NordDesign 2014
August 27 – 29, 2014
Espoo, Finland / Melbourne, Australia

Using PD6 to Explore the Initial Collaboration between Chinese Companies and Chinese Universities-Experiments Done by Sino-Finnish Centre, Tongji University

Fan Fei[1], Lu Zhou[2], Wang Danni[3], Zhou Wenjia[4]

[1]Fan Fei
michellefan.sem@tongji.edu.cn
[2]Lu Zhou
zhouzhou@sinofinnishcentre.org
[3]Wang Danni
dannywang@tongji.edu.cn
[4]Zhou Wenjia
della@sinofinnishcentre.org

Abstract
In the hierarchical but decentralized organization of Chinese universities, individual schools in universities manage the relations between the university and the industry (U-I) independently through the collaborative projects. This paper presents four major challenges via in-depth interviews with school staff in one Chinese university, i.e. having difficult to initiate the U-I communication, being oblivious of recognizing students as stakeholders, being lack of professional personnel or skill training, and being reluctant to take a proactive role. To address the problems, this paper introduces Product Development in 6 hours (PD6) as a method to explore the U-I initial collaboration. An experimental case is presented to gain the feedback from companies, students, and organizers so as to analyse the implications of applying PD6 in Chinese context.

Keywords: University-industry (U-I) collaboration, Product Development in 6 hours (PD6), semi-structured questionnaire

1 Introduction

In China, responding to the globalization and market economy, the collaboration between universities and industries has been developed since 1990s. Meanwhile, there was another change in Chinese policy that university graduates have to apply for their jobs by themselves other than accept the work assignment by the government. This new policy gave freedom for graduates to choose their career. However, with the increasing enrolment of Chinese universities, graduates are facing more intensive pressure when searching for jobs. Such a pressure causes the chain reaction on higher education as well as its relation to the industry in China. In the hierarchical but decentralized organization of Chinese universities, individual schools in universities manage the relations between the university and the industry (U-I)

independently through the collaborative projects. Among the complexity of the U-I relations, the paper is interested in the following questions: 1) What are major challenges from the perspective of school staff who are in charge of the U-I relations; 2) How is it evaluated by different stakeholders in the U-I relations when applying new methods proposed by the authors to explore the initial collaboration; 3) What are the implications in Chinese context from the experimental case?

The paper firstly reviews the general situation of U-I collaboration in China from previous literature, secondly presents the challenges from the perspective of the university staff who work at the front line with companies (data collection I), thirdly introduces the PD6 method to explore the initial collaboration and presents the feedbacks collected from participants in the experiment (data collection II), and finally summarizes the conclusion and implication.

The data were collected by the semi-structured questionnaires during both the staff interview and PD6 participants' interview. In the data collection I, 7 in-depth interviews were conducted and in the data collection II 28 participants were interviewed. Both the interview recordings and the written memos were analysed into thematic groups by the four authors respectively. After the pre-analysis, the four authors worked together to categorize those thematic groups via comparison and then made the final analysis.

2 U-I Collaboration in China

2.1 Integrative Relations of U-I

Scholars have studied the U-I relations from various perspectives and formalized diverse views. One of these views, "Triple Helix" were supported and followed by the main stream of Chinese researchers and universities. "Triple Helix", comprised of university, industry, and government, argues that universities should form direct links with industry to maximize "capitalization of knowledge", and that academia should be (and is now being) closely integrated with the industrial world [1].

In China, knowledge is recognized as a key source of economic growth and firms' competitiveness. The U-I collaboration is regarded as a process of technology and knowledge transfer by researchers [2]. Therefore, the importance of U-I collaboration has been attached to the educational mission in universities, to the innovative progress in industries and to the vision of an innovative country in China. It is part of the social responsibility Chinese universities are expected to undertake in the knowledge economy. In 2007, Chinese Ministry of Education (MoE) introduced the policy to speedup the development of research universities and to enhance the innovation capacity in higher education. Especially, the MoE encourages the research universities to explore the new way of U-I collaboration for technology innovation [3].

Many Chinese scholars have studied different ways of U-I collaboration, such as U-I high-tech science park, national or industrial engineering research and technology transfer center within university, U-I joint research institute, U-I joint education or training program, and universities-run enterprises, etc. Typically, the university-run enterprises have become a "benchmark" for some East Asian countries where universities have had weak and indirect links with industry [2]. According to the rank of Chinese university-run enterprises in 2012, the top five in total revenue is around 5.5-70 billion [4].

2.2 Challenge in general

Apart from the various ways of U-I collaboration and the big number in economic index, there are emerging issues, such as low investment from industry to university on research funds, inefficient mechanism of U-I collaboration, inappropriate assessing criteria, etc. There are three major challenges summarized from previous researches [5].

First of all, the interests from both sides are mismatched in demand-supply. The researchers in universities prefer to study the frontier topics but are lack of the updated market knowledge. Many research outcomes have benefits in the researchers' academic perspective but have no applicable value for industries. On the other side, Chinese companies are interested in the new product/service development and emphasize the short-term return from technology to market.

Secondly, it is expected to have updates upon the legal and policy issue, for instance, IPR. It is found that researchers in universities have to publish the research outcomes to gain the advancing position in academic world but the companies would like to maintain secrecy so as to control the competitive advantages. Scholars analyzed the conflicts on IPR are the key factor to hinder the knowledge transfer in U-I. Besides, policies on tax, credits, HR, etc as well as supervision mechanism are demanded to establish a positive macro-environment. [6]

Thirdly, it is expected to share the risk-benefit fairly. Scholars found that risk-benefit sharing consensus would affect the technology innovation in U-I. The appropriate system for property relation and equity transaction could protect the enthusiasm in U-I so as to further risk-taking investment [7, 8].

3 School staff views upon U-I collaboration

With the understanding of Chinese U-I relations in general, this research takes a closer look at its operation in universities through in-depth interviews with staff working in different schools of one Chinese university. In hierarchical Chinese universities, U-I projects are mainly run in the decentralized way, i.e. daily managed by schools under university guidelines. The interviews were organized individually via semi-structured open-ended questionnaires. Seven in-depth interviews were made with staff from the disciplines of Civil Engineering, Architecture and Urban Planning, Economics and Management, Automobile, Mechanical Engineering, Electronic Engineering, and Design etc. Given the internationalization of higher education, when the staff introduced their partnership, the industrial partners also included foreign companies.

3.1 Ways of U-I collaboration

It is founded that knowledge and technology transfer between U-I could be displayed in different ways according to the interviewees' description of their work.

Joint education: U-I co-design practice-oriented curriculum. Industries provide opportunities for internships, in-company-thesis (BA, MA, PhD). U-I co-organize courses, lectures and seminars taught by company representatives. Chinese universities learned from the western practices, such as Sandwich program in U-I collaboration on engineering education, which could be traced back to Sundland Technical College in UK in 1903.

Donation: Industries offer scholarship for students, funding for chair professorship, or finance faculty mobility, facilities, labs and other showcases.

Joint Research: U-I co-establish projects, joint lab and joint technology center.

Career Service: Schools organize job-application training in cooperation with companies, eg. mock-up interview, or hold networking and recruiting events as well as train-the-trainer program.

Company Events: U-I co-organize student company visits, student competition; and company Day on campus.

Board Member: Industrial representatives participate in strategic consulting and decision-making process.

3.2 Staff Evaluation

The interviewees also made their self-evaluation based on their working experience and reported the challenges they encountered.

Challenge one: It is difficult to initiate communication to understand demands and motivation. It is reported that at the initial stage how far the mutual understanding could be reached would affect the follow-ups in U-I relations. The interviewees emphasized that the sooner U-I find the matching discipline, the smoother U-I projects in joint education or joint research could run. Due to the different demands and working plans from companies, the process to generate cooperative idea, select and evaluate, reach consensus will be an iterated task involving decision-makers and staff.

Challenge two: It often becomes oblivious of students as key stakeholders in U-I collaboration. It is discovered from staff interviews that students are also key stakeholders. In most of U-I projects, such as joint education, scholarship, career service, students are the main beneficiary and participants. Unfortunately, students are not invited to initiate collaborative ideas but involved at the stage after U-I projects are designed.

Challenge three: The team is lack of professional personnel and skill training. It is found that initiating U-I relation replies on the personal networking. University staff would need a set of skills to well manage the collaboration, such as communication skills, people skills and personal skills.

Challenge four: The staff is reluctant to take a proactive role. Despite some individual effort or some specific initiatives, the staff would still wait in their office for the proposal from the companies. Comparing to cold call or visit to the unfamiliar companies, an accessible scenario are expected to lower their anxiety for the first step.

In order to initiate communication among different stakeholders in U-I relations including students as well as to establish personal connection and change passive role to be proactive, new methods is required. This paper introduces Product Development project in 6 hours (PD6) as a new method to address the above issues, esp. at the initial stage of U-I relations. In the context of U-I collaboration, the product could be an agreed cooperative concept, a project plan, a curriculum, a research plan, etc.

4 PD6: Concept and Experiment

4.1 The Concept of PD6

PD6 has been used and tested as an idea generation method and a method that enables critical evaluation of the generated idea for training and education in universities, organizations and

industrial companies by previous researchers in Finland and other countries [9]. PD6 is organized as a workshop by squeezing the PDP course structure within 6 hours, which combines with a non-linear process model to do product development. This non-linear process is constructed by re-arrange the phases of traditional linear product development (shown in the first line on Figure 1) in simultaneous format with prototyping in the center, and in the iterative way (shown in the second line on Figure 1).

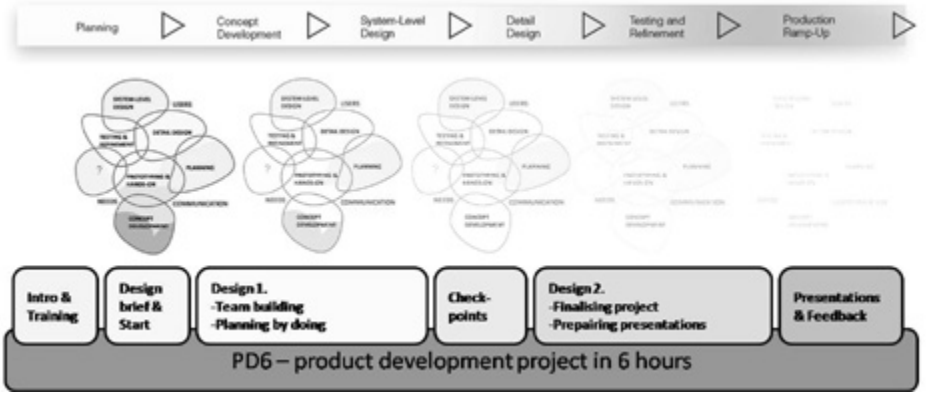

Figure 1 PD6 concept and implementation model [9]

4.2 The settings of the experiment

In 2010, when Aalto University and Tongji University co-established Aalto-Tongji Design Factory (ATDF) and further Sino-Finnish Centre (SFC), PD6, as part of Product Development project (PDP) course, was introduced to a Chinese university at the first time. After three-year of internal learning and adaptive design, SFC held the first Chinese version of PD6, using Chinese as working language. Five representatives from 4 different companies in LED industry were invited (one foreigner accompanied by his Chinese colleague), 20 students from different majors were recruited, 4 SFC staff joined as participants and 3 staff as trainers. To almost all participants, it was the first time to meet each other. Among the three groups, various objectives were found by questionnaires. Company representatives would like to get to know SFC, the students and explore the cooperation potential; students would like to learn new skills, meet with company; and the staff would like to make new contacts with companies, observe the students' motivation and interests, and discuss the research proposal.

4.3 The process of the experiment

The LED workshop was organized according to the PD6 method (shown in the third line on Figure 1) as a fun competition, during which from an idea to a prototype was required.

4.3.1 Intro & Training (1h)

As most of the company representative and students were new to SFC and PD6, in the first hour, they were introduced to SFC, an international interdisciplinary open innovation platform and PD6, the idea generation and evaluation process and methods. Due to the interdisciplinary nature of teams, regular tools for brain storming and design methods were also introduced. This part prepared the mindset of participants so that they could understand the mission of next 6 hours, having fun during interactions without professional titles. After introduction and short Q&A session, the participants were divided into four teams: 1 company+5 students+1 staff.

4.3.2 Design Brief & Start (30min)

One–page of design brief was distributed to each team. The task was to design one appointed room/space of SFC using LED technology to satisfy the user needs. Each team was assigned their own room/space. The teams were further introduced to the general information about the space users and a list of problems regular users encountered. To facilitate the hands-on task, a toolbox with basic prototyping and visualization materials was provided to each team. They were asked to prepare a rough schedule before the checkpoint and to build and define the team roles.

4.3.3 Design 1. Team building and planning by doing (1h 30min)

With the 90-minute time pressure, the teams were separated in their own space to work immediately for team building and information gathering. They were encouraged to make full use of the available resources on the site, on the Internet, or in other communication channel. Trainers would visit each team to check the topic and the process been understood by all participants and answer any necessary questions.

4.3.4 Checkpoint meeting (20min)

Trainers joined the teams one by one. Each team had five minutes to present what they have achieved in 90 minutes: team schedule in details, team members' role and responsibility, generated ideas, etc. The trainers would then challenge teams: how to evaluate, select ideas and present them in convincible way.

4.3.5 Design 2. Deepening design and prototyping (1h 30min)

In these 90 minutes, teams were working on prototyping and final presentations. After the active interaction in the first design phase, team members have been familiar with each other and were busy with hands-on work in pleasant but intensive work. Some teams were using mobile phone to record their happy moment.

4.3.6 Presentations (45 min)

Four teams gathered together and presented their results in turns, 6 minutes per team and 4 minutes for Q&A. When using power point to present, 6 slides would be maximum. The teams were also required to "sell" their prototype in an appealing way.

4.3.7 Feedback and evaluation (25min)

Each team had a representative to present their comments on other three teams' performance in a constructive manner by using "I like…(positive)" and "I wish…(critical)" sentences, and gave each team the grade 1-10. Trainers would also give their feedback and grade to each team. The final grades would be summed up and a winner team would be rewarded.

4.4 The outcomes of the experiment

Within the limited 6 hours, four teams, including members from company, students and staff, achieved the design mission. More importantly, the workshop provided an occasion for the three groups to meet, understand, work and evaluate together for the first time, intensively within half day. The feedback about the workshop from companies, students and staff were collected from semi-structured interview and quoted in thematic groups. The data are shown in Table 1-3.

Table 1 Company feedback about the workshop

Interactive	It is a new way to build business connection.
	It is a sharing process from which everyone "give and take".

	I enjoyed very good interaction with students.
	I experienced lots of will power and wish to learn.
	It is a good learning process when interacting with students.
	It is a good opportunity to exchange with industrial peers.
	I learnt a lot from younger generation, creativity, inspiration and courage.
Fun	It is a fun experience.
Informative	Quite informative and rewarding.
	I get to know the details about SFC.
Efficient	It is interesting to see creative students managing challenge with limited time.
Applicable	I'm willing to recommend such a workshop to others.

Table 2 Students feedback about the workshop

Interactive	I am keen on interacting with company people.
	I learnt a lot from company representative directly.
	I would like to give five-star remark to the interaction with company in less hierarchical environment.
Fun	I enjoyed and created fun.
Informative	I have the best experience to learn from LED industry and customer.
	It is a unique opportunity to deepen the understanding of LED industry.
Interdisciplinary	I learnt to use my specialty to complete the task without relevance.
	It is my first time to have designer experience as a non-design major.
Teamwork	I tried my best to work with team members and contribute to the solution, acting as a coordinator.
	It is valuable to work in team consisting of members from various backgrounds.
	I learnt and managed the interdisciplinary teamwork.
	I learnt to work in teams for idea generation and prototyping, not just by myself.
Learning by doing	It is my first time to learn and practice design thinking, user empathy, idea generation methods and prototyping.

Table 3 Staff feedback about the workshop

Interactive	I could meet and talk with more potential partners and students at the same time.
Fun	The fun atmosphere helps me for better communication.
	It lowered the threshold to build connection with the industry.
	No poker face.
Informative	I could understand the demands from industrial partners via a common channel in short time.
	It is an all-round platform to promote SFC.
Teamwork	I got to know partners and students better via the hands-on teamwork with set target in limited time.

From Table 1-3, some key words could be found to describe the experimental workshop: interactive, fun, informative, efficient, interdisciplinary, teamwork, learning by doing, applicable. Comparing to the best elements and practices of PD6 method, such as interdisciplinary teams, prototyping, structured and tight schedule, demanding subjects and competitive atmosphere [10], the LED workshop achieved good results.

5 Discussion

5.1 PD6 application in the U-I challenges

Using PD6 to organize U-I workshop, although not helpful to solve such macro challenges as policy and mechanism, it brings new insights to explore the U-I initial collaboration. The first experiment in SFC has shown the following concrete advantages to overcome the four challenges proposed in the staff interview.

Solution to Challenge one (initializing the communication): It presents the tangible output of U-I projects within limited time in front of different stakeholders. In the usual practices, during the initial discussion, questions will be raised, from companies "what we could get", from students "what we could learn", and from universities "what we could offer". Using PD6 method will save the time of questioning and wondering, and efficiently answer the questions by DOING. It provides an easy access to the first meeting and communication of different stakeholders. When the language barrier removed, more Chinese companies and students are included in the potential participants. Not like a one-year Product Development Project (PDP) in which more effort and funding are required, the 6-hour workshop is more passion-based but less budget-costed.

Solution to Challenge two (motivating students): Students are regarded as one of main stakeholders in PD6 workshop at the very beginning of workshop design. Apart from the "learning by doing" pedagogical value, students also feel rewarded by the interdisciplinary experience, real-life exposure with industries and potential career development. Such a half-day extracurricular workshop would better motivate students compared to traditional activities.

Solution to Challenge three & four (providing learning community for staff): The concept of in-house staff training is getting more and more attention in Chinese universities. Unlike the academic learning with more focus on individual effort, the staff training, organized as seminar, team building, etc., encourage more focus on collective learning. The experimental PD6 workshop presented us a new way to create a multi-stakeholder community for staff career development.

5.2 The limitation of PD6 in Chinese context

Apart from these results, the experiment workshop provided the implications when apply PD6 methods in Chinese context, which needed to be considered when designing next workshops for future practice and research. 1) Individual vs collective: During the first Chinese version of PD6, it is noticed that constructive evaluation in public among participants needs more tutorial. In the context of Chinese culture, students and teachers/staff get used to the competitive learning culture within formal educational settings, and intend to pursue the best or one correct answer/solution to problems. To nurture the collective learning culture, the workshop designers shall pay more attention on the first introduction content as well as the checkpoint guidance. 2) Hierarchical vs distributive: Observing the team work of the experiment workshop, although no specific roles assigned in advance, the company and staff representatives were regarded by the team students as counsellors. During the interview with students, it was also found that they had expectations for staff and company representatives to be teachers in traditional class settings. It relates to the macro hierarchical environment in China and would interfere the distributive learning of PD6 in which all participants as stakeholders could contribute and share equally. 3) Language: The experiment workshop used Chinese as working language. It is easier to practice in Chinese community but lose the cross-cultural input. When recruiting the Chinese participants for next workshops, it is better to make pre-survey to have their language proficiency if English will be the working language.

Given the English popularity in China, it might be feasible to enlarge the workshop community and to include international participants.

6 Conclusion

The paper illustrates the four major challenges faced by school staff in charge of the U-I relations: difficulty to initiate U-I communication, oblivious of recognizing students as key stakeholders, lack of professional personnel or skill training as well as reluctant to take a proactive role. The paper reports the evaluations of company representatives, students and staff after their participation in the experimental PD6 workshop, discusses the new solutions to the four challenges and analyses the experiment implication referring to the Chinese context: individual vs collective, hierarchical vs distributive and language issue. In general, from the first experiment PD6 workshop, the new method would facilitate the initial communication among different stakeholders effectively.

Last but not least, the Chinese translation of the name PD6 limits its application within the field of product design. Chinese terms, the product design, service design or business design, etc. are all clearly separated. Besides, it is found that design thinking methodology could also facilitate the workshop. Therefore, SFC is considering giving a new name of such U-I workshop and incorporating more tools and methods to develop such a workshop.

Acknowledgement

The authors thank interviewees from different schools who shared their reflections on U-I collaboration and all brave participants in the experimental Chinese workshop applying PD6 method.

References

[1] Etzkowitz, H., *The triple helix: university-industry-government innovation in action*, 2008, Routledge,: New York.

[2] Eun, Jong-Hak, Keun Lee, and Guisheng Wu. "Explaining the "University-run enterprises" in China: A theoretical framework for university–industry relationship in developing countries and its application to China." *Research Policy* 35.9 (2006): 1329-1346.

[3] http://www.dost.moe.edu.cn/dostmoe/jgsz/zcfg/20120426100801

[4] Chinese University-run Enterprises Association, Technology Development Center of Chinese Ministry of Education ed., *Statistic Report of Chinese University-run Enterprises in 2012*. Beijing: BUT Press, 2013.

[5] Hu Zhenhua, Li Yongxia. "The Research on University-Industry Collaboration and Innovation. "*Accounting and Finance*, 2013 (6): 75-79.

[6] Zhou Zhu, and Huang Ruihua. "IPR Conflicts and Coordination in the U-I Collaboration. " *Research and Development Management*, 16.1 (2004): 90-94.

[7] Wang Xiaojun and Zhu Qiang. "On the Rationality of Risk-taking Mechanism Concerning the Technological Innovation of the Tripartite Complexes of Production, Teaching and Research. " *Soft Science*, 15.4 (2001): 56-58.

[8] Li Chaoyang. "Property Right in the U-I Collaboration Innovation." *Academic Ocean,* 5 (2006): 194-197.

[9] Reinikainen, M. T., and T. A. Björklund. "PD6, an idea generation and evaluation method." *SEFI 2008: Proceedings of the SEFI 36th conference on Quality Assessment, Employability and Innovation*. 2008.

[10] Reinikainen, M. T., and T. A. Björklund. "PD6, a method for interdisciplinary product development training and education." *SEFI 2008: Proceedings of the SEFI 36th conference on Quality Assessment, Employability and Innovation*. 2008.