

Innovation and Knowledge Creativity in Regional Development: Combination of Different Missions

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Abstract:

Maximizing socio-economic contribution of innovation system demands a better comprehension of the systems which are made up of the networks of coordination in and out of these contemporary institutes. The existence of different innovation institutes augments regional competitiveness, which demonstrates the combination of teaching, research as well as innovation as missions from different institutes involved in socio-economic engagement. The greater socio-economic role they can play in fostering regional growth, the more necessary it is for the integration of its internal teaching, research and innovation coordination systems. While research on regional innovation has identified the important role that these institutes play in collaboratively generating innovative knowledge, how teaching and research activities trigger knowledge production in the institutes and the combined importance of three factors in knowledge spillovers essential to regional competitiveness still remains relatively unexplored. We analyze the necessity of saving diversity in the missions to explore effective and sustainable approaches to their engagement in regional development.

Keywords: *Industrial-relevant research, Collaborative innovation, Regional engagement.*

I. INTRODUCTION

Science and technology are two important elements to regional developments in knowledge-based economy, and knowledge production, absorption and dissemination are considered as driving force of innovation in a region even for a country. Endogenous Growth Theory explains regional economic performance and innovation are closely related to knowledge production and industry innovation. Innovation is seen as an industrial amalgamation of human capital, science and technology, at the same time, long-run economic growth rate of the region depends on various supportive forces to increase the growth rate. While university plays an enhanced role in producing human capital, innovative knowledge, and academic capital in the regional growth, most important parts of knowledge production cannot be effectively expressed in symbolic forms or forms of representation, but keeps embedded in relatively immobile human capital [1]. Realization the universities' social and economic contribution demands systematic analysis of the systems which consists of a network of communication in and out of contemporary universities.

The evolution of knowledge-intensive economies involves three mechanisms in function: innovation of technology providing variation, market acting as prevailing selectors, and the institutional structures that offer the system with detainment and reflexive control [2]. To explore the complex mechanisms Etzkowitz and Leydesdorff elaborated the volatile communications and interactions into a model of Triple Helix to further study University-Industry-Government relations and the innovation system at different levels within the dynamics [3]. The dynamics is made up of various subdynamics, such as market forces, political power, control of different institutions, social movements, development in technology and science, when faced with pressure from changing environment; it can carry continuous innovations to realize its reconstruction, such as innovation in product, process, organisationa, or marketing [4]. In the process of reconstruction involving more and more complex interaction across national borders and among various researchers and users of research from different institutions and background, roles of each actor are no longer fixed, they jointly influenced each other in the evolution.

The of concept Triple Helix is being used not only as an operational strategy in the development of a regiona, its innovation systems, and the relationships among them, but also provides a new perspective to further explore transformations of different institutions, their evolutionary mechanisms, and position of the contemporary universities. Different from the perspective of evolutionary economists, who consider firms to be the focus of innovations [5], or the policy perspective, in which the innovation system is analyzed as a frame of reference for government mediation, a Triple Helix is not expected to be stable, it can develop an overlay of interaction, networks, and insittutions among the convolution. A challenge shared by administrators and policy-makers in so complex dynamics is to maintain institutional autonomy and develop flexible responses.

The greater socio-economic role a university can play in fostering regional growth, the more necessary for the integration of its internal teaching and research coordination systems. This study was designed to probe the current status of Chinese teachers' industrial-relevant research, the motivation, psychology, determinants and forms, to seek effective and sustainable approaches to promote capacity of the university's engagement in regional growth.

II. LITERATURE REVIEW

As part of our attempts as university missions teachers participate in inside the univeristy, this literature review part begins from differetn angles, attempting to explian the variety and possibilty that teachers contribution can be represented, before progressing to consider a more specifically literature on the motivation and determinants teachers' participating.

2.1 University Missions

Knowledge in universities is considered as driving force of innovative activity in a region even for a country. Faced with a dilemma in Prussia society, German universities led by Humboldt carried out various educational reforms, which caused the academic revolution introducing research into the university

mission, compatible with teaching activities at different levels. Significance of the institutional renovation lies not only in nation building and development, but founding of modern university, where research functions as mission of university together with teaching. The huge success of research from university supplying practical contribution during World War II attracts policy-makers to make full use of potential in university.

The 1970s witnessed America's losing competitiveness in automobile and steel manufacturing compared with Japan and Europe, together with economic growth stalling, and unemployment reaching post-world war highs. Experts consider the low rates of America's growth of manufacturing productivity is the cause of systematic erosion of competitiveness. Meanwhile, Knowledge generated in American universities did not play a major role in regional development of 1970s with its focus on manufacturing. If failure of the "opening to the market" was an effective approach to the managed economies because of neglecting of knowledge-intensive dimension, once knowledge and technology replaced physical capital as a key driving force underlying regional economic growth and prosperity, the renaissance of economy would come true.

Policies were updated in terms of bottom-up processes in terms of reflexive feedbacks. To alter the role of fundamental institutions, Bayh-Dole Act was aiming to cultivate spillovers of knowledge and technology from university research, facilitate knowledge transfer more easily to industry, and provide a catalyst for startups. Scholars' refocusing universities' function away from previous managed economy to the entrepreneurial society has made important contributions to the evolution of entrepreneurship [6]. In addition to the traditional mission of research and teaching, university has a third mission of both knowledge production and engaging in economic production.

With the development of knowledge-based economy, knowledge and technology transition from university is so significant that scholars like Webster and Etzkowitz considered the introduction of 'entrepreneurial activity' in university as a second academic revolution, which embedded the market into the campus of university. The trend of adopting business world criteria, considered [7] to be an unescapable model for modern university, has been imbuing university, traditionally a public institute, with private sector merits [8]. What's more, public universities in many national higher education systems are not seen as a contributor of public good any longer.

Entrepreneurial activity in university could be the consequence of the convergence effect of government policies to encourage innovation, and the driving force can be described as the expectation of profits. "Profit" achieving can mean various institutional changes for the actors involved. To university, it means getting involved in commercialization, or market-oriented behavior, as Slaughter and Leslie mentioned in their study of "Academic Capitalism", which means teaching, researching and transferring of knowledge are proceeding in accordance with market forces or company preference. The Third Mission, facilitated by policies of government, has almost come to be normalized in most universities of USA and Europe.

2.2 Necessity of Saving Diversity

Third mission of university did not bring resurgence of manufacturing industry in America, but conurbations of high technology, like Route 128 and Silicon Valley in US, and some new industries, such as computers, software, and social networks contributing to regional growth and prosperity [9]. The potential of university contributing to regional economy has become an important source of national competition, which is based greatly on the knowledge transfer from university funded by government as well as industry, and in turn involving university into the joint relations with government and industry.

To promote innovation, knowledge creativity, cooperation, and partnerships at the regional level, governments have continuously sought to strengthen interaction and relationship between different institutional actors in regional innovation system [10-11], take the cooperation between company and industry for example, by identifying industrial demands, foster knowledge and technology spillover from universities, facilitating the relationship and interaction [12-13]. The commercial and social contribution of universities has become a cornerstone of American's regional and innovation policies since 1980s. Encouraging campus creative and innovative activities to promote university's social-economic engagement has transformed university from a purely teaching and research instruction into one with Third Mission, not only in the USA, but in many other countries across the world.

University's commercial engagement in a context combining public and private elements can be concluded as the following activities: becoming an entrepreneurial and research university, creativity of technology transfer offices, founding of new firm; and environment including networks of innovative institutions. Third Mission is considered as fostering the institutional growth of other components of university missions, on one hand its successful conduction depends on the degree to which the innovation and entrepreneurial activities are consolidated within universities, on the other hand, mechanisms such as internally key incentives for teachers and the departments involved in Third Mission are important elements for innovative and entrepreneurial strategies within university.

While university's playing an increasingly important role in innovation in knowledge-based societies, entrepreneurial activities have been reshaping the institutional arrangements within universities, its relationship with industries, and agencies from government. A challenge brought by Third Mission performance [14], which is shared by policy-makers and administrators, is to maintain the autonomy institutions, and at the same time can still trigger creativity and innovation to promote the Third Mission so that university in any context can benefit from its increased engagement. However, dispute over the role of university in technology and knowledge transfer to industry, and whether or not the Third Mission will adversely affect campus teaching and research still remains greatly unexplored.

Technology transfer offices in many countries can act as a structural foundation of universities' Third Mission, however, they are not the only or the most important internal determinant performance of Third Mission in many universities. [14]. To foster and develop flexible institutional responses to the demands from regional development, administrators' efforts not only focus on establishing coherent institutional

strategies, but bringing innovative consciousness into organizational context, so as to form innovative climate or culture within the university to foster knowledge production and spillover. That can be realized by establishing coherent strategies guiding organizational evolution, combining social-economic demand into traditional teaching or pure academic research.

According to the current literature, regional innovative network consists of two basic components [15], community network [16] and industrial system [17]. Playing the role of resource pool, community network's three construct elements are financial capital, social capital and human capital, among which human capital especially human capital's function is the most far-reaching and they are seen as soft infrastructure for the construction of a knowledge-intensive innovative architecture [18]. As to the industrial system, factors such as knowledge-sharing, entrepreneurship and cooperation are essential for the viability regional innovative network. Innovation is fostered by an evolutionary, non-linear, interactive and intensive collaboration of various intellectual factors from universities, public institutions and firms [13]. The driving force of innovation activity comes from human capital, research of universities and other institutes, technology transfer organizations, and productive firms [19], which emphasizes the importance of universities' role of cultivating industrial- related knowledge as well as qualified human capital.

University's Third Mission in terms of knowledge creativity and technology transfer can't be implemented effectively or sustainably without supporting from core missions such as teaching and research activities. Literature on universities' engagement in regional growth mainly focus on economic returns from university-based R&D activities, neglecting knowledge transmission from teachers and students who act as human capital of any organization in innovative architecture. But how could knowledge be efficiently transferred to industry without qualified or skilled human capital? How could the research findings be carried further before and after being transmitted into industry? Not only for special grants, startups formed on campus but also university incubator facilities, the role of human capital university are greatly neglected.

III. METHODOLOGY

3.1 Narrative Inquiry

Narrative inquiry became the focus of scholars as a research methodology in social sciences in the 1980s, which is employed in our study because it can offer the following unique benefits. First, it can provide a deep-going description of teachers' daily experiences in campus, how they make sense of their experience and their assumptions or opinions about what they have experienced [20]. Also, it is considered suitable to explore teacher's various forms of research engagement for gathering data over time (i.e., research trajectories) especially their professional development in institutional mission evolution.

3.2 Participants

The study group of the research consists of 87 teachers from different departments of a university in

China. They belong to different ages, genders, teaching experiences, educational backgrounds, and job conditions. The “maximum diversity” sampling method was used in the study. In this sampling method, it is at the forefront of exploring and explaining different research fields related to innovative or entrepreneurial activities in university and the differences related to the motivation of participation are emphasized. Among these differences, similar or common aspects should also be determined.

3.3 Data Collection and Analysis

The first phase of this study was designed to provide an overall description of the current status of university’s engagement in regional growth. A narrative frame (Appendix A) was designed based on an earlier fieldwork of faculty’s innovative or entrepreneurial activities in university, the theoretical framework of the study, and the literature on emergence on different missions beneficial to a region. First, we consulted three narrative inquiry experts and two research experts in regional innovation to give us their recommendation on the wording, content, and outline of the prompts. Then the frame was revised accordingly and piloted it with participants from different departments.

In the second phase, we aim to explore teachers’ research motivation and experience to expand on the understanding from the previous narrative frame, and then turned to narrative interviews (Appendix B). To establish trust with the interviewed teachers, we made them convinced that their experiences were of great significance to our research to make sure that they saw themselves as storytellers rather than interviewees with the mission of answering questions. The interviews were semi-structured (mostly from 40 to 60 min) to allow 12 teachers of different departments to share their opinions that were not introduced in the designed questions. After the data were collected, they were transferred to Microsoft Word.

3.4 Data Analysis

The frames were completed by obtaining data collection from the first stage and content analysis. Each prompt was designed as a coding category below which some sub-categories were designed according to the patterns in the data. They were separately used with the combination of ‘in vivo’ and ‘process’ coding to produce first-level codes. We employed vivo coding to achieve closely to these teachers’ stories and utilized process coding as a complementary approach to enhance the depth of the exploration. To resolve contradictions between the two coders, we employed the ‘consensual coding’ strategy [21]. To derive principal themes from the first-level codes, we conclude three different themes within the gathered data, namely ‘disciplinary background’, ‘institutional policies’, and ‘personal research motivation’. Finally, the overall themes were employed to reconstruct each participant’s story in a process named as ‘restorying’, the result of which as a “restoried narrative” were assigned pseudonyms to all of the 12 teachers.

IV. FINDINGS

In this part, we expatiated on the current status of teachers’ lived research experience and teaching in university’s innovative and entrepreneurial environment based on the narrative frame of their stories and

then explore these teachers' motivation of participating in innovative or entrepreneurial activities.

4.1 The Current State

Teachers' participate in university's social-economic engagement in terms of academic entrepreneurship, knowledge transfer, and spillover effect, of which knowledge transfer is the most common one. Teachers in China's university engage in knowledge transfer through patents, licences and property rights, which are based on the research related to their major field. With the trend of setting close relations with industry, agendas and policies are promulgated in China's universities to direct researchers toward activities with potential economic utility, which foster teachers' get involved in interaction with industry.

Knowledge spillover entrepreneurship [22] is broadly conceived in terms of high tech, venture capital-funded industries, and startups like spanning family firms, small companies and business of self-employment are losing its advantage. In new-firm startups set up on the basis of research and ideas generated from universities, innovation is seen as the combination of human capital and knowledge, and its innovation is shaped by both innovative knowledge and capable human capital. Conversely, this trend is influencing teachers in university to engage in academic entrepreneurship. The model of modern university put forward by Humboldt in Germany and gradually developed by major universities of US, is attaching too much importance to research, especially market oriented. A growing concern over the model is that all the universities are expected to fulfill similar mission: excel in research, knowledge creation and transfer.

4.2 Motivation of Teachers

Interview data on teachers' research and teaching experience help us understand the teachers' research engagement and the situation came about. Teachers' narratives of their stories show that their main motivations for engaging in research are to gain promotion, a better salary, or improve in teaching and research practice. Interactions between university and industry can positively influence their research, which is also a kind of motivation. Teachers interviewed reported that the interactions in and out of universities improved the quantity and quality of their research, and made them better researchers. Refining their experiments and providing a different angle to a problem in basic research that sparks their ideas. Nine teachers agreed that knowledge transfer is taking place in both directions, not only from the university to industry, but also from the industry to university through cooperation.

Disciplinary background influences teachers' motivation and forms of in knowledge transfer. Teachers with Social Science and Humanities as discipline background are less motivated in research market-oriented. Teachers of Natural Sciences and Medical Sciences are more likely to publish research findings. If teachers' researches are aided by fund from industry, they are more productive than their colleagues without funding support from industry. The scientific output of research can be influenced by the co-authorship with experts from industry, which can motivate the productivity and forms of research in university as well.

Cooperation and interaction with industry are concluded as a major motivation, for the relations of Triple Helix for University-Industry-Government can be a climate and also dynamics, in which teachers are motivated from policy, funding, information and resource of cognitive, technical factors. In addition, teachers can gain access to R&D facilities from industry, and the financial support for the purchase of equipment or bringing in human capital for research. These factors serve as the motivation of doing research for teachers and also improving their research performance.

Cooperation with experts from other disciplines is another important motivator. Exploration of university's spillover to the regional industry shouldn't focus on market-oriented knowledge production alone. If newly generated disciplines are often the basis of knowledge innovation in university, the fact is, these disciplines are not generated only from the subdivision old disciplines, but more from syntheses of practice and theoretical improvement. Computer science growing out of electrical engineering, psychology, philosophy, which indicates the importance of teaching as transmitting knowledge between generations, pure research as basis of further exploring of existing discipline.

Offering qualified graduates to society, university is trying to meet the demands from industry by offering skilled and qualified jobseekers or human capital for companies. The demand from industry and regional development is influencing teachers' teaching focus. University's advantage over other institutes is combining continuity with change, institutional and research memory with new human capital and creative ideas, through the process of student generations. The significance of educating or teaching in modern university lies in that it can systematically draw both research and teaching together into a single framework. It can also explain why university is still the important institution of the knowledge sector as long as it retains its original mission of teaching.

V. DISCUSSION

Unlike the American high education system where public and private universities have traditionally co-existed, China has a dominantly large public higher education sector, major part of the higher education system remains to be hold in public hands, and non-marketable research in the university is aided primarily by public funds. While university is playing more and more important roles in regional growth, the notion of higher education has not changed which is traditionally regarded as a public good which should be controlled and funded essentially by the state [23]. With the trend of entrepreneurship research prevails in universities of most countries, a search for balance between basic science and strategic science is becoming difficult. Knowledge and technology transfer (patents, licences, property rights, research joint ventures) together with the founding of technology transfer departments, science parks, and incubators of university makes the core mission greatly neglected.

University is playing a relevant role in the identifying and exploring of entrepreneurial opportunities, and sometimes market oriented, universities are organizations which are rigid and bureaucratic by the nature. To become productive and creative in the interaction with industry, some universities are expanding the entrepreneurship the whole institution including all staff and students. Evolution of universities in

different regions is going on in a same trend, which is largely “decontextualized”. Context matters so profoundly for education system, even the type of entrepreneurship or model research that work in the context of one region is applicable for another region, it surely not for all regions in a country, let alone across the whole world [24].

VI. CONCLUSION

Strong contribution of university is linked to the combination of three missions, in the way of providing both qualified human capital and innovative knowledge to industry or society. University with entrepreneurial environment provides students with traditional teaching as well as entrepreneurial, such as enhancing their managerial skills, offering practice opportunities, transforming their entrepreneurial mindset. Students enrolled in such a university will gain the possibility that the graduates can detect more chances in the labor market and become a major part in the economically active population. Teaching can be seen as university’s important advantage when combined with research and knowledge spillover, because students received education enhances the primacy of university as a source of creativity and innovation. Qualified and skilled graduates are considered as a dynamic flow-through of important “human capital” for small business and big company. Students are also potential inventors and researchers indispensable for the regional innovative system construction, that even if there is a break in the generations or output typically caused by a sharp reduction of research funding, some academic research groups disappear and can be replaced by others in a short time.

Entrepreneurship emerged as a choice of solutions to some of society’s tough problems in a particular situation and context. Take the society of America in the late 1980s and early 1990s for example, the society is burdened by economic stagnation, unemployment problems, and a severe diminished standard of living, where large companies are no longer the major providers of employment opportunities for Americans. Economists and policymakers’ solutions are founding of small or medium-sized firms, which can offer fewer than 500 jobs, provided 80% of new jobs. Furthermore, small businesses accounted for a greater share of innovative activity than that of large companies. While new and small firms can play important roles in the output of conduits for spillover of innovative knowledge, commercialization of knowledge innovation, which ultimately foster regional economic growth, an increasing complexity of the process is making human capital increasingly crucial for carrying the transformation.

Factors such as history, path dependence, and institutional embeddedness often make it difficult to for university to imitate strategies from other countries’. University’s contribution to regional development does not only mean promoting of technology transfer, academic capitalization and birth of startups, ensuring that skilled and qualified human capital thriving in the region. The knowledge, technology, skills, and habits gained through teaching in university transform them into qualified employees or bold entrepreneurs. The goal of the university should focus on sustainability of competitiveness and specific roles in regional development.

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Appendix I

A narrative frame (translated from Chinese)

I am a _____ (gender) and I am ____ years old. I graduated in the field of _____ with a/an _____ (degree level). I was assigned to teach _____ in _____ Department and I for _____ years/months.

My department’s research funding mainly come from:

My research activities with potential economic utility include:

My research funding sources:

My department encourages us to engage in research with potential economic utility in the following forms:

Engaging in research with potential economic utility influences my teaching in the following ways:

I think highly industrial-relevant research focuses on topics such as

I could find _____(type of research) of particular relevance to my classroom practice. They influence students in the following ways:

I (how often) _____ conduct industrial-relevant research. My reason(s) for doing this is/are:

Challenge(s) which have limited my doing of industrial-relevant research is/are:

I will be more engaged in industrial-relevant research if

Appendix II.

A narrative interview (translated from Chinese)

1. What is your research area? What made you interested in industrial-relevant research?
2. Please tell us your story of how you began to engage in research activities with potential economic utility.
3. How did you aim to doing industrial-relevant research? Could you share your story with us?
4. How have your industrial-relevant researches influence your teaching? Could you share your story with us?
5. How is industrial-relevant research viewed in the department where you work? a) Do you think that views have influenced your research? Could you share a story with us?