Innovating Motivation Mechanisms and Interaction Channels of University-Industry Educational Collaboration: A Pilot Chinese Case

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Abstract

This article explores the collaboration between universities and industries in the field of engineering education, with a focus on a case study conducted at Beihang University in China.The study examines the motivations and interaction channels of university-industry educational collaboration, highlighting the impact of such collaboration on engineering education. The findings indicate that educational involvement in university-industry collaboration can contribute to innovation and knowledge creation, and enhance the effectiveness of long-term interactions between academia and industry.

Drawing on insights from field research and semi-structured interviews from university (n=8) and industry (n=5), combining with 4 focus groups with both sides, the findings reveal that both universities and industries have distinct motivations for engaging in educational collaboration. The motivations for universities and industries to engage in university-industry educational collaboration include joint research motivation, human capital flow motivation, policy resonance motivation, human capital accumulation motivation, organization learning and development motivation, and educational passion and social responsibility motivation. These motivations are identified from both the organizational and individual perspectives of universities and industries.

In terms of interaction channels, a synergistic approach called "STEP" (project threads driven by joint mentor groups) has been identified as a key interaction channel at Beihang University. This approach involves joint supervision, technology trends, enterprises, and research projects to synergize collaborative efforts for educational purposes.

The educational involvement in university-industry collaboration contributes to innovation and knowledge creation in engineering education by integrating students as knowledge creators and innovators in the industrial implementation and innovation process. This approach not only enhances educational collaboration but also contributes to the innovation of university-industry relations.

Key words: UIC, educational collaboration, motivation, interaction channel

1 INTRODUCTION

1.1 Background

The advancement of emerging technologies is constantly calling for engineering education to actively respond to the rapid changes in recent years. As a result, how to better prepare engineering students for continuously emerging technologies and global challenges has been attracting growing attention from not only the government but also universities and industry globally.

In China, engineering education has a long tradition intertwined with industry, especially since the “Plan for Educating and Training Outstanding Engineers” (PETOE) launched by the Ministry of Education (MOE) in 2010, which was an endeavor to establish a joint mechanism of engineering education between universitas and industry. Later in 2017, the New Engineering Education (NEE) initiative was launched as an upgrade version of PETOE, with increasing focus on linking universities and industry via transforming Chinese engineering education in terms of re-structuring programs, curricula, and pedagogies towards industrial needs and technology trends (MOE, 2018). Immediately after that, the layout of NEE is refining through the initiative of a first batch of School of Future Technology (SFT) within 12 research-intensive universities and a first batch of School of Modern Industry (SMI) within 50 universities in 2021, as well as and a first batch of National School of Outstanding Engineers at 10 universities and 8 enterprises in 2022. From a policy debrief view, such up-to-bottom initiatives share a common and significant consensus of facilitating UIC to jointly cultivate future engineers, in order to actively respond to burgeoning technologies and increasingly complex societal problems in modern society.

Whilst a surge in UIC has been recognized by not only policy-makers but also educators and practitioners, it still remains largely unexplored about why universities and industry would like to involve in UIC, especially the educational activities in UIC; therefore, clear interaction channels of university-industry educational collaboration are urgently needed. The aim of this study, therefore, is to address these questions with a focus on educational involvement in UIC, and to present the motivation mechanism and interaction channel of university-industry educational collaboration through an exploratory qualitative study at BUAA. The rest of this paper is organized as follows: We first briefly present an overview of UIC with an eye on educational involvement in UIC. The next section provides our methodological approach for this qualitative study. Then in the findings and discussions section, we summarize the findings in two main themes, which we refer to as motivation mechanism and key interaction channel of university-industry educational collaboration. Finally, we present the conclusions and implications lines for future research.

1.2 Literature review

(1) What defines UIC in terms of motivations and channels

Since the 1980s, collaboration between universities and industry has intensified and attracted increasing attention from both policy-makers and educators and practitioners (Etzkowitz, 1998). While UIC has a long history (Bower, 1993), diversified interests in facilitating UIC to encourage knowledge and technology exchange (Arvanitis, Kubli, & Woerter,2008; Siegel, Waldman, & Link,2003), inspire open innovation (Perkmann & Walsh,2007), simulate the production of new knowledge and technology (Freitas, Geuna, & Rossi,2013), and enhance organization’s knowledge block (Cricelli & Grimaldi, 2010) have been highlighted in previous

research. In general, the collaboration between universities and industry can create reciprocal benefits for both and contribute to our society (Muscio, 2010). In the global context, nations or areas such as the United States (e.g., Lehrer, Nell, & Gärber,2009), Japan (e.g., Motohashi & Muramatsu, 2012), Italy (e.g., Abramo, et al.,2009), Netherlands (Bodas, Isabel, & Bart,2017), the United Kingdom, (e.g., Laursen, Reichstein, & Salter,2011), Singapore (e.g., Lee & Win,2004), China (e.g., Xu et al., 2014), and the Europe (e.g., Caloghirou Tsakanikas, & Vonortas,2001). Giving the substantial significance of UIC, a great number of previous studies have concentrated on either academic or industrial side of UIC. In this section, we briefly elucidate the motivations and the interaction channels of UIC.

Motivations of UIC

The motivations for universities to involve in UIC are usually different from those for industry. From the academia side, universities are mostly motivated to collaborate with industry to secure funds for research (Lee,2000), access resources such as equipment, laboratories and emerging techniques (Welsh et al.,2008; Santoro, 2000), advance and complement research agendas (Perkmann, Markus, & Kathryn,2009), expose both student and faculty with practical situations and problems (Ankrah et al.,2013), improve research and teaching via practical application (Arza,2010), as well as enhance universities' image and researchers' reputation and recognition (Dietz & Barry,2005). Indeed, a great number of research has noticed that putting research results into practical application provides a learning context, which seems to be a vital consideration for academia to cooperate with industry. Apart from these organization level motivations, Franco and Heiko (2015) also highlighted that the motivation at individual researcher level for facilitating their own research and increasing academic reputation should not be ignored.

On the part of the industry side, enhancing the firm's competitive advantage through partnering with universities is the main concern (Grant,1996; Bonaccorsi & Piccaluga,1994). Through UIC, industry can get access to state-of-the-art technologies that shorten the product life cycles, particularly, between design and production (Santoro & Gopalakrishnan,2001), as a result, industry can benefit from technologies commercialized for financial performance through knowledge creating and exploration activities partnering with universities (Siegel, Waldman, & Link, 2003; George et al.,2002), and enhance R&D productivity (Fontana et al.,2006). In addition, human capital development also motivates industry to collaborate with universities, such employment considerations include targeting at best students in terms of research programs (Feller, et al.,2002), internships and hiring in a long term (Ankrah, et al., 2013), as well as faculty consulting (Perkmann, et al.,2011).

In particular, Ankrah and Tabbaa (2015) systematically categorized the motivations from both universities and industry perspectives based on the six-dimension framework Oliver (1990) proposed to predict interorganizational relations, which included necessity, reciprocity, efficiency, stability, legitimacy, and asymmetry. The motivations of these two kinds of organizations might share common recognition on UIC or vary differently, for example, both organizations have the necessity to be responsive to government policies, they also pursue growth in new knowledge in the stability dimension, and they have reciprocity in employment; however, universities care more about research fundings to be efficient while industry values cost savings, technologies commercialized, universities have more legitimacy to serve to the industrial community or society and to contribute to regional or national economy, while industry is legitimate to enhance corporate image only.

Interaction channels of UIC

Regarding the forms of UIC, current research shows that industry interacts with universities via varied ways, including licensing and patents (Agrawal & Henderson,2002; Petruzzelli,2011), joint research such as basic and applied R&D projects (Kato & Odagiri,2012), student, graduate and researcher mobility (Thune,2009; Perkmann & Walsh,2007), consulting and training (D'Este & Patel,2007), and academic start-ups (Di Gregorio & Shane,2003). At the same time, these channels did not work alone, Cohen et al. (2002) pointed out that different channels usually interact in conjunction with one another in the process of UIC.

However, there is less unanimity among current literature on interaction channels of UIC, for example, some studies highlight the significance of formal channels such as licensing and R&D contracts (Agrawal, 2006; Rosa & Mohnen, 2008). Others, such as Arvanitis et al. (2008), indicated that diverse informal channels exist during university-industry knowledge and technology transfer, including informational contacts, contracts through graduates, educational activities such as students' involvement in corporate R&D projects, thesis or doctoral projects in collaboration with firms, and joint teaching courses, and academic consulting, conferences, exhibitions and workshops. Engaging in these formalized and non-formalized interaction channels create opportunity for organizational learning (Bruneel, d'Este, & Salter,2010), which are crucial to enhance the effectiveness of long-term interactions (Kogut, 2000).

At individual level, some studies have identified the role of university faculty and technicians as primary agent for the dissemination and commercialization of new knowledge (Shane,2004; Hayter,2015). Recent studies have also put forward the important role of students, especially graduate students in knowledge-based activities and academic spin-off creation (Hayter, et al.,2017; Boh, et al.,2016). For example, Hayter et al. (2017) found that graduate students play similar role to that of individual faculty in university spinoffs, "both in terms of making the initial establishment decision and in reconfiguring the organization for marketable technology development."

(2) Educational involvement in UIC

Although a lot of attention has been putting forward to UIC, educational collaboration during UIC is more or less neglected. This is an interesting phenomenon in current literature, because educational activities in UIC such as students project and training are considered as potential contributors to joint knowledge creation (Weckowska,2015). On the other hand, there is also a mounting societal pressure on universities to act as engines for economic growth and less as fulfilling the traditionally social remit (i.e., education and generating knowledge) (Blumenthal, 2003; Philbin, 2008). Kunttu (2017) utilized the theoretical framework of relational joint learning (Selnes & Salli,2003) which including knowledge sharing, joint sense-making, and knowledge integration as three interconnected phases in joint activities between academia and industry, to investigate how educational collaboration facilitate relational learning and knowledge creation. Results showed that educational involvement such as student projects, thesis projects, joint-organized courses, and tailored degree courses might facilitate relational learning between universities and industry, creation of new knowledge, as well as the innovations of university-industry relations. Kunttu (2017) also pointed out that employing students in the industry implementation process is an effective approach to

integrate the knowledge obtained in educational collaboration within university-industry relations. Taking this perspective, we also find that the involvement of students in industrial research projects will not only facilitate high-quality education in terms of skills and competencies trained but also contribute to industrial needs and long-term human resource development.

To this extent, along with the increasing focus on UIC in China's engineering education, growing number of scholars have been turning their attention to the educational collaborations in UIC with an aim to train innovative talents (e.g., Chen et al.,2018; Ma & Chen, 2018). For example, Ye et al. (2022) proposed an industrial project-oriented synergy framework supported by experts from both academia and industry to facilitate university-industry collaborative engineering education. Zhuang & Zhou (2023) examined the intents and effects of China's national policies on university-industry collaborative education, and found that the national policies on UIC play vital role in enhancing industry's motivation to involve in university education, deepening industry's engagement with engineering education at micro course level, and facilitating the creation of an educational innovation ecosystem. However, current understanding of the educational involvement in UIC is still limited, it remains unclear that why and how the involvement of industry in university education can be a part of innovation collaboration in university-industry relationships.

In sum, we can infer from current literature that participants of UIC constitutes via rich and diversified ways. This study intends to focus on the collaborative education activities between universities and industry to address this potential gap by taking diverse perspectives at both organization and individual level, this is because taking different perspectives might vary significantly according to the mechanisms or interaction channels (Franco& Haase,2015). The remainder of this section will present our research questions and aims.

1.3 Research questions

This study focuses on university-industry educational collaboration with emphasis on the motivations and interaction channels between the academia and industry, and intends to answer to following two questions:
1) For what purposes would universities and industry jointly involve in educational UIC to train future engineers?
2) What are the best practices of educational UIC in facilitating university-industry relations in China?

To address the research questions, we undertake an explorative case study in a higher education institution (the authors' home institution) in China, investigating the motivation mechanism and interaction channels concerning university-industry educational collaboration from both universities and industry sides at organization and individual levels. By taking this diverse perspective, our study contributes to the discussion on educational cooperation in UIC by uncovering the educational involvement process. Therefore, the aim of this paper is twofold: 1) to identify the motivation mechanism of university-industry educational collaboration; 2) and to share best practices that innovating university-industry educational collaboration in China.

2 METHODOLOGY

2.1 Research context

The context of this study is recent engineering education initiative in facilitating UIC at BUAA, therefore, the investigation of this study is based on in-depth field study, as has the utility of relying on data collected from semi-structured interviews and focus groups. In this case, we specifically consider the reforming initiative of BUAA as a single case at institutional level. We seek to explore the motivation mechanism and interaction channels underpinning educational collaboration practices in UIC as parts of long-lasing engineering education reform at BUAA.

The analyzed samples in this paper carried out at BUAA are in the broad field of engineering education covering not only traditional engineering programs such as aerospace engineering and software engineering but also interdisciplinary engineering programs including artificial intelligence in the years 2021-2022. That is, we focus on educational involvement in university-industry relations at BUAA rather than focusing on specific engineering programs to explore the motivation mechanism and interaction channels.

2.2 Research design

A qualitative research design was introduced in this study. In particular, semi-structured interviews consisted the primary source of data with intention to identify the motivations and channels of educational involvement in UIC from perspectives of both university and the industry, complementary with two focus groups and public documents related to the engineering education initiative. This paper is a work-in-progress one, reporting on the findings of the first 7 interviews with engineering educators and 3 with industries, complementary with 2 focus groups respectively from the university mentors' perspective, and HRs' and engineers' perspective. Interviewees were selected through purposive sampling with aim to ensure representation of educational collaboration at both organization and individual levels. We followed ethical regulations and all the respondents were kept anonymous to for the protection of their personal information but remain their titles and roles.

Table 1 provides a brief description of the trajectories and positions of the participants in this study. Both interviews conducted in person and online were audio recorded, in both cases the recordings were transcribed into words which formed the basis of the findings. In the data collection and analysis phase, we adopt the narrative inquiry approach (Polkinghorne,1995; Clandinin & Connelly,2004) to identify, analyze, and explore themes emerging from the data, with aim to explore how educational activities happening in UIC are configured and shape educational collaboration in UIC. In particular, we use the paradigmatic analytic procedure to produce taxonomies and identify relationships among categories from data collected. In addition, the stories gathered from the interviews were checked, complemented and contrasted with analysis of various documents and materials by different authors.

Table 1. Participant information in qualitative research design

Perspective	Data Collection Method	Participant Description
University	Semi-structured interview	A: Deputy dean & University mentor
		B: Deputy dean & University mentor
		C: Dean & University mentor
		D: University mentor
		E: University mentor
		F: University mentor
	Focus group 1	University mentors from different departments/fields
Industry	Semi-structured interview (online)	G: Industry mentor
		H: Industry mentor & CEO
		I: Industry HR
	Focus group 2	HRs & engineers from different enterprises

3 RESULTS

Regarding motivations and interaction channels, the pilot case at BUAA presents complex collaboration relations between the university and industry. Although this study only draws on 9 preliminary interviews and 2 focus groups, main findings still show insights shaping the patterns of educational collaboration. Based on the exploratory analysis, the motivation mechanism and interaction channels are discussed separately below.

3.1 Why involved in university-industry educational collaboration: multiple motivations with hybrid structure

Regarding the motivations of university-industry educational collaboration, the interviewees' opinions coincide greatly. From the perspective of university, bringing in industrial experts as education collaborators is considered as one of vital approaches to improve university engineering education (Wardale & Lord, 2016), this was confirmed by our interviews. Both the administrative staff at organization level and faculty at individual are unanimous in the role of industry in engineering education in terms of joint training of students supported by different kinds of student projects, all taking place during the process of UIC. They greatly value the role of industrial experts play in university engineering education and adopt a "industry mentor" way to facilitate the flow of industrial experts to university. As Interviewee C indicated, "our faculty and students are more active and innovative and focus more on cutting-edge scientific topics, however, industry cares more about short-term projects to and technology commercialized, therefore, the opportunity to combine topics of scientific research and forefront technologies would benefit both sides, this is also key to ensure the quality and effectiveness of UIC and educational activities." In addition, the three deans of the university show high consistency with national and university policy to facilitate educational involvement in UIC, and are active in mobilizing faculty to participate in building relations with industry. In this sense, both human capital flow and policy resonance are motivators at the university side. At individual level, the university faculty shared a high degree of agreement that effective university-industry educational collaboration is vital for their own research projects. For Interviewee D, "we have long-term personal relations with X (i.e., industry mentor of the student) to jointly apply and carry out projects, this represents one of the most important facilitators of close relations with the industry and brings in collaborative foundation and opportunities for us to jointly train our student." Although prior collaborative experience and trust in research projects play important role in UIC, lack of prior collaborations would not

impede their motivation in joint education with the industry. The interviewees at the university side also stressed that educational collaboration enhancing the opportunities for faculty to get access to industry projects and the potential of long-term innovation collaboration. For Interviewee E, “I do not consider that (i.e., no collaboration experience) as a difficulty or challenge to facilitate jointly educate our students, on the contrary, I think this kind of joint education brings me opportunities to get new access to industry and find potential collaborative projects in the near future.” Thus, university faculty are optimistic about innovating university-industry relations via educational collaborations, which means joint research motivation is vital for individual faculty to efficiently involve in educational collaborations in UIC.

At the industry side, managers from both engineering and human resource perspectives strongly highlight the long-term human capital accumulation motivation in terms of student research projects, substantial interships, and theis projects, which indicates that the motivation behind is usually the technology fierce competition for talents. At the same time, they are also challenged by the brain drain phenomena in university-industry educational collaboration. At organization level, since enterprises are profit-oriented and do not have the duty to serve as educators, they not only need well-design collaborative mechanism to reduce communication and coordination costs but also need quick respondence to market needs and technology trends. In this case, human resource development is the main concern for enterprises to participate in university-industry relations. One of the human resource managers mentioned during focus group 2, “We consider this collaboration with university as potential opportunity to find and attract competent students, because we want to employ qualified students who are familiar with both the industrial working and our corporate culture in our collaborative fields.” “If we have huge investing of input cost on the collaborative educated students, we definitely want they become our employees to continue the research projects, this is not only a matter of money and human resources in collaborative education, but more of technology performance.” In addition, industry also value knowledge creating and exploitation activities while partnering with university, as Interviewee H indicated, “Identifying joint demands between university and industry are essential. Effective UIC, especially the educational collaboration requires systematic design, in the beginning, it is crucial to help enterprises find the scientific problems and identify which are suitable for UIC, and university also need to communicate more with industry to jointly form an innovation ecosystem, in which educational collaboration can be the most obvious thing for both universities and industry to do.” In this case, organization learning and development is another key motivator for industry to engage with universities, which requires the support of well-designed collaborative mechanism. At individual level, the trajectory of the industrial mentors’ working and cognition seems to be a main motivator to engage with universities. Our two interviewees from industry reach a consensus that joint research projects will not only reduce communication and coordination costs during educational collaborations with university but also better prepare students for the advancement of technologies and fast development of industry. For Interviewee H, “In the joint research projects, student research project or thesis project can be carried out during the process, in this way, students can be integrated into an industrial way of working and thinking, they would definitely benefit from such kind of training after graduation, but other forms of educational activities might require more time and efforts to communicate and coordinate.” Interviewee G also pointed out, “Joint supervision requires great investment in terms of time and dedication and high-quality communication between us and the university professors,

however, it is still not given much value in our assessment of performance, in this case, I choose to participate in and work as the student's industry mentor is only because I think it is of great importance and meaningfulness, our society and our industry need more competent students, we can participate in university education to jointly prepare the students for our society and our industry." The two industrial experts show a great value of educational passion and social responsibility motivation in university-industry educational collaboration.

Interestingly, both the university side the industry has been finding potential possibilities for university professors and industrial experts enrolled in university-industry educational collaboration as a way to facilitate human capital flow, therefore, can be regarded as an opportunity to be promoted in careers once the legal framework and regulations are adequate, this is somehow inconsistent with current literature (Nelson, 2004).

3.2 Synergistic interaction channel of university-industry educational collaboration: joint mentor groups driven by project threads

In the BUAA context, the attempts to reform engineering education, particularly, the university-industry relations can be summarized as a synergistic approach to motivate multiple stakeholders with collaborative efforts for educational purposes via contracted research projects, signing cooperation partnerships and protocols and joint-organized courses. However, from the perspective of industry, working with university on these educational activities requires not only that the enterprises' boundary spanning actions, but also, they need to build the capabilities to collaborate with university operating within efficient channels. Traditionally, a wide variety of interaction channels taken place in UIC include service and bi-directional research (Gulbrandsen et al.,2011), however, the interface between academia and industry to engage in university-industry educational collaboration remains unclear. At the same time, new developments in industry needs and students' burgeoning self-learning ability as digital natives, as well as increasing callings for pedagogical innovations in engineering education can be identified. Therefore, only efficiently motivate industrial partners to actively engage with university education might contribute to not only high-quality engineering education but also innovation capabilities developed in university-industry relations. In our field research, we find that joint research projects seem to play a significant role, and in line with both university faculty and industrial experts' motivations for university-industry educational collaboration. Thus, we introduce the synergistic interaction channel titled "SETP" identified not only from our interviews but also documentary analysis, which was implemented in the School of Future Technology (SFT) at BUAA (*Fig. 1.*). This channel refers to the project threads driven by joint mentor groups to synergize collaborative efforts with aim to facilitate high-quality research and teaching, as well as engage students in up-to-date research and prepare them for industry-working competencies to satisfy the long-term human capital accumulation motivation.

As shown in *Fig. 1*., the "S" represents students' supervisor, which refers to a mentor group including a distinguished industry supervisor, an industry supervisor among the distinguished supervisor's team, and one university supervisor whose research field is similar or complementary with the industry supervisors. The "T" represents the technology trends or fields of "S", which is the common focus of both university and industry, in particular, technology trends or fields are future research fields for students according to their interests and research projects during university-industry educational collaborations. The "E" represents where the enterprises "S" is belonging to, which provide cutting-edge research

infrastructures for students to carry out their research projects. The “P” represents to research projects that “S” is responsible for, these projects would be scientifically decomposed by the mentor groups into students’ progressive project threads including the freshman exploration project, advanced inquiry project, and senior challenging project, which are designed drawing on key topics around leading-edge technologies.

Regarding the internal interaction of “STEP”, the four elements intertwine with each other and contribute to not only educational collaboration but also the innovation of university-industry relations (*Fig. 2*). Around the node of level 1 technology, distinguished industry supervisor plays an overall coordination role in identifying cutting-edge scientific and technical problems, and are responsible for selecting industry supervisors; then they provide joint supervision in terms of the design of study plans, the innovation of pedagogies and curricula, as well as the evaluation of student outcomes. At the same time, university cooperates with industry selecting suitable university supervisors to form mentor groups and complete the construction of interaction channel. Around the node of level 2 technology, industry supervisor and university supervisor carry out joint research and education, not only co-designing the progressive project threads but also jointly provide guidance for course selection, student research, as well as industry internships. During this process, the partners work together to achieve cognition and jointly make sense of collaborative research and education, boundary spanning activities occur in the relationship between university and industry (Siegel et al., 2004), which unpacks an important way of integrating both collaborative research and education and contribute to innovate university-industry educational collaborations.

We also find that knowledge integration and remix taking place in the “STEP” channel, which may involve the joint development of innovation and technological solutions from the industry perspective, as well as new course design at the university side. Since student project threads are derived from the research projects in industry, these projects constitute examples of collaborative education outcomes that also have value for industry. In this case, one effective method to innovative educational collaboration in UIC is to integrate students as knowledge creators and innovators in the industrial implementation and innovation process, this also verifies the long-term human capital accumulation motivation for industry. At the university side, the “STEP” channel also enables industry to deeply engage with university engineering education at course level, because students can self-design their study play under support of the mentor group and select appropriate courses that directly related to the project threads. However, our interviews also indicate that industry is challenged with indecently organized courses but are optimistic about jointly-organized courses.

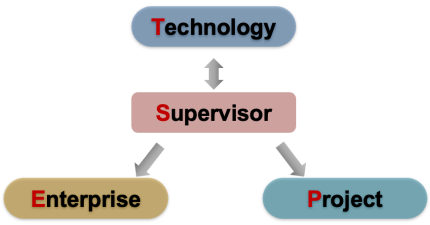

Fig. 1. The “STEP” synergistic interaction channel at BUAA

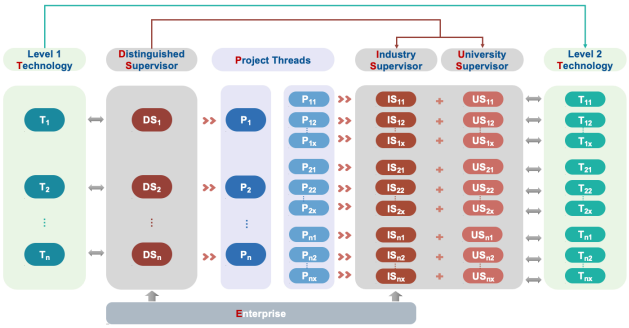

Fig. 2. Generic project threads of the “STEP” synergistic interaction channel at BUAA

4 SUMMARY AND ACKNOWLEDGMENTS

4.1 Conclusions and implications

Although it has been widely understood that UIC is of substantial significance to innovation between universities and industry, limited studied have attempted to investigate the educational involvement in UIC or explore why both parties have motivations to engage with each other in university-industry educational collaboration. The objective of this study is to provide an analysis of the relations between university and industry in terms of motivations and interaction channels used for university-industry educational collaboration. For this purpose, we performed a pilot case study at BUAA in the Chinese context. From the perspective of the interviews with representative from both university and industry, we found that university-industry educational collaboration is not a separate issue from UIC at both organization and individual level. Regarding the motivations, a hybrid structure between university and industry can be identified, from our analysis, we summarize these motivations into six categories:

- ✧ Joint Research Motivation at both organization and individual levels from university and industry perspectives
- ✧ Human Capital Flow Motivation at organization level from both university and industry perspectives
- ✧ Policy Resonance Motivation at organization level from both university and industry perspectives
- ✧ Human Capital Accumulation Motivation at organization level from industry perspective
- ✧ Organization Learning and Development Motivation at organization level from industry perspective
- ✧ Educational Passion and Social Responsibility Motivation at individual level of industry

Regarding interaction channels, we found that traditional research project-based channel still plays a crucial role in UIC. Nonetheless, the educational collaboration requires a more synergistic approach to motivate multiple stakeholders with collaborative efforts for educational purposes. In this case, the “STEP” interaction channel at BUAA appears to be highly relevant as facilitators innovating UIC in terms of synergizing collaborative research and education. In particular, the jointly organized and systematically designed educational collaborations enhance and innovate research-oriented collaborations between university and industry, these educational activities also provide university with access to cutting-edge industrial projects, and the involvement of industry also makes contributions to facilitating research-based knowledge creation and innovation. In this case, a systematic cycle tying in educational activities in research collaborations is formed, which differs from tradition UIC that targeting on either research or education part of UIC. In this cycle, both university and industry can benefit from each other in terms of the combination of research and education of UIC, for example, enterprises might make up for possible risks (e.g., loss of human capital and invalid invest) in separate educational activities through research-oriented collaborations. Therefore, sustainable relations between universities and industry can be build and contribute to not only research and innovation but also education.

Although the findings of this study draw on preliminary interviews and focus on a single pilot case of BUAA, the results demonstrate a complex interaction between university and industry. Apart from the limitations inherent to the case study method and the subjective perceptions of the interviewees, more interviews are necessary for in-depth analysis, and more facets of

university-industry educational collaboration in terms of motivations and interaction channel need to be explored in future research. Furthermore, this study did not include the perspective of students, which also need to be further investigated in future research, supported by both qualitative and quantitative studies in conjunction with our study to unpack other leveraging channels in UIC, with a particular focus on the educational involvement.

4.2 Acknowledgements

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