multi-case analysis from the perspective of university industrial outreach institutions

Ms. Weijia Zhang, Zhejiang University

School of Public Affairs, Zhejiang University, Hangzhou 310058 Melbourne Graduate School of Education, the University of Melbourne, Vicoria 3010

Research field: Doctoral Education; Engineering Education; Interdisciplinary Research; Higher Education Policies

Prof. Wei Zhang, Zhejiang University

2015-Present Professor, Institute of China's Science,Technology and Education Strategy, Zhejiang University Associate director of Research Center on Science and Education Development Strategy, Zhejiang University 2012-2014 Professor, School of manag

Ms. Shuai Wang, School Of Public Affairs, Zhejiang University

Shuai Wang, PhD candidate in School of Public Affairs, Zhejiang University.Research Interests: Engineering education

How do research universities in China pivot from basic research to industrial outreach: a multi-case analysis on university industrial outreach institutions

Abstract

In China, the knowledge and technology gaps between universities and industries, to some extent, have posed challenges for enterprises in absorbing advanced technologies, driving the need for deeper collaboration with universities. As the trend of open innovation gradually from enterprises to academia, research universities appear to face growing pressure to enhance industrial outreach as part of their third mission. This study examines how universities may engage in industrial outreach through open innovation laboratories, industry-university research centers, and joint R&D centers. Based on a multi-case analysis of six institutions, with data collected through interviews and document analysis, the research highlights differences in organizational structures, motivations, and mechanisms. Open innovation laboratories appear to leverage internal academic entrepreneurship, external technology transfer, and talent development to connect the industrial chain, with independent operational mechanisms potentially allowing quick and flexible responses to market demands. Industry-university research centers tend to promote regional industrial cluster development by integrating industrial talent and resources through co-constructed production lines and skills training, potentially forming integrated ecosystems. Meanwhile, joint R&D centers often focus on breakthrough innovations to address corporate challenges and enhance global competitiveness.

Introduction

In many established industry-university relationships, industries often possess strong innovation capabilities, while universities typically focus on early-stage research and technology transfer, with knowledge generally flowing unidirectionally from universities to external entities (Striukova & Rayna, 2015). This dynamic has created a clear division where universities primarily generate knowledge, and industries focus more on implementing innovation. However, many businesses, particularly in China, appear to in building independent innovation capacity and in translating cutting-edge technologies from universities directly into market applications. As a result, they tend to prioritize short-term innovation activities, such as patenting and consulting, over long-term R&D initiatives, reflecting their limited capacity for industrial research (Chen & Liu, 2017).

To address the challenges faced by businesses in adopting advanced technologies and fostering innovation, research universities have faced increasing pressure to expand their industry outreach (Lee, 1996), gradually taking on a pivotal role as intermediaries narrowing the gap between academia and industry by fostering industry-university links with high relational involvement, such as academic entrepreneurship and specialized professional training (Laredo, 2007). In this context, research universities have become central to industry-

university collaboration, especially within the broader framework of open innovation (de las Heras-Rosas & Herrera, 2021). These collaborations, however, often rely on formally established organizations to initiate and maintain their activities. In response, many countries have actively pursued the development of university-industry outreach initiatives, such as the S&T Centers and ERCs proposed by the NSF in the United States. Still, as Perkmann & Walsh (2007) point out, most current research focuses on the impact of industry-university links on innovation-related outcomes, while the organizational dynamics of these relationships remain under-explored.

This study aims to answer a key question: How do research universities in China engage in industrial outreach in open innovation paradigms? Drawing on the frameworks of open innovation and processes of University-Industry Collaboration, we tend to focus on three prominent types of university-industry outreach institutions: open innovation laboratories, industry-university research centers, and joint R&D centers. This research tries to provide a detailed analysis of their organizational structures, the nature of their outreach activities, operational strategies, and the driving motivational factors behind their engagement.

Literature Review

University Industrial Outreach can be considered an important form or specific practice of University-Industry Collaboration or Cooperation (UIC henceforth) (Hellström et al., 2013). This section first examines the relevant literature on UIC and explores its potential transformation under the new paradigm of Open Innovation. This study aims to identify the characteristics of University Industrial Outreach within the context of new innovation paradigms and to develop a framework for case studies.

University-Industry Collaboration and its trend under Open Innovation

University-Industry Collaboration has become a potentially important means of accelerating the flow of knowledge between sectors, fostering innovation in cutting-edge research, and driving technological progress (Ankrah & Al-Tabbaa, 2015). The increasing interaction between industry and universities in the knowledge economy has led to a growing academic discussion on University-Industry Collaboration (UIC). Many scholars have explored the conceptual dimensions, dynamic processes, influencing factors and mechanisms, and theories underpinning UIC.

Conceptual Aspects

Some scholars have discussed the nature, types, and forms of UIC from the aspect of concepts. UIC is generally considered a multidimensional, interdisciplinary process of innovative interaction involving multiple dimensions, with the goal of win-win cooperation between universities and industry. It is characterized by the transfer of knowledge, expertise and technology, as well as the practical application of research results to solve real-world

problems or create new research opportunities (Nsanzumuhire & Groot, 2020; Rossoni et al., 2024).

Most studies generally categorize UIC in terms of depth of industrial involvement and persistence of UIC (Awasthy et al., 2020). For example, Lind et al. (2013) classified UIC into four types: distanced collaboration, translational collaboration, specified collaboration and developed collaboration. Other scholars focus on the causes of UIC formation and classify such collaborations into embedded, emergent and engineered collaborations (Doz et al., 2000; Ring et al., 2005; Al-Tabbaa & Ankrah, 2019). Some also categorize UIC based on its channels of flow, distinguishing bi-directional, commercial, service, and traditional channels (Nsanzumuhire & Groot, 2020).

Regarding UIC forms, these may include information and training, IPR, R&D projects, human resources, commercialization activities, and staff and student mobility. In the context of open innovation, new forms have emerged, such as Inbound (e.g., sourcing, research partnerships), Outbound (e.g., donating IP, corporate incubators), and Coupled (e.g., innovation communities, shared infrastructures) (Flor et al., 2020). Beck et al. (2022) further explore UIC forms in open science, including (inter)disciplinary collaborations, data sharing, and staff mobility, alongside contract research, patenting, and spinout companies.

Dynamic Processes

Academics have conducted a range of research around the constituent stages of the UIC dynamic process, the motivations for the process to begin, and the drivers, barriers, and mechanisms that influence the dynamics of the process. Studies have generally categorized this dynamic process into stages according to the degree of partnership, with Lemos & Cario (2017) categorizing it into three key phases: pre-linkage, establishment, and the latent phase (Passos et al., 2022), while O'Dwyer et al. (2023) described four developmental stages: embryonic stage, initiation stage, engagement stage, and established stage. Although UIC consists of different stages, the entire process begins with motivation to achieve individual and shared goals, often aimed at solving social challenges (Al-Tabbaa & Ankrah, 2019). While motivations may vary between universities and industries, the common driver for both is the need to solve problems (Cyert & Goodman, 1997). For industry, the drivers that may incentivize participation in UIC are reducing innovation risk, acquiring scientific knowledge, and leveraging research infrastructure and expertise (Calcagnini et al., 2016; Passos et al., 2022). In contrast, universities typically pursue collaboration for problem solving, resource sharing, access to information and talent, and skills development (Awasthy et al., 2020). Reconciling these motivations appears to be critical to successful collaboration (Perkmann & Salter, 2012).

Factors and Mechanisms

This dynamic processes of UIC are largely shaped by various barriers, enablers and management mechanisms. Studies have categorized barriers to UICs in various ways. A key

challenge is the cultural gap between universities and companies, arising from differing normative codes (Valentín, 2000). Bruneel et al. (2010) suggested that other barriers could be classified into two types: (i) orientation-related barriers, which may stem from universities' focus on pure science and long-term goals, causing misunderstandings with industry; and (ii) transaction-related barriers, which might include unrealistic expectations, low engagement by liaison offices, IP conflicts, confidentiality concerns, and regulatory constraints. Muscio and Vallanti (2014) identified 16 obstacles and tended to group those into four categories: conflicts with companies, academic networking issues, conflicts with academic goals, and research nature.

Regarding enablers, scholars have explored factors from micro to macro levels, classifying UICs into three contexts: individual, organizational, and institutional. The individual context includes factors like scientists' productivity and academic history, the organizational context might focus on the quality of university departments and incentives for collaboration, and the institutional context could encompass regulations and public policies (Perkmann et al., 2013; Passos et al., 2022). Building on this, Ćudić et al. (2022) suggested dividing influencing factors into input and output categories. Input factors may include institutional factors (e.g., business environment and government effectiveness), human factors (e.g., human capital and research), linkage factors (e.g., relationships between partners), and framework factors (e.g., business infrastructure). Output factors are considered to refer to the level of UIC development within a specific country. Additionally, some scholars have analyzed these factors from the perspectives of different stakeholders. From the firm's perspective, key factors might include innovation capability, innovation strategy, and the origin of firms (Nsanzumuhire & Groot, 2020). From the university's perspective, academic leadership and industrially relevant academic R&D resources are often seen as crucial. From the collaboration process perspective, mechanisms such as absorptive capacity, prior stakeholder engagement, boundary spanners, trust-building mechanisms, and boundary-spanning frameworks are considered to play critical roles (Awasthy et al., 2020; Rossoni et al., 2024).

Underlying Theories

The theoretical foundations of university-industry collaborations (UICs) could provide a robust framework for understanding their structure and impact, mostly drawing from models such as the triple helix (Etzkowitz & Leydesdorff, 1995), resource-based theory (Alunurm et al., 2020), social capital theory (Rossoni et al., 2024), agency theory (Calvo et al., 2019), and open innovation (OI) models (Perkmann & Walsh, 2007).

Open innovation, generally defined as "a distributed innovation process based on planned knowledge flows across organizational boundaries" (Chesbrough, 2006), has significantly influenced UICs by transforming collaboration dynamics at both activity and organizational levels. Open innovation practices in university-industry collaborations may enable local co-value creation by redefining institutional norms, delivering novel products and services, reorganizing processes, and creating new platforms for interaction (Costa et al., 2021; Osorno-Hinojosa et al., 2022). Universities, innovation hubs, and labs are increasingly seen as

natural spaces for fostering collaborations between social innovators and firms (Osorno-Hinojosa et al., 2022), facilitating knowledge exchange and mutual learning. Conversely, UICs can serve as critical platforms for open innovation, enabling the exchange of expertise and resources that may be essential for mutual growth (Opassuwan & Wannamakok, 2024). However, while open innovation literature often encompasses a range of UIC models, it tends to focus on business-to-business transactions or unidirectional university-to-industry collaborations (Kutvonen et al., 2013), leaving gaps in understanding the more complex, reciprocal, and multi-stakeholder dynamics that may characterize contemporary UICs.

Open Innovation and University Industrial Outreach

It seems that universities inherently have an organizational culture that is consistent with the "inside-out" dimension of open innovation, which is characterized by a relatively closed attitude towards technology acquisition but an open stance towards knowledge dissemination and utilization (Lichtenthaler, 2008). Many academics might have unconsciously involved in open innovation processes when conducting research and industry outreach activities, such as professional education and the construction of technology transfer offices (TTOs), but at this stage university research and education activities are still mainly centered on basic research. In this context, the government is becoming increasingly aware of the gap between university research outcomes and industry needs and the innovative value of promoting the external translation of university basic research. Hence, universities are under increasing pressure to adopt a more "outward-looking" approach that emphasizes the integration of real-world industry challenges into their research agendas (Striukova & Rayna, 2015).

The government's increasing emphasis on two-way interaction between universities and industries may further highlight the potential role of open innovation and industrial outreach in the new stage of development for research universities. This aims to encourage universities to become more proactive in participating in industrial development and fostering advanced innovation. This study is based on this perspective. It explores how universities might collaborate with industries and achieve win-win results through university-industrial outreach. Research has pointed out that open innovation might promote the sharing of resources and knowledge complementarity between organizations, and that UIC is one of the common open innovation models that can accelerate technological innovation today (El-Ferik & Al-Naser, 2021). In particular, industry outreach plays a central role in universities' participation in open innovation, and is usually managed by specialized units within the university that work to facilitate links with industry, promote knowledge exchange, and solve practical problems.

Industry outreach has become increasingly important in the development of universities as a key component of their third mission. Previous research on industry outreach has generally focused on the content as well as the impact of outreach activities, which include resource transfer, service delivery, research program recruitment, and industry training internships (Hellström et al., 2013). Some scholars have explored forms of UIC through an educational outreach lens, noting that university-industry collaboration centers around student education activities, including co-design of competency goals (Mucino et al., 2013), course content, and

pedagogical methodologies (Lopez Hurtado et al., 2014), and that ICTs can, to some extent, influence outreach education practices and effectiveness (Saif et al., 2022). In addition, Illingworth and Roop (2015) demonstrate the types of outreach activities that scientific researchers engage in, such as summer schools, rotational courses and workshops.

As universities increasingly open their borders, university industry outreach is gradually evolving from informal relationships between researchers and firms to sustainable strategic partnerships and institutional frameworks. An increasing number of research universities are leveraging their strengths in research quality (Atta-Owusu et al., 2021) to build open innovation laboratories to facilitate the internal and external flow of knowledge and the translation of cutting-edge research results into advanced technologies.

Most studies have explored open innovation practices and the role of university laboratories, mainly through case studies. For example, Moretti (2019) examines open innovation practices in university laboratories, noting that open innovation practices can support the capabilities of small and medium-sized enterprises (SMEs) by reducing uncertainty in the application of new technologies, but that this advantage is less important for large, self-sufficient firms (Bianchi et al., 2010). In addition, Miranda et al. (2019) used the Tecnologico de Monterrey, Mexico, as a case study on the active role of the university's open innovation lab in promoting Education 4.0, and found that the lab, primarily through the provision of flexible learning modalities (e.g., online courses and MOOCs), authentic design methodologies, and platforms for rapid product realization (e.g., remote laboratories, micro-factories, and mobile platforms) appears to facilitate the engagement of multidisciplinary and cross-sectoral communities (Cortés et al., 2022).

Simultaneously, many research universities have engaged in deep collaborations with large corporations, forming R&D partnerships, with joint R&D institutes emerging as a prominent manifestation of these relationships. The concept of joint R&D institutes originates from the broader framework of cooperative research centers and in the Chinese context, joint R&D institutes are typically university-based cooperative research centers officially registered with the universities' research management departments, facilitating cross-sector and cross-border collaboration (Ma, 2019).

Additionally, research universities have reportedly partnered extensively with local governments and industries to establish public research organizations, such as university-industry collaboration centers, which are believed to further promote innovation and regional development (Schillo & Kinder, 2017).

The literature on university industrial research institutions appears to be relatively limited. Current studies have mainly focused on the practices of research universities and factors influencing UIC. This study intends to address this gap by focusing on six research centers in China. Through these cases, it seeks to explore how Chinese research universities provide organizational support for industrial outreach and investigate the current state of industrial outreach practices within these institutions.

Methodology

Case Selection and Description

Based on the literature review, industrial outreach institutions in research universities can potentially be categorized by their origins into three primary types: university-affiliated open innovation laboratories, industry-university research centers established in collaboration with local governments, and joint R&D institutes co-founded by universities and large firms. Open innovation laboratories are typically university-led initiatives that primarily focus on providing outreach services to broader social communities. Industry-university research centers are generally co-established by local governments and universities, with an emphasis on delivering outreach services tailored to the needs of regional industries and supporting local economic development. In contrast, joint R&D institutes are often characterized by deeper collaborations between universities and large firms, with an emphasis on the active participation of the corporate partners.

Based on the three types, this study focuses on six Chinese research universities' research centers for a multi-case analysis. Due to confidentiality agreements, both respondents and institution names are anonymized and are referred to using coded identifiers. For the first type, open innovation laboratories (OILs), the study includes university laboratories affiliated with two research universities in Zhejiang Province. For the second type, industry-university research centers (IURCs), the selected cases comprise two university-local government collaborative platforms located in Hangzhou and Quzhou, Zhejiang Province. For the third type, joint R&D institutes (JRDIs), the study examines a joint research center established through collaborations between a research university in Hangzhou, Zhejiang Province, and leading enterprises in the semiconductor materials and telecommunications sectors. Details of the cases are summarized below (see Table 1).

Table 1 Case Details

Type	Description	Resources
OIL1	This institution was established in July 2020 and is hosted by a research university in Hangzhou, Zhejiang Province. The laboratory focuses on three primary research areas: major mental disorders, genetic and systemic diseases, and blood and immune diseases. By integrating technological innovation with clinical expertise, it merges biotechnology with information technology to create a comprehensive platform that spans fundamental research, product development, and clinical application.	Primary data collected through a 134-min semi-structured interviews with key stakeholders such as laboratory managers, researchers, and postgraduate students. Secondary data, including publicly available institutional reports, and internal policy documents.
OIL2	This laboratory was inaugurated in July 2020 and led by a research university in Hangzhou, Zhejiang Province. This laboratory actively promotes the construction of an innovative scientific hub. Through	Primary data collected through a 91-min semi-structured interviews with key stakeholders such as laboratory

	interdisciplinary research and intersectoral collaborative innovation, the laboratory has formed an innovation chain covering basic research, applied research, clinical diagnosis, and technology transfer.	managers, researchers, and postgraduate students. Secondary data, including publicly available institutional reports, and internal policy documents.
IURC1	This institution is a major scientific and technological innovation platform jointly built by a research university and Quzhou city. It was officially inaugurated on December 28, 2018. Focusing on development and innovation, this institution aims to create an innovative and entrepreneurial platform based on the integration of Industry-University-Research, as well as a world-class research center in chemical materials.	Primary data were collected through 84 minutes of semi-structured interviews with key stakeholders, including institution managers, researchers, local government representatives, and local industry partners. Secondary data, including publicly available institutional reports, and internal policy documents.
IURC2	The institution was established on February 28, 2019, as a major scientific and technological innovation platform jointly developed by a research university in Hangzhou and the Hangzhou city. It focuses on the convergence and integration of material science, information science, and life sciences, creating a comprehensive pipeline that spans cutting-edge scientific research, disruptive technology development, and industrial application of research outcomes. Its research areas encompass five key fields: micro-nano manufacturing, functional materials, micro-nano electronic information, synthetic biology, and ecological and environmental protection.	Primary data were collected through two rounds of semi-structured interviews with key stakeholders, including institution managers, researchers, students, local government representatives, and local industry partners. Secondary data comprised publicly available institutional reports and internal policy documents.
JRDI1	The center was established in 2021 through a strategic cooperation agreement between the State Key Lab at a research university in Hangzhou and a leading enterprise in the telecommunications equipment industry. It focuses on the cross-disciplinary high-tech research area of computer-aided design and computer graphics and aims to achieve comprehensive and in-depth integration between the university and the enterprise in talent cultivation, scientific research innovation, and professional training.	Primary data were collected through 53 minutes of semi-structured interviews with key stakeholders, including institution managers, researchers, students, and corporate partners. Secondary data comprised publicly available institutional reports and internal policy documents.
JRDI2	The center was established in July 1, 2023 through a strategic cooperation agreement between the State Key Lab at a research university in Hangzhou and a	Primary data were collected through 103 minutes of semi-structured interviews with key

	leading enterprise in semiconductor materials industry. It focuses on the cross-disciplinary high-tech research area of silicon and advanced semiconductor materials and focuses on the development, production, technical services, and application transformation of high-end products in the field of novel semiconductor materials.	stakeholders, including institution managers, researchers, students, and corporate partners. Secondary data comprised publicly available institutional reports and internal policy documents.

Research Design

This study conducts a multi-case comparison and content analysis of six university-industry collaboration centers from research universities. The selection of cases is based on two main criteria: First, the chosen centers are intended to be innovation entities with university-industrial outreach activities, and these cases appear to exhibit both similarities and differences in terms of academic background, organizational structure, and outreach methods, which may help ensure both representativeness and homogeneity. Second, the data sources for the selected cases include primary data, such as interview recordings and research meeting notes, as well as secondary data, including information from official websites, internal policy documents, and speeches from leaders. The data sources are intended to complement each other and align with the triangulation validation method.

The interview outline covers four main areas: organizational structure and policy systems, integration of science and education, student cultivation and team development, and collaboration in technology transfer and outreach. It includes open-ended questions, with introductions provided by stakeholders from the organization, followed by in-depth questioning to help generate comprehensive and detailed written materials.

Findings

Based on the literature review, since university industrial outreach can be seen as a type of University-Industry Collaboration (UIC), we have organized the findings according to the UIC process within the framework of open innovation, specifically focusing on organizational structure, motivation, and mechanisms.

Case 1: Open Innovation Laboratory

Organizational structure

Both OIL1 and OIL2 appear to be provincial laboratories located in Zhejiang Province. Due to the disciplinary nature of life sciences, these laboratories are typically jointly established by research universities and hospitals. In terms of organizational structure, the decision-making level is generally led by a governing council, complemented by an academic committee, a management committee, and a supervisory board. At the management level, the laboratory director is often a leading scholar from the research university, supported by an

administrative deputy director and a research deputy director. At the operational level, the structure includes research centers (comprising several shared platforms, basic research centers, and applied research laboratories) and research service centers (encompassing a technology transfer office, logistics office, financial office, and personnel management office).

Thus, in its overall design, OIL functions as a relatively independent organization with autonomous authority over personnel and financial management *(the director of OIL2)*, which seems to significantly distinguish it from laboratories operating within the internal structure of research universities.

Motivation

It appears that OIL1 and OIL2 were established under the leadership of research university-affiliated colleges, and are reportedly provincial laboratories, supported by funding and program resources from the provincial government. In their dual role as university-affiliated institutions and public research organizations, these laboratories seem to be designed to advance disciplines, address critical societal needs, and promote public well-being. Their industry outreach efforts are intended to promote innovative breakthroughs in cutting-edge scientific research, particularly in the life sciences, while facilitating knowledge dissemination and social impact.

They appear to be motivated by the University's developmental pursuits and the external market and policy environment. To improve the quality of innovative talent training and fulfill its third mission, the two laboratories, led by research universities, are geographically separate from the university, which may help OILs acquire advanced social resources while amplifying their social and economic impacts.

One respondent from OIL1 said, "We seem to act as university boundary expanders. On one hand, we're closely connected with hospitals, which gives us access to clinical data and allows us to send postgraduates for clinical practice. This helps enhance their industrial practice skills. On the other hand, as independent organizations, we take on external projects, which allows us to transfer internal knowledge to small and medium-sized enterprises (SMEs)."

Mechanisms

A stable and diverse funding mechanism is likely a prerequisite for the construction and operation of open innovation laboratories (OILs) led by research universities. In this context, OIL1 and OIL2 appear to benefit from a variety of funding sources, including internal research funding from their universities, local government finances, and risk-pool funding from third-party organizations, as well as seed funding. In addition to direct funding mechanisms, OILs seem to broaden their funding sources and strengthen the financial stability of industry-academia collaborations by partnering with hospitals on vocational training programs and academic entrepreneurship initiatives. For example, OIL1, located in

Hangzhou’s West Science and Innovation Corridor, has reportedly established a solid channel for industry expansion by utilizing the corridor’s abundant investment capital and business incubator resources. Additionally, OIL1 has likely formed a cross-border team mechanism in talent team building. It seems that OIL1 not only attracts entrepreneurial researchers from its host research university but also actively recruits innovative scientists and entrepreneurs from around the globe. Under the leadership of leading scientists, it is said to have assembled open innovation teams consisting of clinicians, basic research scientists, and entrepreneurs. Moreover, graduate student training appears to be integrated into these interdisciplinary, cross-departmental, and entrepreneurial team research collaborations. Graduate students reportedly enhance their research and clinical practice by participating in industrial practice, while engaging in academic entrepreneurship and technology translation under mentors allows them to be exposed to the commercialization process and develop an entrepreneurial mindset early in their careers.

In addition to funding and team mechanisms, the evaluation and translation mechanism of research results appears to be a key factor for research universities to realize effective industrial outreach. During the interviews, stakeholders frequently mentioned challenges in the transfer of intellectual property (IP) due to concerns over state asset loss. The root of this issue seems to be that most OIL personnel, equipment, and pre-existing IP are owned by the university. Improper valuation of IP conversion may often lead to the risk of asset loss, which is considered one of the major barriers to technology transfer in Chinese research universities (Dou, 2019). To address this challenge, the open innovation labs have reportedly implemented a milestone-based valuation mechanism, a method that is said to reduce the financial risks associated with one-time valuations by assigning value at different stages of technology maturity. This approach is believed to lead to a more efficient and secure technology commercialization process.

Case 2: Industry-University Research Center

Organizational structure

Industry-University-Research Centers (IURCs) are generally jointly established by local governments and research universities, and as important technological innovation platforms with multifunctional capabilities, their organizational structures tend to be diverse. For example, IURC1 is reportedly managed and governed by a management committee jointly formed by the Quzhou municipal government and Zhejiang University, with subordinate institutions that include research institutes, analysis and testing centers, and pilot testing and training bases. These institutions appear to cover the entire innovation chain, from basic research, applied research, and technology testing to pilot production and industrialization. The industrial expansion of IURCs seems to place more emphasis on the involvement of industrial stakeholders. For instance, IURC1 provides services such as analysis and testing, pilot testing, and collaborative research projects. Similarly, IURC2, like IURC1, is jointly established by the Hangzhou Municipal Government, Xiaoshan District Government, and a research university. It integrates research institutes, enterprises, university faculties, enterprise

think tanks, and venture capital institutions within its organizational structure, aiming to create an open innovation ecosystem to support talent cultivation, scientific and technological innovation, and industrial incubation.

Motivation

The construction of Industry-University-Research Centers (IURCs) generally involves the participation of multiple stakeholders such as local governments, industries, and universities, and its completion and smooth operation may not be fully achievable without the joint effort driven by aligned goals. In this outreach process, local governments appear to play a key role in guiding the development of IURCs, including providing space, funding, and staffing support, as well as creating a space for cooperation and exchanges among various stakeholders, potentially breaking down barriers between them (from a local government department staff when visiting IURC2).

In order to encourage the active participation of university personnel, local governments seem to play a significant role in guiding the outreach process. Specifically, to motivate university personnel to engage in industrial development, local governments appear to have adopted a dual strategy: on one hand, they invite academic leaders to serve as leaders, leveraging their academic influence and social resources to form extensive networks of diverse talent teams; on the other hand, local governments reportedly grant more autonomy to university faculties and departments in allocating space, funds, and other resources. For example, IURC2 appears to have acquired a semiconductor production line, which it uses for technology validation and talent training with support from the local government and enterprises. Additionally, it has introduced the research university's Integrated Circuit School to conduct real engineering education and wafer fabrication training around the production line.

Mechanisms

Based on the above, IURCs tend to attract the participation of multiple stakeholders. These include research universities, local governments, regional leading enterprises, local universities, and business incubators. In order to effectively coordinate the different interest motives of the multiple subjects, the IURCs have adopted a joint working meeting system. This system serves as a mechanism for collaborative decision-making and implementation. It may ensure that the voices and needs of all parties are adequately taken into account. It promotes the formation of goals of common interest. Additionally, it helps build outreach relationships between the university and all types of subjects. Representatives of the various participating parties come together to discuss, plan, and implement relevant initiatives.

In addition to the governance mechanism, the realization mechanism of each function is key to ensuring the sustainable operation of the IURC, as it is a multi-functional platform encompassing scientific research, talent cultivation, and business incubation. The main functions of the IURC include scientific research.

In terms of the realization mechanism for scientific research, IURC2 fully utilizes the platform's resource aggregation and open flow mechanisms. It establishes innovation platforms such as the CMOS IC Innovation Platform and the Advanced Semiconductor Research Institute. These platforms accelerate the innovation and implementation of research results in related fields.

For talent cultivation, IURC1 primarily adopts project-based training. It cooperates with local enterprises to provide "customized training programs" to cultivate technological innovators. Additionally, IURC2 conducts outreach and exchange activities with local universities. This helps realize the flow of knowledge to communities and enhances the regional innovation practice capability.

Regarding the business incubation function, IURC2 has developed a support mechanism, including a venture capital group and business incubators. It also has an incentive mechanism, including seed funding. The integration of these mechanisms effectively promotes business incubation. It accelerates the commercialization of scientific research results and injects continuous vitality into the regional innovation ecosystem.

Case 3: Joint R&D Institute

Organizational structure

Joint Research and Development Institutes (JRDIs) tend to be flatter institutions based on strategic partnerships between research universities and leading companies in their respective industries. These institutions are typically led by senior university academics and business leaders, with high-level research teams that often consist of top talent from both academia and industry.

The organizational forms of JRDIs can include affiliated and independent structures. Affiliated JRDIs are often embedded within university laboratories or corporate R&D facilities, utilizing existing infrastructure to carry out outreach activities. In contrast, independent JRDIs operate separately from universities and corporations, with their own physical space, management, and operational teams. For example, JRDI1 appears to operate as an independent organization. Supported by the space, funds, and technical staff from a communications equipment company, as well as university domain experts, researchers, and graduate students, JRDI1 carries out industrial outreach activities such as collaboration on innovation projects, technology transfer, and personnel training, often aligned with the needs of enterprises.

Motivation

The establishment of JRDIs seems to be the result of strong collaboration between universities with competitive disciplines and leading industry enterprises. In this context, the motivation for research universities likely comes from gaining access to cutting-edge industry

technologies, which could provide new directions for the development of their academic disciplines. On the other hand, the motivation for leading industry enterprises likely stems from leveraging the vast pool of high-level research and innovation talent at universities to help overcome technical bottlenecks at specific stages.

In addition to the drive for self-fulfillment, the National Science Foundation of China and provincial governments are thought to actively encourage collaborations between enterprises and universities to advance cutting-edge technological innovations through initiatives such as specialized science and technology projects.

Mechanisms

The collaboration mechanism of JRDIs mainly focuses on two key areas: technological innovation and talent development. In terms of technological innovation, JRDIs likely leverage an organized large team structure to bring together innovative talents from both the business and academic sectors. Building on the initial university team's research, the collaboration is thought to focus on addressing enterprise needs and industrial bottlenecks through clearly defined project-based cooperation.

In terms of talent development, enterprises appear to expand student and university researcher involvement through hosting industry-specific competitions and engineering practice training activities, thereby enhancing the engineering practice capabilities of students and researchers. Additionally, through curriculum development and joint teaching, enterprises likely help students quickly grasp the current state of technological development in the industry (from a postgraduate and a professor working at JRDI1).

Cross-Case Analysis

Table 2 Case Comparative Analysis

Institutions	Organizational Structures	Motivation	Mechanisms
OIL	More independent; function as relatively autonomous entities	Address societal challenges and advance cutting-edge research	Sustainable mechanisms for academic entrepreneurship: public funding, interdisciplinary teams
IURC	More formal and multifaceted organizational structure	Formalization of collaborations between universities and local industries, with strong government support	Multi-stakeholder integration mechanisms: joint working conference system, diverse funding sources, platform mechanisms
JRDI	Less formalized; often lacks structured	Universities access industry technologies; industries leverage	University-industry integration mechanisms: project-based collaboration,

	organization	academic research talent to address technical bottlenecks	joint teaching initiatives, and shared resources

The three types of institutions—OILs (Open Innovation Laboratories), IURCs (Industry-University-Research Joint Research Centers), and JRDIs (Joint Research and Development Institutes)—are different organizational vehicles for universities to carry out industrial outreach. Their main differences seem to be reflected in their organizational structures.

Although they are all independent institutions with management that coordinates and adjusts organizational goals, there appear to be significant differences in their internal management hierarchies and functional structures. OILs and IURCs are typically larger in scale and involve more stakeholders than JRDIs. As a result, OILs and IURCs tend to have management with a clearer division of labor and a more hierarchical structure. In contrast, JRDIs are often set up under the joint leadership of both university and business leaders, with a more flexible management approach.

This context suggests that OILs and IURCs may operate with a more formalized process, while JRDIs are generally more adaptable to business needs. Additionally, the relationship between different disciplines and industries seems to affect the design of the organizational structure. For example, the OILs in the case study are all in the field of life sciences, which is closely linked to clinical practice. The team members in these OILs typically have substantial practical and entrepreneurial experience. While technology translation in life sciences may take longer, the OILs, supported by a mature team and a high-level research and collaborative environment, appear to be able to rapidly promote the innovation and application of technology.

OILs, IURCs, and JRDIs appear to show different motivations depending on the interest orientation of the participating subjects. However, a common motivation or core driving force seems to be bridging the gap between academic research and practical application, expanding the industrial participation of research universities, and addressing societal and industrial needs. OILs appear to be primarily motivated by the interests of the university and government. They support the development of academic disciplines and talent cultivation. In addition, they seem to play a role in addressing social challenges as part of their third mission. IURCs seem to be driven by local governments, local industrial economies, and existing industry-university cooperation. They appear to focus more on regional talent cultivation, industrial development, and economic growth. JRDIs seem to be motivated by direct industry-academia collaboration. Their focus appears to be on solving specific technological bottlenecks.

OILs, IURCs, and JRDIs seem to be supported and incentivized by financial support, team-building mechanisms, and institutional structures. However, there appear to be differences in these mechanisms based on the interests of the universities involved.

In terms of funding mechanisms, OILs seem to be more reliant on public funds. These include funding from universities, government programs, and government investment incubation funds. This funding structure seems to support OILs in carrying out long-term scientific research, which could be linked to the fact that OILs in the case study focus on life sciences, a field with long research cycles. In contrast, IURCs and JRDIs seem to receive funding from both public sources and corporate or industrial partners. This diversified funding seems to support their outreach activities, which are often closer to the needs of businesses, such as technology transfer and project collaboration.

Regarding team-building mechanisms, all three types of institutions appear to focus on leveraging the social capital of academic leaders to build stable networks. The role of academic leaders as boundary spanners seems to be emphasized, as they link various stakeholders. The success of this mechanism seems to depend on the construction of independent platforms. All three institutions appear to have their own platforms to enable open communication between universities and various other stakeholders.

Conclusions

Summary of Findings

This study explores the current status of industrial outreach institutions in Chinese research universities within the context of open innovation. It provides a comparative analysis of selected cases across three dimensions: organizational structure, motivation, and mechanism. The study suggests that while Open Innovation Labs (OILs), University-Industry Research Centers (IURCs), and Joint Research and Development Institutes (JRDIs) are all aimed at promoting research and facilitating innovation, there appear to be some differences in their organizational structures, motivations, and mechanisms related to industrial outreach.

OILs seem to have a relatively independent structure. They are driven by both the internal disciplinary development needs of research universities and external societal needs. OILs appear to rely mainly on public funding and interdisciplinary teams to conduct industrial outreach activities that focus on internal academic entrepreneurship. In contrast, the structure of IURCs seems to emphasize the synergistic integration of multiple parties. Driven by the common interests of the university, government, and industry, IURCs appear to integrate multiple functions through their platforms to create ecosystems for value co-creation. Their specific industrial outreach activities seem to include industrial talent training programs, pilot services, and production line construction. The structure of JRDIs appears to be flatter. These institutes seem to be directly led by academic and business leaders, and are typically organized into teams focusing on special projects to address specific technological bottlenecks. Their industrial outreach activities likely include personnel training and project recruitment.

Based on the comparative case analysis, the study suggests that the establishment of university industrial outreach organizations is typically supported by diversified funding

sources. Academic leaders seem to play a key role as boundary-crossing nodes for knowledge flow. As important boundary spanners, academic leaders appear to be crucial in team building, resource allocation, and disseminating results, thus connecting different stakeholders.

Contributions to Literature

This study contributes to the literature on university-industry collaborations (UICs) and their organizational models under the trend of open innovation. It does so through a comparative analysis of industrial outreach institutions and practices in Chinese research universities. The study provides insights into how UIC institutions might promote research commercialization, address societal challenges, and potentially drive technological innovation.

The study suggests that there are differences in the implementation pathways of UICs by examining variations in organizational structures, motivations, and related factors and mechanisms. By exploring the similarities and differences between OILs, IURCs, and JRDIs—specifically in terms of government involvement, funding sources, strategic priorities, and operational and management mechanisms—the study helps to deepen our understanding of the role of universities in open innovation and industrial collaborations.

Furthermore, the study provides valuable insights into the potential for proactive and sustained university engagement in industrial collaborations.

Future Research Directions

Future research could explore the differences in organizational structures, motivations, and mechanisms of university-industry collaborations across disciplines. A particular focus could be placed on comparative research across disciplinary areas to identify potential best practices and challenges in each area.

In addition, further research might delve into the effectiveness of various collaborative mechanisms in supporting university-industry collaboration. This could help identify which mechanisms are most suitable for specific contexts and industry needs.

Finally, from an open innovation perspective, future studies could examine the strategic role of universities in promoting technological innovation, industrial cooperation, and addressing societal challenges. Specifically, it would be interesting to investigate how open innovation models might enhance cross-border collaboration and resource sharing to potentially increase their impact on socioeconomic development.

References

Al-Tabbaa, O. and Ankrah, S. (2019) '"Engineered" University-Industry Collaboration: A Social Capital Perspective', European Management Review, 16(3), pp. 543–565. Available at: https://doi.org/10.1111/emre.12174.

Alunurm, R., Rõigas, K. and Varblane, U. (2020) 'The relative significance of higher education–industry cooperation barriers for different firms', Industry and Higher Education, 34(6), pp. 377–390. Available at: https://doi.org/10.1177/0950422220909737.

Ankrah, S. and AL-Tabbaa, O. (2015) 'Universities–industry collaboration: A systematic review', Scandinavian Journal of Management, 31(3), pp. 387–408. Available at: https://doi.org/10.1016/j.scaman.2015.02.003.

Awasthy, R. et al. (2020) 'A framework to improve university–industry collaboration', Journal of Industry-University Collaboration, 2(1), pp. 49–62. Available at: https://doi.org/10.1108/JIUC-09-2019-0016.

Beck, S. et al. (2022) 'The Open Innovation in Science research field: a collaborative conceptualisation approach', Industry and Innovation, 29(2), pp. 136–185. Available at: https://doi.org/10.1080/13662716.2020.1792274.

Bianchi, M. et al. (2010) 'Enabling open innovation in small- and medium-sized enterprises: how to find alternative applications for your technologies', R&D Management, 40(4), pp. 414–431. Available at: https://doi.org/10.1111/j.1467-9310.2010.00613.x.

Bruneel, J., D'Este, P. and Salter, A. (2010) 'Investigating the factors that diminish the barriers to university–industry collaboration', Research Policy, 39(7), pp. 858–868. Available at: https://doi.org/10.1016/j.respol.2010.03.006.

Calcagnini, G. et al. (2016) 'A matching model of university–industry collaborations', Small Business Economics, 46(1), pp. 31–43. Available at: https://doi.org/10.1007/s11187-015-9672-y.

Calvo, N. et al. (2019) 'Analysis of the researcher's motivators to collaborate with firms as drivers of the triple helix dynamics', Global Business and Economics Review, 21(3–4), pp. 304–329. Available at: https://doi.org/10.1504/GBER.2019.099389.

Chen, Y. B. & Liu, Z. X. (2017). The Primary Reason and Solution for the Insufficiency of Innovation Capability in Chinese Enterprises. Study & Exploration, 10, 115–124, 176. (In Chinese)

Chesbrough, H. (2006) 'Open Innovation: A New Paradigm for Understanding Industrial Innovation', in H. Chesbrough, W. Vanhaverbeke, and J. West (eds) Open Innovation. Oxford University PressOxford, pp. 1–12. Available at: https://doi.org/10.1093/oso/9780199290727.003.0001.

Cortés, D., Ramírez, J. and Molina, A. (2022) 'Open Innovation Laboratory to Foster Skills and Competencies in Higher Education', in S. Hosseini et al. (eds) Technology-Enabled Innovations in Education. Singapore: Springer Nature (Transactions on Computer Systems and Networks), pp. 281–291. Available at: https://doi.org/10.1007/978-981-19-3383-7_22.

Costa, J. (2020) 'Why Do Publicly Funded Firms Find the University More Useful to Innovate Than Others? Can We Accomplish the RIS3 Target?', in L. Farinha et al. (eds) Regional Helix Ecosystems and Sustainable Growth: The Interaction of Innovation, Entrepreneurship and Technology Transfer. Cham: Springer International Publishing (Studies on Entrepreneurship, Structural Change and Industrial Dynamics), pp. 45–66. Available at: https://doi.org/10.1007/978-3-030-47697-7_4.

Ćudić, B., Alešnik, P. and Hazemali, D. (2022) 'Factors impacting university–industry collaboration in European countries', Journal of Innovation and Entrepreneurship, 11(1), p. 33. Available at: https://doi.org/10.1186/s13731-022-00226-3.

Cyert, R.M. and Goodman, P.S. (1997) 'Creating effective University-industry alliances: An organizational learning perspective', Organizational Dynamics, 25(4), pp. 45–57. Available at: https://doi.org/10.1016/S0090-2616(97)90036-X.

de las Heras-Rosas, C., & Herrera, J. (2021). Research Trends in Open Innovation and the Role of the University. Journal of Open Innovation: Technology, Market, and Complexity, 7(1), Article 1. https://doi.org/10.3390/joitmc7010029

Doz, Y.L., Olk, P.M. and Ring, P.S. (2000) 'Formation Processes of R&D Consortia: Which Path to Take? Where Does It Lead?', Strategic Management Journal, 21(3), pp. 239–266.

El-Ferik, S. and Al-Naser, M. (2021) 'University Industry Collaboration: A Promising Trilateral Co-Innovation Approach', IEEE Access, 9, pp. 112761–112769. Available at: https://doi.org/10.1109/ACCESS.2021.3104096.

Etzkowitz, H. and Leydesdorff, L. (1995) 'The Triple Helix -- University-Industry-Government Relations: A Laboratory for Knowledge Based Economic Development'. Rochester, NY. Available at: https://papers.ssrn.com/abstract=2480085 (Accessed: 23 May 2023).

Flor, M.L., Blasco Díaz, J.L. and Lara Ortiz, M.L. (2020) 'Innovation policy instruments through the lens of open innovation. An analysis in the Spanish context', Journal of Evolutionary Studies in Business, 5(1), pp. 52–80. Available at: https://doi.org/10.1344/jesb2020.1.j068.

Hellström, T., Jacob, M. and Wigren-Kristoferson, C. (2013) 'Organizing for the Third Mission: Structural Conditions for Outreach and Relevance at Two Swedish HEIs', Industry and Higher Education, 27(3), pp. 193–204. Available at: https://doi.org/10.5367/ihe.2013.0152.

Illingworth, S.M. and Roop, H.A. (2015) 'Developing Key Skills as a Science Communicator: Case Studies of Two Scientist-Led Outreach Programmes', Geosciences, 5(1), pp. 2–14. Available at: https://doi.org/10.3390/geosciences5010002.

Kutvonen, A. et al. (2013) University-Industry Collaboration and Knowledge Transfer in the Open Innovation Framework. Available at: https://doi.org/10.13140/2.1.4950.9767.

Laredo, P. (2007). Revisiting the Third Mission of Universities: Toward a Renewed Categorization of University Activities? Higher Education Policy, 20(4), 441–456. https://doi.org/10.1057/palgrave.hep.8300169

Lee, Y. S. (1996). 'Technology transfer' and the research university: A search for the boundaries of university-industry collaboration. Research Policy, 25(6), 843–863. https://doi.org/10.1016/0048-7333(95)00857-8

Lemos, D. da C. and Cario, S.A.F. (2017) 'University–industry interaction in Santa Catarina: evolutionary phases, forms of interaction, benefits, and barriers', RAI Revista de Administração e Inovação, 14(1), pp. 16–29. Available at: https://doi.org/10.1016/j.rai.2016.12.001.

Lichtenthaler, U. (2008) 'External technology commercialisation projects: objectives, processes and a typology', Technology Analysis & Strategic Management, 20(4), pp. 483–501. Available at: https://doi.org/10.1080/09537320802141452.

Lind, F., Styhre, A. and Aaboen, L. (2013) 'Exploring university‐industry collaboration in research centres', European Journal of Innovation Management, 16(1), pp. 70 – 91. Available at: https://doi.org/10.1108/14601061311292869.

Lopez-Vega, H. and Vanhaverbeke, W. (2009) 'Connecting open and closed innovation markets: A typology of intermediaries'. MPRA Paper No. 27017.

Ma, J. (2019) 'Developing Joint R&D Institutes between Chinese Universities and International Enterprises in China's Innovation System: A Case at Tsinghua University', Sustainability, 11(24), p. 7133. Available at: https://doi.org/10.3390/su11247133.

Miranda, J. et al. (2021) 'The core components of education 4.0 in higher education: Three case studies in engineering education', Computers & Electrical Engineering, 93, p. 107278. Available at: https://doi.org/10.1016/j.compeleceng.2021.107278.

Moretti, F. (2019) '"Open" Lab? Studying the Implementation of Open Innovation Practices in a University Laboratory', International Journal of Innovation and Technology Management, 16(01), p. 1950012. Available at: https://doi.org/10.1142/S0219877019500123.

Mucino, V.H. et al. (2013) 'Bridging Academia and Industry Gap, Through Global Competencies: Industrial Outreach Program US-Mexico', in. ASME 2012 International Mechanical Engineering Congress and Exposition, American Society of Mechanical Engineers Digital Collection, pp. 403–410. Available at: https://doi.org/10.1115/IMECE2012-86444.

Muscio, A. and Vallanti, G. (2014) 'Perceived Obstacles to University–Industry Collaboration: Results from a Qualitative Survey of Italian Academic Departments', Industry and Innovation, 21(5), pp. 410–429. Available at: https://doi.org/10.1080/13662716.2014.969935.

Nsanzumuhire, S.U. and Groot, W. (2020) 'Context perspective on University-Industry Collaboration processes: A systematic review of literature', Journal of Cleaner Production, 258, p. 120861. Available at: https://doi.org/10.1016/j.jclepro.2020.120861.

O'Dwyer, M., Filieri, R. and O'Malley, L. (2023) 'Establishing successful university–industry collaborations: barriers and enablers deconstructed', The Journal of Technology Transfer, 48(3), pp. 900–931. Available at: https://doi.org/10.1007/s10961-022-09932-2.

Opassuwan, T. and Wannamakok, W. (2024) 'Deciphering the Determinants of Firm's Engagement with Universities: An Insight into the Thai Industrial Landscape', Journal of Open Innovation Technology Market and Complexity [Preprint]. Available at: https://doi.org/10.1016/j.joitmc.2024.100248.

Osorno-Hinojosa, R., Koria, M. and Ramírez-Vázquez, D. del C. (2022) 'Open Innovation with Value Co-Creation from University–Industry Collaboration', Journal of Open Innovation: Technology, Market, and Complexity, 8(1), p. 32. Available at: https://doi.org/10.3390/joitmc8010032.

Passos, J.B. et al. (2022) 'University industry collaboration process: a systematic review of literature', International Journal of Innovation Science, 15(3), pp. 479–506. Available at: https://doi.org/10.1108/IJIS-11-2021-0216.

Perkmann, M. and Salter, A. (2012), "How to create productive partnerships with universities", MIT Sloan ManAgement Review, 53(4), p. 79.

Perkmann, M. et al. (2013) 'Academic engagement and commercialisation: A review of the literature on university–industry relations', Research Policy, 42(2), pp. 423–442. Available at: https://doi.org/10.1016/j.respol.2012.09.007.

Perkmann, M., & Walsh, K. (2007). University–industry relationships and open innovation: Towards a research agenda. International Journal of Management Reviews, 9(4), 259–280. https://doi.org/10.1111/j.1468-2370.2007.00225.x

Ring, P.S., Doz, Y.L. and Olk, P.M. (2005) 'Managing Formation Processes in R&D Consortia', California Management Review, 47(4), pp. 137–156. Available at: https://doi.org/10.2307/41166320.

Rossoni, A.L., de Vasconcellos, E.P.G. and de Castilho Rossoni, R.L. (2024) 'Barriers and facilitators of university-industry collaboration for research, development and innovation: a systematic review', Management Review Quarterly, 74(3), pp. 1841–1877. Available at: https://doi.org/10.1007/s11301-023-00349-1.

Saif, S.M. et al. (2022) 'Impact of ICT in Modernizing the Global Education Industry to Yield Better Academic Outreach', Sustainability, 14(11), p. 6884. Available at: https://doi.org/10.3390/su14116884.

Schillo, R.S. and Kinder, J.S. (2017) 'Delivering on societal impacts through open innovation: a framework for government laboratories', The Journal of Technology Transfer, 42(4), pp. 977–996. Available at: https://doi.org/10.1007/s10961-016-9521-4.

Striukova, L., & Rayna, T. (2015). University-industry knowledge exchange: An exploratory study of Open Innovation in UK universities. European Journal of Innovation Management, 18(4), 471–492. https://doi.org/10.1108/EJIM-10-2013-0098

Valentín, E.M.M. (2000) 'University—Industry Cooperation: A Framework of Benefits and Obstacles', Industry and Higher Education, 14(3), pp. 165–172. Available at: https://doi.org/10.5367/000000000101295011.